



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)**

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**SECTION A. General description of project activity.****A.1 Title of the project activity:**

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Project for GHG emission reduction by thermal oxidation of HFC23 in Russian Federation.

Version 1 of the PDD

December 15 2005

The Cooperative Mechanisms programme supports the implementations of the Kyoto mechanism. In this context, its Project-based Mechanisms (PBM) branch focuses on Joint Implementation (JI) and the Clean Development Mechanism (CDM) namely by supporting the JI Supervisory Committee (JISC) and the CDM Executive Board (CDM EB).

This proposed project is Joint Implementation Project defined in the Kyoto Protocol between the two Annex 1 countries, Japan and Russian Federation.

The Modalities and Procedures for Joint Implementation Project as defined in Decision 17/CP.7 and the successive Provisions for CDM project have not decided. Hence, the Project Design Document (PDD) of this proposed project is prepared pursuant to the Modalities and Procedures for CDM project, Guidelines for completing CDM-PDD and so forth.

A.2. Description of the project activity:

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Chimprom is one of HCFC22 manufacturers in Russian Federation. HFC 23 (Chemical Formulae: CHF₃) is inevitably generated as a by-product in the production of HCFC22 (Chemical Formulae: CHClF₂), which is used as refrigerant gas or raw material for fluoroplastics production. HFC23 is non-toxic, but is recognised as one of the most powerful greenhouse gases regulated under the Kyoto Protocol with a high GWP of 11,700 (Reference IPCC 2nd Assessment Report).

HCFC22 is regulated by the Montreal Protocol on Substances that Deplete the Ozone Layer (effective in 1987, as adjusted and amended on 29 June 1990) and the additional agreements to the Protocol such as the Copenhagen Amendment, the Vienna Amendment, and the Beijing Amendment, all of which provide for the gradual reduction and the eventual prohibition of the use and production of HCFC22.

However, there are neither laws nor regulations to limit the production of HCFC22 and its usage in Russia because of belated ratification by Russian government of the additional agreements.

On the other hand, there is no known commercial market for HFC23 in Russia.

As a result, the Russian HCFC22 production has been continuing and HCF23 as a by-product is released continuously into the atmosphere directly.

In order to prevent such a problem, under the JI Project, the off-gas recovery and flaring destruction system is introduced into the HCFC22 production process in the plant of Chimprom, located in Volgograd, Russia, so that HFC23 is completely degraded before its atmospheric release.

The typical mass ratio of HFC23 to HCFC22 being 3-4% on mass basis (The IPCC GHG Recovery Good Practice Guidance Report set its default value, defined as tonnes of HFC23 produced per tonne of HCFC22 produced, as 4%), while the lowest % achieved at Chimprom in last three years is 3.10 %.



To exclude the possibility of manipulating the production process to increase the quantity of waste, the proposed project introduces the waste generation rate of 3.0 % to evaluate the baseline in a conservative way.

The proposed process is single stage thermal oxidation of HFC23 (along with some carry-over of HCFC22 and air). The proposed process thermally oxidises HFC23 at around 1,250°C in an oxidation chamber (furnace). As HFC23 has a comparatively low calorific value, a small quantity of natural gas / any other fuel, as supplemental fuel, along with air and steam is introduced into the oxidation chamber. The oxidation temperature of equal to or more than 1,250°C ensures that dioxins formation is prevented, when coupled with very rapid quenching.

The baseline and monitoring methodology for decomposition of HFC23 waste stream have been approved by the CDM Executive Board as AM0001ver03.

The proposed project has the applicability to the methodology AM0001ver03:

- There is no national/local regulation to restrict emission of HFC23 in Russian Federation.
- Such regulation is not expected to be introduced in the foreseeable future.
- There is definite operating history for three years from 2002 to 2004.

The exhaust gases from the proposed process for decomposition are mainly carbon dioxide and water vapour along with hydrogen fluoride and hydrogen chloride besides nitrogen and oxygen. Other gases like CO, NOx, N2O, SO2 and Dioxins also are expected to be generated but at very low levels, such that their emission is within accepted levels.

This gas stream is then cooled by direct contact with water in a cooling system, whereby acids (hydrochloric acid and hydrogen fluoride) and moisture are absorbed to produce aqueous solution. This solution is recovered and/or neutralized with slaked lime (hydrated lime) to produce calcium chloride (CaCl2) and calcium fluoride (CaF2)), which are transferred to a settling / precipitation tank where settled solids (CaF2 and CaCl2) are removed and filtrate (mother liquor) is removed as overflow. Settled solid are processed to remove water and then used as landfill for safe disposal.

A.3. Project participants:

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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 participants (Yes/No)
Russian Federation	Chimprom Company Limited.,	No
Japan	Sumitomo Corporation	No

**A.4. Technical description of the project activity:****A.4.1. Location of the project activity:**

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A.4.1.1. Host Party(ies):

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Russian Federation

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

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Volgograd State

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

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Volgograd city

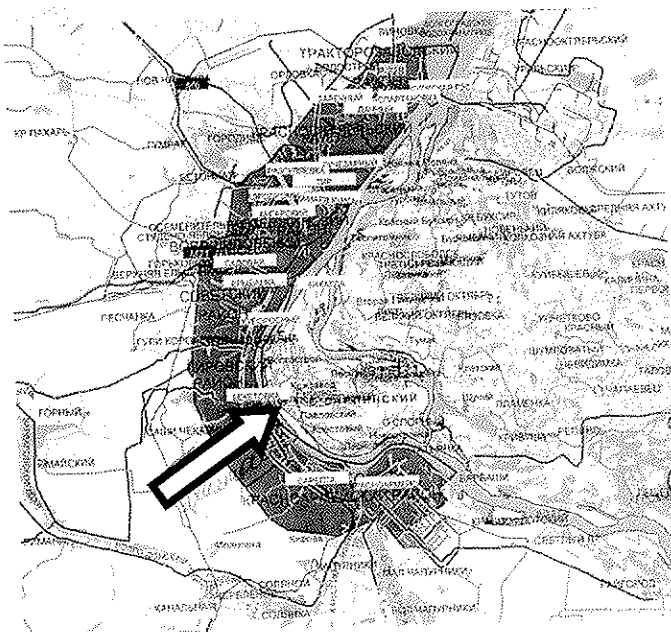
A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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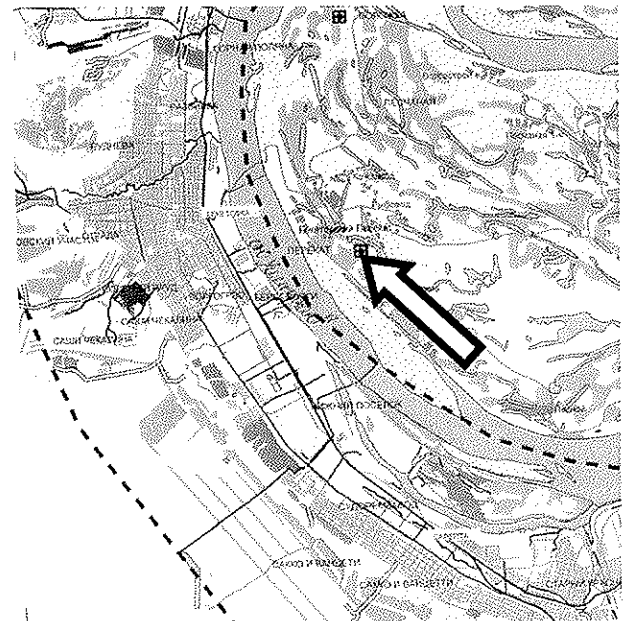
(a) Address

Chimprom Company Limited
23, Promyslovaya Str., Volgograd 400057, Russian Federation

(b) Physical Location (as described on the next page)



Map Volgograd Rev 2
Chimprom is located between “Beketobaka (Beketovka)” and “Capenta (Sarepta)”



Map Volgograd (Bigger Scale)
Location of “Chimprom”

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

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The project is principally 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:

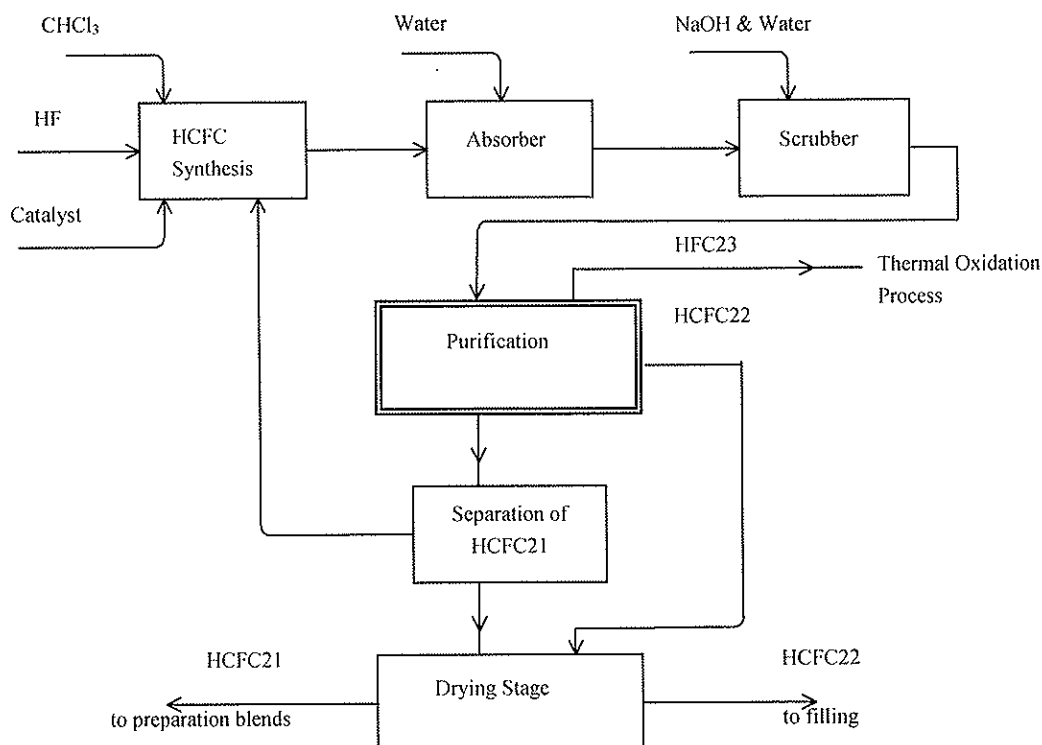
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HFC, its composition & quantity to be thermally oxidised

a) Source of HFC23

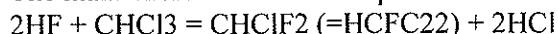
HFC23 is inevitably generated as a by-product from the production facility for HCFC22. Since there is no known market for HFC23 in Russian Federation, it is being vented into the atmosphere. A block diagram of HCFC22 production plant including the source of HFC23 emission is shown as below.

**Block Flow Diagram of HCFC22 Plant
(Source of HFC23)**

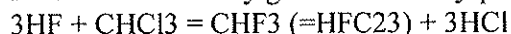




The main chemical reaction to produce HCFC22 is as follows:



HFC 23 is inevitably generated as a by-product of HCFC22 by the following reaction:



In the past, the production facility has generated HFC23 at levels of 3.1 to 3.6% of HCFC22, all of which has released to the atmosphere since there is no Russian governmental regulation on the emission of HFC23.

b) Composition of HFC stream to be thermally oxidised

The typical composition of HFC23 stream from vent of Column No 132 (within the HCFC22 plant) are given below, which could vary due to variations in the HCFC22 plant and the thermal oxidiser is designed to handle the variations:

Component	Unit	Average Range
HFC23	wt%	55-56
HCFC22	wt%	29-30
Air	wt%	13-14

Quantity of HFC23 stream to be thermally oxidised

The quantity of HFC23 stream, with composition as given in the above paragraph, to be thermally oxidized is at 3.0% of HCFC22 production (whichever lower: 3.0% or lowest ratio of last 3 calendar years) as per measurement of HCFC22 production and laboratory analysis by Gas Chromatograph (GC), regularly calibrated as per the standard calibration procedure being followed at Chimprom as given below and defined in Section D.3.

Proposed technology

The specific equipment for the project activity will be decided after complete technical scrutiny and negotiations with equipment manufacturers. The description of typical technology for the proposed thermal oxidation system is given below.

The proposed HFC23 decomposition process, Submerged Combustion Process, has been uniquely developed by Tsukishima Nittetsu Chemical Engineering Ltd.

The technology is distinguished from others by its characteristics:

- : Excellent burning of fuel to keep high oxidising temperature
- : Good turbulence by vortex burner
- : Good mixture of hot gas and waste gas
- : Stable and quick gas quenching
- : Dioxins formation is minimized
- : Excellent durability by the adoption of the fittest material



Vortex burner produces high velocity and short flame in the thermal oxidiser and it provides highly efficient oxidation of HFC23. Its decomposition rate of fluorinated organic waste is more than 99.99%, which is the maximum measuring limit by conventional gas chromatography.

Submerged combustion system produces hot gas in the thermal oxidiser and injects it in the water for direct quenching to minimize dioxins. This system was first applied to treat waste effluent from a chemical manufacturing factory in 1964. Since then, more than 300 plants have been built up using this technology all over the world. Among them, more than a dozen are for fluorinated waste decomposition. Since 1992, they have been recording successful operation in Japan, UK and so forth.

Thermal oxidiser unit

The thermal oxidiser is designed to decompose HFC23 containing organic materials, chlorine and fluorine, and to recover the mixture of hydrochloric acid and hydrofluoric acid from the combustion gas of the thermal oxidiser.

HFC23 and additional fuel gas (because of low calorific values of HFC23) are fed into the thermal oxidiser through an injector gun, and oxidized with sufficient air supplied by a combustion air blower.

In the thermal oxidiser, the organic materials are decomposed completely, and chlorine and fluorine are converted to hydrogen chloride, respectively.

The combustion gas from the thermal oxidiser introduced to the solution of the quencher, then the gas is quenched by the direct contact with the solution. And both hydrogen chloride and hydrogen fluoride included in the combustion gas are absorbed into the dilute acid solution returned from the absorber. The acid solution in the quencher is drawn out a neutralization tank via an acid cooler.

The combustion gas existing from the quencher is fed to the absorber, where hydrogen chloride and hydrogen fluoride are recovered in the form of dilute acid. The dilute acid is fed to the quencher.

The flue gas passing through the absorber is neutralized by NaOH in the scrubber, and then the gas is discharged to the atmosphere.

NaOH to neutralize hydrogen chloride and hydrogen fluoride, and the reducing agent to decompose sodium hypochlorite are supplied to the scrubber. This alkali effluent from the scrubber is discharged to neutralization tank via an effluent water cooler as effluent water.

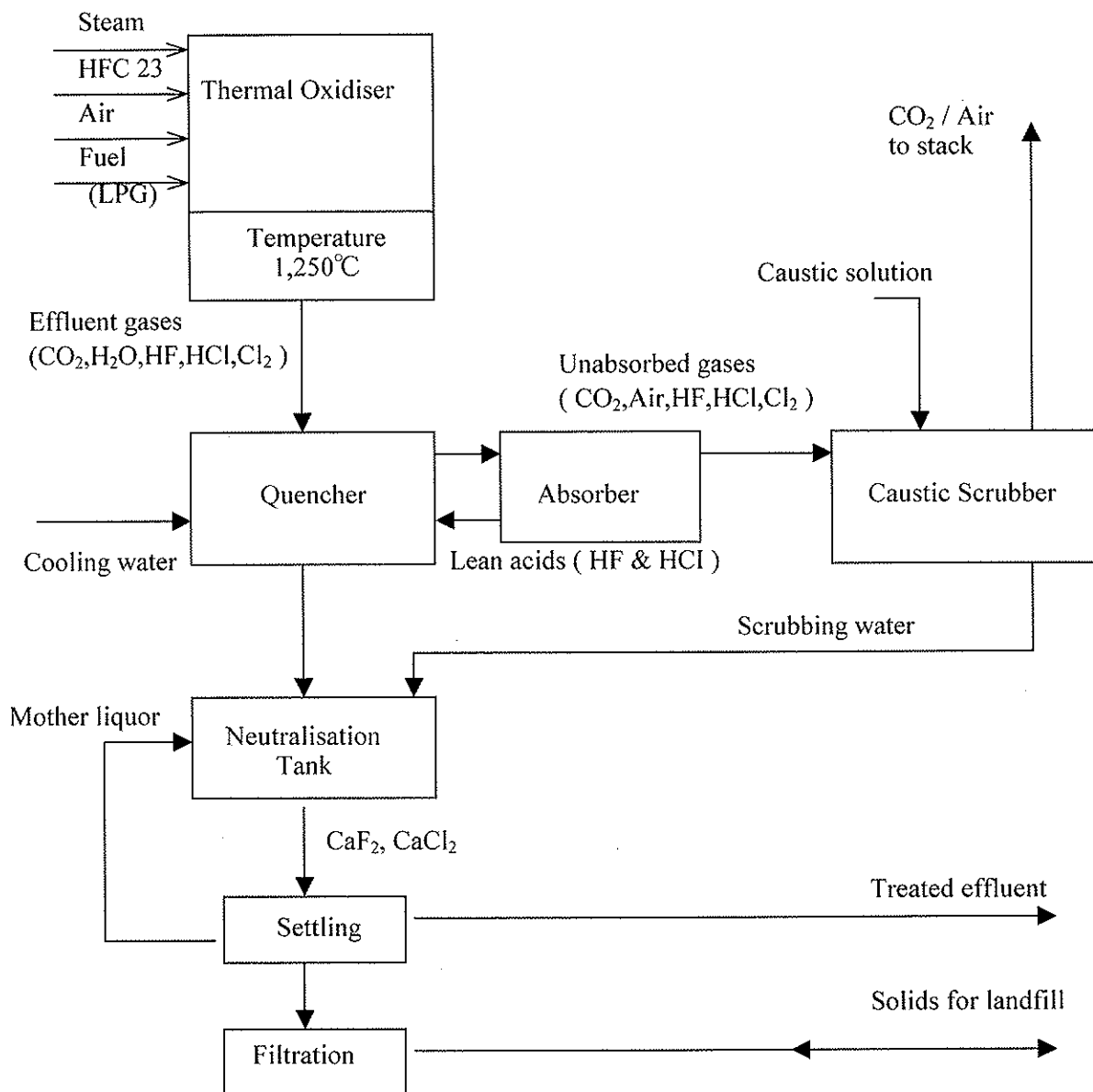
The recovered acid and the effluent water from the thermal oxidiser unit are fed to the neutralization tank where the recovered acid and the effluent water are neutralized with calcium hydroxide $\{Ca(OH)_2\}$. This neutralization yields CaF_2 and $CaCl_2$, the former precipitates as slurry due to its low solubility. This slurry (CaF_2) is separated from supernatant water and concentrated in the settling tank.

The supernatant water is discharged to the outside of the battery limit. The concentrated slurry is fed to a dehydrator where the solid is dehydrated. And the filtrated water is recycled back to the neutralization tank.

A block diagram showing the process scheme of proposed thermal oxidiser is described as below.



Block Diagram of Proposed Thermal Oxidiser



In the proposed thermal oxidation system, HFC23 gas is subjected to a very high temperature of around 1250°C to ensure almost complete decomposition of HFC23 gases and prevent formation of dioxins.

The composition and physical conditions of the HFC23 gas stream to be thermally oxidised is already defined in "Composition of HFC stream to be thermally oxidised" above in this section. The technology



proposed in this document, for the decomposition of HFC23, is a proven technology. The decomposition plant will be very reliable and capable of delivering almost complete destruction of HFC23 and HCFC22 (HCFC22 is carried over with HFC23 from the HCFC plant).

No credit is being claimed for HCFC22. Since HFC23 is non-toxic and its emissions are not regulated in Russian Federation, the installation of thermal oxidation facility is voluntary involving significant capital and operating cost. The installation, however, would bring in the following direct / indirect benefits:

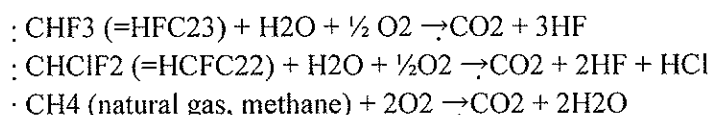
- Better environment due to significantly lower release of GHG
- Transfer of environment technology to the country
- Development of environmental technology skills in the country
- Direct and indirect employment

The process description of each section of the complete thermal oxidation facility is described below section wise.

a) Thermal oxidation chamber (furnace)

The thermal oxidation chamber is the heart of the system. Natural gas/any other fuel along with air (O₂ and N₂) and steam is fed to the thermal oxidation chamber (furnace) where natural gas/any other fuel is oxidised to carbon dioxide (CO₂) and water vapour.

HFC23 (containing low levels of HCFC22, 29-30 %) is simultaneously supplied to the thermal oxidation furnace, where it is oxidised to CO₂, HF and HCl as per the following reactions:



The purpose of firing natural gas/any other fuel is two fold, one to provide additional hydrogen and other to minimise formation of free chlorine among the combustion products.

As can be seen from the above reactions, steam, like natural gas/any other fuel, is an additional source of hydrogen and is necessary to ensure complete conversion of halogens in HFC23 and HCFC22 to the respective hydrogen halides. Steam also controls the temperature of the thermal oxidation chamber.

The thermal oxidation furnace is equipped with a versatile burner, which has multi gas injectors. This is a special burner, which is capable of burning a wide range of both types of wastes, viz., gaseous and liquids wastes with low calorific values with large variation of excess air.

The residence time is of utmost importance in the design of combustion temperature and burner and the entire operation of combustion to ensure complete combustion and at the same time not to allow stranded combustion products within the chamber, causing poor combustion and heat transfer. The oxidation chamber is designed with an optimum residence time, typically more than 2 seconds. The thermal oxidation chamber is lined with a special refractory lining to protect the shell of the chamber (furnace) from the high temperature of the combustion. The shell temperature is maintained above the acid dew point (of HF and HCl) to prevent condensation and thus acid dew point corrosion.

b) Quenching system



The high temperature combustion gas generated in the furnace (thermal oxidiser) is cooled by directly contacting with the liquid in the quencher. The quencher is installed inside down comer tube. The down comer tube is surrounded by a weir.

The combustion gas is injected into sump liquid through slits of down comer tube bottom, and runs up the well formed by the tube and weir making torrents of the liquid. The liquid overflows out of the weir, but returns to the well through slits of weir bottom. Thus injected combustion gas makes liquid circulation in the quencher.

The combustion gas vaporises great amount of the liquid and carries the vapour to the absorber. Make-up liquid containing HCl is supplied via an absorbing section.

c) Absorbing system

The absorber is packed column providing liquid circulation device. Absorbing water is supplied to the top and overflows from the bottom to the quencher, while the bottom liquid is circulated to the top of packing by a circulation pump.

Combustion gas exhausted from the quencher flows into the absorber and goes up in the packing, where almost all HF and HCl in the gas are absorbed in water coming down from the top.

d) Caustic scrubbing system

The caustic scrubbing system is installed to control emission of unabsorbed gases. This is achieved by neutralisation of residual HF, HCl and free chlorine with caustic soda solution.

The unabsorbed gases from the absorbing system pass through packed column (s). In this packed column, the unabsorbed gases flow upwards while caustic soda solution flows downwards absorbing the residual HF, HCl and any free chlorine in the gases. The packed column ensures sufficient mass transfer area between the unabsorbed gases and down coming caustic solution. The treated gases coming out of the top of the caustic scrubber carrying mist (entrained water vapours) are removed by passing these through a demister. The water drops are removed before the treated gases are discharged to the atmosphere. The used caustic solution flowing to the bottom of the scrubber bottom is continuously collected in the sump at the base of the scrubber from where major part is re-circulated to the top of the scrubber along with fresh make-up of caustic solution. A minor part joins the feed (dilute acid from quenching system) to the neutralisation tank. A pH meter is installed in the caustic solution recycle stream. The level of the liquid in the scrubber sump decides the rate at which the minor part of the used caustic solution is taken to the neutralisation tank.

e) Neutralisation and settling system

The recovered acid and the effluent water from the thermal oxidiser unit are fed to the neutralization tank where the recovered acid and the effluent water are neutralized with calcium hydroxide ($\text{Ca}(\text{OH})_2$). This neutralization yields CaF_2 and CaCl_2 , the former precipitates as slurry due to its low solubility.

This slurry (CaF_2) is separated from supernatant water and concentrated in the settling tank.

The supernatant water is discharged to the outside of the battery limit. The concentrated slurry is fed to a dehydrator, where the solid is dehydrated. And then, the filtrated water is recycled back to the neutralization tank.



f) Exhaust stack

The scrubbed gases from the caustic scrubber are discharged to atmosphere via an exhaust stack. Discharge to atmosphere is at an elevation as per local statutory regulations.

HFC23 flow rate and composition

HFC 23 flow rate is as follows.

: HFC 23: 3.0% of HCFC22 production

Composition of HFC23 stream

: Please refer to in “Composition of HFC stream to be thermally oxidised” above in this section.

Process design basis

Gas flow	Approx. 33.42Mton HFC23/year based on installed capacity of HCFC22, generation of HFC23@ 3.0% of HCFC22 production and HFC23 stream composition as mentioned above in this section A4.3 The capacity of the thermal oxidiser would be accordingly designed to meet the instantaneous capacity to take care of stoppages interruption etc.
Thermal oxidation temperature	~1,250°C
Gas residence time	More than 2 seconds

A block diagram showing the process scheme of the thermal oxidation facility is given in “Block Diagram of Proposed Thermal Oxidiser” incorporated in the aforesaid page of this section.

Products of combustion / effluents and emissions (preliminary) will be as below:

a.	Acid effluent from cooling system of the thermal oxidiser chamber to the neutralisation system	Components	HF and HCl
b.	Alkaline effluent from the caustic scrubbing system	Components	NaF / NaCl / NaOCl
c.	Flue gas temperature	79°C	
d.	Flue gas composition at stack (typical)		
	Main components	N2	46-47 % Vol.
		O2	4.5 - 5 % Vol.
		CO2	4-4.5 % Vol.
	Others	HF	≤3 ppm



	HCl	≤ 5 ppm
	CO	≤ 50 ppm
	NOx (as NO ₂)	≤ 200 ppm
	Dioxins	≤ 0.1 ng-TEQ/Nm ³
	Dust	50 mg/Nm ³

The thermal oxidation system based on best available technology results in an emission at the discharge of stack that meets the above criterion (giving other components in flue gases), which is also in accordance with the standard of Russian Federation.

Combustion efficiency

A combustion efficiency of more than 99.99% with regard to destruction/oxidation of HFC23 and related halogenated hydrocarbons is achieved in the proposed thermal oxidation system. The system employs an excellent burner system, where very high combustion efficiency is achieved through the special burner design and the combustion chamber (furnace) of the burner. Air is introduced tangential to the air compartment of the burner. The internal of the air compartment of the burner is so designed that it imparts a whirling motion to the combustion air. This also compresses the combustion air by the time it is ready to exit the air compartment. When the combustion air exits the air compartment and enters the combustion chamber through a nozzle placed centrally, it expands. Natural gas and HFC 23 are fed through the inlet to the combustion chamber placed along its axis. The inlet also terminates at around the centre of the combustion chamber.

There is an intense mixing of HFC23, natural gas and air due to latter's expansion and burning of the mixture at the centre of the combustion chamber. The mixture of HFC23, natural gas and air is ignited at the tip of the nozzle, due to the prevailing temperatures (1,250°C). At the start of the thermal oxidation chamber, a pilot burner is used to ignite the mixture (or natural gas alone).

The burning mixture expands into the chamber, which causes a pressure drop at the centre of the chamber. This pressure drop creates a rush of combustion mixture towards the centre thereby causing an intense mixing of HFC23, natural gas and air, and results in a highly efficient and clean combustion.

Collection, storage & transportation of HFCs

As shown in figure "Monitoring Plan" in section D.1, HFC23 (typically along with 7-8% of HCFC22 and 1-2% Air) is emitted from the vent of Column No.132 of the HCFC22 plant, during purification of HCFC22. Presently, Chimprom is implementing a project for recovery of Anhydrous Hydrofluoric Acid (AHF) from by-product Hydrochloric Acid (HCl) and also to enhance the quality of HCl gas. Because of this project, HFC23 route within the plant will be through the AHF recovery equipment but will ultimately be emitted from the vent of Column No.132 in the HCFC22 plant, as at present.

A provision to store HFC23 in a buffer tank within the Project Activity is being proposed, from where it can be pumped directly to the thermal oxidiser via a flow meter.

Material of construction

The thermal oxidation system produces highly corrosive products through combustion. The system uses special materials like high Cr-Mo steel or composite materials like Hastelloy, where high temperature



and corrosion conditions exist. Wherever ambient temperatures exist, use of plastics like FRP or PP is made.

Technology transfer

The Japan-imported equipment and facility will be installed and operated at the site of Chimprom when approved and demonstrate the state-of-the-art technology. Also operating know-how will be transferred to project participant by training staffs and workers to operate and maintain equipment and facility. It will incline other HCFC22 producers in Russian Federation to introduce such technology, which contribute to improvement of technology level in the country.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

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If the proposed thermal oxidation facility were not installed, all of HFC23 would continue to be emitted to the atmosphere, as there is no capture or storage facility and no HFC23 has been captured for sale. HFC23 has a GWP of 11,700, while on decomposition the principal GHG shall be CO₂, which has a GWP of 1. The proposed thermal oxidation facility would result in almost complete destruction of HFC23 and therefore reduction in the emission of HFC23. This results in conversion of high GWP emission to low GWP emission resulting in GHG emission reduction. The net reduction in emission of GHG from the existing Chimprom's complex would be an amount equal to the quantity of HFC23 actually oxidised thermally minus GHG emissions caused by the Project Activity.

The carbon dioxide equivalence of the HFCs is given by "quantity of decomposed HFCs multiplied by the GWP associated with that HFC". This relationship will be used to calculate the reduction in GHG emission by the installation of thermal oxidation facility. The quantity of HFC decomposed can be monitored on regular and continuous basis.

The 'Additionality criteria' from environmental angle of GHG emission reduction is well demonstrated by the introduction of this new technology of thermal oxidation of HFC23 to reduce GHG emissions in the plant.

Considering that there is no regulation on emission of HFC 23 in Russian Federation, it would be correct to adopt the baseline condition as that condition where the entire HFC23 is being vented to the atmosphere and calculate the total estimate of anticipated reduction in the CO₂ (Carbon Dioxide) equivalent. This anticipated reduction will be based on the quantity of HFC thermally oxidised.

Further, it may be noted that under the Montreal Protocol with its amendments, the phase out regulation for HCFC22 production in industrialized countries is set out for the year 2020. This implies that HCFC22 can be produced in Russian Federation till the year 2020. In other words, HFC23, a by-product generated in the production of HCFC22 may also be produced and emitted to the atmosphere till the year 2020.

Lowest of the three production ratios of HFC23, as a by-product of HCFC22, divided by the production of main product, HCFC22 for the last three (3) years at Chimprom can be used to establish a production norm for HFC23, called the cut-off rate. Fixing of cut-off rate ensures a cap on the decomposition of



HFC23 and therefore avoids unfair benefits of obtaining credit by decomposing extra HFC23 than the cut-off rate of HFC23. This would also ensure that HCFC 22 plant is run at its best efficiency.

The international norm of HFC23 generation is 3-4% of HFC23 / HCFC22 production against which the value in Chimprom is 3.1 – 3.6% in the past three years.

The ratio of generation of HFC23 to HCFC22 based on laboratory analysis of and measurement of HCFC22 production, for the last 3 years is summarised in 3.1% for 2002, 3.2% for 2003 and 3.6% for 2004. The generation norm 3.0% is conservative enough as confirmed by recent measurements using a mass flow meter.

The thermal oxidation, which would result in reduction in GHG such as HFC23, releases other GHGs such as CO₂, which would be emitted by the thermal oxidation of HFCs and burning of fuel in thermal oxidiser, directly (due to thermal oxidation process) or in-directly (leakages) in production of electric power, steam, caustic soda, hydrated lime etc. A list of all possible emissions from the project activity is given below.

Due to thermal oxidation (Direct)	: HFC23 leakage, i.e., release of un-decomposed HFC23 from the thermal oxidation system
	: CO ₂ emission due to oxidation (burning) of HFC23.
	: CO ₂ emission due to oxidation (burning) of natural gas.
Leakages (Indirect)	: CO ₂ emission due to generation of that quantity of power that is consumed by the system.
	: CO ₂ emission due to generation of that quantity of steam that is consumed by the system.
	: CO ₂ emission due to production of that quantity of hydrated lime that is consumed by the system.
	: CO ₂ emission due to production of that quantity of caustic soda that is consumed by the system. This only includes equivalent CO ₂ to the energy consumed by the caustic soda plant.
	: CO ₂ emission due to disposal of solid waste.

Process water, cooling water, effluent treatment cum water recovery plant, solid waste treatment and compressed air system are part of the thermal oxidation system. CO₂ emission from these facilities is equivalent to the power consumed in operating these facilities.

Hence, CO₂ equivalent of power consumed to operate these systems will be calculated based on the power consumed by these units and the same is clubbed with the total power requirement of the project activity, i.e., the thermal oxidation system.

No other reagents or chemicals, other than those described above are used in the thermal oxidation system. No component of the system is a consumable, consumption of which would produce CO₂ on regular basis. These are the only emission sources from the Project Activity emitting CO₂. The emission due to these GHG is subtracted from the reduction in emission due to thermal oxidation of HFC23.

A.4.4.1.	Estimated amount of emission reductions over the chosen crediting period:
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Years	Annual estimation of emission reductions in tonnes of CO ₂ e
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2008	390,563
2009	390,563
2010	390,563
2011	390,563
2012	390,563
2013	390,563
2014	390,563
2015	390,563
2016	390,563
2017	390,563
Total estimated reductions (ton of CO ₂)	3,905,630
Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (ton of CO ₂)	390,563

A.4.5. Public funding of the project activity:

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The project is proposed to be financed by the project sponsors, who propose to undertake the JI Project Activity as the project proponent. No public funding is envisaged.

SECTION B. Application of a baseline methodology**B.1. Title and reference of the approved baseline methodology applied to the project activity:**

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Approved methodology AM0001ver03 – Incineration of HFC23 waste streams.

This is a revised baseline methodology/version 03 approved by the 19th CDM EB, in effective as of 13 May 2005. For more detail, please refer to the UNFCCC web site:
<http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

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The applicability conditions of AM0001ver03 “Incineration of HFC23 waste streams” are as follows:

This methodology is applicable to HFC23 (CHF₃) waste streams from an existing HCFC22 production facility with at least three (3) years of operating history between beginning of the year 2002 and the end of the year 2004 where the project activity occurs and where no regulation requires the destruction of the total amount of HFC23 waste.

This baseline methodology shall be used in conjunction with the approved monitoring methodology AM0001ver03 (“Incineration of HFC23 waste streams”).



The proposed project fully meets the applicability conditions of the AM0001 mentioned above without any deviations. The justification of choice and the reason of applicability to the methodology AM0001 are as follows for the proposed project:

- (a) There are no regulations in Russian Federation on the production of HCFC22, the main product of Chimprom. Also, there are no restrictions on production of HFC23 being a by-product of HCFC22.
So far, there are no regulations in Russian Federation applicable to the emission of HFC23.
- (b) The technology and process for destruction of HFC23 to be adopted in the proposed project as described in section A.4.3 is exactly similar to the one described in AM0001 “Incineration of HFC23 waste streams”.
- (c) The existing HCFC22 production facility of Chimprom has been in position of successive operation since 2002, and has been archiving at least three (3) years of operating history between 2002 and 2004. Such data of annual HCFC22 production are 1,114tonnes for 2002, 1,100tonnes for 2003 and 1,050tonnes for 2004, sourced by the yearly production report of Chimprom.
In compliance with the requirement of the approved methodology AM0001ver03 – Incineration of HFC23 waste streams, the maximum historical annual production level of HCFC22 at Chimprom plant shall be determined in 1,114 tonnes/year for 2002.
- (d) The cut-off rate shall be determined by the waste generation rate (HFC23/HCFC22) archived for three (3) most recent years through the operation of originated plant of Chimprom. The waste generation rate (HFC23/HCFC22) archived for three (3) most recent years are 3.1% for 2002, 3.2% for 2003 and 3.6% for 2004. These values of waste generation rate (HFC23/HCFC22) mentioned above have already been made correction with the concentration of waste stream. The cut-off rate for the proposed project is set 3.0%, since the HFC23/HCFC22 ratio for the most recent 3 years (2002, 2003 and 2004) achieved by Chimprom are more than 3.0% of upper limit defined in the baseline methodology AM0001ver03.
The cut-off rate is found to be 3.0 % i.e., 3.0kg of HFC23 per 100kg kg of HCFC22.

Therefore, it can be justified that the approved methodology AM0001ver03 is applicable to the proposed project activity.

B.2. Description of how the methodology is applied in the context of the project activity:

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The proposed project is almost same as the one described in the approved methodology AM0001ver03 “Incineration of HFC23 waste streams” and satisfies the applicability conditions as per mentioned in section B.1. Thus, the baseline methodology and the formula for calculation of emission reductions in the approved AM0001ver03 have been applied to the proposed project without modification.

Outline

In accordance with the approved methodology, it is applied by measuring the actual amount of HFC23 fed into the oxidizer. HFC23 is a by-product in the production of HCFC22 from Chloroform and HF. At present, the waste stream of HFC23 (typically consisting of 55-56% HFC23, 29-30% of HCFC22 and balance air) is the only feed for the proposed thermal oxidation system.



The amount of HFC23 fed to the thermal oxidation system is measured at the point of entry into the oxidiser. It is easier to monitor and measure the feed to the thermal oxidizing system, and calculate the equivalent CO₂ emission.

As the feed is a mixture of HFC23 – 55-56%, HCFC22 – 29-30% and Air – 13-14%, the composition of HFC23 stream will also be monitored so that credit is claimed only for HFC23 and not for HCFC22 or air, which are part of HFC23 stream.

Though the approved methodology AM0001ver03 adopts a formula where the cut off rate on the baseline emissions of HFC23 is calculated as “HCFC22 production in that year × cut-off rate HFC23 average yearly sales volume from the year 2002 to the year 2004”, to the best of knowledge, there is no known market that we are aware of for HFC23 in Russian Federation and hence the cut-off value on the baseline emission is calculated as ‘HCFC22 production x cut-off rate’.

Emission Reductions

The greenhouse gas (GHG) emission reduction, E_R , achieved by the proposed project for a given year is equal to the quantity of HFC23, Q_{HFC23} , from HCFC22 production facility destroyed by the project activity less the baseline HFC23 destruction, $Q_{BL\ HFC23}$, during that year multiplied by the Global Warming Potential (GWP) value for HFC23 less the GHG emissions generated by the thermal oxidation process, E_{TOP} , less GHG leakage, E_L , due to the thermal oxidation process, as per the equation given below:

$$E_R = (Q_{HFC23} - Q_{BL\ HFC23}) \times GWP_{HFC23} - E_P \text{ (where } E_P = E_{TOP} + E_L \text{)}$$

Abbreviation:

GHG emission reduction measured in tonnes of CO ₂ equivalent	: E_R
Quantity of waste HFC23, in metric tonnes, destroyed during the year measured	: Q_{HFC23}
Baseline quantity of HFC23, in metric tonnes, destroyed during the year	: $Q_{BL\ HFC23}$
Sum of GHG emissions due to thermal oxidation process and leakages in metric of CO ₂ equivalent	: E_P
GHG emissions (project emissions) due to thermal oxidation process in metric of CO ₂ equivalent	: E_{TOP}
GHG emissions due to GHG leakages, in metric tonnes of CO ₂ equivalent	: E_L
Global warming potential	: GWP

The Global Warming Potential (GWP) converts 1 tonne of HFC23 to tonnes of CO₂ equivalents (tonnes CO₂e/tonnes HFC23). The Global Warming Potential value for HFC23 is 11,700 tonnes CO₂/tonne HFC23.

The thermal oxidation process uses fuel (natural gas), steam, electric power, caustic soda and hydrated lime. The steam and electric power would be purchased from the existing facilities at external complex and hence the emissions associated with steam and electric power are included in the leakage calculations. Similarly emissions associated with caustic soda and hydrated lime is included in the



leakage calculations, as these will also be purchased. The emissions due to thermal oxidation process, E_{TOP} , are the emissions due to the use of natural gas (CO₂ released due to burning of natural gas), the emissions due to HFC23 not destroyed and GHG emissions of the thermal oxidation process (CO₂ released due to burning of HFC23). This can be written as:

$$E_{TOP} = Q_{HFC23} \times F_{HFC23\ NO} \times GWP_{HFC23} + Q_{HFC23} \times F_{HFC23} + Q_{natural\ gas} \times F_{natural\ gas}$$

Fraction of HFC23 not thermally oxidised by the oxidiser	: $F_{HFC23\ NO}$
GWP of HFC23	: GWP_{HFC23}
Emission factor for thermal oxidation of HFC23	: F_{HFC23}
Quantity of natural gas used for thermal oxidation during the year, measured in M3	: $Q_{natural\ gas}$
Emission factor for burning of natural gas	: $F_{natural\ gas}$

Though the fraction of HFC23 not destroyed is typically very small (0.01% as per guaranteed combustion efficiency of 99.99%), the monitoring plan provides for its periodic measurement at stack. Though HFC23 can also leak to atmosphere through water, but the possibility is infinitesimally small and ignored as per AM0001.

Baseline

The baseline quantity of HFC23 destroyed is the quantity of the HFC23 waste stream required to be destroyed by the applicable regulations. The quantity of HFC23 required destruction by the applicable regulations is:

$$Q_{BL\ HFC23} = Q_{HFC23} \times Z_y$$

Abbreviation:

Quantity of waste HFC23, in metric tonnes, destroyed during the year measured	: Q_{HFC23}
Fraction of waste stream, HFC23, required to be destroyed by the regulations of the country that apply during the year y	: Z_y

In the absence of any regulations requiring destruction of HFC23 waste, Z_y for Russian Federation = 0 and HFC23 waste is typically released to the atmosphere. Hence the baseline destruction ($Q_{BL\ HFC23}$) for this project is 0.

In order to exclude the unfair practice of manipulating the production to increase the quantity of waste HFC23 to be destroyed, the quantity of HFC23 waste (Q_{HFC23}) is limited to cut-off rate of actual HCFC production during the year at the originated plant.

Q_{HFC23} : if $Q_{HFC23} < \% \text{ Cut-off Rate} \times Q_{HCFC22}$ production in that year or

$Q_{HFC23} = \% \text{ Cut-off Rate} \times Q_{HCFC22}$: if $Q_{HFC23} > \% \text{ Cut-off Rate} \times Q_{HCFC22}$

The amount of Q_{HCFC22} is limited to the maximum historical annual production level at the plant (in tonnes of HCFC22) during any of the last three (3) years between 2002 and 2004.



The fraction of HFC23/HCFC22 can be calculated as the average 3.29% for recent three years based on the cumulative data collected in Chimprom plant. Therefore, the Cut-off rate must be defined in 3.0%, according to the approved methodology AM0001ver03.

As mentioned in B.1 of this PDD, in accordance with the approved methodology AM0001ver03, the maximum historical annual production quantity of HCFC22 at Chimprom plant shall be defined in 1,114 ton/year for 2002.

Leakages

Leakage is emissions of GHGs due to the project activity that occur outside the project boundary. The sources of leakages due to the thermal oxidation process are the following:

- a) GHG (CO₂ and N₂O) emissions associated with the production of purchased electric power and steam.
- b) CO₂ emissions due to transport of solids for safe disposal to landfills.

In case of this Chimprom project, the quantity of sludge waste to be disposed is assumed in 300~400ton/year on wet basis. However, the landfill area of disposal is closely located in about one (1) km from the solid treatment plant within the same factory of Chimprom. Hence, CO₂ emissions due to transport of solid for safe disposal is very small and negligible amount compared with the other emissions.

Aside from the quantity of a) & b) mentioned above, CO₂ emissions associated with the production of caustic soda and hydrated lime are occurred outside the project boundary. However those CO₂ emissions are also negligible small compared with the other emissions.

Therefore, the leakage occurred outside the project boundary is shown by the following equation.

$$EL = Q_{\text{Power}} \times F_{\text{Power}} + Q_{\text{Steam}} \times F_{\text{Steam}}$$

Where Q_{power} and Q_{steam} are the quantities of electric power & steam, respectively used for thermal oxidation and F_{power} & F_{steam} are their GHG emission factors.

B.3. 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:
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Since Russian Federation has no regulation, which requires limiting the emission of HFC23, the thermal decomposition facility is not required to install. In the absence of installation of the facility, HFC23 is being released to the atmosphere. With the JI project activity a high GWP gas is destroyed resulting in net GHG emission reduction.

The additionality criteria is clearly demonstrated by the economic/financial/investment barrier due to installation of the facility. In the absence of a regulatory requirement or financial/economic incentive, there is no rationale for implementation of the project barring the desire to contribute to mitigation of climate change impacts.

The additionality of the proposed project activity could be demonstrated and assessed by "Tool for demonstration and assessment of additionality (version 2)" provided by CDM EB 22 Report. This tool provides for a step by step approach that can be applied as following.

**Step 0. Preliminary screening based on the starting date of the project activity**

The Marrakesh Accords and decision 18/CP.9 provide guidance on the eligibility of a proposed JI project activity which started before registration.

However, this proposed project is not expected to start before its registration, and thus this eligibility check (Step 0) is not applicable.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations**Sub-step 1a. Define alternatives to the project activity:**

Chimprom has been having the production of HCFC22 as an alternate to CFC12 for almost 4 years since 2001 after abandon of CFC12 production in 2000. Under these circumstances, the project participants identify the plausible and credible alternatives available to Chimprom other than the proposed project activity as follows:

- a) The Alternative 1 is that all HFC23 associated with the production of HCFC22 are released to the atmosphere without destruction. Because there will be still no regulations in Russian Federation near future Alternative 1: Continuation of the current situation
- b) The Alternative 2 is that HFC23 is collected and used as raw materials for other chemical products.
However, these alternatives are not plausible or credible in reality, because there is no market demand for HFC23 in Russian Federation Alternative 2
- c) The Alternative 3 is that a certain quantity of HFC23 is captured and destroyed by using the facility same as the thermal oxidiser, but not as JI project.
However, Chimprom does not have economic incentive to collect and destroy HFC23 unless such activity is approved as JI, because of no regulatory requirement in Russian Federation Alternative 3

Sub-step 1b. Enforcement of applicable laws and regulations:

The above three Alternative are in compliance with currently enforceable Russian Federation laws and regulations. There are no applicable legal and regulatory requirements in Russian Federation to limit, capture or destroy HFC23 gas, so the continuation of the current situation is the realistic and credible alternatives to the project activity that can be the baseline scenario.

Step 3. Barrier analysis**Sub-step 3a; Identify barriers that would prevent the implementation of type of the proposed project activity:**

The proposed project activity has clear investment and technological barriers. These barriers prevent the proposed project activity if it is not registered as a JI activity.



a) Investment barrier

Chimprom is an integrated chemical company in Russian Federation and is engaged in many development activities and has many investment and businesses. The proposed project requires substantial investment and operating expenses.

Unless it is registered as JI project and is accessible to international capital markets, such investment and related risk exceeds the corporate guideline of Chimprom.

Currently, the foreign companies that cooperate with Chimprom for the proposed project are Sumitomo Corporation and the Kansai Electric Company Ltd. These companies intend to participate in the project but are unable to share the risk unless the project is registered as JI and ERU are issued.

b) Technological barrier

There are no technical providers adequate for this project and the Project Participants in Japan are expected to provide the plant and equipment. As there is no precedent in Russian Federation, the project faces a series of technological barriers from procurement of equipment, erection, test run to operation of the plant. Furthermore, the project lacks opportunities to train personnel for operation and maintenance of the facility. Without any special consideration, Chimprom would not invest in the project. However, if JI scheme can be introduced, the profit associated with ERU will enable the participants to proceed to the investment.

c) Barriers due to prevailing practice

The thermal oxidiser for HFC23 destruction is the first of its kind and the unique facility, which has not entered into operation in Russian Federation. Chimprom is unable to implement the project by itself without foreign co-operators, financial support, technical support and/or purchase of ERU.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

The barriers identified at Sub-step 3a clearly do not prevent Alternative 1 from its implementation. So, the Alternative 1 is viable alternative.

Hence this barrier analysis firmly assures additionality of the proposed project activity.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activity similar to the proposed project activity:

In Russian Federation, there is no example of implementation of projects similar to the proposed project.

Sub-step 4b. Discuss any similar options that are occurring:

All similar project activities in Russian Federation, without exception, are facing investment and technological barriers same as claimed in above Step 3, and are trying to overcome such difficulties by applying JI scheme to their projects. Hence it has been demonstrated that HFC23 decomposition projects in Russian Federation commonly have additionality and they will not be implemented without JI application in Russian Federation.

**Step 5. Impact of JI Agreement**

The proposed project activity will be able to overcome barriers shown in Sub-step 3a, after it is registered as JI project, particularly as the sales proceeds of ERU will dramatically improve Chimprom's project risk profile.

The above application of the "Tool for the demonstration and assessment of additionality" shows that the proposed project activity is additional.

That is, in absence of regulations to restrict HFC23 emissions in Russian Federation, all HFC23 that is not recovered for sale in the case of Chimprom, is assumed to be released to the atmosphere. And as no HFC23 is recovered for sale as described in above Sub-step 1a, all HFC23 generated by Chimprom will be counted as emission in the baseline scenario.

With regard to "the description of the project scenario", it is also described in section B.2 that the project activity will destroy all HFC23 generated within the project boundary with negligible small GHG emission by leaking little quantity of HFC23 undestroyed and by emitting small amount of carbon dioxide as a result of incineration.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

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In the approved methodology, the approved project boundary definition is the same that has directly been applied herein. The application of applying the Project Boundary is very clearly explained in section B.2. The facility to decompose the HFC 23, which starts from the Column 132 vent (in the HCFC22 plant) for HFC23 and includes the following:

- : HFC23 at the inlet of HFC23 tank located in the Project Activity.
- : Flue gas discharge at the outlet of stack.
- : Hydrated lime, caustic soda, electric power, steam and raw water at the battery limit of the thermal oxidation system.
- : Dried solids after dryer .
- : Recovered water from water recovery / effluent treatment plant.
- : Air compressor.

The boundaries exist physically on hardware and are clearly defined for each input and output of the project activity. The boundaries, therefore, are not subject to change within the scope of this JI project and will not be different for the baseline methodology and actual operation.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

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Date of completing the final draft of this baseline study (DD / MM / YYYY): 15 / 12 / 2005

Name of person/entity that determined the baseline:

Name: Hiroshi Eguchi

Title: Manager



Company: Sumitomo Corporation (Project Participant)
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Daikin Corporation and Tsukishima Nittetsu Chemical Engineering Ltd. have assisted the Project Participants in developing the Project Design Document and designed the project in order to be compatible with Host Government Approval criteria.

**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:**

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The emission reductions from the Project Activity are expected to commence by January 2008, i.e., about twelve months from the registration of the Project.

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

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15 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:**

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Not opted for

C.2.1.2. Length of the first crediting period:

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Not opted for

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

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01/01 /2008

The starting date of the first crediting period would be the date of commissioning of the thermal oxidation system expected to be by 1st January 2008 (assuming project registration by the end of December 2006)

C.2.2.2. Length:

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10 years

SECTION D. Application of a monitoring methodology and plan**D.1. Name and reference of approved monitoring methodology applied to the project activity:**

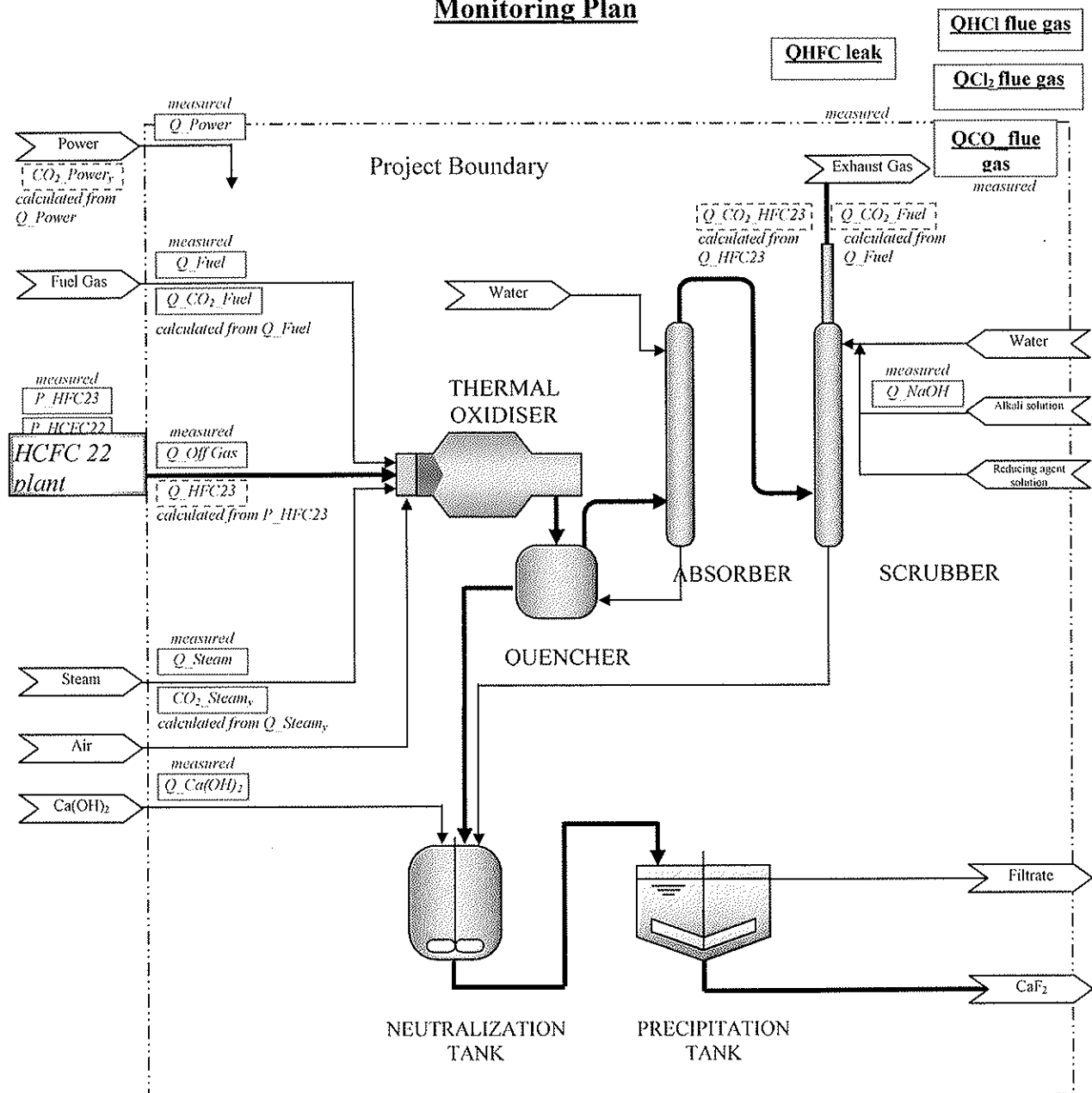
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Approved methodology AM0001 – Incineration of HFC 23 waste streams.



This is a revised monitoring methodology/version 03 approved by the 19th CDM EB, in effective as of 13 May 2005. For more detail, please refer to the UNFCCC web site:
<http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

Monitoring Plan





Monitoring Methodology

The monitoring methodology is same as 'Approved Monitoring Methodology AM0001' for 'Incineration of HFC23 Waste Streams' for Ulsan Chemical Co. Ltd, Korea.

The monitoring methodology is based on direct and continuous measurement of the actual amount of HFC23 destroyed and of the energy used by the thermal oxidiser process as shown above in the Figure "Monitoring Plan".

This monitoring methodology provides for direct and continuous measurement of the actual quantity HFC23 destroyed, as well as the quantities of electricity, steam and fossil fuel (natural gas) used by the thermal oxidiser process.

Since the emission reductions are dominated by the amount of HFC23 destroyed, the correct measurement of HFC23 is very important. To measure accurately the quantity, two (2) mass flow meters, in series but read simultaneously, each of which is recalibrated weekly, are employed.

Where the flowmeter readings differ by greater than twice their claimed accuracy (for example 10% if the accuracy is claimed to be $\pm 5\%$) then the reaction 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 HFC23 waste flows.

Other factors in the monitoring process for quantity control are:

- a) Purity of HFC23 waste stream is checked monthly by sample using gas chromatograph. 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.
- b) Amount of waste generated. The output of HFC23 from the HCFC22 plant will be checked yearly by comparing the amount of HCFC22 produced to the sum of the recovered for sales and HFC23 decomposed.

The quantities of gaseous effluents (CO, HCl, HF, Cl₂, Dioxin and NO_x) and liquid effluents (pH, COD, BOD, normal hexane extraction, SS, phenol), and metals (Cu, Zn, Mn & Cr), if any, are measured every six months to ensure compliance with local environmental regulations.

The baseline methodology and the formulae for calculation of GHG emission reduction were described in section B of this PDD. The formulae derived for the calculation of baseline emission was:

$$E_B = Q_{HFC23} \times GWP_{HFC23}, \text{ if } Q_{HFC23} < \% \text{ Cut-off} \times Q_{HCFC22} \text{ production } (=0.03 \times 1,114\text{t/y})$$
$$E_B = \% \text{ Cut-off} \times Q_{HCFC22} \times GWP_{HFC23}, \text{ where } Q_{HFC23} > \% \text{ Cut-off} \times Q_{HCFC22} (=0.03 \times 1,114\text{t/y})$$

Baseline Emission due to project activity

$$E_B = Q_{HFC23} \times GWP_{HFC23}$$

Equation 1

The Baseline Methodology assumes that the HFC23, being released to atmosphere at present, will be completely oxidised in the Thermal Oxidation system. When HFC23 is oxidised in the Thermal



Oxidation system, there will be GHG emissions due to Thermal Oxidation Process (direct) from within the battery limit (B/L) of the system and leakages (indirect emission due to thermal oxidation process) from outside the battery limit of the system.

The actual reduction in emission due to oxidation of HFC23 in the thermal oxidation system can be calculated by the following formula: These are explained as below:

$$\text{Actual Emission Reduction} = \text{Baseline Emission} - \text{Sum of GHG emissions due to thermal oxidation process and leakages.}$$

Example of GHG emissions due to thermal oxidation process are CO₂ released due to oxidation (burning) of HFC23 and fuel in the thermal oxidiser and un-oxidised HFC23 in flue gases while leakages GHG emission are due to CO₂ released outside the project boundary in generating electric power and steam, which are consumed by the project activity and CO₂ released due to generation of energy for and otherwise in production of hydrated lime and caustic soda, which are used by the project activity.

As already explained in Section B, process water, cooling water, compressed air, effluent treatment and solid waste treatment will be required within the thermal oxidation system and CO₂ emission on account of these activities because of power consumption in these units has been clubbed with the power requirement of the thermal oxidation system. An exhaustive list covering all possible and measurable quantities are listed below. The detailed equations are given in section E:

Thermal Oxidation Process (Direct)	<ul style="list-style-type: none"> : Release of un-decomposed HFC23 from the thermal oxidation system. : CO₂ emission due to oxidation (burning) of HFC23. : CO₂ emission due to oxidation (burning) of natural gas (fuel)
Leakage (Indirect)	<ul style="list-style-type: none"> : CO₂ emission due to generation of that quantity of power that is consumed by the system including power consumed in operating water treatment plant, cooling water system, air compressor and effluent treatment plant. : CO₂ emission due to generation of that quantity of steam that is consumed by the system. : CO₂ emission due to production of that quantity of hydrated lime that is consumed by the system. : CO₂ emission due to production of that quantity of caustic soda that is consumed by the system. This only includes equivalent CO₂ to the energy consumed by the caustic soda plant. : CO₂ emission due to disposal of solid waste.

Other factors

The above equation has been derived on the following basis:

- a) Regulation on emission of HFC23 in Russian Federation.
At present, there are no regulations on emission of HFC23 and hence the fraction of waste HFC23, Z_y, to be destroyed has been taken as '0'.



- b) HFC23 is produced at more than the normal rate of by-production, in which case the cut-off rate will apply. HFC23 forms as a by-product in the production of HCFC22, the main product. Though HCFC22 plant envisages minimum production of HFC23 yet, a certain quantity of HFC23 is always produced.

The IPCC GHG Inventory Good Practice Guidance Report sets the cut-off rate for HFC23 production as a by-product of HCFC22 as 4% (always expressed as percentage of HCFC22 production). While the average% achieved at Chimprom in most recent three years is 3.29 % as described in A.2, the upper limit of HFC23 to be counted for the project is restrained in 3.0% of HCFC22 production. Therefore the amount of HFC23 to be oxidized in the project activity will be equivalent to 3.0% of HCFC22 production in that year.

Therefore, no credit will be allowed for amounts of HFC23 produced and thermally oxidised at value more than the cut-off rate. The method for calculating the cut-off rate is explained in section B of this PDD. Since Chimprom does not sell any HFC23 and to best of our knowledge there is no known market for HFC23 in Russian Federation. Hence, there is no difference between the production and quantity that is thermally oxidised.

Other products/effluents from thermal oxidation system

- a) Solid
Solids (CaF₂ and CaCl₂) obtained after the settling/precipitation tank, filter and dryer are solidified by cement for safe disposal.
- b) Liquid effluents
Bleed stream of aqueous effluent from the bottom of caustic scrubber and filtrate from the solid precipitation tank are the liquid effluents, which will be treated before discharge, if any, to meet the national and local discharge regulations.
- c) Flue gas
The main components of flue gas coming out of the top of caustic scrubber are CO₂ and Nitrogen. The flue gas also contains CO, HF, HCl, Cl₂, NO_x and traces of dioxins formed as a result of high temperature oxidation of halogenated, nitrogen and other hydrocarbons.

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:
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In accordance with the applicability conditions of approved monitoring methodology AM0001 ver03, this methodology can be applicable to HFC23 waste streams from an existing HCFC22 production facility with at least three (3) years of operating history between the beginning of 2000 and the end of 2004. The proposed project activity is planned where no regulation requires the destruction of HFC23 waste.

The proposed project completely meets the requirement of applicability conditions of the AM0001 with the following reasons:



- a) HFC23 thermal oxidation process to be adopted by the proposed project is in line with the project activities planned by the AM0001 in Ulsan, Korea, laid aside the usage of fossil fuel and supply of steam.
- b) The proposed project is planned at the existing HCFC22 production facility in Chimprom , which has the operating data for at least three (3) years from the beginning of 2002 to the end of 2004.
- c) In Russian Federation, no regulation has required the destruction of the amount of HFC23 waste in the past.
- d) This monitoring methodology is applied in conjunction with the approved baseline methodology AM0001ver03 “Incineration of HFC23 waste streams”

Therefore, it has been justified that the monitoring methodology AM0001ver03 can be applied to the proposed project.

**D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario**

Not applicable

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number (Please use numbers to ease cross-referencing to D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂

equ.)

>>

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

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D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Note1: This section D.2.2 of the CDM PDD template-version 02 does not have the same format as stipulated in the approved monitoring methodology AM0001ver03 to collect and archive necessary data. Hence, the category of the approved monitoring methodology AM0001ver03 is partly modified for maintaining the consistency to CDM PDD template-version 02.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment
1. Q HFC23	HFC23 fed to the thermal oxidiser	Flow meter	mt-HFC23	(m)	monthly	100%	Electronic	A computer system will be used to record data from the Mass Flow Meters employed to measure HFC23 feed to the thermal oxidation system. The paper records would be maintained as back up.
2. Composition of HFC23	Composition of HFC23 fed to the thermal oxidiser	Gas chromatography	%	(m)	monthly	100%	Electronic	The chromatographs will be printed to establish the authenticity of the data recorded. Composition of HFC23 and HCFC22 of the HFC23 waste stream should be measured and recorded
3. Q Fuel	Fuel fed to the thermal oxidiser	Flow meter	m ³	(m)	monthly	100%	Electronic	

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4. Q HFC23-Leak	Un-oxidised HFC23 in Flue gas	Flow meter & gas chromatography (sampling)	mt-HFC23	(m) & (c)	monthly	100%	Electronic	Analysis of flue gas is done to check leaked HFC23 by sampling. Q HFC23 x F HFC23 NO in the section B.2 of PDD should be calculated. Please refer to Note 1 described below.
7. Q HCFC22	HCFC22 production by the existing plant	Flow meter	mt-HCFC22	(m)	monthly	100%	Electronic	Reference data to check cut-off rate and rough estimation of Q HFC23.
8. Q HFC23 _{solid}	HFC23 sold by the facility generating HFC23 waste	Meter	mt-HFC23	(m)	annually	100%	Electronic	Same as the above comment.
9. Temp	Incineration temperature	Thermometer of incinerator	°C	(m)	monthly	100%	Electronic	For assuring of incinerator operation
10. O2 contents	O2 contents of flue gas	Sensor in the stack	%	(m)	monthly	100%	Electronic	For assuring of incinerator operation
11. C Fuel	No of carbon atoms per molecule of Fuel	Analysis of sample or specifications	No	(c)	Yearly or whenever change in specification	100%	Electronic	
12. M Fuel	Molecular weight of fuel	Analysis of sample or specifications	No	(c)	Yearly or whenever change in specification	100%	Electronic	
13. F Power	CO2 generated per unit of power	○○○○	mt-CO2/kWh	(e)	yearly	100%	Electronic	
14. F Steam		○○○○	mt-CO2/mt-steam	(e)	yearly	100%	Electronic	



In addition the quantities of gaseous effluent (CO, HCl, HF, Cl₂ dioxin and NOX) and liquid effluents (pH, COD, BOD, n-H (normal hexane extracts), SS (suspended solid), phenol; and metals (Cu, Zn, Mn and Cr) are measured in a manner and with a frequency that complies with local environmental regulations.

Note 1: Q_{HFC23-Leak} is listed in section D.4 of the approved monitoring methodology AM0001 as potential sources of emissions, which are not included in the project boundary. However, this emission of Q_{HFC23-Leak} occurs within the project boundary, and thus is transferred to section D.2.2.1 as described above. While, in the AM0001 version 03, the equipment for measurement of Q_{HFC23-Leak} is not specified, the proposed project will use a gas chromatography for analysis of samples taken from the stack and flow meter to measure the quantity of flue gas.

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

>>

The project emissions due to thermal oxidation process (TOP) are stood for by the following three (3) equations for the respective sources.

- a. CO₂ equivalent of fraction of HFC23 remaining un-oxidised in the flue gases from the thermal oxidation system (TOP)

$$= Q_{HFC23} \times F_{HFC23} \times GWP_{HFC23}$$

Equation 2

- b. CO₂ released due to thermal oxidation of HFC23 = $Q_{HFC23} \times F_{HFC23}$

$$+ Q_{HFC23} \times (HFC22/HFC23 = 30wt\%/55wt\%) \times F_{HFC22} \quad (\text{Note 1})$$

Equation 3

Note 1: $F_{HFC23} = \text{Mol. Wt. of CO}_2 \times \text{No. of Carbon Atoms in HFC23} / \text{Mol. Wt. of HFC23} = 44 \times 1/70 = 0.6285 \text{ t CO}_2 / \text{t of HFC23}$

$F_{HFC22} = \text{Mol. Wt. of CO}_2 \times \text{No. of Carbon Atoms in HFC22} / \text{Mol. Wt. of HFC22} = 44 \times 1/86.4 = 0.5096 \text{ t CO}_2 / \text{t of HFC22}$

- c. CO₂ released from burning of fuel = $Q_{\text{Fuel}} \times F_{\text{natural gas}}$ (Note 2)

Note 2: $F_{\text{natural gas}} = \text{Mol. Wt. of CO}_2 \times \text{No. of carbon atoms in one molecule of Fuel (C)} / \text{Mol. Wt. of Fuel} = 44 \times \text{C Fuel} / \text{M Fuel}$
 $= 44 \times 1.0 / 16.3 \text{ kg-CO}_2 / \text{kg-Natural gas} = 2.70 \text{ t-CO}_2 / \text{ton-Natural gas}$

Equation 4

Hence, the total project GHG emissions within the project boundary are given by the following equation:

$$d. E_{\text{TOP}} = Q_{HFC23} \times F_{HFC23} \times GWP_{HFC23} + Q_{HFC23} \times F_{HFC23} + Q_{HFC23} \times (HFC22/HFC23 = 30wt\%/55wt\%) \times F_{HFC22} + Q_{\text{Fuel}} \times F_{\text{natural gas}}$$

or

$$E_{\text{TOP}} = Q_{HFC23} \times 0.0001 \times 11,700 + Q_{HFC23} \times 0.6285 + Q_{HFC23} \times 0.5454 \times 0.5096 + Q_{\text{Fuel}} \times 2.70$$

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**D.2.3. Treatment of leakage in the monitoring plan**

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity.

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
5. Q Power	Electricity consumption by the thermal oxidiser	Electricity meter	kWh	(m)	monthly	100%	Electronic	The electric power meter and steam flow meter would have the facility of recording the monthly readings, with devices to minimize the human errors.
6. Q Steam	Steam consumption by the thermal oxidiser	Flow meter	mt-steam	(m)	monthly	100%	Electronic	Same as the above comment.
8. Q								

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

>>

The leakage effect occurred outside the project boundary is the indirect emissions associated with the utilities, chemicals and transportation of materials for the project activity.

However, the GHG emissions caused by the production of chemicals such as hydrated lime and caustic soda, the fuel oil consumption for transportation of waste solid are negligible small, compared with other emissions in the proposed project.

Therefore, the estimation of leakage for the proposed project can use the following formulae:

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- a. Equivalent of Power consumed by the Thermal Oxidation System

$$= Q_{\text{Power}} \times F_{\text{Power}} (\text{CO}_2 \text{ generated per unit of Power Consumed}) \text{ Note 1}$$

Note 1: F_{Power} = The value of CO_2 generated per unit of power is obtained based on the data from the grid of power distribution.

- b. Equivalent of Steam used by the Thermal Oxidation System

$$= Q_{\text{Steam}} \times F_{\text{Steam}} (\text{CO}_2 \text{ generated per MT of Steam Consumed}) \text{ Note 2}$$

Note 2: F_{Steam} = the value of CO_2 generated per unit of steam is calculated from the average fuel consumed by the boiler producing steam

The total leakages (indirect emissions) due to destruction of HFC23 (E_L) are given by the sum of the equation 5 and 6 mentioned above.

$$E_L = \text{GHG emissions due to usage of Power \& Steam}$$

$$E_L = Q_{\text{Power}} \times F_{\text{Power}} + Q_{\text{Steam}} \times F_{\text{Steam}}$$

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

As described the formulae of emission reductions in section B.2, the greenhouse gas (GHG) emission reduction, E_R , is estimated by the following equation.

$$E_R = (Q_{\text{HFC 23}} - Q_{\text{BL HFC 23}}) \times \text{GWP}_{\text{HFC 23}} - E_P \text{ (where } E_P = E_{\text{TOP}} + E_L)$$

Abbreviation:

GHG emission reduction measured in tonnes of CO_2 equivalent	: E_R
Quantity of waste HFC 23, in metric tonnes, destroyed during the year measured	: $Q_{\text{HFC 23}}$
Baseline quantity of HFC 23, in metric tonnes, destroyed during the year	: $Q_{\text{BL HFC 23}}$
Sum of GHG emissions due to thermal oxidation process and leakages in metric of CO_2 equivalent	: E_P

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GHG emissions due to thermal oxidation process in metric of CO ₂ equivalent	: E _{TOP}
GHG emissions due to GHG leakages, in metric tonnes of CO ₂ equivalent	: E _L
Global warming potential	: GWP

The Global Warming Potential (GWP) converts 1 tonne of HFC23 to tonnes of CO₂ equivalents (tonnes CO₂e/tonnes HFC23).
The Global Warming Potential value for HFC23 is 11,700 tonnes CO₂/tonne HFC23.

In the case of this proposed project, Q_{BL HFC23} is zero (0), because of no destruction of HFC23 at present in Russian Federation.
Therefore, GHG emission reduction, E_R, is rearranged as follows

$$E_R = Q_{HFC23} \times 11,700 - [Q_{HFC23} \times 0.0001 \times 11,700 + Q_{HFC23} \times 0.6285 + Q_{HFC23} \times 0.5454 \times 0.5096 + Q_{Fuel} \times 2.70] - [Q_{Power} \times F_{Power} + Q_{Steam} \times F_{Steam}]$$

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data (Indicate table and ID number e.g. 3.-1.; 3.2.)	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1. Q _{HFC23} (Table D.2.2.1)	Low	<p>The existing QA & QC organisation will be extended to form separate cell for the thermal oxidation project and QA & QC procedures in terms of equipment and analytical method will be set. The measurement will be done using two flow meters in series to be read simultaneously with weekly re-calibration frequency with help of zero check. ASTM or other equivalent standards shall be used.</p> <p>QA & QC procedures exist & implement to –</p> <ol style="list-style-type: none"> 1. Well defined procedures and instructions to provide consistent results to successfully implement & operate the CDM project 2. Fix clear job responsibilities 3. Provide requisite tools & training to achieve the objectives.
2. Composition of HFC23 (Table D.2.2.1)	Low	These data shall be measured by gas chromatograph. ASTM or other equivalent standards shall be used. The gas chromatograph will be calibrated once a week using secondary working standard gas prepared from the certified reference gas. QA & QC procedures are the same as those described above.

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3. Q _{D.2.2.1} Fuel (Table D.2.2.1)	Low	These data shall be measured using Natural gas/any other meter. ASTM or other equivalent standards shall be used. QA & QC procedures are the same as those described above.
4. Q _{D.2.2.1} HFC23-Leak (Table D.2.2.1)	Low	These data shall be measured for the flue gases at the stack of the thermal oxidiser. ASTM or other equivalent standards shall be used. QA & QC procedures are the same as those described above.
7. Q _{D.2.2.1} HCFC22 (Table D.2.2.1)	Low	These data shall be obtained from HCFC22 production records at Chimprom. ASTM or other equivalent standards shall be used. QA & QC procedures are the same as those described above.
8. Q _{D.2.2.1} HFC23 _{solid} (Table D.2.2.1)	Low	These data shall be obtained from HCFC22 production and HFC23 sale records at Chimprom. ASTM or other equivalent standards shall be used. QA & QC procedures are the same as those described above.
5. Q _{D.2.3.1} Power (Table D.2.3.1)	Low	These data shall be measured by Electric Power Meter. ASTM or other equivalent standards shall be used. QA & QC procedures are the same as those described above.
6. Q _{D.2.3.1} Steam (Table D.2.3.1)	Low	These data shall be measured by a flow meter. ASTM or other equivalent standards shall be used. QA & QC procedures are the same as those described above.

As already described elsewhere in this PDD, since baseline emission is calculated as $Q_{HFC23} \times GWP_{HFC23}$ (11,700), items to be measured other than Q_{HFC23} are very small in comparison. Hence, the most important monitoring & measurement are the following:

1. Q_{HFC23} Stream
2. Composition of Q_{HFC23} Stream to calculate Q_{HFC23}
3. Q_{HCFC22} (Production)
4. Q_{HFC23_Leak}

All of the measurement instruments are to be re-calibrated monthly per internationally accepted procedures except for the Q_{HFC23} flow meters whose recalibration frequency is weekly to reduce the error level. It shall be as per the Quality System (to International Standards/GOST) at Chimprom.

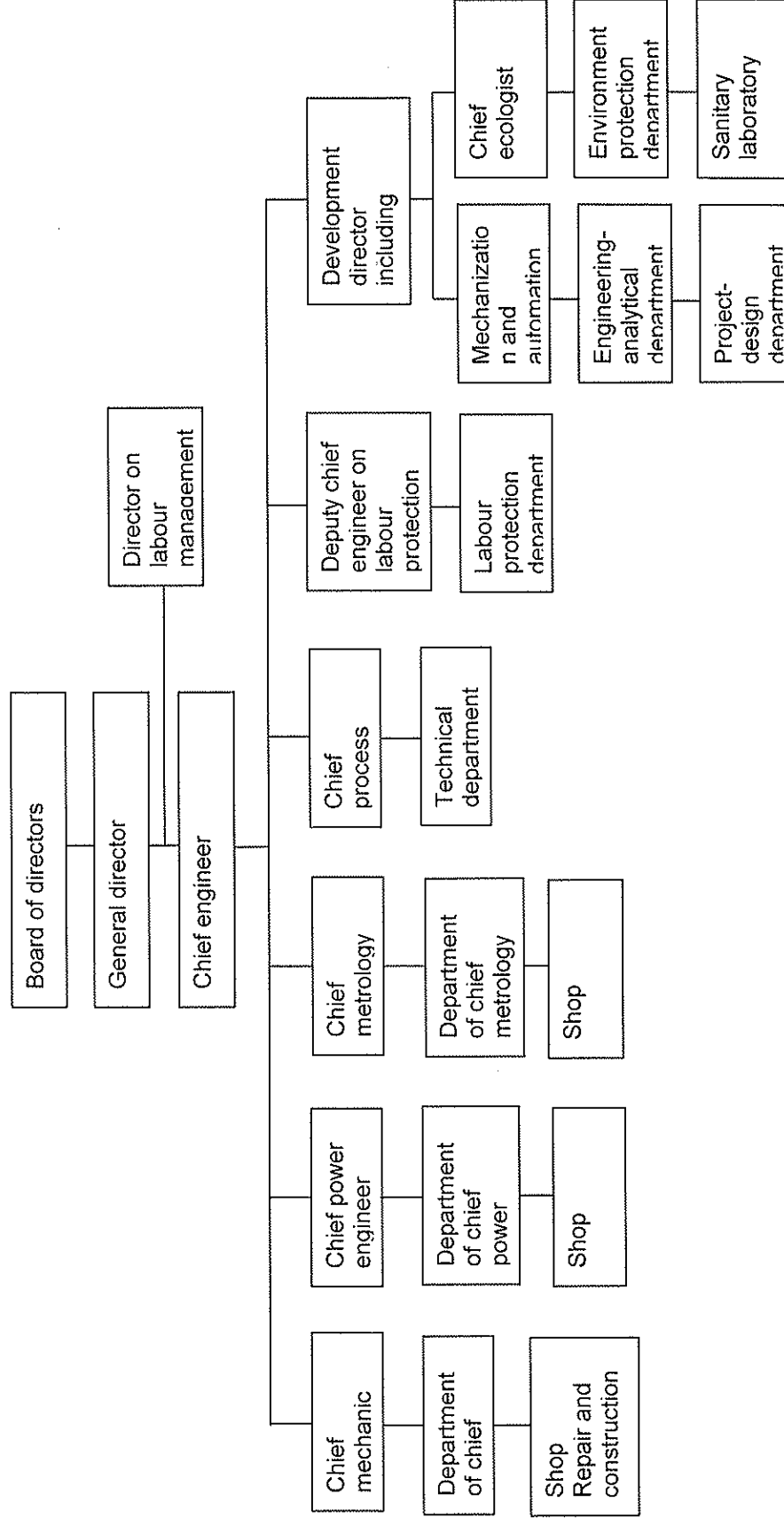
D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>>

The figure shown on the next page of this PDD outlines the operational and management structure including quality assurance and quality control for Joint Implementation Project. The project participants will archive the data in order to monitor emission reductions and any leakage effect generated by the project activity using the following structure on the next page.



Organization Chart of Chimprom for Joint Implementation Project



**D.5 Name of person/entity determining the monitoring methodology:**

>>

Daikin Corporation has assisted the project participants in developing the Project Design Document and designing the project in order to be compatible with Host Government Approval criteria. Daikin Corporation, established in 1912, is providing with the world's famous, competitive and professional services for plant engineering for fluorocarbon gas production. The contact details of Daikin Corporation are provided hereunder.

Name:	Mr. Masaji Kobayashi whose contact details are provided in Annex 1.
Title:	
Department:	Engineering
Address:	Daikin Corporation 〒566-8585 1-1 Nishi Hitotsuya, Settsu-shi, Osaka, Japan
Telephone:	+81-6-6349-6993
Fax:	+81-6-6349-2578
E-mail:	mkobayas@notes.che.daikin.co.jp

**SECTION E. Estimation of GHG emissions by sources****E.1. Estimate of GHG emissions by sources:**

>>

The estimation of GHG emissions due to the thermal oxidiser process is calculated using the formulae mentioned in section D.2.2.2.

$$\begin{aligned}
 E_{\text{TOP}} &= E_{\text{TOP}} = Q_{\text{HFC 23}} \times 0.0001 \times 11,700 + Q_{\text{HFC 23}} \times 0.6285 + Q_{\text{HFC 23}} \times 0.5454 \times 0.5096 + Q_{\text{Fuel}} \\
 &\quad \times 2.70 \\
 &= 33.42 \times 0.0001 \times 11,700 + 33.42 \times 0.6285 + 33.42 \times 0.5454 \times 0.5096 + 124.08 \times 2.70 \\
 &= 404.4 \text{ ton-CO}_2/\text{year}
 \end{aligned}$$

E.2. Estimated leakage:

>>

The estimated leakage occurred outside the project boundary is calculated using the formulae also mentioned in the D.2.3.2.

$$\begin{aligned}
 E_L &= Q_{\text{Power}} \times F_{\text{Power}} + Q_{\text{Steam}} \times F_{\text{Steam}} \\
 &= 73,320 \times 0.0517 + 28.2 \times 0.275 \\
 &= 45.65 \text{ ton-CO}_2/\text{year}
 \end{aligned}$$

E.3. The sum of E.1 and E.2 representing the project activity emissions:

>>

The project activity emissions (E_p) are represented as follows:

$$\begin{aligned}
 E_p &= E_{\text{TOP}} + E_L \\
 &= [Q_{\text{HFC 23}} \times 0.0001 \times 11,700 + Q_{\text{HFC 23}} \times 0.6285 + Q_{\text{HFC 23}} \times 0.5454 \times 0.5096 + Q_{\text{Fuel}} \times 2.70] \\
 &\quad + [Q_{\text{Power}} \times F_{\text{Power}} + Q_{\text{Steam}} \times F_{\text{Steam}}] \\
 &= 404.4 + 45.65 \\
 &= 450.05 \text{ ton-CO}_2/\text{year}
 \end{aligned}$$

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

>>

Baseline emissions (E_B) in a year are calculated as follows:

$$E_B = (Q_{\text{HFC23}} - Q_{\text{BL HFC23}}) \times \text{GWP}_{\text{HFC23}}$$

Where, $Q_{\text{BL HFC23}}$ is the baseline quantity of HFC23 required by local regulation to be destroyed during the year measured in metric tonnes.

As far as there is no regulation to destroy the emission of HFC23 in Russian Federation, $Q_{\text{BL HFC23}}$ incorporated in the above equation is zero (0), and thus the allowed maximum amount of baseline emissions is calculated as follows:



$$E_B = Q_{HFC23} \times GWP_{HFC23} = Q_{HCFC22} \times \text{Cut-off rate} \times GWP_{HFC23}$$

$$= 1,114 \text{ tonnes HCFC22} \times 0.03 \times 11,700 \text{ tonnes-CO}_2\text{-e/year} = 391,014 \text{ t-CO}_2\text{/year}$$

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

>>

The emission reductions of proposed project during the year are estimated as follows:

$$E_R = E_B - E_P$$

$$= Q_{HCFC22} \times \text{Cut-off rate} \times GWP_{HFC23} - [Q_{HFC23} \times F_{HFC23\ NO} \times 11,700 + Q_{HFC23} \times (44/70) + Q_{HFC23} \times (HCFC22/HFC23=30\%/55\%) \times (44/86.4) + Q_{Fuel} \times (44 \times C_{Fuel}/M_{Fuel})] - [Q_{Power} \times F_{Power} + Q_{Steam} \times F_{Steam}]$$

$$= 391,014 - [Q_{HFC23} \times 0.0001 \times 11,700 + Q_{HFC23} \times (44/70) + Q_{HFC23} \times (HCFC22/HFC23=30\%/55\%) \times (44/86.4) + Q_{Fuel} \times (44 \times 1/16.3)] - [Q_{Power} \times F_{Power} + Q_{Steam} \times F_{Steam}]$$

$$= 391,014 - 404.4 - 45.65 \text{ ton-CO}_2\text{/year}$$

$$= 390,563 \text{ ton-CO}_2\text{/year}$$

E.6. Table providing values obtained when applying formulae above:

>>

Years	Estimation of baseline emission (ton-CO ₂)	Estimation of project emission (ton-CO ₂)	Estimation of emission reductions (ton-CO ₂)
2008	391,014	451	390,563
2009	391,014	451	390,563
2010	391,014	451	390,563
2011	391,014	451	390,563
2012	391,014	451	390,563
2013	391,014	451	390,563
2014	391,014	451	390,563
2015	391,014	451	390,563
2016	391,014	451	390,563
2017	391,014	451	390,563
Total (ton-CO ₂)	3,910,140	4,510	3,905,630

The above estimation of emission reductions are calculated by using the parameter and data of baseline/project activity.

Summary of parameter and data for baseline/project activity

No	Key element	Value assumed	Reference
1.	Maximum production of HCFC22 in the existing plant	1,1,14 ton/year	
2.	Maximum release of HFC23 associated with the production of HCFC22	33.42 ton/year	
3.	Cut-off rate obtained by the most current three years' data	3.0 wt%	
4.	GWP _{HFC23} based on the IPCC second report	11,700	IPCC Guideline
5.	CO ₂ emission factor of Natural gas used in thermal oxidiser	2.70 t-CO ₂ /t-Natural gas	
6.	CO ₂ emission factor of electricity used in thermal oxidiser	0.517 kg-CO ₂ /kWh	
7.	CO ₂ emission factor of steam used in thermal oxidiser	0.275 t-CO ₂ /t-steam	
8.	CO ₂ emission factor of HFC23 burning in thermal oxidiser	0.6285 t-CO ₂ /t-HFC23	
9.	CO ₂ emission factor of HCFC22 burning in thermal oxidiser	0.5096 t-CO ₂ /t-HCFC22	

The emission reductions claimed by the proposed project is subject to a cut-off rate, designed to ensure that no unfair claim of credit can be made by the destruction of HFC23 in excess of that permitted under the CDM project.

The proposed project has calculated the above value of cut-off rate based on the most current three years' data of HCFC22 production and HFC23 release by the existing plant.

SECTION F. Environmental impacts**F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

>>

An 'Environmental Impact Assessment Study' for the proposed project has been undertaken and shall be available before start of project construction.

F.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:

>>

Executive Summary of EIA report shall be included on conclusion of the EIA.

Environmental Impact information for a similar project in Japan



Experience for the plant in Japan which has been destroying HFC23 and HCFC22 mixtures since 1994, suggests that dioxin levels rarely exceed $0.005 \text{ ng (I-TEQ)/m}^3$, which is only 5 % of the consented level of $0.1 \text{ ng (I-TEQ)/m}^3$.

Prediction of dioxin concentrations based on dispersion modelling of the plant emissions.

The plant is located at Daikin's factory in Settsu city Osaka, Japan. Extensive experiment for performance check was carried out between 1994 and 2003. The results of this experiment are shown in the table below.

Parameter	Daikin's Settsu, Japan	Remarks
Dioxin Mass Release ($\mu \text{ g/h}$)	0.00236	
Maximum annual average increase in the Predicted Concentration (pg-TEQ/m^3) (Note 1)	0.0019	
Percentage increase in local air quality (Note 2)	0.82 %	

Note 1: The long-term concentration parameter is likely to be more significant for dioxins, because their health effect is thought to be chronic (Long Term) in the small doses. This is because the main pathway to humans is via contaminated food eaten over a lifetime. Average concentration use the average meteorological data available for the location

Note 2: The average total daily intake of dioxins for the general adult in Japan population in 2001 is $1.5 \text{ pg(TEQ) per kg of bodyweight per day}$, for an adult weighing 60 kg.

Source of Daikin Settsu's data is a report by Daikin entitled "Investigation Report for Living Environmental Effect by waste treatment incinerator".

The conclusion of Daikin report was that the environmental and health effects of the dioxin releases from these incinerators was insignificant and was vastly outweighed by the benefit generated by incineration the vent gases.

SECTION G. Stakeholders' comments

>>

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

>>

The project participants, Sumitomo Corporation and Chimprom, identified employees and labour, local communities, as the most important stakeholders with an interest in the proposed project activity.

Accordingly, the project participants, mainly Chimprom sent out a notice to representatives of various stakeholder groups, with a brief on the project, informing them of the proposed meeting at Chimprom



plant and office at Volgograd, requesting each stakeholder group to send representatives to the said meeting.

The meeting with representatives of employees and labour was held in Chimprom Headquarters on 17th October 2005. The participants to the stakeholder meeting and the subject discussed were as follows. The detailed discussion with stakeholder was summarized in the Annex 6-1 attached.

Participants to the stakeholder meeting with Labour Union

Sumitomo Corporation	Manager	Mr. Hiroshi Eguchi
	Senior staff	Mr. Alexander Kubyshev
Chimprom Co., Ltd	R&D director	Mr. Igor Sizykh
	Advisor to general director	Mr. Dmitry Chervichkin
Labour Union	Deputy chairman of Chimprom's labour union	Mrs. Ludmila Luneva

Subject discussed

The stakeholder meeting process with Chimprom's Labour Union involved:

- Welcome to the representatives of employees and labour by Chimprom's director
- Expressing the gratitude for attending the meeting by Sumitomo Corporation, Mr. Eguchi
- Briefing the main concept of Introduction of the project by Sumitomo Corporation
- Open house discussion on the merits of the project
- Summation of the concerns expressed by the stakeholder and the commitments to address the concerns made by Sumitomo Corporation and Chimprom
- Preparation and circulation of draft Minutes of the Meeting and signing of the MOM

Furthermore, the meeting with representatives of local communities was held in Chimprom Headquarters on 18th October 2005. The participants to the meeting and the subject discussed were as follows. Please refer to the detailed discussion in the Annex 6-2 attached.

Participants to the meeting with Local Communities

Sumitomo Corporation	Manager	Mr. Hiroshi Eguchi
	Senior staff	Mr. Alexander Kubyshev
Chimprom Co., Ltd	R&D director	Mr. Igor Sizykh
	Head of department	Mrs. Yulia Fedko
Local Communities	Deputy head ecological	Mr. Pavel Mikhaev



safety and environment
control department of natural
resource and environment
protection committee of
Volgograd region

Subject discussed

The stakeholder meeting process with Local Communities involved the almost same matter as with Labour Union as mentioned above.

G.2. Summary of the comments received:

>>

At the meeting with the representative of Chimprom's Labour Union, questions were raised and discussed with regard to starting year of the project, opportunity of increasing employment and project management during construction stage. The questions and comments are received as below from Labour Union. The detailed question/concern/suggestion from Labour Union should be referred to the attached Annex 6-1.

- a) Starting year of the proposed project
- b) Opportunity of increasing employment and the skill required for personnel/staff of Chimprom
- c) Project management of construction phase and technology transfer

On the other hand, the following questions/comments are received and discussed at the meeting with Local Community, as shown the detail of them in the attached Annex 6-2.

- a) Reliability upon the technology and design of HFC23 destruction plant
- b) Negative impact on the environment by the operation of HFC23 destruction plant
- c) Positive impact on the environment and contribution to sustainable development

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

>>

Sumitomo Corporation and Chimprom, the project participants, also informed the stakeholders that the proposed project activity, the destruction of HFC23, contributes to the sustainable development of the region and country by facilitating and catalysing sustainable operations of Chimprom, thereby the creation of sustainable shareholder, economic, social and environmental value. The clarifications for these questions/comments received and due accounts taken by the project participant are mainly as follows:

- a) The operation of the plant will start before 2008, that is the starting year of Kyoto Protocol Commitment
- b) Sumitomo Corporation will be in charge of project management during construction stage
- c) No negative impacts on the environment are perceived for the operation of the plant
- d) The proposed project contributes to the sustainable development for Chimprom and Local Community
- e) The technology transfer of submerged combustion system will be effectively implemented



The detail of due account and clarification taken of questions/comments are summarized in the attached Annex 6-1 and 6-2.

Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Chimprom Co., Ltd
Street/P.O.Box:	Promyslovaya Str.
Building:	23
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E-Mail:	zamgen_razv@vocco.ru
URL:	www.vocco.ru
Represented by:	
Title:	Development director
Salutation:	Mr.
Last Name:	Sizykh
Middle Name:	Igor
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Department:	
Mobile:	7 905 333 28 62
Direct FAX:	7 8442 45 87 44
Direct tel:	7 8442 45 89 40
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project is proposed to be financed by the project sponsors, who propose to undertake the JI project activity as the project proponent.

At present, no public funding is envisaged. In case public funding is sought, the proponent shall duly ensure that it is additional to any ODA.

Annex 3**BASELINE INFORMATION**

The key information to determine the baseline emission is summarized in the following table (parameter, factors and data sources).

Key Information for Determination of Baseline Emission

Variable	Definition and formulae	Data source
Q _{HCFC22}	The quantity of HCFC22 Production during most recent three years in the existing plant	Past operation record of the existing plant. Refer to section B.1 & B.2
Q _{HFC23}	The quantity of HFC23 released to atmosphere in the existing. The quantity of HFC23 fed to the thermal oxidiser	Past operation record of the existing plant. Monitored in the proposed project. Refer to section B.1 & B.2
Composition of HFC23	The purity of HFC23 in HFC23 waste stream	Monitored
Cut-off rate	The lowest value of waste generation rate HFC23/HCFC22 calculated by the most recent three years' data	Past operation record of the existing plant.
Q _{BL HFC23}	The quantity of HFC23 required to be destroyed by the regulation	Relevant regulation
GWP _{HFC23}	Global warming potential of HFC23: 11,700	IPCC default value (1996)

Refer to section B and E for estimated value of each parameter.

Annex 4**MONITORING PLAN**

The monitoring plan defines a standard against which the performance in terms of the emission reductions (ERs) for the proposed project will be monitored and verified, pursuant to all relevant requirements of the Clean Development Mechanism (CDM) of the Kyoto Protocol.

The requirements of CDM define monitoring as the systematic surveillance of a project's performance by measuring and recording performance-related indicators relevant to the proposed project activity.

The monitoring report including the spread sheet of data monitored will be submitted to the Designated Operational Entity (DOE), together with the procedures and result of calculation, in order to enable DOE to verify emission reductions occurred by the proposed project.

Project participant, especially Chimprom as the operator of proposed project, will establish credible, transparent, and adequate data measurement, collection, recording and management system to successfully develop and maintain the proper information required for an audit and for the verification and certification of the achieved ERU and other outcomes of the proposed project.

All relevant works will be implemented in accordance with the management system established in the above, while covering the requirements of the approved monitoring methodology AM0001 "Incineration of HFC23 waste stream".

Monitoring Obligations

The monitoring plan will identify the key performance indicators of the proposed project and set out the procedures for metering, monitoring calculating and verifying the emission reductions generated by the proposed project, annually.

Furthermore, the monitoring plan will provide the requirements and instructions for:

- a) establishing and maintaining the appropriate monitoring system including spreadsheets for estimation of the emission reductions by the proposed project (ERs)
- b) checking whether the proposed project meets key sustainable development indicators, where not only positive but also negative environmental and social effects should be conceivable
- c) implementing the necessary measurement and management operations,
- d) preparing for the requirements of independent third party verifications and audits

The monitoring performance of proposed project requires the fulfilment of operational data collection and processing obligations by the project participants, especially Chimprom which has the primary obligation of ensuring that sufficient and accurate information is available to calculate ERs in transparent manner.

In case of a CDM activity, the proposed project shall meet the requirements of the Kyoto Protocol Article 12 for CDM Projects, which states that the CDM activity shall assist the host country in achieving sustainable development. In the planning stage of proposed project, the numerous environmental assessments and the prediction of socio-economic effects were sufficiently considered by the project proponent.



In addition to perform the emission reductions (ERs), pursuant to the Modalities and Procedures for CDM, the project participants will monitor the environmental sustainability/impact on local pollution and socio-economic sustainability by the proposed project.

Monitoring Organization

The project participant will be responsible to develop and implement a management and operational system that meets the requirements of the proposed project and this monitoring plan. The organizational structure for management and operation of the proposed project is described in section D.4.

The project manager nominated by the project participant will appoint an operation manager who is dedicated for operating and monitoring of proposed thermal oxidiser. The operation manager will report the aspects obtained by the operation of proposed thermal oxidiser to the project manager. The project manager is in a position to report to the top of project participant. The monitoring team will be formed with the project manager, operation manager and operation superintendent.

The management and operational system shall include the following activities:

a) Data handling:

The establishment of a transparent system for the collection, computation and storage of data, including adequate record archiving and data monitoring systems is required. The project participant shall develop and implement a protocol that provides for these critical functions and processes, which shall be ready for independent auditing.

For electronic-based and paper-based data entry and recording system, there must be clarity in terms of the procedures and protocols for collection and entry of data, usage of the spreadsheets and any assumption made, so that compliance with requirements can be assessed by a third party. Stand-by processes and system, e.g. paper-based systems, must be outlined and used in the event of, and to provide for, the possibility of systems failure.

b) Quality assurance:

Based on the original quality control procedure of the HCFC22 production, quality control and inspection procedure will be established for monitoring and calibration of the proposed project activity to assure monitoring accuracy.

- Periodical test and calibration of monitoring equipment
- Weekly recalibration of the two HFC23 flow meters
- Definition of malfunction of monitoring equipment
- Corrective actions in case of malfunction/breakdown
- Internal audit and project performance review

c) Training:

The project participant, especially Chimprom, will identify training needs associated with the relevant monitoring works. It will provide training or take other action to meet these needs, and retain associated records. The training needs shall include the following educations:

- Comprehensive knowledge with regard to general and technical aspects of CDM
- Instruction on instalment, operation, maintenance and calibration of monitoring equipment
- Comprehensive knowledge on QA/QC



d) Preparation for operations:

The management and operational systems and the capacity to implement monitoring plan will put in place before the proposed project can start generating emission reductions (ERs) or by the end of the first year of crediting period.

Verification

The periodic auditing and verification of monitoring results for the proposed project are a mandatory component for all CDM projects.

The main objective of the audit is to independently verify that the proposed project has achieved the emission reductions reported by the project participants.

Audits are an integral part of the verification process and are undertaken in conjunction with verification. The monitoring team should cooperate closely with the verifier (DOE) to assure credible and transparent outcome. The following actions will be included in those works:

- a) Efficient contact with the DOE who verifies the emission reductions
- b) Providing all necessary monitoring information on emission reduction
- c) Preparatory work for the verification to obtain result of high quality and efficiency

Annex 5**INFORMATION REGARDING BASELINE AND PROJECT EMISSIONS****1. Summary of baseline and project data**

The data regarding to the baseline and project activity is summarized in the following table. Those data are obtained by the on-site survey at the HCFC22 production plant in Russian Federation, in collaboration with Chimprom.

Summary of parameter and data for baseline/project activity

No	Key element	Value assumed	Reference
a.	Maximum historical annual production of HCFC22 in the existing plant	1,114 ton/year	
b.	Release of HFC23 associated with the production of HCFC22	33.42 ton/year	
c.	Cut-off rate obtained by the most current three years' data	3.0 wt%	
d.	HFC23 ratio required to be destroyed by regulation (Zy)	0	
e.	HFC23 leakage not destroyed by thermal oxidiser	3.342 kg/year	
f.	GWP HFC23 based on the IPCC second report	11,700	
g.	Fuel consumption in thermal oxidiser (Natural gas)	124.08 ton/year	
h.	CO ₂ emission factor of Natural gas used in thermal oxidiser	2.70 t-CO ₂ /t-Natural gas	
i.	Electricity consumption in the thermal oxidiser	73,320 kWh	
j.	CO ₂ emission factor of electricity used in thermal oxidiser	0.517 kg-CO ₂ /kWh	
k.	Steam consumption in the thermal oxidiser	28.2 t-steam/year	
l.	CO ₂ emission factor of steam used in thermal oxidiser	0.275t-CO ₂ /t-steam	
m.	CO ₂ emission factor of HFC23 burning in thermal oxidiser	0.6285 t-CO ₂ /t-HFC23	
o.	CO ₂ emission factor of HCFC22 burning in thermal oxidiser	0.5096 t-CO ₂ /t-HCFC22	



2. Baseline

a) Cut-off rate

The waste generation rate (HFC23/HCFC22) archived for three (3) most recent years are 3.1% for 2002, 3.2% for 2003 and 3.6% for 2004. These values of waste generation rate (HFC23/HCFC22) mentioned above have already been made correction with the concentration of waste stream. In accordance with the approved methodology AM0001ver03, the cut-off rate for the proposed project is set 3.0%, i.e. 3.0kg of HFC23 per 100kg kg of HCFC22, since the HFC23/HCFC22 ratio for the most recent 3 years (2002, 2003 and 2004) achieved by Chimprom are more than 3.0% of upper limit defined in AM0001ver03.

b) Maximum historical annual production

The amount of HCFC22 annual production by the existing facility of Chimprom shall be limited to the maximum historical annual production level during any of the last three (3) years between 2002 and 2004. Such data of annual HCFC22 production are 1,114tonnes for 2002, 1,100tonnes for 2003 and 1,050tonnes for 2004, sourced by the yearly production report of Chimprom. In compliance with the requirement of the approved methodology AM0001ver03 – Incineration of HFC23 waste streams, the maximum historical annual production level of HCFC22 at Chimprom plant shall be determined in 1,114 ton/year for 2002.

c) HFC23 emission

Baseline emissions (E_B) in a year are calculated as follows:

$$E_B = (Q_{HFC23} - Q_{BL\ HFC23}) \times GWP_{HFC23}$$

Where, Q_{BL HFC23} is the baseline quantity of HFC23 required by local regulation to be destroyed during the year measured in metric tonnes.

As far as there is no regulation to destroy the emission of HFC23 in Russian Federation, Q_{BL HFC23} incorporated in the above equation is zero (0), and thus the allowed maximum amount of baseline emissions is calculated as follows:

$$\begin{aligned} E_B &= Q_{HFC23} \times GWP_{HFC23} = Q_{HCFC22} \text{ (maximum historical annual production)} \\ &\quad \times \text{Cut-off rate} \times GWP_{HFC23} \\ &= 1,114 \text{ ton HCFC22} \times 0.03 \times 11,700 \text{ ton CO}_2\text{-e/year} \\ &= 391,014 \text{ t-CO}_2\text{/year} \end{aligned}$$

3. Emission factor

a) CO₂ emission factor of HFC23 burning in thermal oxidiser

The emission factor of HFC23 (F_{HFC23}) burning in the thermal oxidiser is calculated as follows:

$$F_{HFC23} = \frac{\text{Molecular weight of CO}_2 \times \text{Number of Carbon atoms in HFC23}}{\text{Molecular weight of HFC23}}$$



$$= 44 \times 1/70 = 0.6285 \text{ t-CO}_2 / \text{t-HFC23}$$

b) CO₂ emission factor of HCFC22 burning in thermal oxidiser

The emission factor of HCFC22 (F_{HCFC22}) burning in the thermal oxidiser is calculated as follows:

$$\begin{aligned} F_{\text{HCFC22}} &= \text{Molecular weight of CO}_2 \times \text{Number of Carbon atoms in HCFC22} / \\ &\quad \text{Molecular weight of HCFC22} \\ &= 44 \times 1/86.4 = 0.5096 \text{ t-CO}_2 / \text{t-HCFC22} \end{aligned}$$

c) CO₂ emission factor of Natural gas used in thermal oxidiser

The emission factor of natural gas burning in the thermal oxidiser is calculated as follows:

$$\begin{aligned} F_{\text{natural gas}} &= \text{Molecular weight of CO}_2 \times \text{Number of carbon atoms in natural gas} / \text{Molecular} \\ &\quad \text{weight of natural gas} \\ &= 44 \times \text{Number of carbon atoms in natural gas} / \text{Molecular weight of natural gas} \\ &= 44 \times 1.0 / 16.3 \text{ kg-CO}_2 / \text{kg-Natural gas} = 2.70 \text{ t-CO}_2 / \text{t-Natural gas} \end{aligned}$$

d) CO₂ emission factor of electricity used in thermal oxidiser

Chimprom would purchase the electricity supplied from power station outside of its plant. The CO₂ emission factor of electricity obtained in the site survey was 0.517 kg-CO₂/kWh assuming 10% transmission loss as the emission factor (F_{power}) of electricity used in the project activity.

$$F_{\text{power}} = 0.517 \text{ kg-CO}_2 / \text{kWh}$$

e) CO₂ emission factor of steam used in thermal oxidiser

The emission factor of steam (F_{steam}) used in thermal oxidiser is calculated as follows, based on “Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories” and the following assumption of operating condition in conservative manner.

$$\begin{aligned} F_{\text{steam}} &= \text{Carbon Emission factor (default value by IPCC for oil)} \times 44/12 \\ &\quad \times \text{Heat Capacity of low Pressure Steam} \times \text{Boiler Efficiency} \times \text{Heat loss of} \\ &\quad \text{steam supply} \times \text{Conversion Factor (for Joule/kcal)} \end{aligned}$$

Carbon Emission factor based on default value by IPCC for oil = 20.0 t-C/TJ

Heat Capacity of 2 kg/cm²G saturated Steam = 645 kcal/kg-steam

Boiler Efficiency = 80%

Heat Loss of steam supply = 10%

Conversion Factor = 4.1868×10^3 Joule/kcal

$$F_{\text{steam}} = 20.0 \times 44/12 \times 645 \times 1/0.8 \times 1/0.9 \times 4.1868 \times 10^3 = 0.275 \text{ t-CO}_2 / \text{t-steam}$$

**4. Project emission****a) Emission of equivalent CO₂ by HFC23 not destroyed**

A combustion efficiency of more than 99.99% with regard to destruction/oxidation of HFC23 and related halogenated hydrocarbons is achieved in the proposed thermal oxidation system. The fraction of HFC23 not destroyed is anticipated less than 0.01% HFC23 supplied to the thermal oxidiser.

$$\begin{aligned}\text{Equivalent CO}_2 \text{ by HFC23 not destroyed} &= 0.0001 \times Q_{\text{HCFC22}} (\text{maximum historical} \\ &\quad \text{annual production}) \times \text{Cut-off rate} \times \text{GWP}_{\text{HFC23}} \\ &= 0.0001 \times 391,014 \text{ t-CO}_2/\text{year} \\ &= 39.1 \text{ t-CO}_2/\text{year}\end{aligned}$$

b) Emission of equivalent CO₂ by destroyed HFC23

$$\begin{aligned}\text{Equivalent CO}_2 \text{ by destroyed HFC23} &= Q_{\text{HCFC22}} (\text{maximum historical annual} \\ &\quad \text{production}) \times \text{Cut-off rate} \times \text{GWP}_{\text{HFC23}} \\ &= 1,114 \text{ ton HCFC22} \times 0.03 \times 44/70 \text{ t-CO}_2/\text{year} \\ &= 21.0 \text{ t-CO}_2/\text{year}\end{aligned}$$

c) Emission of equivalent CO₂ by destroyed HCFC22

$$\begin{aligned}\text{Equivalent CO}_2 \text{ by destroyed HCFC23} &= Q_{\text{HCFC22}} (\text{maximum historical annual} \\ &\quad \text{production}) \times \text{Cut-off rate} \times 30/55 \times 44/86.4 \\ &= 1,114 \text{ t-HCFC22} \times 0.03 \times 30/55 \times 44/86.4 \\ &= 9.3 \text{ t-CO}_2/\text{year}\end{aligned}$$

d) CO₂ Emission by Natural gas burned in the thermal oxidiser

The emission factor of Natural gas ($F_{\text{natural gas}}$) burned in the thermal oxidiser is calculated as described above.

$$F_{\text{natural gas}} = 2.70 \text{ t-CO}_2 / \text{t-Natural gas}$$

The consumption of Natural gas in the thermal oxidiser will be measured in the monitoring phase. The anticipated consumption of Natural gas is determined in 124.08 t-Natural gas/year by the following process design basis of thermal oxidiser.

$$\begin{aligned}\text{Operating time of one batch} &= 120 \text{ hrs} \\ \text{Number of batch operation} &= 47 \text{ batches} \\ \text{Annual operating time} &= 120 \times 47 = 5,640 \text{ hrs}\end{aligned}$$

$$\begin{aligned}\text{Annual consumption of Natural gas} &= 5,640 \times 22 \text{ kg-Natural gas/year} \\ &= 124.08 \text{ t-Natural gas/year}\end{aligned}$$

$$\begin{aligned}\text{CO}_2 \text{ Emission by Natural gas burned in the thermal oxidiser} \\ &= 2.70 \times 124.08 \\ &= 335.0 \text{ t-CO}_2/\text{year}\end{aligned}$$

**e) CO₂ Emission occurred by unburned Natural gas and N₂O from Natural gas burning**

The equivalent CO₂ emission occurred by unburned Natural gas and N₂O from Natural gas burning in thermal oxidiser are nil. Therefore these emissions will not be counted in the project.

5. Leakage emission**a) CO₂ Emission occurred by electricity consumption**

The emission factor of electricity (F_{power}) supplied from the outside grid is set up as described above.

$$F_{\text{power}} = 0.517 \text{ kg-CO}_2/\text{kWh}$$

The consumption of electricity in the plant will be measured in the monitoring phase. The anticipated consumption of electricity is determined in 73,320kWh/year by the following process design basis of the plant.

$$\begin{aligned} \text{Operating time of one batch} &= 120 \text{ hrs} \\ \text{Number of batch operation} &= 47 \text{ batches} \\ \text{Annual operating time} &= 120 \times 47 = 5,640 \text{ hrs} \end{aligned}$$

$$\text{Annual consumption of electricity} = 5,640 \times 13 \text{ kWh/year} = 73,320 \text{ kWh/year}$$

$$\begin{aligned} \text{CO}_2 \text{ Emission occurred by electricity consumption} &= F_{\text{power}} \times \text{Consumption of electricity} \\ &= 0.517 \times 73,320 = 37.9 \text{ t-CO}_2/\text{year} \end{aligned}$$

b) CO₂ Emission occurred by steam consumption

The emission factor of 2 kg/m³G steam (F_{steam}) supplied from the utility plant is set up as described above.

$$F_{\text{steam}} = 0.275 \text{ t-CO}_2/\text{t-steam}$$

The consumption of steam in the plant will be measured in the monitoring phase. The anticipated consumption of steam is determined in 28.2t-steam/year by the following process design basis of the plant.

$$\begin{aligned} \text{Operating time of one batch} &= 120 \text{ hrs} \\ \text{Number of batch operation} &= 47 \text{ batches} \\ \text{Annual operating time} &= 120 \times 47 = 5,640 \text{ hrs} \end{aligned}$$

$$\text{Annual consumption of steam} = 5,640 \times 5 \text{ kg-steam/year} = 28.2 \text{ t-steam /year}$$

$$\text{CO}_2 \text{ Emission occurred by steam consumption} = 0.275 \times 28.2 = 7.75 \text{ t-CO}_2/\text{year}$$



c) HFC23 leakage to effluent liquid

The solubility of HFC23 to water is very low. The effluent from precipitation tank of the project will not include HFC23 at all. Therefore, HFC23 leakage to effluent from the plant will not be counted.



Annex 6-1

Minutes of meeting with Labour Union of Chimprom

MINUTES OF MEETING

**SUMITOMO CORPORATION AND CHIMPROM
PROPOSED HFC23 DESTRUCTION PROJECT**

**CHIMPROM'S HEADQUARTERS, VOLGOGRAD CITY
17th OCTOBER, 2005 15:00**

PARTICIPANTS:

FROM SUMITOMO CORPORATION:

Mr Hiroshi Eguchi – Manager;
Mr Alexander Kubyshev – Senior staff

From Chimprom:

Mr Igor Sizykh – R&D director;
Mr Dmitry Chervichkin – Adviser to general director

From Labour Union:

Mrs Ludmila Luneva – Deputy chairman of Chimprom's labour union

Subjects Discussed.

Mr Eguchi expressed his gratitude to Mrs Ludmila Luneva, who represented the labour union of Chimprom for attending the meeting. He then briefly explained the main concept of the project as follows:

In accordance with requirement of Kyoto protocol, which entered into force in yearly 2005 after ratification by Russian Federation, Japan has obligations to reduce emission of greenhouse gases by minus 6 % of the level of 1990. In this regards, Sumitomo Corporation, one of the biggest trading house in Japan, works hard to find and execute Joint Implementation (JI) projects using a flexibility mechanism defined in Article 6 in the Kyoto protocol in order to obtain emission reduction units (ERU).

JSC Chimprom is one of the major manufacturer of HCFC22 gas in Russia. In the process of production of HCFC22 gas, a by-product gas, HFC23 is enviably generated in the quantity of approx 3 percent and then emitted into the atmosphere. HFC23 is a harmless and inert gas, thus there's no regulation on emissions of HFC23 in Russia. However HFC23 is a green house gas with high GWP (Global warming potential) of 11,700. Therefore, the companies agreed to consider possibilities of implementation of the JI project to destroy HFC23.



Destruction of HFC23 would be done through a state-of-the-art submerged combustion system. This project will be executed and operated in compliance with all necessary regulations and permissions, and would meet all environment regulations and standards.

It was emphasized that the project would be implemented on the funds arranged by Sumitomo Corporation and its materialization could lead to environment preservation as well as increased employment opportunities. Implementation of the project would contribute to development of the plan infrastructure and bring the up-to-date technology to Chimprom.

The following questions were raised, discussed and clarified at the meeting:

	Question/Concern/Suggestion	Clarification
1.	When will the project be implemented?	The target is to materialize the project before 2008, that is the beginning of the first commitment period of the Kyoto protocol, set for 2008-2012
2.	Who will be attracted for implementation of the project?	Some skilled personnel would be required for installation and commissioning of HFC-23 destruction unit, however unskilled staff also would be employed for the proposed project.
3.	Who will control and manage implementation of the project during construction stage?	Sumitomo corporation and its partners will be in charge of supply and installation of equipment. The exact responsibilities of each party will be defined more exactly at later stage.

Mrs Luneva expressed satisfaction over the explanation given, and declared that she fully supported the project and wished every success to Chimprom and Sumitomo in their efforts in improving the local and global environment.

Mr Eguchi concluded the meeting with a vote of thanks to Mrs Luneva.

MINUTES ATTESTED BY

Mrs Ludmila Luneva/

Mr Hiroshi Eguchi/

Mr Igor Sizykh/

Mr Alexander Kubyshev/

Mr Dmitry Chervichkin/

Annex 6-2

Minutes of meeting with Local Community

MINUTES OF MEETING**SUMITOMO CORPORATION AND CHIMPROM
PROPOSED HFC23 DESTRUCTION PROJECT****CHIMPROM'S HEADQUARTERS, VOLGOGRAD CITY
18th OCTOBER, 2005 12:00****PARTICIPANTS:****FROM SUMITOMO CORPORATION:**

Mr Hiroshi Eguchi – Manager;
Mr Alexander Kubyshev – Senior staff

From Chimprom:

Mr Igor Sizykh – R&D director;
Mrs Yulia Fedko – head of department

From Local Community:

Mr Pavel Mikhaev – Deputy head of ecological safety and environment control department of natural resource and environment protection committee of Volgograd region

Subjects Discussed.

Mr Eguchi thanked Mr Mikhaev for attending the meeting on behalf of local community. Then Mr Eguchi and Mr Sizykh briefly explained the main concept of the project and reasons why the companies initiated the project as follows:

In accordance with requirement of Kyoto protocol, which entered into force in yearly 2005 after ratification by Russian Federation, Japan has obligations to reduce emission of greenhouse gases (GHGs) by minus 6 % of the level of 1990. In this regards, Sumitomo Corporation, one of the biggest trading house in Japan, works hard to find and execute Joint Implementation (JI) projects using a flexibility mechanism defined in Article 6 in the Kyoto protocol in order to obtain emission reduction units (ERU).

JSC Chimprom is one of the major manufacturer of HCFC22 gas in Russia. In the process of production of HCFC22 gas, a by-product gas, HFC23 is inevitably generated in the quantity of approx 3 percent and then emitted into the atmosphere. HFC23 is a harmless and inert gas, thus there's no regulation on emissions of HFC23 in Russia. However HFC23 is a green house gas with high GWP (Global warming potential) of 11,700. Therefore, the companies agreed to consider possibilities of implementation of the JI project to destroy HFC23.



Destruction of HFC23 would be done through a state-of-the-art submerged combustion system. This project will be executed and operated in compliance with all necessary regulations and permissions, and would meet all environment regulations and standards.

It was emphasized that the project would be implemented on the funds arranged by Sumitomo Corporation and its materialization could lead to environment preservation as well as increased employment opportunities. Implementation of the project would contribute to development of the plan infrastructure and bring the up-to-date technology to Chimprom.

The following questions were raised, discussed and clarified at the meeting:

	Question/Concern/Suggestion	Clarification
1.	Will there be any negative side effect to the environment from operation of the HFC23 destruction system?	The proposed technology guarantees stable and reliable operation without any negative impact on the environment. Exhaust gas from the incinerator will be neutralized and cleaned before release to the atmosphere. Waste water will be treated to comply with the level of existing standards.
2.	Are the proposed design and technology for incineration of HFC23 gas reliable and proven enough?	The most effective submerged combustion system will be used to destroy HFC23 gas. This state-of-the-art system was developed in Japan and showed good performance for more than 7 years
3.	How big would be a positive effect to the environment from the proposed project since the emission of HFC23 gas is rather small.	Though the ratio of HFC23 to HCFC22 is only about 3%, GWP of HFC23 is 11,700 times higher than CO ₂ . Therefore, if we calculate CO ₂ equivalent of HFC23 gas using GWP of 11,700 we can understand that that proposed project would contribute greatly to the environment preservation

Mr Mikhaev expressed satisfaction over the explanation given. Mr Mikhaev declared that he was supporting the initiative of Chimprom and Sumitomo to implement the GHG emission reduction project. He also mentioned importance of measures that could contribute to environment preservation.

Mr Eguchi concluded the meeting with a vote of thanks to Mr Mikhaev.

MINUTES ATTESTED BY

Mr Pavel Mikhaev/

Mr Hiroshi Eguchi/

Mr Igor Sizykh/

Mr Alexander Kubyshev/

Mrs Yulia Fedko/