Monitoring report form
(Version 03.1)

Monitoring report

Title of the project activity	SF_6 recovery and reclamation project, South Korea
Reference number of the project activity	4274
Version number of the monitoring report	03
Completion date of the monitoring report	27/08/2013
Registration date of the project activity	01/04/2011
Monitoring period number and duration of this monitoring period	Monitoring Period Number : 01 Monitoring Period: 01/04/2011~26/04/2012
Project participant(s)	Solvay Fluor Korea Co. Ltd Solvay Energy Services SAS EcoSecurities International Limited (withdrawn)
Host Party(ies)	Republic of Korea
Sectoral scope(s) and applied methodology(ies)	Sectoral Scopes: 11 : Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride Applied methodology: AM0079 version 2, "Recovery of SF_6 from Gas insulated electrical equipment in testing facilities"
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	177,304
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	101,074

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Purpose of the project activity:

The Project activity aims to reduce emissions of SF_6 from the Korea Electrotechnology Research Institute (KERI) testing facility of electrotechnical equipment in South Korea that would have been vented in a business-as-usual scenario. SF_6 that has been used in the testing of gas insulated electrical equipment (GIEE), especially gas circuit breakers (GCB) and gas insulated switchgears (GIS) at KERI, is recovered and then reclaimed at Solvay's SF_6 manufacturing facility located in Ulsan, South Korea.

Brief description of the installed technology and equipments:

Under the project activity, used SF_6 is recovered using a compressor and a piping system and stored in pressurised dedicated recovery cylinders. These cylinders are then transported to a SF_6 manufacturing facility, Solvay Fluor Korea (SFK). At the SFK plant, chemical analysis is used to evaluate the moisture, gaseous and solid decomposition of the recovered gas. After checking that used SF_6 gas fulfils specifications for reclamation, the used SF_6 gas is fed into the new SF_6 production stream through a system of injection piping at a rate of 3 to 10 kg gas/hour. The production line will remove impurities and reclaim the gas to the same purity as new SF_6 in order to be sold in the market.

Relevant dates for the project activity:

The project was started on 23 November 2007 and SF_6 recovery equipments at KERI site started commissioning on 29 April 2008.

Total emission reductions achieved in this monitoring period:

The total emission reductions for the monitored period account to 101,074 tCO_2e.

A.2. Location of project activity

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Solvay Fluor Korea Co. Ltd: 383, Daejung-Ri, Onsan-Eup, Ulju-kun, Ulsan, Republic of Korea
Coordinates: Latitude 35.426374 Longitude 129.340193
Korea Electrotechnology Research Institute: 28-1 Seongju-dong, Changwon-si, Gyeongsangnamdo, Republic of Korea
Coordinates: Latitude 35.189363 Longitude 128.718224

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (as applicable)**	**Indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Republic of Korea (host)	Solvay Fluor Korea Co. Ltd (Private entity)	No
France	Solvay Energy Services SAS (Private entity)	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities International Limited (Withdrawn)	No

A.4. Reference of applied methodology

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AM0079 “Recovery of SF_6 from Gas insulated electrical equipment in testing facilities” (version 2)

“Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01)

A.5. Crediting period of project activity

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Crediting period type: 10 years (Fixed)
Crediting period: 01/04/2011 ~ 31/03/2021

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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The project was started on 23 November 2007 and the commissioning at the recovery site started on 29 April 2008.
The project consists of two sites, one is the SF_6 recovery site and the other is the SF_6 reclamation site. The operational period for both sites is presented in the Table B.1.

Note that recovery-reclamation cylinder *i* refers to each recovery-reclamation cycle that a cylinder goes through (i.e. from the moment the cylinder is taken to the recovery site until the moment the gas contained in the cylinder has been injected into the reclamation facility) and not the physical cylinder. The project uses bundles of two interconnected gas cylinders as its unit of transport; therefore one cylinder *i* for the purposes of the methodology refers to a “bundle”, or two connected physical cylinders, also referred to as the “cylinder bundle”.

Table B.1 The operational period at KERI and SFK site

	SF_6 Recovery at KERI site		SF_6 Reclamation at SFK site	
i	Recovery Period from	Recovery Period to	Reclamation Period from	Reclamation Period to
CDM-11003	2-Apr-11	10-Jun-11	19-Jul-11	28-Jul-11
CDM-11004	11-Jun-11	13-Jul-11	23-Aug-11	2-Sep-11
CDM-11005	13-Jul-11	30-Sep-11	25-Oct-11	3-Nov-11
CDM-11006	1-Oct-11	1-Dec-11	20-Dec-11	29-Dec-11
CDM-11007	2-Dec-11	6-Feb-12	29-Feb-12	9-Mar-12
CDM-12001	8-Feb-12	29-Mar-12	19-Apr-12	26-Apr-12

There was no event occurred during this monitoring period, which may have impact on the applicability of the methodology.

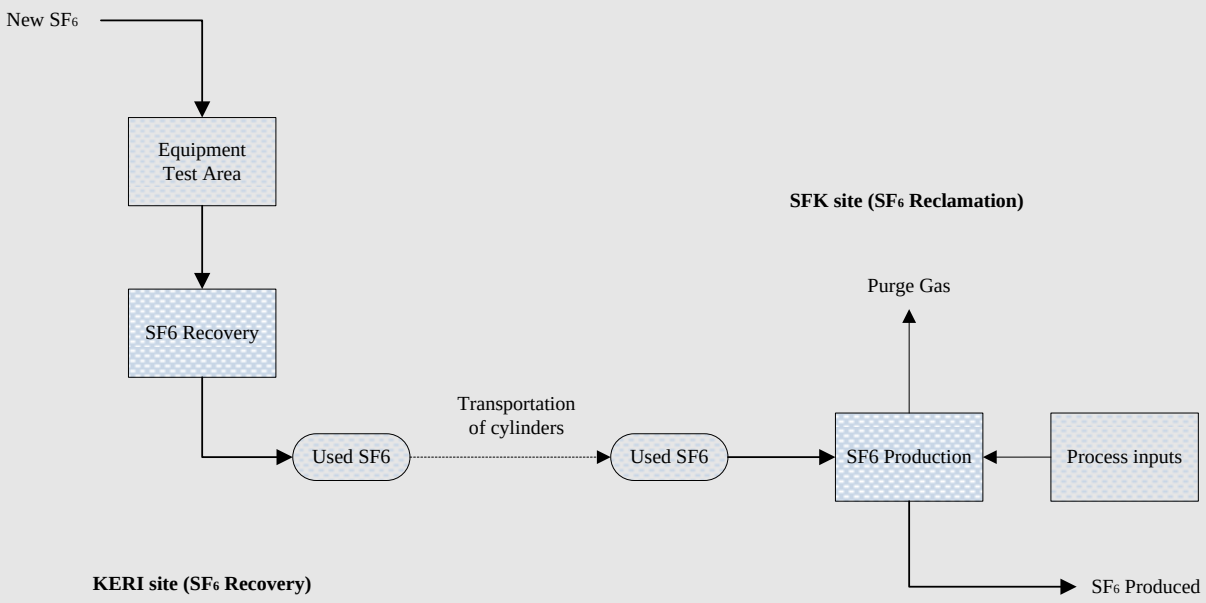

Fig B.1 Diagram of the recovery & reclamation process and the monitoring points

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

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A request for temporary deviation from the monitoring plan was approved by EB on 27 Aug 2013.
http://cdm.unfccc.int/Projects/DB/DNV-CUK1292915045.72/view

The detailed information of the deviation to monitoring plan is demonstrated below as it's important to explain the emission reduction calculation in Section D and Section E of the monitoring report.

Background information of the deviation:

The project activity was registered on 01 Apr 2011 with methodology AM0079 version 2 applied. In the registered PDD (version 7), $Q_{SF6,y}$ is required to be monitored to calculate discount factor (DFT_y) for baseline emission calculation.

$$BE_y = MIN\{V_{SF6,hist}, DFT_y * EA_y\} * GWP_{SF6}$$

Where:

BE_y	=	Baseline emissions year *y*, tCO_2e
DFT_y	=	Discount factor for testing in year *y*
EA_y	=	Quantity of SF_6 reclaimed during the year *y*, tonnes SF_6
$V_{SF6,hist}$	=	Historical annual baseline venting of SF_6, tonnes SF_6
GWP_{SF6}	=	Global warming potential of SF_6, tCO_2e/tonnes SF_6

DFT_y is obtained through:

$$DFT_y = \frac{\sum_k \left(Q_{SF6,k,y} * RT_{k,y}\right)}{Q_{SF6,y}}$$

Where:

DFT_y	=	Discount factor for testing in year *y*
$Q_{SF6,k,y}$	=	Total amount of SF_6 filled in the testing of equipments in category *k* in year *y*, tonnes SF_6

$Q_{SF6,y}$	=	Total amount of SF_6 filled in testing of all equipments in the project activity in year *y*, tonnes SF_6
$RT_{k,y}$	=	Ratio of number of eligible testing items in category *k* (maximum value is set at 1)

In PDD, all the equipments were classified into two categories. Therefore,

$$DFT_y = \frac{\sum_k \left(Q_{SF6,k,y} * RT_{k,y}\right)}{Q_{SF6,y}} = \frac{Q_{SF6,1,y} * RT_{1,y} + Q_{SF6,2,y} * RT_{2,y}}{Q_{SF6,y}}$$

The project started commissioning at the recovery site on 29 April 2008.
The project consists of two sites, one is the SF_6 recovery site and the other is the SF_6 reclamation site. The operational period for both sites is presented in the table below.

The operational period at KERI and SFK site

	SF_6 Recovery at KERI site		SF_6 Reclamation at SFK site	
i	Recovery Period from	Recovery Period to	Reclamation Period from	Reclamation Period to
CDM-11003	2-Apr-11	10-Jun-11	19-Jul-11	28-Jul-11
CDM-11004	11-Jun-11	13-Jul-11	23-Aug-11	2-Sep-11
CDM-11005	13-Jul-11	30-Sep-11	25-Oct-11	3-Nov-11
CDM-11006	1-Oct-11	1-Dec-11	20-Dec-11	29-Dec-11
CDM-11007	2-Dec-11	6-Feb-12	29-Feb-12	9-Mar-12
CDM-12001	8-Feb-12	29-Mar-12	19-Apr-12	26-Apr-12

Note that recovery-reclamation cylinder *i* refers to each recovery-reclamation cycle that a cylinder goes through (i.e. from the moment the cylinder is taken to the recovery site until the moment the gas contained in the cylinder has been injected into the reclamation facility) and not the physical cylinder. The project uses bundles of two interconnected gas cylinders as its unit of transport; therefore one cylinder *i* for the purposes of the methodology refers to a "bundle", or two connected physical cylinders, also referred to as the "cylinder bundle".

Actual measurement situation:
$Q_{SF6,k,y}$ was not monitored and recorded for the cylinder bundle CDM-11003, CDM-11004 and CDM-11005 during the recovery period from 02 April 2011 to 30 Sep 2011.

Deviation to the monitoring plan:
As analysed above,

$$DFT_y = \frac{\sum_k \left(Q_{SF6,k,y} * RT_{k,y}\right)}{Q_{SF6,y}} = \frac{Q_{SF6,1,y} * RT_{1,y} + Q_{SF6,2,y} * RT_{2,y}}{Q_{SF6,y}}$$

There are two scenarios:
Scenario a): $RT_{1,y}$ is bigger than or equal to $RT_{2,y}$ ($RT_{1,y} \geq RT_{2,y}$),

$$DFT_y = \frac{\sum_k \left(Q_{SF6,k,y} * RT_{k,y}\right)}{Q_{SF6,y}} = \frac{Q_{SF6,1,y} * RT_{1,y} + Q_{SF6,2,y} * RT_{2,y}}{Q_{SF6,y}} \geq \frac{Q_{SF6,1,y} * RT_{2,y} + Q_{SF6,2,y} * RT_{2,y}}{Q_{SF6,y}}$$

And

$$\frac{Q_{SF6,1,y} * RT_{2,y} + Q_{SF6,2,y} * RT_{2,y}}{Q_{SF6,y}} = \frac{RT_{2,y} * (Q_{SF6,1,y} + Q_{SF6,2,y})}{Q_{SF6,y}},$$

For $Q_{SF6,1,y} + Q_{SF6,2,y} = Q_{SF6,y}$,

$$\frac{RT_{2,y} * (Q_{SF6,1,y} + Q_{SF6,2,y})}{Q_{SF6,y}} = \frac{RT_{2,y} * Q_{SF6,y}}{Q_{SF6,y}} = RT_{2,y}.$$

Therefore, when $RT_{1,y} \geq RT_{2,y}$, $DFT_y \geq RT_{2,y}$.

Scenario b): $RT_{2,y}$ is bigger than $RT_{1,y}$ ($RT_{2,y} > RT_{1,y}$),

$$DFT_y = \frac{\sum_k \left(Q_{SF6,k,y} * RT_{k,y}\right)}{Q_{SF6,y}} = \frac{Q_{SF6,1,y} * RT_{1,y} + Q_{SF6,2,y} * RT_{2,y}}{Q_{SF6,y}} > \frac{Q_{SF6,1,y} * RT_{1,y} + Q_{SF6,2,y} * RT_{1,y}}{Q_{SF6,y}}$$

And

$$\frac{Q_{SF6,1,y} * RT_{1,y} + Q_{SF6,2,y} * RT_{1,y}}{Q_{SF6,y}} = \frac{RT_{1,y} * (Q_{SF6,1,y} + Q_{SF6,2,y})}{Q_{SF6,y}}$$

For $Q_{SF6,1,y} + Q_{SF6,2,y} = Q_{SF6,y}$,

$$\frac{RT_{1,y} * (Q_{SF6,1,y} + Q_{SF6,2,y})}{Q_{SF6,y}} = \frac{RT_{1,y} * Q_{SF6,y}}{Q_{SF6,y}} = RT_{1,y}$$

Therefore, when $RT_{2,y} > RT_{1,y}$, $DFT_y > RT_{1,y}$.

Deviation proposal: when $RT_{1,y}$ is bigger than(or equal to) $RT_{2,y}$, the value of $RT_{2,y}$ being used as the discount factor (DFT_y); when $RT_{2,y}$ is bigger than $RT_{1,y}$, the value of $RT_{1,y}$ being used as the discount factor (DFT_y). therefore, DFT_y = Min {$RT_{1,y}$, $RT_{2,y}$}

It can be concluded from above analysis that when the data of $Q_{SF6,k,y}$ was not monitored the deviation proposal of using the value of $RT_{1,y}$ or $RT_{2,y}$ under different scenarios to substitute DFT_y is conservative.

B.2.2. Corrections

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The sub-index "*k*" has been determined in registered PDD according to the approved methodology AM0079 ver.2 and the GIEE tested during 2007. The approved methodology requires to define the maximum number of equal range categories, in kV, that contain at least 5 equipments both of the historic and project samples. In the proposed project activity, there are 56 equipments for 2007 that were tested. The capacity of these equipments ranges from 72kV to 800kV and has been organized in the following two categories;

k =1: 40 – 419 kV

k =2: 420 – 800 kV.

In the project year, the equipment range is 12- 800 kV, according to the SF_6 gas test records at recovery site during 2011-04-02 to 2012-04-26. In order to comply with the methodology that the maximum number of the range should be applied, the categories had been updated as;

k =1: 12 – 405 kV

k =2: 406 – 800 kV.

The request for the correction to project information was approved by EB on 27 Aug 2013.
http://cdm.unfccc.int/Projects/DB/DNV-CUK1292915045.72/view

B.2.3. Permanent changes from registered monitoring plan or applied methodology

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Not applicable

B.2.4. Changes to project design of registered project activity

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Not applicable

B.2.5. Changes to start date of crediting period

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Not applicable

B.2.6. Types of changes specific to afforestation or reforestation project activity

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Not applicable

SECTION C. Description of monitoring system

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The monitoring methodology employed is in line with the approved methodology AM0079 (version 2).

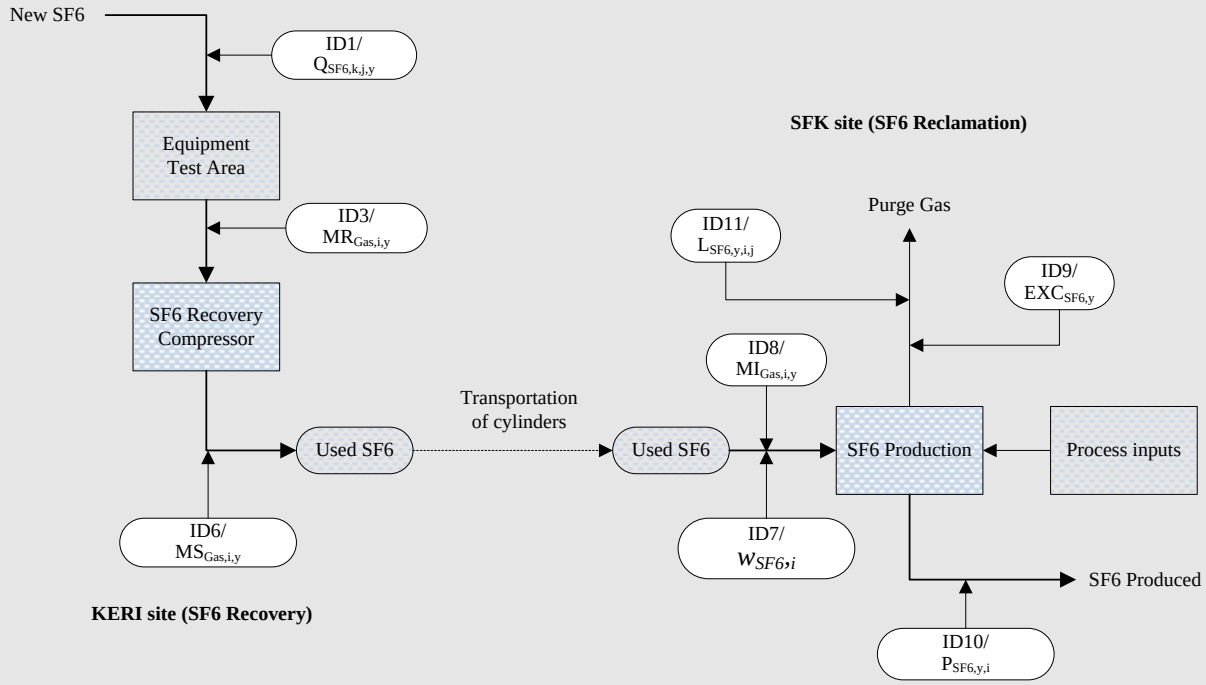

Fig C1. Diagram of the monitoring system

Project Monitoring Plan

Number	Code	Description	Purpose / Use	Location
1	$Q_{SF6,k,j,y}$	Mass of SF_6 that is filled into equipment *j* of category k in year *y* at the SF_6 recovery site	Baseline Emissions	SF_6 recovery site
2	$NT_{PJ,k,y}$	Average number of total testing items where recovery was done per equipment in the project, for category *k*	Baseline Emissions	SF_6 recovery site
3	$MR_{Gas,i,y}$	Mass of used gas that is recovered into cylinder *i* at the SF_6 recovery site in year y	Baseline Emissions	SF_6 recovery site
4	*i*	Sub-index used for each cylinder that completed a recovery-reclamation cycle	Baseline Emissions	SF_6 recovery site, SF_6 reclamation site

		included in the estimation of emissions avoided for the year *y*		
5	*n*	Number of cylinders that completed a recovery-reclamation cycle in the year *y*. Only these cylinders are eligible to be included in the estimation of emissions avoided for the year *y*	Baseline Emissions	SF_6 recovery site, SF_6 reclamation site
6	$MS_{Gas,i,y}$	Mass of used gas stored in recovery cylinder bundle *i* in year *y*	Baseline Emissions	SF_6 recovery site
7	$w_{SF6,i}$	Concentration of SF_6 in the cylinder *i*	Baseline Emissions	SF_6 reclamation site/Laboratory
8	$MI_{Gas,i,y}$	Mass of used gas from cylinder *i* which is injected for reclamation	Baseline Emissions	SF_6 reclamation site
9	$EXC_{SF6,y}$	Quantity of SF_6 which was being injected to the reclamation facility during exceptional events occurred in year *y*	Project Emissions	SF_6 reclamation site
10	$P_{SF6,i,y}$	Production of SF_6 during the reclamation period of cylinder *i*, in year *y*	Project Emissions	SF_6 reclamation site
11	$L_{SF6,y,i,j}$	Amount of SF_6 loss from point j during the reclamation period of cylinder i in year y	Project Emissions	SF_6 reclamation site

1. Monitoring organization

Each of the Project sites, the SF_6 recovery site (KERI) and the SF_6 reclamation site (SFK), designates an on-site CDM coordinator. The CDM coordinators have the overall responsibility for the relevant monitoring of emissions reductions of the project activity according to the monitoring plan. The CDM coordinators report regularly to their respective senior management. All other technical staff which are involved in the data collection process have defined roles and responsibilities. The overall monitoring responsibility for both the SFK and KERI sites is with the CDM coordinator of the SF_6 reclamation site (SFK). The standard operation procedures (SOP) were developed for the project and were in place at both recovery and reclamation sites. All the personnel involved in the CDM activity were properly trained for both the normal project operation and CDM specific activities. CDM training records and SOP training records were both properly retained.

2. Monitoring equipment

The primary equipment used for the monitoring of CDM parameters project is the following:

(i) Weighing scale: A weighing scale is used for weighing the cylinders in a bundle at the SF_6 recovery site. The scale has been appropriately calibrated.

(ii) Mass flow meter: Flow meters are used to quantify the amount of SF_6 both at the SF_6 recovery and reclamation sites. The flow meters have been appropriately calibrated.

(iii) Gas chromatograph: The SF_6 content of the used gas in each cylinder bundle is analyzed using a gas chromatography. The equipment has been appropriately calibrated.
Two cylinders filled with used SF_6 as one cylinder bundle are transported to the reclamation site with each cylinder bundle clearly identified and marked. Upon arrival at the SF_6 reclamation site, each cylinder bundle would be analysed, to determine the proportion of SF_6 gas and the proportion of impurities.

3. Data and records management
Data monitored for CDM purposes would be recorded and filed electronically once the cylinder bundle is filled with SF_6. All relevant data were archived electronically, and backed up regularly. Moreover, it will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this project activity (whichever occurs later). The electronic files would be backed up. The CDM Coordinators are responsible for checking the data quality and are responsible for managing the collection, storage and archiving of all data and records.

4. Quality Assurance
All data collected is checked by the CDM coordinators. Standard Operation Procedures are in place to ensure consistent quality of all data collection, recording, storage, reporting and possible monitoring data adjustments and uncertainties as well as emergencies. Moreover, regular internal audits are conducted to assure that the project is in compliance with operational and CDM requirements.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Copy this table for each piece of data and parameter.)

Data/Parameter	**GWP_{SF6}**
Unit	tCO_2e/tSF_6
Description	Global warming potential of SF_6
Source of data	IPCC 2nd assessment report
Value(s) applied	23,900
Purpose of data	Baseline emissions calculation
Additional comment	Shall be updated according to any future COP/MOP decisions

Data/Parameter	**-**
Unit	MW
Description	Rated capacity of the operating equipment used for project activity of the testing facilities at recovery site and reclamation site in year y
Source of data	Records at recovery and reclamation sites
Value(s) applied	At recovery site = 0.0169 corresponds to total capacity of following corresponding equipments, 1. Two Compressors – 10kW 2. Suctioning Pump – 0.6 kW 3. Vacuum Pump – 1.5kW 4. Evaporator – 4.8kW Total: 16.9kW = 0.0169MW At reclamation site = 0.000006, corresponds to the following equipment, 1. One flow meter – 6 W
Purpose of data	Project emissions calculation
Additional comment	The specification of the above monitoring instruments will be checked

Data/Parameter	**$EF_{elec,j,y}$**
Unit	tCO_2e/MWh
Description	Emissions factor for electricity consumed by process “j” in year “y”

Source of data	The registered PDD
Value(s) applied	1.30
Purpose of data	Project emissions calculation
Additional comment	As per the description in the registered PDD, the emission factor of grid electricity in Korea is around 0.56 tCO_2e/MWh. Hence, 1.3 is considered to be a conservative assumption Value to be fixed during all the crediting period

Data/Parameter	**$TDL_{j,y}$**
Unit	-
Description	Average technical transmission and distribution losses for providing electricity to source j year y
Source of data	The registered PDD, and the adopted value is in line with "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"
Value(s) applied	20%
Purpose of data	Project emissions calculation
Additional comment	-

Data/Parameter	**$TI_{SF6,used,t}$**
Unit	tonnes gas
Description	Used gas vented during eligible testing item for the historical baseline year
Source of data	The registered PDD
Value(s) applied	6.9452
Purpose of data	Baseline emissions calculation
Additional comment	-

Data/Parameter	**$NT_{BL,k}$**
Unit	-
Description	Average number of eligible testing items where venting occurred per equipment in the baseline, for category k
Source of data	The registered PDD
Value(s) applied	For k category 40 - 419kV, $NT_{BL,1}$: 2.76 For k category 420 - 800 kV, $NT_{BL,2}$: 1.90
Purpose of data	Baseline emissions calculation
Additional comment	-

Data/Parameter	**$L_{SF6,hist,j}$**
Unit	tonnes SF_6
Description	Historical amount of SF_6 loss from point j, tonnes SF_6
Source of data	The registered PDD and it's estimated according to the records of the SF_6 reclamation site
Value(s) applied	0.434
Purpose of data	Project emissions calculation
Additional comment	-

Data/Parameter	**$P_{SF6,hist}$**
Unit	tonnes SF_6
Description	Production of SF_6 during the historical period, tonnes SF_6
Source of data	The registered PDD and it's estimated according to the records of the SF_6 reclamation site
Value(s) applied	748.608
Purpose of data	Project emissions calculation
Additional comment	-

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

Data/Parameter	**GWP_{SF6}**
Unit	tCO_2e/tSF_6
Description	Global warming potential of SF_6
Measured/Calculated /Default	Default
Source of data	IPCC 2nd assessment report
Value(s) of monitored parameter	23,900 The value of the parameter is fixed for the first commitment period and shall be updated according to any future COP/MOP decisions
Monitoring equipment	-
Measuring/Reading/ Recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data	Baseline emissions calculation
Additional comment	-

Data/Parameter	**$w_{SF6,BL,hist,y}$**
Unit	tonnes SF_6/ tonnes gas
Description	Concentration of SF_6 in used gas in the baseline, to be used as a substitute for $w_{SF6,hist}$ where the record of the concentration of SF_6 in the gas vented in the baseline is not available
Measured/Calculated /Default	Measured and calculated The 50% of cylinder bundles (CDM-11003, CDM-11006 and CDM-11007) i that represent the most conservative measurements are used to the parameter definition.
Source of data	Laboratory test results
Value(s) of monitored parameter	i: Value CDM-11003: 99.53% CDM-11004: 97.18% CDM-11005: 99.62% CDM-11006: 98.27% CDM-11007: 99.22% CDM-12001: 99.58% $w_{SF6,BL,hist,y}$: 98.23%
Monitoring equipment	Monitoring equipment: Gas Chromatograph Serial No.: CN10622030 Calibration frequency: 2 years Accuracy: The detection limit of all the gases analysed is at least 50 ppm. Calibration Agency: SFK Date of calibration: 11 Feb 2010; 14 May 2011 Validity of calibration: 2 years
Measuring/Reading/ Recording frequency	The gas sample is collected every time a cylinder bundle arrives at SFK plant. This sample is analyzed in SFK laboratory using Gas Chromatography tests in accordance with the internal Standard Operational Procedure (SOP). The detection limit of all the gases analysed will be at least 50 ppm.
Calculation method (if applicable)	-

QA/QC procedures	The SOP uses ASTM D 2685, ASTM D 2029, ASTM D 2284, Din IEC 60376, VDE 0373, ASTM 2472 and/or other sector, national or international Standards.
Purpose of data	Baseline emissions calculation
Additional comment	This variable does not exist in equations, however provided in monitoring table to be used as substitute to the variable $w_{SF6,hist}$, for the cases where the record of the concentration of SF_6 in the gas vented in the baseline is not available

Data/Parameter	**$Q_{SF6,k,j,y}$**
Unit	tonnes SF_6
Description	Mass of SF_6 that is filled into equipment j of category k in the year y at the SF_6 recovery site
Measured/Calculated /Default	Measured
Source of data	Records from the SF_6 recovery site
Value(s) of monitored parameter	As the data of $Q_{SF6,k,y}$ was not available for the cylinder bundle CDM-11003, CDM-11004 and CDM-11005 (Please refer to B.2.1 for more detailed analysis), the data of $Q_{SF6,k,i,y}$ for the cylinder bundle CDM-11006, CDM-11007 and CDM-12001 during the recovery period from 1 Oct 2011 - 26 Apr 2012 is listed below. During the monitoring period, the equipments ranging from 12 to 800 KV were tested so the range is set at 12 KV to 800 KV and the categories are: 12 to 405 KV and 406 to 800 KV, so $Q_{SF6,1,y}$ represents the total amount of SF_6 filled in the testing of equipments in category 1(12 to 405KV) in year y and $Q_{SF6,2,y}$ represents the total amount of SF_6 filled in the testing of equipments in category 2 (406 to 800 KV) in year y. $Q_{SF6,1}$= 3.12, for the cylinder bundles CDM-11006~CDM12001; $Q_{SF6,2}$ = 1.10, for the cylinder bundles CDM-11006~CDM12001;
Monitoring equipment	

Monitoring equipment	Mass flow meter	Mass flow meter
Serial No.	14122007	14111339
Calibration frequency	5years, recommended by FMTech Co., Ltd	5years, recommended by FMTech Co., Ltd
Accuracy	±0.100%	±0.100%
Calibration Agency	FMTech Co., Ltd	FMTech Co., Ltd
Date of calibration	05 Feb 2009	21 Nov 2008
	25 May 2012	21 May 2012
Validity of calibration	5 years	5 years

Measuring/Reading/ Recording frequency	Measuring continuously and recording after each injection
Calculation method (if applicable)	-
QA/QC procedures	Meters subject to regular calibration according to standard FMT-QG-06
Purpose of data	Baseline emissions calculation
Additional comment	-

Data/Parameter	**$MR_{Gas,i,y}$**
Unit	tonnes gas
Description	Mass of used SF_6 recovered into cylinder bundle i at the SF_6 recovery site in year y
Measured/Calculated /Default	Measured
Source of data	Records from the SF_6 recovery site

Value(s) of monitored parameter	

i	MR_{Gas} (kg)
CDM-11003	1024.61
CDM-11004	1097.67
CDM-11005	1074.38
CDM-11006	1106.85
CDM-11007	1059.30
CDM-12001	1176.44
Sum	6539.25

Monitoring equipment	

Monitoring equipment	Mass flow meter
Serial No.	14069408
Calibration frequency	5years, recommended by FMTech Co., Ltd
Accuracy	±0.100%
Calibration Agency	FMTech Co., Ltd
Date of calibration	27 May 2009
	25 May 2012
Validity of calibration	5 years

Measuring/Reading/ Recording frequency	Measuring continuously and recording after each recovery of the SF_6 being vented
Calculation method (if applicable)	-
QA/QC procedures	Meter subject to regular calibration according to standard FMT-QG-06
Purpose of data	Baseline emissions calculation
Additional comment	-

Data/Parameter	**$MS_{Gas,i,y}$**
Unit	Tonnes of gas
Description	Mass of used gas stored in recovery cylinder bundle i in year y
Measured/Calculated /Default	Measured
Source of data	Records from SF6 recovery site
Value(s) of monitored parameter	

i	MS_{Gas} (kg)
CDM-11003	1020.00
CDM-11004	1080.00
CDM-11005	973.50
CDM-11006	1058.50
CDM-11007	1014.00
CDM-12001	1179.00
Sum	6325.00

Monitoring equipment	<table><tr><td>Monitoring equipment</td><td>Weighing Scale</td></tr><tr><td>Serial No.</td><td>FR3</td></tr><tr><td>Calibration frequency</td><td>2 years</td></tr><tr><td>Accuracy</td><td>0.5kg/5000kg</td></tr><tr><td>Calibration Agency</td><td>KML for the 1st and 2nd calibrations; Pyunghwa HiTech for the 3rd calibration</td></tr><tr><td rowspan="3">Date of calibration</td><td>28 May 2009</td></tr><tr><td>20 Oct 2010</td></tr><tr><td>05 Jan 2012</td></tr><tr><td>Validity of calibration</td><td>2 years</td></tr></table>
Measuring/Reading/ Recording frequency	Measuring and recording for each bundle of cylinders
Calculation method (if applicable)	-
QA/QC procedures	Meter subject to regular calibration according to standard KML-CAL-M05 and PH-I003
Purpose of data	Baseline emissions calculation
Additional comment	-

Data/Parameter	**$MI_{Gas,i,y}$**
Unit	Tonnes of gas
Description	Mass of used gas from the cylinder bundle i injected into the production process for reclamation process in year y
Measured/Calculated /Default	Measured
Source of data	Records from SF_6 recovery site
Value(s) of monitored parameter	<table><tr><td>i</td><td>MI_{Gas} (kg)</td></tr><tr><td>CDM-11003</td><td>970.40</td></tr><tr><td>CDM-11004</td><td>911.58</td></tr><tr><td>CDM-11005</td><td>906.69</td></tr><tr><td>CDM-11006</td><td>1,016.15</td></tr><tr><td>CDM-11007</td><td>977.34</td></tr><tr><td>CDM-12001</td><td>1,134.67</td></tr><tr><td>Sum</td><td>5,916.83</td></tr></table>
Monitoring equipment	<table><tr><td>Monitoring equipment</td><td>Mass flow meter</td></tr><tr><td>Serial No.</td><td>14014422</td></tr><tr><td>Calibration frequency</td><td>5years, recommended by FMTech Co., Ltd</td></tr><tr><td>Accuracy</td><td>±0.100%</td></tr><tr><td>Calibration Agency</td><td>FMTech Co., Ltd</td></tr><tr><td rowspan="2">Date of calibration</td><td>08 Jun 2009</td></tr><tr><td>21 May 2012</td></tr><tr><td>Validity of calibration</td><td>5 years</td></tr></table>
Measuring/Reading/ Recording frequency	Measuring continuously and recording after each injection of the SF_6 into the SF_6 production line
Calculation method (if applicable)	-
QA/QC procedures	Meter subject to regular calibration according to standard FMT-QG-06
Purpose of data	Baseline emissions calculation
Additional comment	-

<table>
<tr><td>Data/Parameter</td><td>$L_{SF6,y,i,j}$</td></tr>
<tr><td>Unit</td><td>Tonnes SF_6</td></tr>
<tr><td>Description</td><td>Amount of SF_6 loss from point j during the reclamation period of cylinder i in year y</td></tr>
<tr><td>Measured/Calculated /Default</td><td>Measured
The measurement period is the period in which cylinder i is connected for gas reclamation</td></tr>
<tr><td>Source of data</td><td>Records from SF_6 reclamation site</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th>i</th><th>$L_{SF6,y,i,j}$ (kg)</th></tr>
<tr><td>CDM-11003</td><td>63.2</td></tr>
<tr><td>CDM-11004</td><td>36.5</td></tr>
<tr><td>CDM-11005</td><td>51.5</td></tr>
<tr><td>CDM-11006</td><td>17.6</td></tr>
<tr><td>CDM-11007</td><td>21.8</td></tr>
<tr><td>CDM-12001</td><td>21.7</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td>Monitoring equipment</td><td>Mass flow meter</td></tr>
<tr><td>Serial No.</td><td>14014074</td></tr>
<tr><td>Calibration frequency</td><td>5years, recommended by FMTech Co., Ltd</td></tr>
<tr><td>Accuracy</td><td>±0.35%</td></tr>
<tr><td>Calibration Agency</td><td>FMTech Co., Ltd</td></tr>
<tr><td rowspan="2">Date of calibration</td><td>08 Jun 2009</td></tr>
<tr><td>24 May 2012</td></tr>
<tr><td>Validity of calibration</td><td>5 years</td></tr>
</table>
<table>
<tr><td>Monitoring equipment</td><td>Gas Chromatograph</td></tr>
<tr><td>Serial No.</td><td>CN10622030</td></tr>
<tr><td>Calibration frequency</td><td>2 years</td></tr>
<tr><td>Accuracy</td><td>The detection limit of all the gases analysed is at least 50 ppm.</td></tr>
<tr><td>Calibration Agency</td><td>SFK</td></tr>
<tr><td rowspan="2">Date of calibration</td><td>11 Feb 2010</td></tr>
<tr><td>14 May 2011</td></tr>
<tr><td>Validity of calibration</td><td>2 years</td></tr>
</table>
</td></tr>
<tr><td>Measuring/Reading/ Recording frequency</td><td>Measuring continuously and recording daily</td></tr>
<tr><td>Calculation method (if applicable)</td><td>$L_{SF6,y,i,j}$ = Daily purge mass amount of gas × Volume% of SF_6</td></tr>
<tr><td>QA/QC procedures</td><td>Meter subject to regular calibration according to standard FMT-QG-06</td></tr>
<tr><td>Purpose of data</td><td>Project emissions reduction</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$P_{SF6,y,i}$</td></tr>
<tr><td>Unit</td><td>Tonnes SF_6</td></tr>
<tr><td>Description</td><td>Production of SF_6 during the reclamation period of cylinder i, in year y</td></tr>
<tr><td>Measured/Calculated /Default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Records from regular production monitoring at SF_6 reclamation site</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th>i</th><th>$P_{SF6,y,i}$ (kg)</th></tr>
<tr><td>CDM-11003</td><td>45,107</td></tr>
<tr><td>CDM-11004</td><td>46,656</td></tr>
<tr><td>CDM-11005</td><td>35,930</td></tr>
<tr><td>CDM-11006</td><td>32,523</td></tr>
<tr><td>CDM-11007</td><td>42,488</td></tr>
<tr><td>CDM-12001</td><td>34,257</td></tr>
</table>
</td></tr>
</table>

Monitoring equipment	There are two storage tanks, so called daily tank, which are operated alternatively day by day. Daily production amount is stored to A and B tank alternatively day by day for quality check and is transferred to a third big storage tank (weekly tanks) for SF_6 filling work. As SF_6 is a liquefied gas in the storage tank, it is difficult to measure the amount directly so by measuring the difference of tank level (volume), temperature and pressure of daily tank between certain time point of the day to the time point of next day, the daily production amount is calculated.
Measuring/Reading/ Recording frequency	Measured and recorded daily
Calculation method (if applicable)	-
QA/QC procedures	The measurement period is the period in which cylinder *i* is connected for gas reclamation, as measured in days. Production to be measured daily. The production measurement will follow the Specific Operational Procedure (SOP) SFK-SOP-SF6-086, where is defined the detailed procedure, the responsible for measuring it, the reporting system and the equipments(Level gauge, pressure, temperature of daily tank) used to measure. The accuracy of each monitoring equipment will be at least: Level gauge : ±50mm Pressure gauge : ± 0.5% Temperature : ± 0.5 %
Purpose of data	Project emissions reduction
Additional comment	-

Data/Parameter	**$NT_{PJ,k,y}$**
Unit	N/A
Description	Average number of total testing items where recovery was done per equipment in the project, for category k
Measured/Calculated /Default	Calculated In the registered PDD, it states that the equipments ranging from 40 KV to 800 KV were tested in the historic baseline period, and two categories were formed: 40 to 419 KV and 420 KV to 800 kV. $NT_{BL,1}$ and $NT_{BL,2}$ were calculated based on the historical records in the registered PDD. During the monitoring period, the equipments ranging from 12 to 800 KV were tested so the range is set at 12 KV to 800 KV and the categories are: 12 to 405 KV and 406 to 800 KV.
Source of data	Records from the SF_6 recovery site

Value(s) of monitored parameter	<table><tr><th></th><th>CDM-11003 ~ CDM-11005</th><th>CDM-11006 ~ CDM-12001</th><th>CDM-11003~ CDM-12001 (calculation results based on the whole monitoring period)</th></tr><tr><td>$NT_{,PJ,1}$ (for category: 12~405 kV)</td><td>2.30</td><td>2.05</td><td>2.19</td></tr><tr><td>$NT_{,PJ,2}$ (for category: 406~800 kV)</td><td>3.29</td><td>2.79</td><td>2.95</td></tr></table> For bundles CDM-11003~CDM-11005, the $NT_{pi,k,v}$ are used to calculate DFT_y in a very conservative way as deviated from the monitoring plan; For bundles CDM-11006~CDM-12001, two sets of $NT_{PJ,k,v}$ have been calculated in the monitoring workbook. One is calculated based on the average number of total testing items where recovery was done per equipment in the project, for category k in the monitoring period for cylinder bundle CDM-11006, CDM-11007 and CDM-12001; the other set is based on the data of the whole monitoring period (for cylinder bundle CDM-11003, CDM-11004, CDM-11005, CDM-11006, CDM-11007 and CDM-12001). The two sets data of $NT_{PJ,k,y}$ are used for the calculation of DFT_y. The value of DFT_y using the first set of $NT_{PJ,k,y}$ is 0.92 and the value of DFT_y is 0.91 when using the 2nd set of $NT_{PJ,k,y}$. Since the calculation result of the 2nd set of $NT_{PJ,k,y}$ based on the whole monitoring period is more conservative, it has been used for the baseline emission calculation. Please refer to the monitoring workbook and E.1 part of the MR for more detailed information.
Monitoring equipment	-
Measuring/Reading/ Recording frequency	-
Calculation method (if applicable)	Count the number of testing items where gas was recovered for the year y, by referring to the testing records compiled during the project year at the SF_6 recovery site. Count the number of equipment in each category for the year y, by referring to the testing records compiled during the project year at the SF_6 recovery site. For each category k, make an average of the counts for equipment in that category to derive $NT_{PJ,k,y}$
QA/QC procedures	-
Purpose of data	Baseline emissions reduction
Additional comment	-

Data/Parameter	***i***
Unit	N/A
Description	Sub-index used for each cylinder bundle that completed a recovery-reclamation cycle included in the estimation of emissions avoided for the year y
Measured/Calculated /Default	-
Source of data	Records from the SF_6 recovery site and SF_6 reclamation site

Value(s) of monitored parameter	The relation between the Sub-index "i" and the number of cylinder bundle "n" is illustrated below.

i	n
CDM-11003	0001
CDM-11004	0003
CDM-11005	0004
CDM-11006	0001
CDM-11007	0003
CDM-12001	0004

Monitoring equipment	-
Measuring/Reading/ Recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	When used gas is filled into a recovery cylinder bundle, weighed, and sent for reclaiming, the activity should be noted using the cylinder bundle identification information
Purpose of data	-
Additional comment	Recovery cylinder bundles must be visibly distinguishable from new gas cylinder bundles. Records from both sites should coincide An individual cylinder bundle may be used more than one time per year, i.e. it may go through the recovery-reclamation process more than once. However, the labelling will show the unique identity of each cylinder bundle as it is involved in one recovery- reclamation process

Data/Parameter	**n**
Unit	N/A
Description	Number of cylinder bundles that completed a recovery-reclamation cycle in the year y. Only these cylinder bundles are eligible to be included in the estimation of emissions avoided for the year y
Measured/Calculated /Default	-
Source of data	Records from the SF_6 recovery site and SF_6 reclamation site
Value(s) of monitored parameter	The relation between the Sub-index "i" and the number of cylinder bundle "n" is illustrated below.

i	n
CDM-11003	0001
CDM-11004	0003
CDM-11005	0004
CDM-11006	0001
CDM-11007	0003
CDM-12001	0004

Monitoring equipment	-
Measuring/Reading/ Recording frequency	-

Calculation method (if applicable)	-
QA/QC procedures	The site keeps records of each cylinder bundle i for which recovery and reclamation has been completed. All individual identification and dates information are available for a clear definition of each year y the process was finished.
Purpose of data	-
Additional comment	Records from both sites should coincide. In the case in which a cylinder bundle has not completed reclamation in year y, it will be accounted in year y+1 as mentioned in Step 2 of baseline emissions of the methodology

Data/Parameter	**$w_{SF6,i}$**
Unit	Tonnes SF_6/ tonnes gas
Description	Concentration of SF_6 in the cylinder bundle i
Measured/Calculated /Default	Measured
Source of data	laboratory test result
Value(s) of monitored parameter	

i	$w_{SF6,i}$
CDM-11003	99.53%
CDM-11004	97.18%
CDM-11005	99.62%
CDM-11006	98.27%
CDM-11007	99.22%
CDM-12001	99.58%

Monitoring equipment

Monitoring equipment	Gas Chromatograph
Serial No.	CN10622030
Calibration frequency	2 years
Accuracy	The detection limit of all the gases analysed is at least 50 ppm.
Calibration Agency	SFK
Date of calibration	11 Feb 2010
	14 May 2011
Validity of calibration	2 years

Measuring/Reading/ Recording frequency	The gas sample is collected every time a cylinder bundle arrives in SFK plant. This sample is analyzed in SFK laboratory using Gas Chromatography tests in accordance with the internal Standard Operational Procedure (SOP). The detection limit of all the gases analysed is at least 50 ppm.
Calculation method (if applicable)	-
QA/QC procedures	The SOP uses ASTM D 2685, ASTM D 2029, ASTM D 2284, Din IEC 60376, VDE 0373, ASTM 2472 and/or other sector, national or international Standards.
Purpose of data	Baseline emissions calculation
Additional comment	Given that the recovery and reclamation process are batch processes, and that the concentration of SF_6 in the used gas remains constant after recovery and before reclamation, $w_{SF6,i}$ needs to be measured only once per cylinder bundle to determine the proportion of SF_6 in the gas contained in that cylinder bundle.

Data/Parameter	**$PE_{TF,y}$**
Unit	tCO_2e
Description	Project emissions as a result of increased electricity consumption at the testing facility attributable to project activity in year y

Measured/Calculated /Default	Calculated
Source of data	Records from SF_6 testing facility
Value(s) of monitored parameter	230.95
Monitoring equipment	-
Measuring/Reading/ Recording frequency	-
Calculation method (if applicable)	Follow the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"; Electricity consumption approximated by the rated capacity of the operating equipment multiplied by operating hours of the equipment. Please refer to Section E.2
QA/QC procedures	-
Purpose of data	Project emissions calculation
Additional comment	

Data/Parameter	**$PE_{RF,y}$**
Unit	tCO_2e
Description	Project emissions as a result of increased electricity consumption at the reclamation facility attributable to project activity in year y
Measured/Calculated /Default	Calculated
Source of data	Records from SF_6 reclamation facility
Value(s) of monitored parameter	0.08
Monitoring equipment	-
Measuring/Reading/ Recording frequency	-
Calculation method (if applicable)	Electricity consumption approximated by the rated capacity of the operating equipment multiplied by operating hours of the equipment and a conservative approach of 8760 hours per year is used. Please refer to Section E.2
QA/QC procedures	-
Purpose of data	Project emissions calculation
Additional comment	-

Data/Parameter	**$EXC_{SF6,y}$**
Unit	Tonnes SF_6
Description	Quantity of SF_6 which was being injected to the reclamation facility during exceptional events occurred in year y
Measured/Calculated /Default	Measured
Source of data	Records from SF_6 reclamation facility
Value(s) of monitored parameter	

i	$EXC_{SF6,y}$ (kg)
CDM-11003	0
CDM-11004	48.0
CDM-11005	24.3
CDM-11006	0
CDM-11007	0
CDM-12001	14.0
Sum	86.3

Monitoring equipment	<table><tr><td>Monitoring equipment</td><td>Mass flow meter</td></tr><tr><td>Serial No.</td><td>14014422</td></tr><tr><td>Calibration frequency</td><td>5years, recommended by FMTech Co., Ltd</td></tr><tr><td>Accuracy</td><td>±0.100%</td></tr><tr><td>Calibration Agency</td><td>FMTech Co., Ltd</td></tr><tr><td rowspan="2">Date of calibration</td><td>08 Jun 2009</td></tr><tr><td>21 May 2012</td></tr><tr><td>Validity of calibration</td><td>5 years</td></tr></table>
Measuring/Reading/ Recording frequency	The project proponent records the date and time of any exceptional event that occurs in year y that results in the unusual emission of SF_6 The SF_6 quantity ($EXC_{SF6,y}$) from any reclamation that coincides with the event must be considered as project emissions ($PE_{EXC,y}$) For example, if a cylinder bundle of used gas was being reclaimed when the event occurred, then the total amount of gas injected from the cylinder bundle into the reclamation line between 5 hours prior to the event and until the time that the injection line was shut off must be considered as $EXC_{SF6,y}$. The total amount of gas is to be taken from the continuous measurement of the flow meter on the injection line used to determine $MI_{Gas,i.}$ The concentration of the SF_6 was considered as 1for the calculation of $EXC_{SF6,y}$, and this is conservative.
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data	Project emissions calculation
Additional comment	-

D.3. Implementation of sampling plan

>>
N/A

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

Baseline Emission Reduction Calculations

In this section the baseline emission reduction calculation equation is explained. The formula for calculation of Emission Reductions is:

$$BE_y = MIN\{V_{SF6,hist}, DFT_y * EA_y\} * GWP_{SF6}$$

Where:

BE_y	=	Baseline emissions year *y*, tCO_2e
DFT_y	=	Discount factor for testing in year *y*
EA_y	=	Quantity of SF_6 reclaimed during the year *y*, tonnes SF_6
$V_{SF6,hist}$	=	Historical annual baseline venting of SF_6, tonnes SF_6
GWP_{SF6}	=	Global warming potential of SF_6, tCO_2e/tonnes SF_6

Results:

	Parameter	Unit	Value	Reference
CDM-11003 CDM-11004 CDM-11005 *(CDM-11003~CDM-11005)*	DFT_y	-	0.58	Conservatively calculated
	EA_y	t	2.75	Measured
	$V_{SF6,hist}$	t	3.40	Calculated
	GWP_{SF6}	-	23,900	default

	BE_y	t	38,075	Calculated
CDM-11006 CDM-11007 CDM-12001 *(CDM-11006~CDM12001)*	DFT_y	-	0.91	Calculated
	EA_y	t	3.11	Measured
	$V_{SF6,hist}$	t	3.38	Calculated
	GWP_{SF6}	-	23,900	default
	BE_y	t	67,183	Calculated
Sum	BE_y	*t*	105, 258	Calculated

Step1: Calculation of $V_{SF6,hist}$:

$$V_{SF6,hist} = w_{SF6,hist} \sum_t TI_{SF6,used,t}$$

Where:

$TI_{SF6,used,t}$ = Used gas vented during eligible testing item *t*, tonnes gas
$w_{SF6,hist}$ = Concentration of SF_6 expected in used gas in the historical period, tonnes SF_6/tonnes gas

Results:

Parameter	Value	Unit	Reference
$\sum TI_{SF6,used,t}$	6.95	t	The registered PDD
$\sum TI_{SF6,used,}$ *CDM-11003~CDM-11005*	3.46	t	Calculated in a conservative way (refer to the Monitoring Workbook)
$TI_{SF6,used,t}$ *CDM-11006~CDM12001*	3.44	t	Calculated in a conservative way (refer to the Monitoring Workbook)
$w_{SF6,hist}$	98.23%	-	Measured and calculated (refer to D.2)
$V_{SF6,hist}$ *CDM-11003~CDM-11005*	3.40	t	Calculated (refer to the Monitoring Workbook)
$V_{SF6,hist}$ *CDM-11006~CDM-12001*	3.38	t	Calculated (refer to the Monitoring Workbook)

Step 2: Calculation of EA_y

$$EA_y = \sum_i CA_{i,y} * w_{SF6,i}$$

Where:

$CA_{i,y}$ = Cylinder minimum for cylinder *i* in year *y*, tonnes gas
$w_{SF6,i}$ = Concentration of SF6 in the cylinder i, tonnes SF6/tonnes gas

$$CA_{i,y} = MIN\{MR_{Gas,i,y}, MS_{Gas,i,y}, MI_{Gas,i,y}\}$$

Where:

$MR_{Gas,i,y}$ = Mass of used gas recovered into cylinder *i* at the SF_6 recovery site in year *y*
$MS_{Gas,i,y}$ = Mass of used gas stored in recovery cylinder *i* in year *y*, tonnes gas
$MI_{Gas,i,y}$ = Mass of used gas from cylinder *i* which is injected for reclamation process in year *y*, tonnes gas

Results:

i	MR_{Gas} (kg)	MS_{Gas} (kg)	MI_{Gas} (kg)	Concentration of SF_6	$CA_{i,y}$ (kg)	EA_i (tonne)
CDM-11003	1024.61	1020.00	970.40	99.53%	970.40	0.97
CDM-11004	1097.67	1080.00	911.58	97.18%	911.58	0.89
CDM-11005	1074.38	973.50	906.69	99.62%	906.69	0.90
				Sum (CDM-11003~11005)	2788.67	2.75
CDM-11006	1106.85	1058.50	1016.15	98.27%	1016.15	1.00

CDM-11007	1059.30	1014.00	977.34	99.22%	977.34	0.97
CDM-12001	1176.44	1179.00	1134.67	99.58%	1134.67	1.13
				Sum (CDM-11006~12001)	3128.16	3.10

Note: please refer to D.2 and the Monitoring Workbook.

Step 3: Calculation of DFT_y

$$DFT_y = \frac{\sum_k \left(Q_{SF6,k,y} * RT_{k,y}\right)}{Q_{SF6,y}}$$

Where:

$$Q_{SF6,k,y} = \sum_j Q_{SF6,k,j,y}$$

$$Q_{SF6,y} = \sum_k Q_{SF6,k,y}$$

Where:

DFT_y	=	Discount factor for testing in year *y*
$Q_{SF6,k,y}$	=	Total amount of SF_6 filled in the testing of equipments in category *k* in year *y*, tonnes SF_6
$Q_{SF6,y}$	=	Total amount of SF_6 filled in testing of all equipments in the project activity in year *y*, tonnes SF_6
$RT_{k,y}$	=	Ratio of number of eligible testing items in category *k* (maximum value is set at 1)
$Q_{SF6,k,j,y}$	=	Amount of SF_6 that is filled into equipment *j* of category *k* in year *y* at the SF_6 recovery site, tonnes SF_6

	Parameter	Value	Unit	Reference
CDM-11003 CDM-11004 CDM-11005 *(CDM-11003 ~ CDM-11005)*	$Q_{SF6,1,y}$	-	t	Measured
	$RT_{1,y}$	1.00	-	Calculated
	$Q_{SF6,2,y}$	-	t	Measured
	$RT_{2,y}$	0.58	-	Calculated
	DFT_y	0.58	-	Calculated
CDM-11006 CDM-11007 CDM-12001 *(CDM-11006~CDM-12001)*	$Q_{SF6,1,y}$	3.12	t	Measured
	$RT_{1,y}$	1.00	-	Calculated
	$Q_{SF6,2,y}$	1.10	t	Measured
	$RT_{2,y}$	0.64	-	Calculated
	$Q_{SF6,y}$	4.22	-	Measured
	DFT_y	0.91	t	Calculated

Note: As the data of $Q_{SF6,k,y}$ was not available for the cylinder bundle CDM-11003, CDM-11004 and CDM-11005, a conservative deviation method was used to calculate DFT_y. Please refer to B.2.1 for more detailed analysis.

During the monitoring period, equipment ranging from 12 to 800 KV were tested according to the methodology, the range is set at 12 KV to 800 KV and two categories with equal range in KV are formed: 12 to 405 KV and 406 to 800 KV, so $Q_{SF6,1,y}$ represents the total amount of SF_6 filled in the testing of equipments in category 1(12 to 405KV) in year y and $Q_{SF6,2,y}$ represents the total amount of SF_6 filled in the testing of equipments in category 2 (406 to 800 KV) in year y.

$RT_{k,y}$:

$$RT_{k,y} = \frac{NT_{BL,k}}{NT_{PJ,k,y}}$$

Where:

$RT_{k,y}$	=	Ratio of number of eligible testing items in category *k* (maximum value is set at 1)
$NT_{BL,k}$	=	Average number of eligible testing items where venting occurred per equipment in the baseline, for category *k*
$NT_{PJ,k,y}$	=	Average number of total testing items where recovery was done per equipment in the project, for category *k*

Results:

	Parameter	Value	Reference
CDM-11003 CDM-11004 CDM-11005 *(CDM-11003~CDM-11005)*	$NT_{BL,1}$	2.76	The registered PDD
	$NT_{BL,2}$	1.90	The registered PDD
	$NT_{PJ,1,y}$	2.30	Calculated (refer to the Monitoring Workbook)
	$NT_{PJ,2,y}$	3.29	Calculated (refer to the Monitoring Workbook)
	$RT_{1,y}$	1.00	Calculated
	$RT_{2,y}$	0.58	Calculated
CDM-11006 CDM-11007 CDM-11006 *(CDM-11006~CDM12001)*	$NT_{BL,1}$	2.76	The registered PDD
	$NT_{BL,2}$	1.90	The registered PDD
	$NT_{PJ,1,y}$	2.19	Calculated (refer to the Monitoring Workbook)
	$NT_{PJ,2,y}$	2.95	Calculated (refer to the Monitoring Workbook)
	$RT_{1,y}$	1.00	Calculated
	$RT_{2,y}$	0.64	Calculated

$NT_{PJ,k,y}$:

The average number of total testing items where recovery was done per equipment in the project in category k in the year y, ($NT_{PJ,k,y}$) are derived by using the testing records from the project year.

In the registered PDD, it states that the equipment ranging from 40 KV to 800 KV were tested in the historic baseline period, and two categories with equal range were formed: 40 to 419 KV and 420 KV to 800 kV. $NT_{BL,1}$ and $NT_{BL,2}$ were calculated based on the historical records in the registered PDD.

During the monitoring period, the equipments ranging from 12 to 800 KV were tested, so according to the methodology, the range is set at 12 KV to 800 KV and two categories with equal range in KV are formed: 12 to 405 KV and 406 to 800 KV**.**

For bundles CDM-11003~CDM-11005, the $NT_{pj,k,y}$ are used to determine DFT_y in a very conservative way as deviated from the monitoring plan; $NT_{PJ,k,y}$ results for CDM-11003~CDM-11005:

Category	**Number of tested equipment**	**Number of testing items where recovery was done in year y**	**Average number per equipment in year y $NT_{PJ,k,y}$**
Category 1 (12 KV~ 405 KV)	47	108	2.30
Category 2 (406 KV~ 800KV)	7	23	3.29
Note: "Number of tested equipment" and "Number of testing items where recovery was done in year y" were counted in sheet "KERI data" in the Monitoring Workbook.			

$NT_{PJ,k,y}$ results for CDM-11006~ CDM-12001 are calculated as follow:

a) $NT_{PJ,k,y}$ Could be calculated out as the average number of total testing items where recovery was done per equipment in category k for cylinder bundle CDM-11006, CDM-11007 and CDM-12001;

Category	**Number of tested equipment**	**Number of testing items where recovery was done in year y**	**Average number per equipment in year y $NT_{PJ,k,y}$**
Category 1 (12 KV~ 405 KV)	37	76	2.05
Category 2 (406 KV~ 800KV)	14	39	2.79
Note: "Number of tested equipment" and "Number of testing items where recovery was done in year y" were counted in sheet "KERI data" in the Monitoring Workbook.			

The estimated value of $RT_{1,y}$ and $RT_{2,y}$ is 1.00 and 0.68 respectively when using the estimated value of $NT_{PJ,k,y}$ in the table above. Accordingly, the estimated value of DFT_y is 0.92.

b) $NT_{PJ,k,y}$ could be calculated out as the average number of total testing items where recovery was done per equipment in category k based on the data of the whole monitoring period (for cylinder bundle CDM-11003, CDM-11004, CDM-11005, CDM-11006, CDM-11007 and CDM-12001).

Category	Number of tested equipment	Number of testing items where recovery was done in year y	Average number per equipment in year y $NT_{PJ,k,y}$
Category 1 (12 KV~ 405 KV)	84	184	2.19
Category 2 (406 KV~ 800KV)	21	62	2.95
Note: "Number of tested equipment" and "Number of testing items where recovery was done in year y" were counted in sheet "KERI data" in the Monitoring Workbook.			

The estimated value of $RT_{1,y}$ and $RT_{2,y}$ is 1.00 and 0.64 respectively when using the estimated value of $NT_{PJ,k,y}$ in the table above. Accordingly, the estimated value of DFT_y is 0.91.

Two sets of $NT_{PJ,k,y}$ have been calculated in the monitoring workbook. One is calculated based on the average number of total testing items where recovery was done per equipment in the project, for category k in the monitoring period for cylinder bundle CDM-11006, CDM-11007 and CDM-12001; the other set is based on the data of the whole monitoring period (for cylinder bundle CDM-11003, CDM-11004, CDM-11005, CDM-11006, CDM-11007 and CDM-12001). The two sets data of $NT_{PJ,k,y}$ are used for the calculation of DFT_y. The value of DFT_y using the first set of $NT_{PJ,k,y}$ is 0.92 and the value of DFT_y is 0.91when using the 2nd set of $NT_{PJ,k,y}$. Since the calculation result using the 2nd set of $NT_{PJ,k,y}$ based on the whole monitoring period is more conservative, it is used for the baseline emission calculation. Please refer to the monitoring workbook for more detailed calculation.

E.2. Calculation of project emissions or actual net GHG removals by sinks

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$$PE_y = PE_{RCL,y} + PE_{TF,y} + PE_{RF,y} + PE_{EXC,y}$$

Where:

PE_y	=	Project emissions in year *y*, tCO_2e
$PE_{RCL,y}$	=	Project emissions from emission of SF_6 during reclamation in year *y*, tCO_2e
$PE_{TF,y}$	=	Project emissions as a result of increased electricity consumption at the testing facility attributable to project activity in year *y*, tCO_2e
$PE_{RF,y}$	=	Project emissions as a result of increased electricity consumption at the reclamation facility attributable to project activity in year *y*, tCO_2e
$PE_{EXC,y}$	=	Project emissions from exceptional event(s) at the SF_6 reclamation site in year *y*, tCO_2e

Results:

Parameter	Value (t)	Reference
$PE_{RCL,y}$	1,889.75	Calculated
$PE_{TF,y}$	230.95	Calculated
$PE_{RF,y}$	0.08	Calculated
$PE_{EXC,y}$	2062.57	Calculated
PE_y	4,183	Calculated

$PE_{RCL,v:}$

$$PE_{RCL,y} = GWP_{SF6} \cdot \sum_{j,i} (R_{SF6,y,j,i} - R_{SF6,hist,j}) \cdot P_{SF6,y,i}$$

Where

$PE_{RCL,y}$	=	Project emissions from the emission of SF_6 during reclamation in the year *y*, tCO_2e
GWP_{SF6}	=	Global warming potential of SF_6, $tCO_2e/t\ SF_6$
$R_{SF6,v,i,i}$	=	Rate of SF_6 loss from point *j* during the reclamation period of cylinder *i*, in year *y*, %
$R_{SF6,hist,j}$	=	Historical rate of SF_6 loss from point *j*, %
$P_{SF6,y,i}$	=	Production of SF_6 during reclamation period of cylinder *i* in year *y*, t SF_6

Results:

Parameter		Value	Reference
GWP_{SF6}		23,900	default
$R_{SF6,hist,j}$		0.058%	The registered PDD
i	$R_{SF6,y,j,i}$	$P_{SF6,y,i}$ *(kg)*	-
CDM-11003	0.140%	45,107	Measured
CDM-11004	0.078%	46,656	Measured
CDM-11005	0.143%	35,930	Measured
CDM-11006	0.054%	32,523	Measured
CDM-11007	0.051%	42,488	Measured
CDM-12001	0.063%	34,257	Measured
$PE_{RCL,y}$ (t)		1,889.75	Calculated

$$R_{SF6,hist,j} = \frac{L_{SF6,hist,j}}{P_{SF6,hist}}$$

Where:

$R_{SF6,hist,j}$ = Historical rate of SF_6 loss from point *j*, %
$L_{SF6,hist,j}$ = Historical amount of SF_6 loss from point *j*, tonnes SF_6
$P_{SF6,hist}$ = Production of SF_6 during the historical period, tonnes SF_6
j = Sub-index used for SF_6 emission points

$R_{SF6,hist,j}$ was determined in the registered PDD as 0.058%.

$$R_{SF6,y,j} = \sum_i \frac{L_{SF6,y,j,i}}{P_{SF6,y,i}}$$

Where:

$R_{SF6,y,i}$ = Rate of SF_6 loss from point *j* in year *y*, %
$L_{SF6,y,j,i}$ = Amount of SF_6 loss from point *j* during the reclamation period of cylinder *i* in year *y*, tonnes SF_6
$P_{SF6,y,i}$ = Production of SF_6 during the reclamation period of cylinder *i*, in year *y*, tonnes SF_6
j = Sub-index used for SF_6 emission points

i	$R_{SF6,y,j,i}$	$P_{SF6,y,i}$ *(kg)/measured*	$L_{SF6,hist,j}$ */measured*
CDM-11003	0.140%	45,107	63.2
CDM-11004	0.078%	46,656	36.5
CDM-11005	0.143%	35,930	51.5
CDM-11006	0.054%	32,523	17.6
CDM-11007	0.051%	42,488	21.8
CDM-12001	0.063%	34,257	21.7

$PE_{TF,Y}$:

Rated capacity of the operating equipment: project operating equipment at the Testing Facility comprises two Compressors – 10kW; Suctioning Pump – 0.6 kW; Vaccum Pump – 1.5kW; and Evaporator –4.8kW, 16.9 kW in total.

The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is applied and $EC_{PJ,i,y}$ is approximated by the rated capacity of the operating equipment multiplied by operating hours of the facility, as permitted by AM0079 version 2.

$$PE_{TF,y} = \sum_j EC_{PJ,j,y} * EF_{EL,j,y}(1 + TDL_{j,y})$$

Parameter	Value	Reference
Rated capacity of all equipment (MW)	0.0169	nameplates and manufacturer's documents
Operating hours	8760	Conservatively estimated
$EF_{EL,j,y}$ (tCO_2e/MWh)	1.3	The registered PDD
$TDL_{j,y}$	20%	The registered PDD

$PE_{TF,y}$(t)	230.95	Calculated
j	Testing facility	-

$PE_{RF,y}$:
Rated capacity of the operating equipment: project operating equipment added at the Reclamation Facility comprises one mass flow meter – 6 W.
Operating hours: Conservatively estimated as 8760 hr/yr.

$$PE_{RF,y} = \sum_{j} EC_{PJ,j,y} * EF_{EL,j,y}(1 + TDL_{j,y})$$

Parameter	Value	Reference
Rated capacity of all equipment (MW)	0.000006	MW
Operating hours	8760	Conservatively estimated
$EF_{EL,i,y}$ (tCO_2e/MWh)	1.3	The registered PDD
$TDL_{i,y}$	20%	The registered PDD
$PE_{RF,y}$(t)	0.08	Calculated
j	Reclamation facility	-

$PE_{EXC,y}$:

$EXC_{SF6,y}$ is considered when an exceptional event occurred at the SF_6 reclamation site, for example an accident or emergency plant shutdown leading to the emission of SF_6 injected for reclamation.

The SF_6 quantity ($EXC_{SF6,y}$) from any reclamation that coincides with the event is considered as project emissions ($PE_{EXC,y}$). If a recovery cylinder of used gas was being reclaimed when the event occurred, then the amount of gas extracted from the cylinder between 5 hours prior to the exceptional event and the time that the injection line was closed is considered as $EXC_{SF6,y}$.

$$PE_{EXC,y} = GWP_{SF6} \cdot EXC_{SF6,y}$$

Where

$PE_{EXC,y}$	=	Project emissions from exceptional event(s) at the SF_6 reclamation site in year *y*, tCO_2e
GWP_{SF6}	=	Global warming potential of SF_6, t CO_2e/t SF_6
$EXC_{SF6,y}$	=	Quantity of SF_6 which was being injected to the reclamation facility during exceptional events occurred in year *y*, tonnes SF_6

Parameter	Value	Reference
GWP_{SF6}	23,900	default
$EXC_{SF6,y}$ *(kg)*	86.3	Measured
$PE_{EXC,y}$ (t)	2062.57	Calculated

E.3. Calculation of leakage

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According to the registered PDD, the leakage emissions associated with the Project are considered to be very marginal as to be negligible compared to the range of uncertainty of the GWP estimate, and they can be ignored during the crediting period.
Therefore, $LE_y = 0$.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Total	105,258	4,183	0	101,074

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	177,304	101,074

Note: The ex-ante estimation value is an average value calculated based on registered PDD. The monitoring period covers 392 days, and the annual estimated CERs are 165,092 tCO_2e in the registered PDD, so the average one is calculated as follows: 165,092 / 365 * 392 = 177,304.

E.6. Remarks on difference from estimated value in registered PDD

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The achieved emission reductions are much lower than the PDD estimation value. This is caused by two main reasons. One is the application of deviation to methodology, which made the DFT (for cylinder bundle CDM-11003~CDM-11005) smaller and the emission reductions smaller accordingly. The other reason is that PDD was developed several years ago and meanwhile, with technical development of GIS manufacturing, manufacturer can make circuit breakers (which is big part of GIS) smaller than the ones in the past, so the SF_6 gas demanding amount per each GIS being tested decreases and consequently the emission reductions of the project are affected.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	101,074	0

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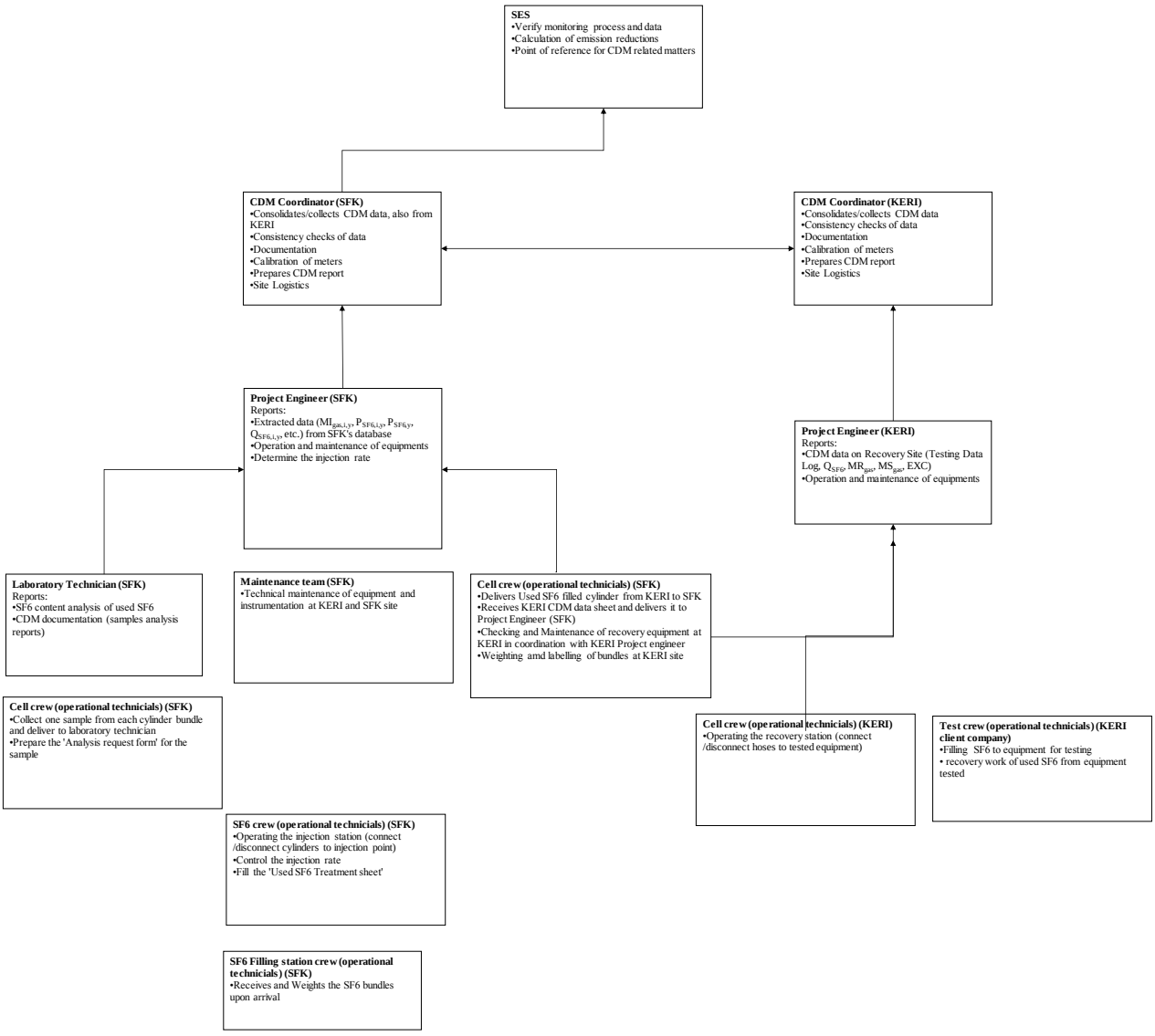
Annex 1 Organizational structure of CDM monitoring

Organizational structure of CDM Monitoring at the South Korea SF6 Recovery and Reclamation Project



Document information

Version	*Date*	*Description*
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
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