Monitoring report form
(Version 04.0)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

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	02
Completion date of the monitoring report	09/02/2015
Registration date of the project activity	01/04/2011
Monitoring period number and duration of this monitoring period	Monitoring Period Number : 02 Monitoring Period: 27/04/2012~31/12/2014
Project participant(s)	Solvay Fluor Korea Co. Ltd Solvay Energy Services SAS EcoSecurities International Limited (withdrawn)
Host Party(ies)	Republic of Korea
Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)	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	442,808
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	374,404
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	65,302
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	309,102

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 SF_6 emissions 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 at KERI site. 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 374,404tCO_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

A.4. Reference of applied methodology and standardized baseline

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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)
Standard for application of the global warming potentials to Clean Development Mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol (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

A.6. Contact information of responsible persons/ entities

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Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Solvay Energy Services
Street/P.O. Box	No.74,
Building	FengYi, Ditan Park,
City	DongCheng District, Beijing
State/Region	Beijing
Postcode	100011
Country	China
Telephone	+86 (01) 6426 6008
Fax	+86 (01) 6426 7008
E-mail	river.zhang@solvay.com
Website	www.solvay.com
Contact person	Zhang Shoudou
Title	CO2 Operations Senior Project Manager, Asia
Salutation	Mr.
Last name	Zhang
Middle name	-
First name	ShouDou
Department	CO2 Operation
Mobile	+86 186 0059 8494
Direct fax	+86 (01) 6426 7008
Direct tel.	+86 (01) 6426 6008 Ext. 602
Personal e-mail	river.zhang@solvay.com

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 (KERI) and the other is the SF_6 reclamation site (SKF). 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-12002	29 Mar 2012	19 Jul 2012	08 Aug 2012	23 Aug 2012
CDM-12003	23 Jul 2012	12 Oct 2012	05 Nov 2012	15 Nov 2012
CDM-12004	15 Oct 2012	27 Nov 2012	20 Dec 2012	28 Dec 2012
CDM-12005	28 Nov 2012	12 Jan 2013	02 Feb 2013	12 Feb 2013
CDM-13001	15 Jan 2013	23 Feb 2013	15 Mar 2013	25 Mar 2013
CDM-13002	26 Feb 2013	05 Apr 2013	07 Apr 2013	17 Apr 2013
CDM-13003	08 Apr 2013	17 Apr 2013	18 Apr 2013	22 Apr 2013
CDM-13004	17 Apr 2013	07 May 2013	24 May 2013	03 Jun 2013
CDM-13005	08 May 2013	29 Jun 2013	15 Jul 2013	23 Jul 2013
CDM-13006	01 Jul 2013	20 Jul 2013	28 Jul 2013	08 Aug 2013
CDM-13007	23 Jul 2013	24 Aug 2013	09 Sep 2013	24 Sep 2013
CDM-13008	26 Aug 2013	16 Sep 2013	15 Oct 2013	28 Oct 2013
CDM-13009	19 Mar 2014	15 Apr 2014	18 Apr 2014	24 Apr 2014
CDM-14001	17 Apr 2014	15 May 2014	03 Jun 2014	12 Jun 2014
CDM-14002	16 May 2014	17 Jun 2014	01 Jul 2014	10 Jul 2014
CDM-14003	20 Jun 2014	23 Jul 2014	11 Aug 2014	20 Aug 2014
CDM-14004	25 Jul 2014	24 Sep 2014	06 Oct 2014	15 Oct 2014
CDM-14005	27 Sep 2014	29 Nov 2014	12 Dec 2014	20 Dec 2014
CDM-14006	02 Dec 2014	19 Dec 2014	21 Dec 2014	25 Dec 2014

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

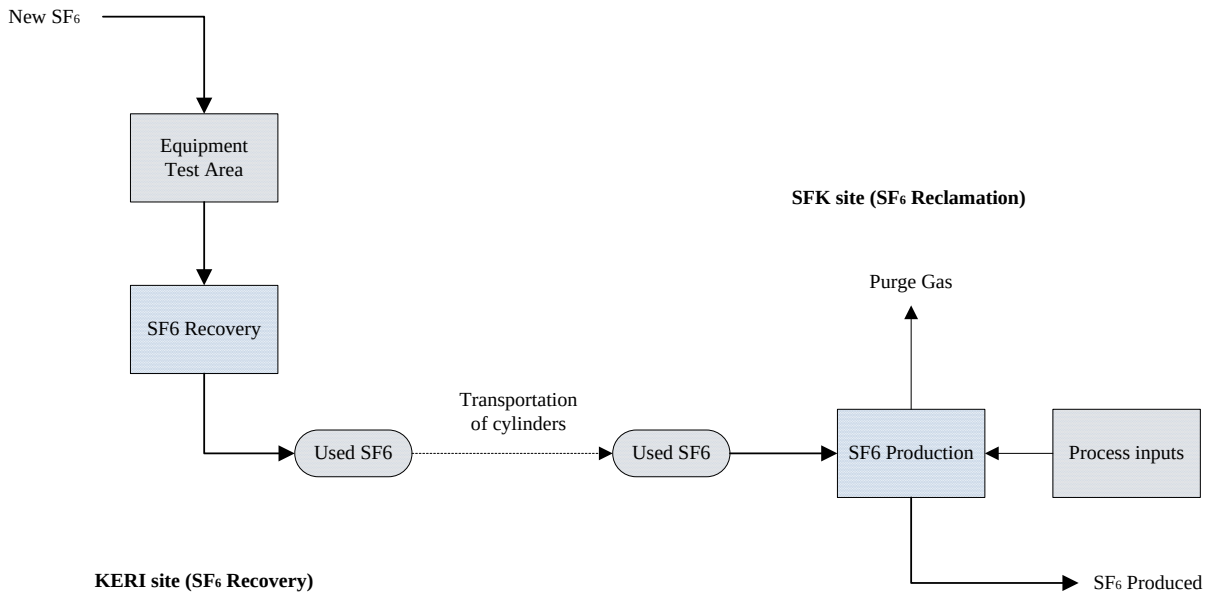

Fig B.1 Diagram of the recovery & reclamation process and the monitoring points

B.2. Post registration changes

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

>>
Not applicable for this monitoring period

B.2.2. Corrections

>>
Not applicable for this monitoring period

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

>>
Not applicable for this monitoring period

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

>>
Not applicable for this monitoring period

B.2.5. Changes to start date of crediting period

>>
Not applicable for this monitoring period

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

>>
Not applicable for this monitoring period

SECTION C. Description of monitoring system

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

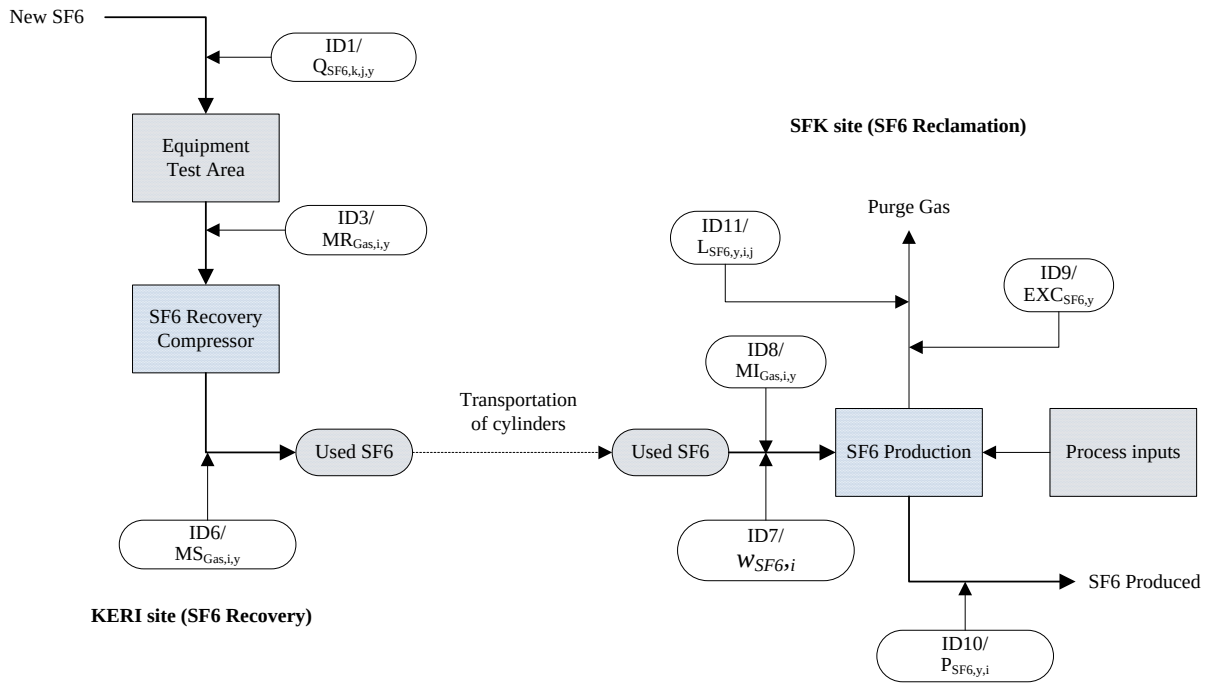

Fig C1. Diagram of the monitoring system

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 included in the estimation of emissions avoided for the year *y*	Baseline Emissions	SF_6 recovery site, SF_6 reclamation site
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 who 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 analysed 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

Data / Parameter:	**GWP_{SF6}**
Unit:	tCO_2e/tSF_6
Description:	Global warming potential of SF_6
Source of data:	IPCC 2nd Assessment Report; IPCC Fourth Assessment Report;
Value(s) applied):	23,900 for the first commitment period of the Kyoto Protocol (for all emission reductions achieved before Jan 1st 2013), 22,800 for the second commitment period of the Kyoto Protocol (for all emission reductions achieved starting Jan 1st 2013)
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 MW 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 MW, 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 12 - 405kV, $NT_{BL,1}$: 2.76 For k category 406 - 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

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; IPCC Fourth Assessment Report;
Value(s) of monitored parameter:	23,900 for the first commitment period of the Kyoto Protocol (for all emission reductions achieved before Jan 1st 2013), 22,800 for the second commitment period of the Kyoto Protocol (for all emission reductions achieved starting Jan 1st 2013)
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 that represent the most conservative measurements are used to the parameter definition.
Source of data:	Laboratory test results
Value(s) of monitored parameter:	<table><tr><th>i</th><th>Value</th></tr><tr><td>CDM-12002</td><td>98.71%</td></tr><tr><td>CDM-12003</td><td>99.59%</td></tr><tr><td>CDM-12004</td><td>99.73%</td></tr><tr><td>CDM-12005</td><td>99.84%</td></tr><tr><td>CDM-13001</td><td>99.58%</td></tr><tr><td>CDM-13002</td><td>99.65%</td></tr><tr><td>CDM-13003</td><td>99.16%</td></tr><tr><td>CDM-13004</td><td>99.73%</td></tr><tr><td>CDM-13005</td><td>99.65%</td></tr><tr><td>CDM-13006</td><td>99.17%</td></tr><tr><td>CDM-13007</td><td>99.34%</td></tr><tr><td>CDM-13008</td><td>99.47%</td></tr><tr><td>CDM-13009</td><td>99.36%</td></tr><tr><td>CDM-14001</td><td>98.58%</td></tr><tr><td>CDM-14002</td><td>98.90%</td></tr><tr><td>CDM-14003</td><td>99.76%</td></tr><tr><td>CDM-14004</td><td>99.26%</td></tr><tr><td>CDM-14005</td><td>98.22%</td></tr><tr><td>CDM-14006</td><td>99.24%</td></tr><tr><td>$w_{SF6,BL,hist,y}$</td><td>98.95%</td></tr></table> Note: only the data of 9 cylinder bundles of lower SF_6 concentration (out of 19 cylinder bundles) is used for calculation for conservative reason.
Monitoring equipment:	<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="3">Date of calibration</td><td>14 May 2011</td></tr><tr><td>20 Feb 2013</td></tr><tr><td>04 Dec 2014</td></tr><tr><td>Validity of calibration</td><td>2 years</td></tr></table>
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

<table>
<tr><td>Measured/
Calculated /
Default:</td><td>Measured</td></tr>
<tr><td>Source of data:</td><td>Records from the SF_6 recovery site</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>$Q_{SF6,1}$: mass of SF6 that is filled into testing equipment of category 1 (12 to 405 KV)
$Q_{SF6,2}$: mass of SF6 that is filled into testing equipment of category 2 (406 to 800 KV)
$Q_{SF6,1}$=16.16t, $Q_{SF6,2}$ = 6.12t;</td></tr>
<tr><td>Monitoring equipment:</td><td>
<table>
<tr><th>Monitoring equipment</th><th>Mass flow meter</th><th>Mass flow meter</th></tr>
<tr><td>Serial No.</td><td>14122007</td><td>14111339</td></tr>
<tr><td>Calibration frequency</td><td>5years, recommended by FMTech Co., Ltd</td><td>5years, recommended by FMTech Co., Ltd</td></tr>
<tr><td>Accuracy</td><td>±0.100%</td><td>±0.100%</td></tr>
<tr><td>Calibration Agency</td><td>FMTech Co., Ltd</td><td>FMTech Co., Ltd</td></tr>
<tr><td rowspan="2">Date of calibration</td><td>05 Feb 2009</td><td>21 Nov 2008</td></tr>
<tr><td>25 May 2012</td><td>21 May 2012</td></tr>
<tr><td>Validity of calibration</td><td>5 years</td><td>5 years</td></tr>
</table>
</td></tr>
<tr><td>Measuring/
Reading/
Recording frequency:</td><td>Measuring continuously and recording after each injection</td></tr>
<tr><td>Calculation method
(if applicable):</td><td>-</td></tr>
<tr><td>QA/QC procedures:</td><td>Meters subject to regular calibration according to standard FMT-QG-06</td></tr>
<tr><td>Purpose of data:</td><td>Baseline emissions calculation</td></tr>
<tr><td>Additional comment:</td><td>-</td></tr>
</table>

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-12002	1,098.00
CDM-12003	1,049.00
CDM-12004	1,111.00
CDM-12005	1,165.00
CDM-13001	1,162.20
CDM-13002	1,167.20
CDM-13003	547.10
CDM-13004	1,108.00
CDM-13005	1,157.50
CDM-13006	1,185.70
CDM-13007	1,108.60
CDM-13008	967.10
CDM-13009	861.90
CDM-14001	1,041.00
CDM-14002	999.80
CDM-14003	1,098.80
CDM-14004	1,058.20
CDM-14005	1,045.70
CDM-14006	396.79
Sum	19,328.59

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-12002	1,096.00
CDM-12003	1,045.00
CDM-12004	1,108.00
CDM-12005	1,160.50
CDM-13001	1,170.00
CDM-13002	1,175.00
CDM-13003	551.50
CDM-13004	1,114.00
CDM-13005	1,157.50
CDM-13006	1,196.00
CDM-13007	1,095.50
CDM-13008	982.00
CDM-13009	871.00
CDM-14001	1,053.50
CDM-14002	1,009.00
CDM-14003	1,111.00
CDM-14004	1,065.00
CDM-14005	1,055.00
CDM-14006	400.00
Sum	19,415.50

Monitoring equipment:	

Monitoring equipment	Weighing Scale
Serial No.	FR3
Calibration frequency	2 years
Accuracy	0.5kg/5000kg
Calibration Agency	Pyunghwa HiTech for the 3rd calibration
Date of calibration	05 Jan 2012
	12 Dec 2013
Validity of calibration	2 years

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:	

i	MI_{Gas} (kg)
CDM-12002	1,110.80
CDM-12003	1,004.30
CDM-12004	1,085.20
CDM-12005	1,057.90
CDM-13001	1,153.30
CDM-13002	1,175.50
CDM-13003	552.10
CDM-13004	1,056.80
CDM-13005	1,208.70
CDM-13006	1,185.70
CDM-13007	1,073.90
CDM-13008	875.20
CDM-13009	817.00
CDM-14001	983.10
CDM-14002	944.00
CDM-14003	941.00
CDM-14004	982.00
CDM-14005	971.00
CDM-14006	386.00
Sum	**18,563.50**

Monitoring equipment:	

Monitoring equipment	Mass flow meter
Serial No.	14014422
Calibration frequency	5years, recommended by FMTech Co., Ltd
Accuracy	±0.100%
Calibration Agency	FMTech Co., Ltd
Date of calibration	08 Jun 2009
	21 May 2012
Validity of calibration	5 years

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:	-

Data / Parameter:	**$L_{SF6,y,i,j}$**
Unit:	Tonnes SF_6
Description:	Amount of SF_6 loss from point j during the reclamation period of cylinder i in year y
Measured/ Calculated / Default:	Measured The measurement period is the period in which cylinder i is connected for gas reclamation
Source of data:	Records from SF_6 reclamation site

Value(s) of monitored parameter:

i	$L_{SF6,y,i,j}$ (kg)
CDM-12002	61.15
CDM-12003	99.23
CDM-12004	69.82
CDM-12005	49.26
CDM-13001	114.69
CDM-13002	112.86
CDM-13003	78.45
CDM-13004	26.68
CDM-13005	3.98
CDM-13006	1.19
CDM-13007	9.71
CDM-13008	56.95
CDM-13009	47.36
CDM-14001	58.58
CDM-14002	52.38
CDM-14003	53.74
CDM-14004	10.12
CDM-14005	5.99
CDM-14006	0.00

Monitoring equipment:

Monitoring equipment	Mass flow meter
Serial No.	14014074
Calibration frequency	5years, recommended by FMTech Co., Ltd
Accuracy	±0.35%
Calibration Agency	FMTech Co., Ltd
Date of calibration	08 Jun 2009
	24 May 2012
Validity of calibration	5 years

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	14 May 2011
	20 Feb 2013
	04 Dec 2014
Validity of calibration	2 years

Measuring/ Reading/ Recording frequency:	Measuring continuously and recording daily
Calculation method (if applicable):	$L_{SF6,y,i,j}$ = Daily purge mass amount of gas × Volume% of SF_6
QA/QC procedures:	Meter subject to regular calibration according to standard FMT-QG-06
Purpose of data:	Project emissions reduction
Additional comment:	-

Data / Parameter:	**$P_{SF6,y,i}$**
Unit:	Tonnes SF_6
Description:	Production of SF_6 during the reclamation period of cylinder i, in year y
Measured/ Calculated / Default:	Measured
Source of data:	Records from regular production monitoring at SF_6 reclamation site
Value(s) of monitored parameter:	
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 %

i	$P_{SF6,y,i}$ (kg)
CDM-12002	77,349
CDM-12003	47,683
CDM-12004	43,805
CDM-12005	53,043
CDM-13001	49,106
CDM-13002	49,507
CDM-13003	21,936
CDM-13004	24,335
CDM-13005	23,722
CDM-13006	33,226
CDM-13007	72,663
CDM-13008	57,712
CDM-13009	33,284
CDM-14001	48,700
CDM-14002	42,300
CDM-14003	44,379
CDM-14004	33,303
CDM-14005	22,374
CDM-14006	13,549

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
Source of data:	Records from the SF_6 recovery site
Value(s) of monitored parameter:	$NT_{,PJ,i}$ $NT_{,PJ,1}$ (for category: 12~405 kV): 2.97 $NT_{,PJ,2}$ (for category: 406~800 kV): 2.00
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-12002	0003
CDM-12003	0004
CDM-12004	0001
CDM-12005	0002
CDM-13001	0001
CDM-13002	0002
CDM-13003	0001
CDM-13004	0002
CDM-13005	0001
CDM-13006	0002
CDM-13007	0001
CDM-13008	0002
CDM-13009	0004
CDM-14001	0002
CDM-14002	0004
CDM-14003	0004
CDM-14004	0001
CDM-14005	0004
CDM-14006	0001

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-12002	0003
CDM-12003	0004
CDM-12004	0001
CDM-12005	0002
CDM-13001	0001
CDM-13002	0002
CDM-13003	0001
CDM-13004	0002
CDM-13005	0001
CDM-13006	0002
CDM-13007	0001
CDM-13008	0002
CDM-13009	0004
CDM-14001	0002
CDM-14002	0004
CDM-14003	0004
CDM-14004	0001
CDM-14005	0004
CDM-14006	0001

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-12002	98.71%
CDM-12003	99.59%
CDM-12004	99.73%
CDM-12005	99.84%
CDM-13001	99.58%
CDM-13002	99.65%
CDM-13003	99.16%
CDM-13004	99.73%
CDM-13005	99.65%
CDM-13006	99.17%
CDM-13007	99.34%
CDM-13008	99.47%
CDM-13009	99.36%
CDM-14001	98.58%
CDM-14002	98.90%
CDM-14003	99.76%
CDM-14004	99.26%
CDM-14005	98.22%
CDM-14006	99.24%

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	14 May 2011
	20 Feb 2013
	04 Dec 2014
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 analysed 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:	619.45
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:	0.22
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. 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-12002	0.00
CDM-12003	89.20
CDM-12004	0.00
CDM-12005	24.90
CDM-13001	25.00
CDM-13002	0.00
CDM-13003	0.00
CDM-13004	24.90
CDM-13005	0.00
CDM-13006	24.90
CDM-13007	0.00
CDM-13008	10.80
CDM-13009	32.60
CDM-14001	0.00
CDM-14002	20.00
CDM-14003	24.00
CDM-14004	22.00
CDM-14005	25.00
CDM-14006	0.00
Sum	**139.10**

Monitoring equipment:

Monitoring equipment	Mass flow meter
Serial No.	14014422
Calibration frequency	5years, recommended by FMTech Co., Ltd
Accuracy	±0.100%
Calibration Agency	FMTech Co., Ltd
Date of calibration	08 Jun 2009
	21 May 2012
Validity of calibration	5 years

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

>>
Not applicable.

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

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

>>
According to Standard for application of the global warming potentials to Clean Development Mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol (version 01), for emission reductions achieved starting 1 January 2013, the updated global warming potentials of SF_6 should be used, which is 22,800 ($GWP_{SF6,2}$).
For the same reason, baseline emissions and project emissions are divided into two periods, one is before 1 Jan 2013, belonging to the 1st commitment period of the Kyoto Protocol and the other is starting from Jan 1st 2013, belonging to the 2nd commitment period of the Kyoto Protocol.

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
DFT_y	-	0.94	Calculated
EA_y	t	18.36	Measured and calculated
$V_{SF6,hist}$	t	18.43	Calculated
$GWP_{SF6,1}$	-	23,900	default
$GWP_{SF6,2}$	-	22,800	default

Since the value of $V_{SF6,hist}$ is bigger than the value of EA_y, the formula could be updated to:

$$BE_y = DFT_y * EA_y * GWP_{SF6} = DFT_y * (EA_1 * GWP_{SF6,1} + EA_2 * GWP_{SF6,2}) = BE_1 + BE_2$$

Results:

Parameter	Unit	Value	Reference
DFT_y	-	0.94	Calculated
EA_1	t	3.16	Measured and calculated
EA_2	t	15.20	Measured and calculated
$GWP_{SF6,1}$	-	23,900	default
$GWP_{SF6,2}$	-	22,800	default
BE_1	t	70,753.56	Calculated
BE_2	t	324,135.18	Calculated
BE_y	t	**394,889**	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
$TI_{SF6,used}$	6.95	t	The registered PDD
$\sum TI_{SF6,used}$	18.63	t	Calculated (refer to the ER Workbook)
$w_{SF6,hist}$	98.95%	-	Measured and calculated (refer to D.2 and ER workbook)
$V_{SF6,hist}$	18.43	t	Calculated (refer to the ER 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 SF_6 in the cylinder i, tonnes SF_6/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)	$w_{SF6,i}$	$CA_{i,y}$ (kg)	EA_i (tonne)
CDM-12002	1,098.00	1,096.00	1,110.80	98.71%	1096.00	1.08
CDM-12003	1,049.00	1,045.00	1,004.30	99.59%	1004.30	1.00
CDM-12004	1,111.00	1,108.00	1,085.20	99.73%	1085.20	1.08
CDM-12005	1,165.00	1,160.50	1,057.90	99.84%	1057.90	1.06
CDM-13001	1,162.20	1,170.00	1,153.30	99.58%	1153.30	1.15
CDM-13002	1,167.20	1,175.00	1,175.50	99.65%	1167.20	1.16
CDM-13003	547.10	551.50	552.10	99.16%	547.10	0.54
CDM-13004	1,108.00	1,114.00	1,056.80	99.73%	1056.80	1.05
CDM-13005	1,157.50	1,157.50	1,208.70	99.65%	1157.50	1.15
CDM-13006	1,185.70	1,196.00	1,185.70	99.17%	1185.70	1.18
CDM-13007	1,108.60	1,095.50	1,073.90	99.34%	1073.90	1.07
CDM-13008	967.10	982.00	875.20	99.47%	875.20	0.87
CDM-13009	861.90	871.00	817.00	99.36%	817.00	0.81
CDM-14001	1,041.00	1,053.50	983.10	98.58%	983.10	0.97
CDM-14002	999.80	1,009.00	944.00	98.90%	944.00	0.93
CDM-14003	1,098.80	1,111.00	941.00	99.76%	941.00	0.94
CDM-14004	1,058.20	1,065.00	982.00	99.26%	982.00	0.97
CDM-14005	1,045.70	1,055.00	971.00	98.22%	971.00	0.95
CDM-14006	396.79	400.00	386.00	99.24%	386.00	0.38
				Sum	**18484.20**	**18.36**

Note: please refer to D.2 and the ER Workbook for more detailed calculation.

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:

Discount factor for testing in year *y*
Total amount of SF_6 filled in the testing of equipments in category *k* in year *y*, tonnes SF_6
Total amount of SF_6 filled in testing of all equipments in the project activity in year *y*, tonnes SF_6
Ratio of number of eligible testing items in category *k* (maximum value is set at 1)
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
$Q_{SF6,1,y}$	16.16	t	Measured
$RT_{1,y}$	0.93	-	Calculated
$Q_{SF6,2,y}$	6.12	t	Measured
$RT_{2,y}$	0.95	-	Calculated
DFT_y	0.94	-	Calculated

$RT_{k,y}$:

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

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
$NT_{BL,1}$	2.76	The registered PDD
$NT_{BL,2}$	1.90	The registered PDD
$NT_{PJ,1,y}$	2.97	Calculated (refer to the ER Workbook)
$NT_{PJ,2,y}$	2.00	Calculated (refer to the ER Workbook)
$RT_{1,y}$	0.93	Calculated
$RT_{2,y}$	0.95	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.

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)	123	365	2.97

Category 2 (406 KV~ 800KV)	42	84	2.00
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 ER Workbook.			

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

>>

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

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

As explained in E.1, project emissions should be divided into two periods too. They are PE_1 and PE_2, representing project emissions achieved in the 1st commitment period and 2nd commitment period.

Results:

Parameter	Value (t)	Reference
$PE_{RCL,1}$	3,162.25	Calculated
$PE_{TF,1}$	157.55	Calculated
$PE_{RF,1}$	0.06	Calculated
$PE_{EXC,1}$	2,131.88	Calculated
$PE_{RCL,2}$	9,233.35	Calculated
$PE_{TF,2}$	461.90	Calculated
$PE_{RF,2}$	0.16	Calculated
$PE_{EXC,2}$	5,337.48	Calculated
PE_1	5,451.73	Calculated
PE_2	15032.89	Calculated
$\boldsymbol{PE_y}$	**20,485**	Calculated

$PE_{RCL,y}$:

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

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, $tCO_2e/t\ SF_6$
$R_{SF6,y,j,i}$	=	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
$GWP_{SF6,1}$	23,900	default
$GWP_{SF6,2}$	22,800	default
$R_{SF6,hist,j}$	0.058%	The registered PDD

i	$R_{SF6,y,j,i}$	$P_{SF6,y,i}$ (kg)	Reference
CDM-12002	0.079%	77,349	Measured
CDM-12003	0.208%	47,683	Measured
CDM-12004	0.159%	43,805	Measured
$PE_{RCL,1}$ (t)		3,162.25	calculated

Only the above 3 bundles completed SF6 reclamation by 31 Dec 2012			
CDM-12005	0.093%	53,043	Measured
CDM-13001	0.234%	49,106	Measured
CDM-13002	0.228%	49,507	Measured
CDM-13003	0.358%	21,936	Measured
CDM-13004	0.110%	24,335	Measured
CDM-13005	0.017%	23,722	Measured
CDM-13006	0.004%	33,226	Measured
CDM-13007	0.013%	72,663	Measured
CDM-13008	0.099%	57,712	Measured
CDM-13009	0.142%	33,284	Measured
CDM-14001	0.120%	48,700	Measured
CDM-14002	0.124%	42,300	Measured
CDM-14003	0.121%	44,379	Measured
CDM-14004	0.030%	33,303	Measured
CDM-14005	0.027%	22,374	Measured
CDM-14006	0.000%	13,549	Measured
$PE_{RCL,2}$ (t)		9,233.35	Calculated
$PE_{RCL,y}$ (t)		12,395.59	

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

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:

$R_{SF6,y,j}$ = 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***	***$L_{SF6,hist,i}$ /measured***
CDM-12002	0.079%	77,349	61.15
CDM-12003	0.208%	47,683	99.23
CDM-12004	0.159%	43,805	69.82
CDM-12005	0.093%	53,043	49.26
CDM-13001	0.234%	49,106	114.69
CDM-13002	0.228%	49,507	112.86
CDM-13003	0.358%	21,936	78.45
CDM-13004	0.110%	24,335	26.68
CDM-13005	0.017%	23,722	3.98
CDM-13006	0.004%	33,226	1.19
CDM-13007	0.013%	72,663	9.71
CDM-13008	0.099%	57,712	56.95
CDM-13009	0.142%	33,284	47.36
CDM-14001	0.120%	48,700	58.58

CDM-14002	0.124%	42,300	52.38
CDM-14003	0.121%	44,379	53.74
CDM-14004	0.030%	33,303	10.12
CDM-14005	0.027%	22,374	5.99
CDM-14006	0.000%	13,549	0.00

$PE_{TF,y}$:

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 $EC_{PJ,j,y}$ 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 during the 1st commitment period of Kyoto Protocol	5,976	Estimated as =24h*249days for conservative reason
Operation hours during the 2nd commitment period of Kyoto Protocol	17,520	Estimated as =24h*730days for conservative reason
$EF_{EL,j,y}$ (tCO_2e/MWh)	1.3	The registered PDD
$TDL_{j,y}$	20%	The registered PDD
$PE_{TF,1}$(t)	157.55	Calculated
$PE_{TF,2}$(t)	461.90	Calculated
$PE_{TF,y}$(t)	619.45	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 during the 1st commitment period of Kyoto Protocol	5,976	Estimated as =24h*249days for conservative reason
Operation hours during the 2nd commitment period of Kyoto Protocol	17,520	Estimated as =24h*730days for conservative reason
$EF_{EL,j,y}$ (tCO_2e/MWh)	1.3	The registered PDD
$TDL_{j,y}$	20%	The registered PDD
$PE_{RF,1}$(t)	0.06	Calculated
$PE_{RF,2}$(t)	0.16	Calculated
$PE_{RF,y}$(t)	0.22	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
$GWP_{SF6,1}$	23,900	default
$GWP_{SF6,2}$	22,800	default
$EXC_{SF6,1}$ (kg)	89.20	Measured
$EXC_{SF6,2}$ (kg)	234.10	Measured
$PE_{EXC,1}$ (t)	2,131.88	Calculated
$PE_{EXC,2}$ (t)	5,337.48	Calculated
$PE_{EXC,y}$ (t)	7,469.36	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	394,889	20,485	0	374,404

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)	442,808	374,404

Note: The monitoring period covers 979 days, and the annual estimated CERs are 165,092 tCO_2e in the registered PDD, so the values estimated in ex-ante calculation of registered PDD are calculated as follows: 165,092* 979 / 365 = 442,808.

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

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The actual values achieved during this monitoring period are 374,404tons, less than the values estimated in ex-ante calculation of registered PDD. One of the main reasons for emission reduction decrease is the application of the updated GWP_{SF6} value for emission reduction achieved calculation in the second commitment period of Kyoto Protocol.

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)	65,302	309,102

Please refer to ER Workbook for more detailed calculation.

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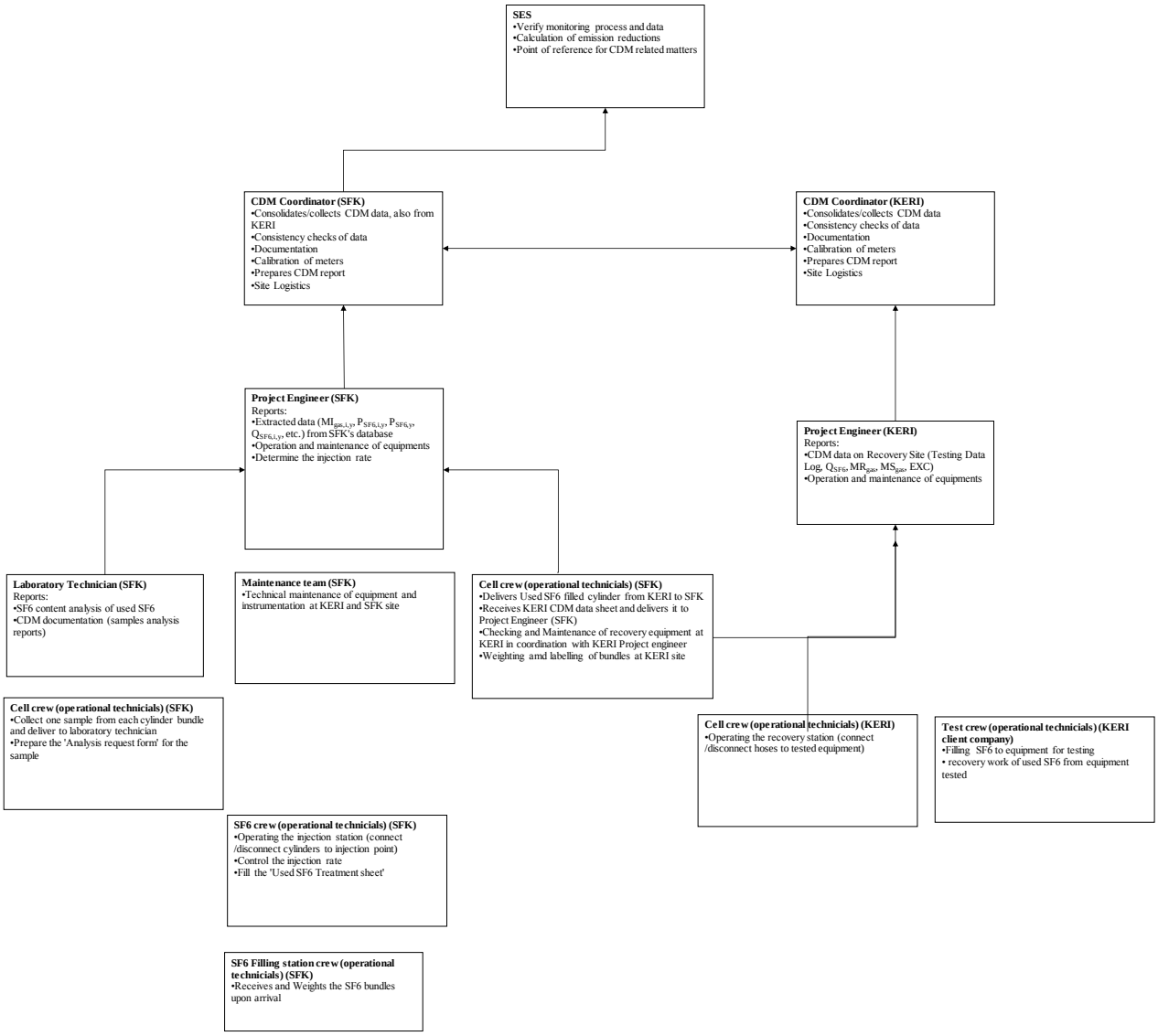
Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Solvay Energy Services
Street/P.O. Box	No.74,
Building	FengYi, Ditan Park,
City	DongCheng District, Beijing
State/Region	Beijing
Postcode	100011
Country	China
Telephone	+86 (01) 6426 6008
Fax	+86 (01) 6426 7008
E-mail	river.zhang@solvay.com
Website	www.solvay.com
Contact person	Zhang Shoudou
Title	CO2 Operations Senior Project Manager, Asia
Salutation	Mr.
Last name	Zhang
Middle name	-
First name	ShouDou
Department	CO2 Operation
Mobile	86 186 0059 8494
Direct fax	+86 (01) 6426 7008
Direct tel.	+86 (01) 6426 6008 Ext. 602
Personal e-mail	river.zhang@solvay.com

Appendix 2. Organizational structure of CDM monitoring

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



Document information

Version	*Date*	*Description*
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
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).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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