Monitoring report form for CDM project activity
(Version 06.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT		
Title of the project activity	N2O Emission Reduction in ONSAN, REPUBLIC OF KOREA	
UNFCCC reference number of the project activity	UNFCCC 0099	
Version number of the PDD applicable to this monitoring report	12	
Version number of this monitoring report	1.0	
Completion date of this monitoring report	12/12/2018	
Monitoring period number	Monitoring period #77	
Duration of this monitoring period	01/09/2017 – 31/08/2018 (365 days)	
Monitoring report number for this monitoring report	1	
Project participants	1. Korea Energy Agency 2. Solvay Energy Services Korea Co., Ltd. 3. Solvay Energy Services SAS 4. Rhodia Energy GHG SAS 5. Rhodia Japan Ltd	
Host Party	The Republic of Korea	
Sectoral scopes	Category 5: Chemical Industry	
Applied methodologies and standardized baselines	Methodology AM0021, Version 3	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0	9,145,495.0 tCO2e

Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	9,738,994 tCO2e

SECTION A. Description of project activity

A.1. General description of project activity

Nitrous oxide (N2O) is a by-product of adipic acid production. It is of low toxicity but is a greenhouse gas (GHG) whose global warming potential (GWP) is large (as of IPCC 298 tCO2/tN2O). Emissions of N2O are considered under the Kyoto Protocol and there are no national or regional regulations or restrictions on the emission of N2O in Korea.

In this project thermal decomposition process equipment has been added to the adipic acid manufacturing plant. This installation reduces the GHG emissions which would have been otherwise released to the atmosphere if the project was not implemented.

The thermal decomposition facility was installed and commissioned in the manufacturing site of Onsan Solvay during May 2006 and the destruction of N2O was started in September 2006. The N2O destruction unit is in continuous operation since its start-up and has only stopped for short periods due to planned and corrective maintenance operations.

A.2. Location of project activity

Host Party: The Republic of Korea
Region: Ulju-gun, Ulsan
City: Onsan
GPS coordinates: 35.412778, 129.341667

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Korea (host)	• Public entity : Korea Energy Agency • Private entity : Solvay Energy Services Korea Co., Ltd.	No
France	• Private entity: Solvay Energy Services SAS • Private entity: Rhodia Energy GHG SAS	No
Japan	• Private entity: Rhodia Japan Ltd	No
Switzerland	• Private entity: Rhodia Energy GHG SAS • Private entity: Rhodia Japan Ltd.	No

A.4. Reference to applied methodologies and standardized baselines

- Baseline Methodology for decomposition of N2O from existing adipic acid production plants (AM0021, V 03)
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (V 01)
- Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (V 02)

A.5. Crediting period type and duration

The length of the crediting period is 21 years (renewable 3 * 7 years). The first crediting period is finished (01/09/2006 to 31/08/2013). The second crediting period is on-going (01/09/2013 to 31/08/2020).

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The project is fully implemented according to the description presented in the PDD. The project activity is completely operational since the start date of operation on 01/09/2006.

A thermal oxidizer with 2 chambers is the technology used to decompose N_2O at the Solvay Onsan site.

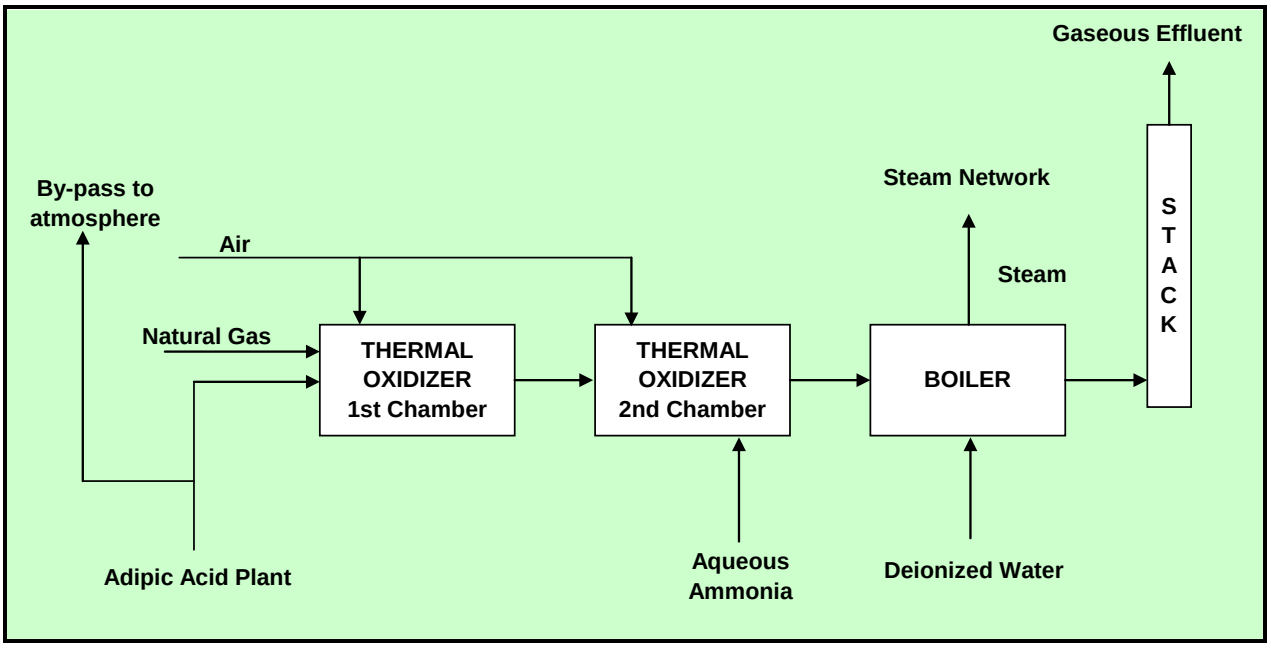
Natural gas is fed with the off gas from the adipic acid production containing N_2O and a controlled amount of air into a reduction chamber where it burns (oxidizes) to carbon dioxide (CO_2) and water vapour. N_2O is used as an oxidizer. Being oxygen deficient the oxidation is not complete and carbon monoxide and hydrogen are present.

$$CH_4 + 4\ N_2O \rightarrow CO_2 + 2\ H_2O + 4\ N_2$$

The temperature in the furnace is kept at about 1,300°C and under fuel rich conditions in order to promote the complete decomposition of N_2O while minimizing the formation of unwanted combustion by-products such as NO and NO_2.

The gas is then quenched with air to complete the combustion of carbon monoxide and hydrogen at a temperature of about 950°C in a second chamber. Steam and ammonia are injected to control the emission of NO and NO_2.

Before release to the stack the flue gas coming from the thermal oxidizer is used to produce saturated steam which is fed into the existing on-site steam network.



Special events during current monitoring period:

- Only minor disconnection of the N_2O destruction unit has occurred.
- No particular event occurred that impacted the destruction unit.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

No request for temporary deviation from registered monitoring plan or applied methodology was applied to this monitoring period.

B.2.2. Corrections

No correction related to project information or parameters fixed at validation was approved during this monitoring period or submitted with this monitoring report.

B.2.3. Changes to the start date of the crediting period

No changes to the start date of crediting period was approved during this monitoring period or submitted with this monitoring report.

B.2.4. Inclusion of monitoring plan

No inclusion of monitoring plan was approved during this monitoring period or submitted with this monitoring report.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

No permanent changes to the registered monitoring plan or permanent deviation of monitoring from the applied methodology, standardized baseline or other applied standards or tools was approved during this monitoring period or submitted with this monitoring report.

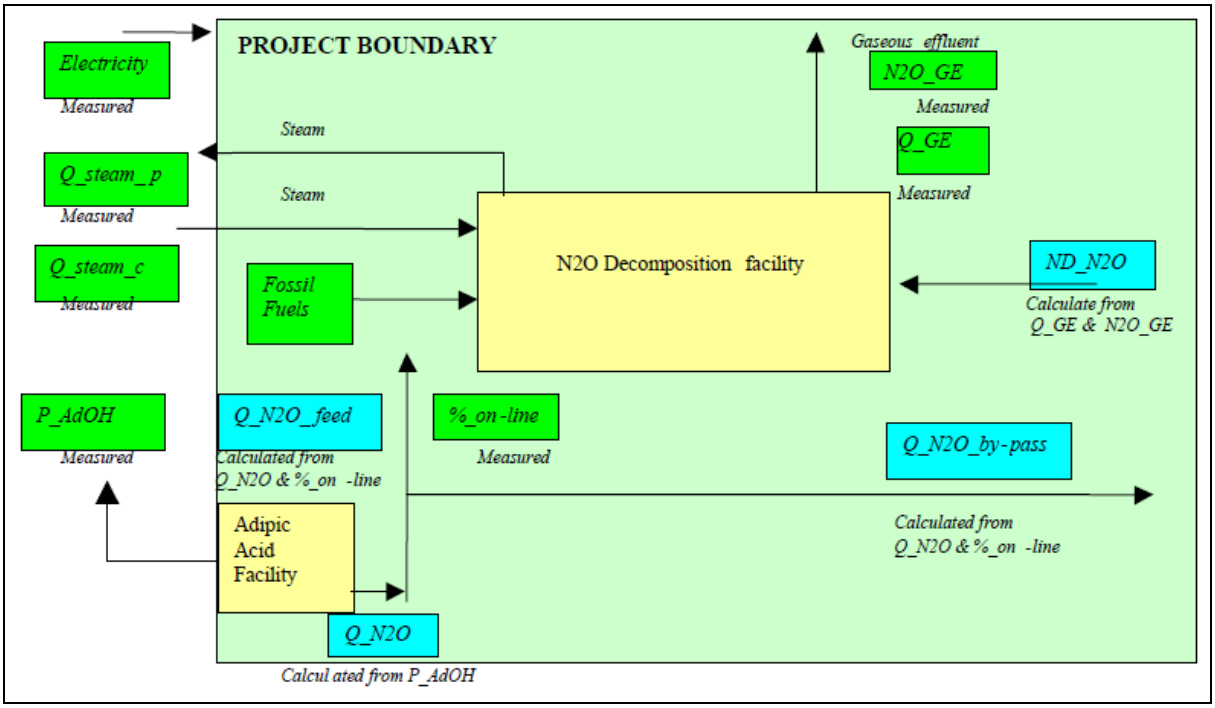
B.2.6. Changes to project design

No changes to the project design was approved during this monitoring period or submitted with this monitoring report.

SECTION C. Description of monitoring system

The project boundary related to the "Baseline Methodology for decomposition of N_2O from existing adipic acid production plants (AM0021, V 03)" is shown below with the measured parameters in green colour.

Potential sources of anthropogenic emissions by sources of GHG within the project boundary and emissions which are not included in the project boundary are also shown in below and the details of the parameters are informed in the section D.



All data collection procedures, the organizational structure, the roles and responsibilities and procedures for dealing with abnormal situations are described in detail in the Data Handling Protocol and Data Review Protocol which are documents of Solvay Quality System. Solvay Onsan plant is ISO9001 and ISO14001 certified.

The adipic acid Plant Manager is responsible for implementing and maintaining the monitoring procedures on site (Data Handling Protocol, training, calibration and maintenance, data review) and for validating all data. The overall responsibility of the project belongs to the CO2 Operations Director of Solvay Energy Services located in Paris, France.

All the data used for monitoring the baseline, project and leakage emissions are collected either in the PIMS (Plant Information Management System) or the Daily Production Reports:

(a) Process data (flow rates, pressures, temperatures etc.) are continuously acquired by the DCS (Distributed Control System) and automatically stored by the PIMS;

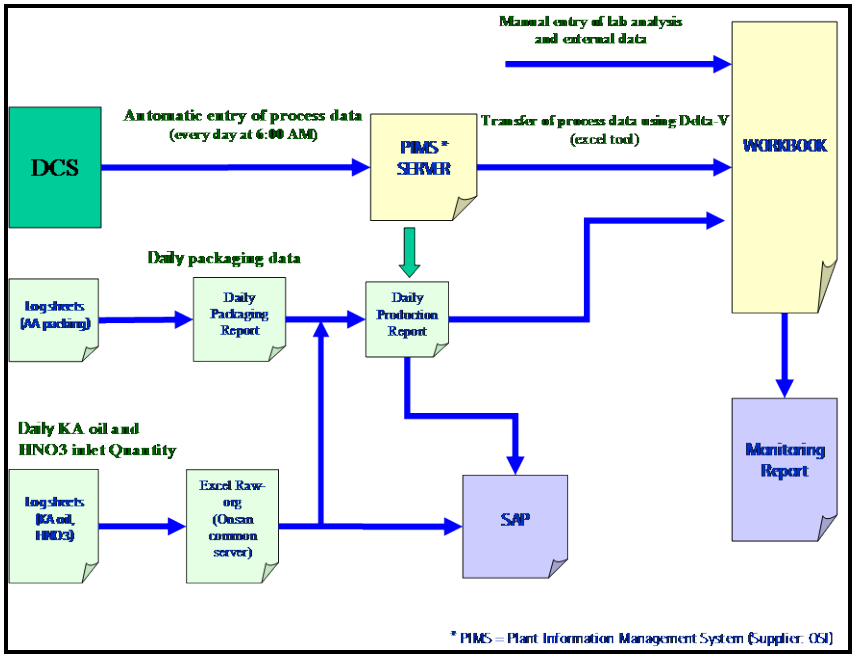
(b) Packed dry adipic acid daily data from log sheets are entered in dedicated excel files (Daily Packaging Reports). These reports are validated by the daily foreman and the supply chain manager before being manually transferred into the SAP database every working day by the authorized staff.

All measuring instruments used in this project are calibrated and maintained according to the specifications provided by the manufacturers and/or the relevant national and international standards.

The calculation of the daily production of adipic acid is carried out using the data stored in PIMS and daily packing report, and the daily nitric acid consumption quantity is calculated by using the data stored in PIMS and raw data stored in an excel sheet called Raw-org. The results obtained are collected in a Daily Production Report (excel sheet) and transferred to the Workbook. In parallel the packed quantities are entered in SAP system (System, Applications and Products for Data Processing) which is the official system used by Solvay for production management, supply chain management and accounting purposes.

The emission reductions calculations are performed in a dedicated excel spreadsheet called the Workbook. Process data are periodically extracted from PIMS using an excel tool called Delta-V and transferred to the Workbook. The laboratory and some external data such as natural gas composition are entered manually directly into the Workbook (e.g.: natural gas composition). The calculations made in the Workbook are used for the preparation of the monitoring report.

The following diagram illustrates the entire process of data acquisition, storage and transfer to the Workbook and preparation of the monitoring report:



Norm EN14181:
QAL1 and QAL2 steps of the norm have been achieved. QAL3 internal procedures are in place and followed for the measurement of the N2O gas at the entrance and the exit of the destruction unit.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	GWP_{N2O}
Unit	tCO_2e / tN_2O
Description	Global warming potential of N_2O during the crediting period
Source of data	Kyoto Protocol (Decision 2/CP.3) and IPCC
Value(s) applied	298
Choice of data or measurement methods and procedures	Fixed value
Purpose of data/parameter	BASELINE EMISSION and PROJECT EMISSION
Additional comments	IPCC http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14 "Standard for application of the global warming potentials to CDM project activities and PoAs for the second commitment period of the Kyoto Protocol" (version 01,0)

Data/Parameter	$EF_{N2O,BL,y}$
Unit	t N_2O per tonne of adipic acid produced
Description	N_2O Emission factor
Source of data	IPCC Good Practice Guidance
Value(s) applied	0.27
Choice of data or measurement methods and procedures	Fixed value
Purpose of data/parameter	BASELINE EMISSION
Additional comments	Cap value for emission factor for baseline emissions

Data/Parameter	ΔH
Unit	kcal/t of steam
Description	Enthalpy of vaporization of water
Source of data	Calculated based on the enthalpy of steam at 165°C and 6kg/cm^2 and the enthalpy of feed water at 100°C and 6kg/cm^2
Value(s) applied	557,960
Choice of data or measurement methods and procedures	Fixed value
Purpose of data/parameter	BASELINE EMISSION
Additional comments	Use to calculate $EF_{CO2,Steam,y}$

Data/Parameter	η
Unit	%
Description	Operational efficiency of the boiler for steam production

Source of data	As a conservative approach we assume that all substituted steam is generated by a highly efficient state of the-art natural gas condensing boiler with an operational efficiency of 97 % (30°C flue gas temperature).
Value(s) applied	97%
Choice of data or measurement methods and procedures	Fixed value
Purpose of data/parameter	BASELINE EMISSION
Additional comments	Use to calculate $EF_{CO2,Steam,y}$

Data/Parameter	**$P_{AdOH,BL}$**
Unit	Tonne
Description	Maximum value of total amount of adipic acid produced in most recent 3 years before the implementation of the project activity
Source of data	Measured
Value(s) applied	121,431.05
Choice of data or measurement methods and procedures	Calculated fixed value
Purpose of data/parameter	BASELINE EMISSION and PROJECT EMISSION
Additional comments	For the cases, where adipic acid production cannot be measured directly, refer to the procedure under Annex 1 on “Procedure to calculate adipic acid production in cases it cannot be measured directly.

Data/Parameter	**EFEL,j/k/l,y**
Unit	tCO_2/MWh
Description	Emission factor for electricity generation
Source of data	Tool to calculate baseline, project and/or leakage emissions from electricity consumption; option A2: default value
Value(s) applied	1.3
Choice of data or measurement methods and procedures	Fixed value
Purpose of data/parameter	PROJECT EMISSION
Additional comments	/

Data/Parameter	**$TDL_{j,y}$**
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Source of data	Tool to calculate baseline, project and/or leakage emissions from electricity consumption
Value(s) applied	20%
Choice of data or measurement methods and procedures	Fixed value
Purpose of data/parameter	PROJECT EMISSION
Additional comments	/

D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

Data / Parameter:	**NCG_h**				**(1)**
Unit:	tonne N_2O/m^3 at normal conditions				
Description:	N_2O concentration at the inlet of the destruction facility during the hour h				
Measured /Calculated /Default:	Measured				
Source of data:	DCS data				
Value(s) of monitored parameter:	Period Value:	From	To	$NCG_{h,NVR1}$	$NCG_{h,NVR2}$
		01/09/2017	31/08/2018	-	-
	Monthly values:	01/09/2017	30/09/2017	0.000452	0.000783
		01/10/2017	31/10/2017	0.000494	0.000798
		01/11/2017	30/11/2017	0.000507	0.000756
		01/12/2017	31/12/2017	0.000420	0.000754
		01/01/2018	31/01/2018	0.000517	0.000763
		01/02/2018	28/02/2018	0.000472	0.000855
		01/03/2018	31/03/2018	0.000550	0.000821
		01/04/2018	30/04/2018	0.000514	0.000843
		01/05/2018	31/05/2018	0.000497	0.000789
		01/06/2018	30/06/2018	0.000490	0.000782
		01/07/2018	31/07/2018	0.000510	0.000771
		01/08/2018	31/08/2018	0.000512	0.000792
Monitoring equipment:	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	NVR1 Gas analyzer (new laser diode) (AI55012) Serial Number: 17025	Laser diode	+/- 1%	2/ year	Last Calibration 24/07/2018 Valid Until 23/07/2020
	NVR2 Gas analyzer (new laser diode) (AI56012) Serial Number: 17026	Laser diode	+/- 1%	2/ year	Last Calibration 24/07/2018 Valid Until 23/07/2020
	Gas analyzer (existing laser diode for backup) (AI57017) Serial Number: 17004	Laser diode	+/- 3.87%	2/ year	Last Calibration 23/07/2018 Valid Until 22/07/2020
Measuring/ Reading/ Recording frequency:	Measured using gas analyser. Norm EN14181				
Calculation method (if applicable):	N/A				
QA/QC procedures:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:					

Data / Parameter:	**VSG_h at normal conditions**				**(2)**
Unit:	m^3 / h				
Description:	Volume of gas flow at the inlet of the destruction facility during the hour h				
Measured /Calculated /Default:	Measured				
Source of data:	DCS data				
Value(s) of monitored parameter:	Period Value:	From	To	VSG_h - NVR1 at normal conditions	VSG_h - NVR2 at normal conditions
		01/09/2017	31/08/2018		
	Monthly values:	01/09/2017	30/09/2017	1,444.0	5,044.7
		01/10/2017	31/10/2017	1,462.9	5,516.5
		01/11/2017	30/11/2017	1,021.8	5,740.5
		01/12/2017	31/12/2017	718.9	6,498.4
		01/01/2018	31/01/2018	1,386.8	4,824.7
		01/02/2018	28/02/2018	1,298.5	5,075.3
		01/03/2018	31/03/2018	2,050.3	4,253.2
		01/04/2018	30/04/2018	1,926.9	4,115.5
		01/05/2018	31/05/2018	2,040.7	4,110.3
		01/06/2018	30/06/2018	1,700.8	4,567.1
		01/07/2018	31/07/2018	1,908.9	4,015.7
		01/08/2018	31/08/2018	1,960.2	4,534.4
Monitoring equipment:	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	LNOX D51500 to E55030 (FQ51525) Serial Number: 91EC29665 551	Orifice type flow transmitter	+/- 5%	Annually	Last Calibration
					24/11/2017
					Valid Until
					23/11/2018
	LNOX D52400 to E56030 (FQ52428) Serial Number: 12B605179 224	Orifice type flow transmitter	+/- 5%	Annually	Last Calibration
					24/11/2017
					Valid Until
					23/11/2018
	Entrance gas flow for backup (FT57015) Serial Number: 8145782	Annubar	+/-1%	annually	Last Calibration
					07/11/2017
					Valid Until
					06/11/2018
Measuring/ Reading/ Recording frequency:	Measured using a flow meter. Norm EN14181				
Calculation method (if applicable):	N/A				
QA/QC procedures:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:	/				

Data / Parameter:	h_y				(3)
Unit:	-				
Description:	Number of hours of operation in a year y (AA plant)				
Measured /Calculated /Default:	Measured value. Several instruments are used				
Source of data	KA Oil feeding valve (HSV11509) & KA Oil flow meter (FT12701)				
Value(s) of monitored parameter:	Period Value:	From	To	h_y	
		01/09/2017	31/08/2018	8,346.0	
	Monthly values:	01/09/2017	30/09/2017	716.6	
		01/10/2017	31/10/2017	576.1	
		01/11/2017	30/11/2017	495.3	
		01/12/2017	31/12/2017	744.0	
		01/01/2018	31/01/2018	735.9	
		01/02/2018	28/02/2018	672.0	
		01/03/2018	31/03/2018	744.0	
		01/04/2018	30/04/2018	720.0	
		01/05/2018	31/05/2018	734.5	
		01/06/2018	30/06/2018	720.0	
		01/07/2018	31/07/2018	743.6	
		01/08/2018	31/08/2018	744.0	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	KAOP to Oxidation (FT12701) Serial Number: 14208217 until 20/12/2017	Mass flow meter	+/- 1%	Annually	Last Calibration 21/12/2016 Valid Until 20/12/2017
	KAOP to Oxidation (FT12701) Serial Number: 45012E02000 from 21/12/2017	Mass flow meter	+/- 1%	Annually	Last Calibration 05/12/2017 Valid Until 04/12/2018
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily.				
Calculation method (if applicable):	When KA Oil feeding valve open and flow rate is indicated then the value of h_y is 1.				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:	/				

Data / Parameter:	$P_{AdOH,pr,y}$	(4)
Unit:	Tonne	
Description:	Quantity of adipic acid produced during the year y	
Measured /Calculated /Default:	Measured value. Several instruments are used	
Source of data:	DCS data and packaging log sheets	

Value(s) of monitored parameter:	Period Value:	From	To	$P_{AdOH,pr,y}$ Produced	$P_{AdOH,pr,y}$ Eligible *
		01/09/2017	31/08/2018	144,279.8	121,431.1
	Monthly values:	01/09/2017	30/09/2017	12,327.9	12,327.9
		01/10/2017	31/10/2017	11,289.4	11,289.4
		01/11/2017	30/11/2017	8,625.1	8,625.1
		01/12/2017	31/12/2017	14,423.5	14,423.5
		01/01/2018	31/01/2018	12,368.1	12,368.1
		01/02/2018	28/02/2018	12,347.1	12,347.1
		01/03/2018	31/03/2018	12,941.4	12,941.4
		01/04/2018	30/04/2018	12,030.2	12,030.2
		01/05/2018	31/05/2018	11,773.4	11,773.4
		01/06/2018	30/06/2018	11,901.3	11,901.3
		01/07/2018	31/07/2018	11,401.9	1,403.8
		01/08/2018	31/08/2018	12,850.7	-
	$P_{AdOH,pr,y}$ accumulated current year				144,279.8
	$P_{AdOH,BL,y}$ (= CAP)				121,431.1
	** Adipic acid production for BE after cap application*				

Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Small bags and bags balance (W42811) Serial Number: MA7	Load cell weighing indicator	+/- 0.03 kg	Annually	Last Calibration 06-03-2018 Valid Until 05/03/2019
	Big bags and bags balance (W43741) Serial Number: 2003105	Load cell weighing indicator	+/- 0.3 kg	Annually	Last Calibration 06/03/2018 Valid Until 05/03/2019
	Big bags and bags balance (W43742) Serial Number: 044134	Load cell weighing indicator	+/- 0.3 kg	Annually	Last Calibration 06/03/2018 Valid Until 05/03/2019
	SILO R42500 (W42505) Serial Number: 9009132	Load cell weighing indicator	+/- 3 t	Annually	Last Calibration 01/02/2018 Valid Until 31/01/2019

Measuring/ Reading/ Recording frequency:	Measured and read when used, recorded monthly and yearly.
Calculation method (if applicable):	The daily Adipic Acid production is measured directly by the weight of packed finished product and the silo weight difference between two consecutive days. The EB45 guidance Annex 13 in reference does not apply to such cases.
	The cumulated production of adipic acid over the current year (starting last September 1st and ending with the last day of this period) is 144,279.8 t. This production is above the cap and only 121,431.1 t out of the 144,279.8 t of adipic acid produced are used for defining the baseline emissions.
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30
Purpose of data/parameter	BASELINE EMISSION and PROJECT EMISSION

Additional Comment:	/

Data / Parameter:	$Q_{HNO3,cons,y}$				**(5)**
Unit:	tonne				
Description:	Quantity of HNO_3 consumption during the year y				
Measured /Calculated /Default:	Measured. Several instruments are used				
Source of data	DCS data and log sheets				
Value(s) of monitored parameter:	Period Value:	From	To	$Q_{HNO3,cons,y}$	
		01/09/2017	31/08/2018	123,951.0	
	Monthly values:	01/09/2017	30/09/2017	10,713.0	
		01/10/2017	31/10/2017	9,376.0	
		01/11/2017	30/11/2017	7,582.0	
		01/12/2017	31/12/2017	12,386.0	
		01/01/2018	31/01/2018	10,600.0	
		01/02/2018	28/02/2018	10,698.0	
		01/03/2018	31/03/2018	11,100.0	
		01/04/2018	30/04/2018	10,370.0	
		01/05/2018	31/05/2018	10,097.0	
		01/06/2018	30/06/2018	10,242.0	
		01/07/2018	31/07/2018	9,787.0	
		01/08/2018	31/08/2018	11,000.0	

Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Potentiometric Titrator Serial Number: 10179427	Potentio mettic	0.10%	Weekly	Last Calibration
					27/08/2018
					Valid Until
					Following week
	Fresh nitric acid HANWHA (FT6C069) Serial Number: 14506121	Mass flow meter	+/- 0.65%	Annually	Last Calibration
					07/02/2018
					Valid Until
					06/02/2019
	Fresh nitric acid HANWHA (FT760CD) Serial Number: 14645542	Mass flow meter	+/- 0.65%	Annually	Last Calibration
					20/06/2018
					Valid Until
					19/06/2019
	Fresh nitric acid tank (LT92005) Serial Number: 90A-15477	Flash type level transmitter	+/- 2%	Annually	Last Calibration
					06/04/2018
					Valid Until
					05/04/2019
	Fresh nitric acid tank (LT92015) Serial Number: 12B900230-232	Flash type level transmitter	+/- 2%	Annually	Last Calibration
					06/04/2018
					Valid Until
					05/04/2019
	Truck scale (W9000) Serial Number: '17-02	Load cell weighing indicator	+/- 10 kg	Annually	Last Calibration
					08/08/2018
					Valid Until
					07/08/2019

Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily. Truck scale (W9000): Measured and read when used, recorded daily.
Calculation method (if applicable):	The Nitric acid consumption quantity is calculated based on sum of daily fresh HNO3 incoming quantity from Hanwha, and holding volume and concentration variation of the fresh HNO3 storage tank (R92000 & R92010) and process storage tank (Mother acid tank, concentration acid tank and Oxidation acid tank)
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30
Purpose of data/parameter	BASELINE EMISSION
Additional Comment:	/

Data / Parameter:	**$Q_{HNO3,ww,y}$**			**(6)**	
Unit:	tonne				
Description:	Quantity of HNO_3 loss in waste water during the year y				
Measured /Calculated /Default:	Measured Several instruments are used				
Source of data	DCS data and laboratory analysis data				
Value(s) of monitored parameter:	Period Value:	From	To	$Q_{HNO3,ww,y}$	
		01/09/2017	31/08/2018	2,034.9	
	Monthly values:	01/09/2017	30/09/2017	180.9	
		01/10/2017	31/10/2017	169.1	
		01/11/2017	30/11/2017	121.1	
		01/12/2017	31/12/2017	210.4	
		01/01/2018	31/01/2018	180.1	
		01/02/2018	28/02/2018	174.4	
		01/03/2018	31/03/2018	181.8	
		01/04/2018	30/04/2018	164.4	
		01/05/2018	31/05/2018	164.2	
		01/06/2018	30/06/2018	161.9	
		01/07/2018	31/07/2018	165.3	
		01/08/2018	31/08/2018	161.4	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Potentiometric Titrator Serial Number: 10179427	Potentio mettic	0.10%	Weekly	Last Calibration
					27/08/2018
					Valid Until
					Following week
	HPCE R61380 to K83160 (FQ61782) Serial Number: L523C519000 until 13/12/2017	Magnetic Flow Meter	+/- 1%	Annually	Last Calibration
					16/12/2016
					Valid Until
					15/12/2017
	HPCE R61380 to K83160 (FQ61782) Serial Number: S5N402980 314	Magnetic Flow Meter	+/- 1%	Annually	Last Calibration
					05/12/2017
					Valid Until
					04/12/2018

	from 14/12/2017				
	Waste water to R83200 (FQ83401) Serial Number: 6205429 until 26/12/2017	Magnetic Flow Meter	+/- 1%	Annually	Last Calibration 29/12/2016 Valid Until 28/12/2017
	Waste water to R83200 (FQ83401) Serial Number: 0870143563 from 27/12/2017	Magnetic Flow Meter	+/- 1%	Annually	Last Calibration 26/12/2017 Valid Until 25/12/2018
	Waste water to R83200 (FQ62281) Serial Number: M20FE519000	Magnetic Flow Meter	+/- 0.25%	Annually	Last Calibration 25/07/2018 Valid Until 24/07/2019
Measuring/ Reading/ Recording frequency:	This is measured as product of nitrate concentration by laboratory equipment in waste water and waste water flow by flow meter.				
Calculation method (if applicable):	QHNO3,ww,y is calculated based on sum of daily HNO3 loss quantity from HPC waste water and LPC1&2 waste water.				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:	/				

Data / Parameter:	**$Q_{HNO3,by-p,y}$**			**(7)**	
Unit:	tonne				
Description:	Quantity of HNO_3 in byproducts, during the year y				
Measured /Calculated /Default:	Measured by laboratory equipment and flow meter				
Source of data	DCS data and laboratory analysis data				
Value(s) of monitored parameter:	Period Value:	From	To	$Q_{HNO3,by-p,y}$	
		01/09/2017	31/08/2018	235.3	
	Monthly values:	01/09/2017	30/09/2017	37.3	
		01/10/2017	31/10/2017	31.2	
		01/11/2017	30/11/2017	24.7	
		01/12/2017	31/12/2017	38.9	
		01/01/2018	31/01/2018	28.8	
		01/02/2018	28/02/2018	15.7	
		01/03/2018	31/03/2018	11.7	
		01/04/2018	30/04/2018	6.9	
		01/05/2018	31/05/2018	5.5	
		01/06/2018	30/06/2018	10.3	
		01/07/2018	31/07/2018	10.4	
		01/08/2018	31/08/2018	13.9	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Potentiometric Titrator Serial Number: 10179427	Potentio mettic	0.10%	Weekly	Last Calibration 27/08/2018

					Valid Until
					Following week
	Truck scale (W9000) Serial Number: '17-02	Load cell weighing indicator	+/- 10 kg	Annually	Last Calibration
					08/08/2018
					Valid Until
					07/08/2019
	DBA R81100 to K83300 (FQ82351) Serial Number: 91K906367 036	Magnetic Flow Meter	+/- 1%	Annually	Last Calibration
					26/12/2017
					Valid Until
					25/12/2018
	DIVA Big bags and bags balance (W58741) Serial Number: B370732	Load cell weighing indicator	+/- 0.5 kg	Annually	Last Calibration
					06/03/2018
					Valid Until
					05/03/2019
	DIVA Big bags and bags balance (W58742) Serial Number: MG2	Load cell weighing indicator	+/- 1.0 kg	Annually	Last Calibration
					06/03/2018
					Valid Until
					05/03/2019
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second, recorded daily. Lab equipment: Measured and read when used, recorded daily. Truck scale (W9000): Measured and read when used, recorded daily.				
Calculation method (if applicable):	QHNO3,by-p,y is calculated based on sum of daily HNO3 loss quantity from byproduct.				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:	/				

Data / Parameter:	**$Q_{HNO3,AdOH,y}$**			**(8)**
Unit:	tonne			
Description:	Quantity of HNO_3 in adipic acid produced during the year y			
Measured /Calculated /Default:	This is measured as product of nitrate concentration in adipic acid and adipic acid produced by laboratory equipment.			
Source of data	DCS data and laboratory analysis data			
Value(s) of monitored parameter:	Period Value:	From	To	$Q_{HNO3,AdOH,y}$
		01/09/2017	31/08/2018	0.143
	Monthly values:	01/09/2017	30/09/2017	0.013
		01/10/2017	31/10/2017	0.012
		01/11/2017	30/11/2017	0.010
		01/12/2017	31/12/2017	0.018
		01/01/2018	31/01/2018	0.012
		01/02/2018	28/02/2018	0.013
		01/03/2018	31/03/2018	0.013
		01/04/2018	30/04/2018	0.011
		01/05/2018	31/05/2018	0.010
		01/06/2018	30/06/2018	0.010

		01/07/2018	31/07/2018	0.010	
		01/08/2018	31/08/2018	0.012	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	HPLC Serial Number: DE23919856	Chromatography	< 0.3% RSD	Daily	Last Calibration
					31/08/2018
					Valid Until
					Following day
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second, recorded daily. Lab equipment: Measured and read when used, recorded daily.				
Calculation method (if applicable):	QHNO3,AdOH,y is calculated based on sum of daily HNO3 loss quantity from product.				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:	/				

Data / Parameter:	**$Q_{NOx,offgases,y}$**			**(9)**	
Unit:	tonne				
Description:	Quantity of nitrogen content in off gases during the year				
Measured /Calculated /Default:	This is measured as product of NO_X concentration in flue gases, flow of gas, and appropriate conversion factor from N in NO_X to N in HNO_3 by analyzer and flow meter.				
Source of data	DCS data and laboratory analysis data				
Value(s) of monitored parameter:	Period Value:	From	To	$Q_{NOx,offgases,y}$	
		01/09/2017	31/08/2018	88.5	
	Monthly values:	01/09/2017	30/09/2017	6.9	
		01/10/2017	31/10/2017	6.0	
		01/11/2017	30/11/2017	4.9	
		01/12/2017	31/12/2017	7.6	
		01/01/2018	31/01/2018	6.5	
		01/02/2018	28/02/2018	8.2	
		01/03/2018	31/03/2018	9.1	
		01/04/2018	30/04/2018	7.7	
		01/05/2018	31/05/2018	7.9	
		01/06/2018	30/06/2018	8.1	
		01/07/2018	31/07/2018	7.3	
		01/08/2018	31/08/2018	8.3	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	NOx gas DCN inlet (AYA51526) Serial Number: W0625001	NDIR (Non Dispersive Infrared)	+/- 3%	4/year	Last Calibration
					23/08/2018
					Valid Until
					22/11/2018
	LNOX E56010 to A56020 (AYA-56026)	NDIR (Non Dispersive	+/- 5%	4/year	Last Calibration

	Serial Number: W0624984	Infrared)			23/08/2018
					Valid Until
					22/11/2018
	LNOX D51500 to E55030 (FQ51525) Serial Number: 91EC29665 551	Orifice type flow transmitter	+/- 5%	Annually	Last Calibration
					24/11/2017
					Valid Until
					23/11/2018
	LNOX D52400 to E56030 (FQ52428) Serial Number: 12B605179-224	Orifice type flow transmitter	+/- 5%	Annually	Last Calibration
					24/11/2017
					Valid Until
					23/11/2018
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second, recorded daily. Lab equipment: Measured and read when used, recorded daily.				
Calculation method (if applicable):	QNOx,offgases,y is calculated based on sum of daily HNO3 loss quantity from offgases.				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:	/				

Data / Parameter:	**$R_{N2O-N2,y}$**				**(10)**
Unit:	%				
Description:	Ratio of N_2O to N_2				
Measured /Calculated /Default:	Measured/Calculated				
Source of data:	Not applicable				
Value(s) of monitored parameter:	Period Value:	From	To	$R_{N2O-N2,y}$	
		01/09/2017	31/08/2018		
	Monthly values:	01/09/2017	30/09/2017	86.699%	
		01/10/2017	31/10/2017	86.660%	
		01/11/2017	30/11/2017	86.671%	
		01/12/2017	31/12/2017	86.653%	
		01/01/2018	31/01/2018	86.650%	
		01/02/2018	28/02/2018	91.399%	
		01/03/2018	31/03/2018	86.918%	
		01/04/2018	30/04/2018	90.172%	
		01/05/2018	31/05/2018	86.721%	
		01/06/2018	30/06/2018	86.656%	
		01/07/2018	31/07/2018	86.650%	
		01/08/2018	31/08/2018	86.650%	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	HPLC Serial Number:	Chromato graphy	< 0.3% RSD	Daily	Last Calibration
					31/08/2018

	DE23919856				Valid Until Following day
Measuring/ Reading/ Recording frequency:	Calculated and recorded monthly				
Calculation method (if applicable):	The following method was applied: • A table of R_{N2O-N2} in relation to the ratio of cyclohexanone and cyclohexanol was established drawing upon validated in-house data, taking into account uncertainty; • A ceiling value of R_{N2O-N2} ($R_{N2O-N2,max}$) was established based on the lowest annual average of the key factors affecting R_{N2O-N2} during the past three years (2010, 2011, 2012); During monitoring the remaining step has been applied as follows: • Establish an estimate of R_{N2O-N2} realtime ($R_{N2O-N2,y}$) based on the key figures obtained during the implementation of project. $R_{N2O-N2,y}$ should not exceed $R_{N2O-N2,max}$. During monitoring the average of the OL ratio was calculated on a monthly basis. Then the corresponding value of R_{N2O-N2} was determined as of the established table (bullet point 1). If the corresponding value was lower than the ceiling value, the corresponding value was chosen; if it was above the ceiling value, the ceiling value was chosen.				
QA/QC procedures applied:	Measuring instruments shall be calibrated regularly according to industry standards. Measuring instrument to determine the OL-ratio in KA oil is a chromatograph. Accuracy of matched value (final value for parameter $R_{N2O-N2,y}$) as of reference table is +/- 0.5%.				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:	/				

Data / Parameter:	**$Q_{N2O,reg}$** **(11)**
Unit:	Tonne
Description:	Quantity of N_2O allowed under regulations
Measured /Calculated /Default:	Default value
Source of data:	South Korean legislation
Value(s) of monitored parameter:	Not applicable
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Recorded at date of the regulatory value introduction or change of the regulation
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Solvay follows the evolution of Korean legislation about N_2O emissions that could affect the project Emission as part of its Care Management System which is covering ISO14000 standard which requires following any update on Environmental regulations.

	The Framework Act on Low Carbon and Green Growth has become effective on 14/04/2010. Within the scope of this Governmental law the list of controlled companies has been announced in September 2010. Designated "controlled" companies have submitted a 3 years historical data on GHG emissions and energy consumption in September 2011. CDM units are excluded from this obligation. There is no applicable limitation from this new regulation on the N_2O emissions of the Onsan Adipic Acid plant.
Purpose of data/parameter	BASELINE EMISSION
Additional Comment:	/

Data / Parameter:	**$EF_{N2O,reg}$** **(12)**
Unit:	Tonne N_2O/tonne AdOH
Description:	Quantity of N_2O allowed under regulations per tonne of AdOH produced
Measured /Calculated /Default:	Default value
Source of data:	South Korean legislation
Value(s) of monitored parameter:	Not applicable
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Recorded at date of the regulatory value introduction or change of the regulation
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Solvay follows the evolution of Korean legislation about N_2O emissions that could affect the project Emission as part of its Care Management System which is covering ISO14000 standard which requires following any update on Environmental regulations. The Framework Act on Low Carbon and Green Growth has become effective on 14/04/2010. Within the scope of this Governmental law the list of controlled companies has been announced in September 2010. Designated "controlled" companies have submitted a 3 years historical data on GHG emissions and energy consumption in September 2011. CDM units are excluded from this obligation. There is no applicable limitation from this new regulation on the N_2O emissions of the Onsan Adipic Acid plant.
Purpose of data/parameter	BASELINE EMISSION
Additional Comment:	/

Data / Parameter:	**r_y** **(13)**
Unit:	%
Description:	share of the N_2O in the waste stream required to be destroyed
Measured /Calculated /Default:	Default value
Source of data:	South Korean legislation

Value(s) of monitored parameter:	Not applicable
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Recorded at date of the regulatory value introduction or change of the regulation
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Solvay follows the evolution of Korean legislation about N_2O emissions that could affect the project Emission as part of its Care Management System which is covering ISO14000 standard which requires following any update on Environmental regulations. The Framework Act on Low Carbon and Green Growth has become effective on 14/04/2010. Within the scope of this Governmental law the list of controlled companies has been announced in September 2010. Designated "controlled" companies have submitted a 3 years historical data on GHG emissions and energy consumption in September 2011. CDM units are excluded from this obligation. There is no applicable limitation from this new regulation on the N_2O emissions of the Onsan Adipic Acid plant.
Purpose of data/parameter	BASELINE EMISSION
Additional Comment:	/

Data / Parameter:	**$Q\_Steam_{p,y}$**				**(14)**
Unit:	Tonne				
Description:	Steam production by the decomposition process				
Measured /Calculated /Default:	Measured, steam supplier data				
Source of data:	The data are automatically and continuously acquired by DCS and stored in the PIMS.				
Value(s) of monitored parameter:	Period Value:	From	To	$Q_{\_Steam\_p,y}$	
		01/09/2017	31/08/2018	181,251.3	
	Monthly values:	01/09/2017	30/09/2017	16,040.8	
		01/10/2017	31/10/2017	14,152.7	
		01/11/2017	30/11/2017	12,061.6	
		01/12/2017	31/12/2017	17,808.5	
		01/01/2018	31/01/2018	15,284.2	
		01/02/2018	28/02/2018	15,710.9	
		01/03/2018	31/03/2018	16,328.3	
		01/04/2018	30/04/2018	15,341.9	
		01/05/2018	31/05/2018	14,583.8	
		01/06/2018	30/06/2018	14,539.4	
		01/07/2018	31/07/2018	13,953.6	
		01/08/2018	31/08/2018	15,445.8	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Steam production by	Vortex flow	+/- 1%	Annually	Last Calibration

	N2O system (FIQ58213) Serial Number: S5N507490 321 until 27/10/2017	meter			31/05/2017 Valid Until 30/05/2018
	Steam production by N2O system (FIQ58213) Serial Number: 294795 003 01 from 28/10/2017	Vortex flow meter	+/- 1%	Annually	Last Calibration 19/10/2017 Valid Until 18/10/2018
	Boiler feed water flow rate (FIQ58204) Serial Number: 294795 002 01	Vortex flowmeter (Back up for FIQ58213)	+/- 0.3%	Annually	Last Calibration 30/10/2017 Valid Until 29/10/2018
	Boiler continuous purge flow rate (FIQ58303) Serial Number: 91P310606 until 10/12/2017	Orifice type flowmeter (Back up for FIQ58213)	+/- 0.6%	Annually	Last Calibration 14/12/2016 Valid Until 13/12/2017
	Boiler continuous purge flow rate (FIQ58303) Serial Number: 91K713049 from 11/12/2017	Orifice type flowmeter (Back up for FIQ58213)	+/- 0.6%	Annually	Last Calibration 07/12/2017 Valid Until 06/12/2018
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	BASELINE EMISSION				
Additional Comment:	/				

Data / Parameter:	**$EF_{CO2,Steam,y}$** **(15)**
Unit:	tCO_2/tonne steam
Description:	CO_2 intensity for steam
Measured /Calculated /Default:	Calculated
Source of data:	Excel workbook
Value(s) of monitored parameter:	0.121
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Not Applicable/each monitoring period

Calculation method (if applicable):	The rolling year value is calculated with the data available for the year prior to the end of the period in order to assure to have the data. $EF_{CO2,Steam,y}$ can then be calculated using the following formula: $EF_{CO2,Steam,y} = Q_{NG\ tsteam}$ (Nm^3/ t of steam) x $COEF_{NG,y}$ (t CO_2/Nm^3) Where: $Q_{NG\ tsteam}$ (Nm^3/ t of steam) = ΔH (kcal/t) / (HHV (kcal/Nm^3) x η (%)) $Q_{NG\ tsteam}$ (Nm^3/ t of steam) = 557,960 (kcal/t) / (HHV average (kcal/Nm^3) x 0.97) ΔH is calculated based on the enthalpy of steam at 165°C and 6kg/cm^2 and the enthalpy of feed water at 100°C and 6kg/cm^2. HHV is based on the yearly average based upon monthly data from Kyung Dong City Gas Co,Ltd.
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30
Purpose of data/parameter	BASELINE EMISSION
Additional Comment:	/

Data / Parameter:	**$Q_{GE,y}$**			**(16)**	
Unit:	Tonne/h				
Description:	Quantity of effluent gas generated during the year y				
Measured /Calculated /Default:	Measured				
Source of data:	Data are automatically acquired continuously by the DCS and stored in the PIMS data base.				
Value (s) of monitored parameter:	Period Value:	From	To	$Q_{GE,y}$	
		01/09/2017	31/08/2018		
	Monthly values:	01/09/2017	30/09/2017	21.9	
		01/10/2017	31/10/2017	23.4	
		01/11/2017	30/11/2017	21.4	
		01/12/2017	31/12/2017	23.3	
		01/01/2018	31/01/2018	21.5	
		01/02/2018	28/02/2018	22.1	
		01/03/2018	31/03/2018	21.3	
		01/04/2018	30/04/2018	21.1	
		01/05/2018	31/05/2018	20.6	
		01/06/2018	30/06/2018	21.2	
		01/07/2018	31/07/2018	20.0	
		01/08/2018	31/08/2018	22.0	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Effluent gas (FIQ58407) Serial Number: 080421-1	Pitot tube differential pressure flow meter	+/- 3%	Annually	Last Calibration 03/01/2018 Valid Until 02/01/2019
Measuring/ Reading/ Recording	Measured continuously, read every second and recorded daily.				

frequency:	
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30
Purpose of data/parameter	PROJECT EMISSION
Additional Comment:	Records to be maintained during project's lifetime. The monitoring system shall comply with the European Norm 14181. Further details are provided in the baseline methodology procedure

Data / Parameter:	**$C_{N2O,GE,y}$**				**(17)**
Unit:	Tonne of N_2O / Nm^3				
Description:	N_2O concentration in the effluent gas				
Measured /Calculated /Default:	Measured				
Source of data:	Data are automatically acquired continuously by the DCS and stored in the PIMS data base.				
Value (s) of monitored parameter:	Period Value:	From	To	$C_{N2O,GE,y}$	
		01/09/2017	31/08/2018		
	Monthly values:	01/09/2017	30/09/2017	0.0000000242	
		01/10/2017	31/10/2017	0.0000000296	
		01/11/2017	30/11/2017	0.0000000279	
		01/12/2017	31/12/2017	0.0000000327	
		01/01/2018	31/01/2018	0.0000000299	
		01/02/2018	28/02/2018	0.0000000266	
		01/03/2018	31/03/2018	0.0000000257	
		01/04/2018	30/04/2018	0.0000000274	
		01/05/2018	31/05/2018	0.0000000270	
		01/06/2018	30/06/2018	0.0000000270	
		01/07/2018	31/07/2018	0.0000000267	
		01/08/2018	31/08/2018	0.0000000274	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Stack N_2O analyzer (AIT58408) Serial Number: 17005	Gas analyzer, type in-situ and laser diode on wet basis	+/- 5 vppm	2/year	Last Calibration 13/07/2018 Valid Until 12/01/2019
	Stack N_2O analyzer (AI58418) Serial Number: W01894257	NDIR (Non Dispersive Infrared)	+/- 5 vppm	weekly	Last Calibration 31/08/2018 Valid Until Following week
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily.				
Calculation method (if applicable):	The daily average concentration on wet basis is calculated (option C of mass flow tool is used) in the DCS as the flow averaged value of concentration values measured				

	every 10 sec: $$C_{N2O\_GE,\,y} = \frac{\int (Q_{GE,\,y} * C_{N2O\_GE})\,dt}{Q_{GE,\,y}}$$
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30
Purpose of data/parameter	PROJECT EMISSION
Additional Comment:	Records to be maintained during project's lifetime. The monitoring system shall comply with the European Norm 14181. Further details are provided in the baseline methodology procedure

Data / Parameter:	**$FC_{NG,y}$**				**(18)**
Unit:	Nm^3				
Description:	Quantity of fuel combusted during the year y Natural gas burning				
Measured /Calculated /Default:	Measured by flow meter				
Source of data:	Data are automatically acquired continuously by the DCS and stored in the PIMS data base.				
Value (s) of monitored parameter:	Period Value:	From	To	**$FC_{NG,y}$**	
		01/09/2017	31/08/2018	12,259,080.5	
	Monthly values:	01/09/2017	30/09/2017	949,359.2	
		01/10/2017	31/10/2017	827,133.2	
		01/11/2017	30/11/2017	961,509.2	
		01/12/2017	31/12/2017	1,618,619.9	
		01/01/2018	31/01/2018	930,072.4	
		01/02/2018	28/02/2018	1,306,382.6	
		01/03/2018	31/03/2018	1,038,666.7	
		01/04/2018	30/04/2018	934,125.6	
		01/05/2018	31/05/2018	920,955.6	
		01/06/2018	30/06/2018	911,628.4	
		01/07/2018	31/07/2018	888,233.4	
		01/08/2018	31/08/2018	972,394.3	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Natural Gas burning (FIQ91485A) Serial Number: 80105172 from 15/12/2017 to 09/02/2018	Turbine flow meter	+/- 0.3%	Annually	Last Calibration 14/02/2018 Valid Until 13/02/2019
	Natural Gas burning (FIQ91485B) (Back up flow meter) Serial Number: 80124613 from 14/02/2018	Turbine flow meter	+/- 0.3%	Annually	Last Calibration 15/03/2017 Valid Until 14/03/2018
	Natural Gas burning (FIQ91485B) (Back up flow meter)	Turbine flow meter	+/- 0.3%	Annually	Last Calibration 19/12/2017 Valid Until

	Serial Number: 80119190 from 22/12/2017 to 13/02/2018				18/12/2018
	Natural Gas burning (FIQ91485B) (Back up flow meter) Serial Number: 80124613 installed on 22/03/2018	Turbine flow meter	+/- 0.3%	Annually	Last Calibration 09/03/2018 Valid Until 08/03/2019
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily.				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	PROJECT EMISSION				
Additional Comment:	/				

Data / Parameter:	$w_{C,NG,y}$				**(19)**
Unit:	tC/Nm^3				
Description:	Weighted average mass fraction of carbon in fuel type i in year y				
Measured /Calculated /Default:	Measured				
Source of data:	Data provided by natural gas supplier (KYUNG DONG City Gas Ltd.)				
Value (s) of monitored parameter:	Monthly values:	01/09/2017	01/10/2017	01/11/2017	2017-12-01
		30/09/2017	31/10/2017	30/11/2017	2017-12-31
	CH4 (Methane)	93.45%	93.45%	93.45%	93.45%
	C2H6 (Ethane)	4.28%	4.28%	4.28%	4.28%
	C3H8 (Propane)	1.34%	1.34%	1.34%	1.34%
	I-C4H10 (I-Butane)	0.31%	0.31%	0.31%	0.31%
	N-C4H10 (N-Butane)	0.35%	0.35%	0.35%	0.35%
	I-C5H12 (I-Pentane)	0.02%	0.02%	0.02%	0.02%
	N-C5H12 (N-Pentane)	0.00%	0.00%	0.00%	0.00%
	N2 (Nitrogen)	0.25%	0.25%	0.25%	0.25%
	CO2 (Carbon dioxide)	0.00%	0.00%	0.00%	0.00%
	Total	100.00%	100.00%	100.00%	100.00%
	$COEF_{NG,y}$ (tCO_2/Nm^3)	**0.00214**	**0.00214**	**0.00214**	**0.00213**
	Monthly values:	01/01/2018	01/02/2018	01/03/2018	2018-04-01
		31/01/2018	28/02/2018	31/03/2018	2018-04-30
	CH4 (Methane)	93.45%	93.45%	93.45%	93.45%
	C2H6 (Ethane)	4.28%	4.28%	4.28%	4.28%
	C3H8 (Propane)	1.34%	1.34%	1.34%	1.34%
	I-C4H10 (I-Butane)	0.31%	0.31%	0.31%	0.31%
	N-C4H10 (N-Butane)	0.35%	0.35%	0.35%	0.35%
	I-C5H12 (I-Pentane)	0.02%	0.02%	0.02%	0.02%
	N-C5H12 (N-Pentane)	0.00%	0.00%	0.00%	0.00%
	N2 (Nitrogen)	0.25%	0.25%	0.25%	0.25%

	CO2 (Carbon dioxide)	0.00%	0.00%	0.00%	0.00%
	Total	100.00%	100.00%	100.00%	100.00%
	$COEF_{NG,y}$ (tCO_2/Nm^3)	**0.00214**	**0.00216**	**0.00215**	**0.00213**
	Monthly values:	01/05/2018	01/06/2018	01/07/2018	2018-08-01
		31/05/2018	30/06/2018	31/07/2018	2018-08-31
	CH4 (Methane)	93.45%	93.45%	93.45%	93.45%
	C2H6 (Ethane)	4.28%	4.28%	4.28%	4.28%
	C3H8 (Propane)	1.34%	1.34%	1.34%	1.34%
	I-C4H10 (I-Butane)	0.31%	0.31%	0.31%	0.31%
	N-C4H10 (N-Butane)	0.35%	0.35%	0.35%	0.35%
	I-C5H12 (I-Pentane)	0.02%	0.02%	0.02%	0.02%
	N-C5H12 (N-Pentane)	0.00%	0.00%	0.00%	0.00%
	N2 (Nitrogen)	0.25%	0.25%	0.25%	0.25%
	CO2 (Carbon dioxide)	0.00%	0.00%	0.00%	0.00%
	Total	100.00%	100.00%	100.00%	100.00%
	$COEF_{NG,y}$ (tCO_2/Nm^3)	**0.00213**	**0.00214**	**0.00214**	**0.00213**

Monitoring Equipment	$w_{C,NG,y}$ is used to calculate the $COEF_{NG,y}$ monthly value. The average number of C in a mole of NG is calculated from the composition = S (number of C in each mole) x (volume ratio). The CO_2 specific gravity in standard state is 1.965.
Measuring/ Reading/ Recording frequency:	Provided by supplier and recorded monthly
Calculation method (if applicable):	$COEF_{NG,y}$ (tCO_2/Nm^3) = 1.965 x (average number of C) 1.965 is the specific gravity of CO_2 in standard conditions in kg/Nm^3
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30
Purpose of data/parameter	PROJECT EMISSION
Additional Comment:	/

Data / Parameter:	**$T_{Open,y}$**		**(20)**
Unit:	%		
Description:	% of time the valve on the line feeding the decomposition facility is open in year y		
Measured /Calculated /Default:	Measured		
Source of data:	Data are automatically acquired continuously by the DCS and stored in the PIMS data base.		
Value (s) of monitored parameter:	Period Value:	From	To	$T_{Open,y}$
		01/09/2017	31/08/2018	0.00%
	Monthly values:	01/09/2017	30/09/2017	0.00%
		01/10/2017	31/10/2017	0.00%
		01/11/2017	30/11/2017	0.00%
		01/12/2017	31/12/2017	0.00%
		01/01/2018	31/01/2018	0.00%
		01/02/2018	28/02/2018	0.00%
		01/03/2018	31/03/2018	0.00%
		01/04/2018	30/04/2018	0.00%
		01/05/2018	31/05/2018	0.00%

		01/06/2018	30/06/2018		0.00%
		01/07/2018	31/07/2018		0.00%
		01/08/2018	31/08/2018		0.00%
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	By-pass valves position detectors (HV57001) Serial Numbers: 302100164 until 30/10/2017	Butterfly type On-off valve	below 1% relative accuracy	Annually	Last Calibration 03/05/2017 Valid Until 02/05/2018
	By-pass valves position detectors (HV57001) Serial Numbers: 368503001/15 from 01/11/2017	Butterfly type On-off valve	below 1% relative accuracy	Annually	Last Calibration 16/10/2017 Valid Until 15/10/2018
	By-pass valves position detectors (HV57003) Serial Numbers: 302100163 until 30/10/2017	Butterfly type On-off valve	below 1% relative accuracy	Annually	Last Calibration 03/05/2017 Valid Until 02/05/2018
	By-pass valves position detectors (HV57003) Serial Numbers: 222038415002 from 01/11/2017	Butterfly type On-off valve	below 1% relative accuracy	Annually	Last Calibration 16/10/2017 Valid Until 15/10/2018
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily and monthly				
Calculation method (if applicable):	$Q_{N2O,bypass,y}$ is monitored via the time of opening the bypass line to enable gas venting into the atmosphere. This parameter is used when $Q_{N2O,bypass,y}$ is not directly monitored. The % of the time the position switches are in the right position will be calculated automatically by the Data Control System.				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	PROJECT EMISSION				
Additional Comment:	/				

Data / Parameter:	**$EC_{PJ,EL,y}$** **(21)**
Unit:	kWh
Description:	Quantity of electricity consumed by the project electricity consumption source j in year y (decomposition)
Measured /Calculated	Measured

/Default:					
Source of data:	Data are automatically acquired continuously by the DCS and stored in the PIMS data base.				
Value (s) of monitored parameter:	Period Value:	From	To	$EC_{PJ,EL,y}$	
		01/09/2017	31/08/2018	1,087,644.3	
	Monthly values:	01/09/2017	30/09/2017	91,718.6	
		01/10/2017	31/10/2017	101,591.8	
		01/11/2017	30/11/2017	73,241.7	
		01/12/2017	31/12/2017	113,544.2	
		01/01/2018	31/01/2018	77,375.0	
		01/02/2018	28/02/2018	95,350.9	
		01/03/2018	31/03/2018	89,495.5	
		01/04/2018	30/04/2018	83,023.8	
		01/05/2018	31/05/2018	78,574.3	
		01/06/2018	30/06/2018	92,550.8	
		01/07/2018	31/07/2018	84,865.4	
		01/08/2018	31/08/2018	106,312.2	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Electricity meter (LV22WH) Serial Number: 0780501 until 09/11/2017	Incremental Electricity meter	+/- 15 kWh	3 years	Last Calibration 18/11/2014 Valid Until 17/11/2017
	Electricity meter (LV22WH) Serial Number: 0940048 from 10/11/2017	Incremental Electricity meter	+/- 15 kWh	3 years	Last Calibration 14/11/2017 Valid Until 13/11/2020
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily.				
Calculation method (if applicable):	The daily amounts are automatically calculated online on the DCS.				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	PROJECT EMISSION				
Additional Comment:	/				

Data / Parameter:	**$Q_{St,c,y}$**			**(22)**
Unit:	Tonne			
Description:	Steam consumption by the decomposition process			
Measured /Calculated /Default:	Measured			
Source of data:	Data are automatically acquired continuously by the DCS and stored in the PIMS data base.			
Value (s) of monitored	Period Value:	From	To	$Q_{St,c,y}$
		01/09/2017	31/08/2018	1,026.4

parameter:	Monthly values:	01/09/2017	30/09/2017	84.5	
		01/10/2017	31/10/2017	84.7	
		01/11/2017	30/11/2017	79.3	
		01/12/2017	31/12/2017	90.6	
		01/01/2018	31/01/2018	89.8	
		01/02/2018	28/02/2018	79.4	
		01/03/2018	31/03/2018	87.7	
		01/04/2018	30/04/2018	84.7	
		01/05/2018	31/05/2018	87.4	
		01/06/2018	30/06/2018	84.4	
		01/07/2018	31/07/2018	87.0	
		01/08/2018	31/08/2018	86.8	
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Steam import to N_2O system (FIQ58082) Serial Number: S5F206714 609	Vortex flow meter	+/- 1.0%	Annually	Last Calibration 30/10/2017 Valid Until 29/10/2018
Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily and monthly.				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				
Purpose of data/parameter	LEAKAGE EMISSION				
Additional Comment:	/				

Data / Parameter:	**$EF_{St,c,y}$** **(23)**
Unit:	tCO_2/tonne steam
Description:	CO2 intensity for steam (consumed)
Measured /Calculated /Default:	Calculated
Source of data:	Internal or external suplier data (Excel Worbook on natural gas and steam data or KZC external supplier data)
Value (s) of monitored parameter:	0.326
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Calculated and recorded monthly

Calculation method (if applicable):	The steam consumed in the facility can be supplied either from internal supplier (on-site supplier) or external supplier. a) an external supplier KZC which produced steam from coal b) existing boilers on site which produced steam from natural gas As a conservative approach, if external supplier has been used over the period, we use the highest of the 2 emission coefficients. For the external supplier, the annual report gives the CO2 emission factor for steam from KZC annual report in t CO2 / GJ, Efh. EFSt,c,y_KZC = Efh x 4.1868 Gcal/GJ x 822 Mcal/t of steam / 1000 For the Onsan plant , steam production and natural gas consumption are continuously monitored. From the monthly natural gas consumption and the monthly value of E_NG, monthly emissions of CO2 for steam production are calculated and cumulated over the year. Q_NG_tsteam in Nm3/t of steam is obtained from the ratio of annual natural gas consumption over the annual steam production. EFSt,c,y_ONSAN = E_NGy x Q_NG_tsteam EFSt,c,y = MAX (EFSt,c,y_ONSAN, EFSt,c,y_KZC)

Year ending	$EF_{St,c,y}$ ONSAN	EFSt,c,y_KZC
	kg CO2 / kg of steam	t CO2 / t of steam
01/09/2017	0.297	0.326

QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30
Purpose of data/parameter	LEAKAGE EMISSION
Additional Comment:	

Data / Parameter:	**NO_X**				**(24)**
Unit:	vppm				
Description:	Compliance with local regulation on NO_X ($NO + NO_2$ concentration in stack gas)				
Measured /Calculated /Default:	Measured				
Source of data:	On-line analyser				
Value (s) of monitored parameter:	Parameter	Unit	Limit	Average value in Period	
	NO_X	vppm	200 max at least 95% of time	91.1	Average is less than 200 for 100% of time
Monitoring equipment	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Stack NO_X analyzer (AT58401) Serial Number: 3.377667.6	NDIR (Non Dispersive Infrared)	+/- 1.0%	Weekly	Last Calibration 31/08/2018 Valid Until Following week

Measuring/ Reading/ Recording frequency:	Measured continuously, read every second and recorded daily and monthly. According to local government environmental law, NO_X value is transmitted to local government agency as a part of the TeleMonitoring System (TMS) from 01/07/2007.
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	To make sure of the on-line analysis value, KumHo Environmental Co, Ltd had carried out the analysis of the gas discharged from the N_2O stack during this monitoring period. The analysis values were under the control specification limit of the Korea environmental regulation (KumHo Company has an analysis license for air emission which is permitted by the Korean environmental government) Data Handling Protocol - RP-Q1-706-30
Purpose of data/parameter	Compliance with local regulation on NO_X
Additional Comment:	/

Calibrations during current Monitoring Period

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
(1) NCG_h	NVR1 N2O analyzer (in-situ, laser diode)	AI55012	2 / year	Section 5.3 of the LaserGas II SP Monitor, User's reference v.1.2 from vender (page : 45)	Third party	28/07/2017 27/09/2017 27/11/2017 26/01/2018 26/03/2018 25/05/2018	24/07/2018
	NVR2 N2O analyzer (in-situ, laser diode)	AI56012	2 / year	Section 5.3 of the LaserGas II SP Monitor, User's reference v.1.2 from vender (page : 45)	Third party	28/07/2017 27/09/2017 27/11/2017 26/01/2018 26/03/2018 25/05/2018	24/07/2018
	Entrance N2O analyzer (in-situ, laser diode)	AI57017	2 / year	Section 5.3 of the LaserGas II SP Monitor, User's reference v.1.2 from vender (page : 45)	Third party	31/07/2017 26/09/2017 23/11/2017 23/01/2018 23/03/2018 23/05/2018	23/07/2018
(2) VSG_h	LNOX D51500 TO E55030	FQ-51525	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292)	Solvay	25/11/2016	24/11/2017

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
	LNOX D52400 TO E56030	FQ-52428	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292)	Solvay	25/11/2016	24/11/2017
	Entrance gas flow	FT57015	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295)	Third party	10/11/2016	07/11/2017
(3) hy	KAOP TO OXIDATION	FT-12701	Annually	Standard rule of calibration& maintenance guide book from Korea association of standards& testing organization (Page:295)	Third party	21/12/2016	05/12/2017
(4) $P_{AdOH,pr,y}$	SILO R42500	W-42505	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287)	Solvay	02/02/2017 26/10/2017	01/02/2018
	Small bags and bags Balance	W42811	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287)	Solvay	09/03/2017	06/03/2018

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
	Bigbags and bags Balance	W43741	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287)	Solvay	09/03/2017	06/03/2018
	Bigbags and bags Balance	W43742	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287)	Solvay	09/03/2017	06/03/2018
(5) $Q_{HNO3,cons,y}$	Truck Scale	W-9000	Annually	- Article 32 of the Korean law on weighing - Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287)	Third party	18/08/2017	08/08/2018
	FRESH NIITRIC ACID HANWHA	FT6C069	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295)	Third party	01/02/2017	07/02/2018
	FRESH NIITRIC ACID HANWHA	FT760CD	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295)	Third party	29/06/2017 27/12/2017	20/06/2018

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
	FRESH NIITRIC ACID TANK R92000	LT-92005	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292)	Solvay	06/04/2017	06/04/2018
	FRESH NIITRIC ACID TANK R92010	LT-92015	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292)	Solvay	06/04/2017	06/04/2018
(6) $Q_{HNO3,ww,y}$	Waste water to R83200	FQ-83401	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295)	Third party	29/12/2016	26/12/2017
	HPCE R61380 to K83160	FQ-61782	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295)	Third party	16/12/2016	05/12/2017
	Waste water to R83200	FQ-62281	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295)	Third party	01/08/2017	25/07/2018

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
(5) $Q_{HNO3,cons,y}$ + (6) $Q_{HNO3, ww,y}$ + (7) $Q_{HNO3, by-p,y}$	Potentiometric titrator	Lab analyzer	weekly	Calibration ferquency by vendor recommendation	Solvay	28/08/2017 04/09/2017 11/09/2017 18/09/2017 25/09/2017 02/10/2017 09/10/2017 16/10/2017 23/10/2017 31/10/2017 13/11/2017 20/11/2017 27/11/2017 04/12/2017 11/12/2017 18/12/2017 25/12/2017 01/01/2018 08/01/2018 15/01/2018 22/01/2018 29/01/2018 05/02/2018 12/02/2018 19/02/2018 26/02/2018 05/03/2018 12/03/2018 19/03/2018 26/03/2018 02/04/2018 09/04/2018 16/04/2018 23/04/2018 30/04/2018 07/05/2018 14/05/2018 21/05/2018 28/05/2018 04/06/2018 11/06/2018 18/06/2018 25/06/2018 02/07/2018 09/07/2018 16/07/2018 23/07/2018 30/07/2018 06/08/2018 13/08/2018 20/08/2018	27/08/2018

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
(7) $Q_{HNO3,by-p,y}$	DBA R81100 TO K83300	FQ-82351	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295)	Third party	29/12/2016	26/12/2017
	Big bags and bags Balance	W58741	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287)	Third party	09/03/2017	06/03/2018
	Big bags and bags Balance	W58742	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287)	Third party	09/03/2017	06/03/2018
(8) $Q_{HNO3,AdOH,y}$ + (10) $R_{N2O-N2,y}$	HPLC	Lab analyzer	Daily	Calibration ferquency by vendor recommendation	Solvay	Daily	31/08/2018

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
(9) $Q_{HNO3,offgases,y}$	NOX GAS DCN INLET	AYA-51526	4 / year	Section 4.2 of the reference book of Instructions 015-556383-K from Beckman Industrial.	Solvay	24/08/2017 07/09/2017 20/09/2017 12/10/2017 09/11/2017 22/11/2017 08/12/2017 21/12/2017 04/01/2018 19/01/2018 01/02/2018 22/02/2018 08/03/2018 22/03/2018 05/04/2018 19/04/2018 03/05/2018 18/05/2018 31/05/2018 14/06/2018 28/06/2018 12/07/2018 27/07/2018 09/08/2018	23/08/2018
	LNOX E56010 TO A56020	AYA-56026	4 / year	Section 4.2 of the reference book of Instructions 015-556383-K from Beckman Industrial.	Solvay	24/08/2017 07/09/2017 20/09/2017 12/10/2017 09/11/2017 22/11/2017 08/12/2017 21/12/2017 04/01/2018 19/01/2018 01/02/2018 22/02/2018 08/03/2018 22/03/2018 05/04/2018 19/04/2018 03/05/2018 18/05/2018 31/05/2018 14/06/2018 28/06/2018 12/07/2018 27/07/2018 09/08/2018	23/08/2018
(14) $Q\_Steam_{p,y}$	Steam production by N2O system	FIQ-58213	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization	Third party	31/05/2017	19/10/2017

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
				(Page:296)			
	Boiler feed water to N2O system	FIQ58204	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295)	Third party	11/05/2017	30/10/2017
	Boiler continuous purge flow rate	FIQ58303	Annually	Standards rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292)	Third party	14/12/2016	07/12/2017
(16) Q_{GE}	Effluent Gas	FIQ-58407	Annually	National Environmental regulation	Third party	23/01/2017	03/01/2018
(17) $C_{N2O,GE,y}$	Stack N2O analyzer (in-situ, laser diode)	AIT-58408	2 / year	Section 5.3 of the LaserGas II SP Monitor, User's reference v.1.2 from vender (page : 45)	Solvay	21/07/2017 21/09/2017 21/11/2017 18/01/2018 16/03/2018 16/05/2018	13/07/2018

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
	Stack N2O analyzer (extractive infrared)	AI58418	Weekly	Section 7.2 of instruction manual (90002929, 07/2005) from vender	Solvay	26/08/2017 01/09/2017 08/09/2017 15/09/2017 22/09/2017 29/09/2017 10/10/2017 13/10/2017 20/10/2017 27/10/2017 03/11/2017 10/11/2017 17/11/2017 24/11/2017 01/12/2017 08/12/2017 15/12/2017 22/12/2017 29/12/2017 05/01/2018 12/01/2018 19/01/2018 26/01/2018 02/02/2018 09/02/2018 14/02/2018 19/02/2018 23/02/2018 02/03/2018 09/03/2018 16/03/2018 23/03/2018 30/03/2018 06/04/2018 13/04/2018 20/04/2018 27/04/2018 04/05/2018 11/05/2018 18/05/2018 25/05/2018 01/06/2018 08/06/2018 15/06/2018 22/06/2018 29/06/2018 06/07/2018 13/07/2018 20/07/2018 27/07/2018 03/08/2018 10/08/2018 17/08/2018 24/08/2018	31/08/2018

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
(18) $FC_{NG,y}$	Natural Gas burning	FIQ91485 A	Annually	Standards rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:296)	Third party	24/02/2017	14/02/2018
	Natural Gas burning (Back up flow meter)	FIQ91485 B	Annually	Standards rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:296)	Third party	15/03/2017 19/12/2017	09/03/2018
(20) $T_{Open,y}$	By-pass Valves Integrity Check	HV-57001	Annually	Section D.3 of PDD	Third party	03/05/2017	16/10/2017
	By-pass Valves Integrity Check	HV-57003	Annually	Section D.3 of PDD	Third party	03/05/2017	16/10/2017
(21) $EC_{PJ,EL,y}$	Electricity meter	LV22WH	Every 3 years	Table 13 of the Korean law on electricity measurement	Third party	18/11/2014	14/11/2017
(22) $Q_{St,c,y}$	Steam import to N2O system	FIQ-58082	Annually	Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:296)	Third party	31/05/2017	30/10/2017

Related Para-meter	Instrument Location	Tag number	Perio-dicity	Reference for calibration frequency	Done by	Previous calibration date	Last calibration date
(24) NO_X	NOx N2O unit stack	AT58401	Weekly	Section 3.6 of instruction manual (C79000-G5276-C143-07) from vender (Environment management corporation)	Solvay	25/08/2017 01/09/2017 08/09/2017 15/09/2017 22/09/2017 29/09/2017 10/10/2017 13/10/2017 20/10/2017 27/10/2017 03/11/2017 10/11/2017 17/11/2017 24/11/2017 01/12/2017 08/12/2017 15/12/2017 22/12/2017 29/12/2017 05/01/2018 12/01/2018 19/01/2018 26/01/2018 02/02/2018 09/02/2018 19/02/2018 23/02/2018 02/03/2018 09/03/2018 16/03/2018 23/03/2018 30/03/2018 06/04/2018 09/04/2018 13/04/2018 20/04/2018 27/04/2018 04/05/2018 11/05/2018 18/05/2018 25/05/2018 01/06/2018 08/06/2018 15/06/2018 22/06/2018 29/06/2018 06/07/2018 13/07/2018 20/07/2018 27/07/2018 03/08/2018 10/08/2018 17/08/2018 24/08/2018	31/08/2018

D.3. Implementation of sampling plan

Not applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

The amount of baseline emissions BE_y in the given period y and the quantity of N_2O emitted over the period y are calculated using the below formulas according to AM0021 /version 3.

- N_2O destroyed in the project activity
- Steam generated in the project activity using waste heat of N_2O destruction process

By manual calculation of BEy the result may differ slightly from the value shown due to rounding down effects applied to remain conservative.

$$BE_y = Q_{N2O,y} \times GWP_{N2O} + Q\_Steam_{p,y} \times EF_{CO2,Steam,y} \quad (1)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
BE_y	**t CO_2e**	**9,174,990.7**	**935,440.2**	**828,654.5**	**671,702.0**	**1,095,889.0**	**917,545.7**	**944,475.3**
$BE_{N2O,y}$	t CO_2e	9,153,059.3	933,499.2	826,942.0	670,242.6	1,093,734.2	915,696.3	942,574.3
$BE_{STEAM,y}$	t CO_2e	21,931.4	1,940.9	1,712.5	1,459.4	2,154.8	1,849.4	1,901.0

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
BE_y	**t CO_2e**	**9,174,990.7**	**975,358.4**	**910,789.4**	**886,605.4**	**899,478.5**	**107,183.3**	**1,868.9**
$BE_{N2O,y}$	t CO_2e	9,153,059.3	973,382.7	908,933.1	884,840.7	897,719.2	105,495.0	-
$BE_{STEAM,y}$	t CO_2e	21,931.4	1,975.7	1,856.4	1,764.6	1,759.3	1,688.4	1,868.9

<u>N_2O destroyed in the project activity</u>

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$BE_{N2O,y}$	**t CO_2e**	**9,153,059.3**	**933,499.2**	**826,942.0**	**670,242.6**	**1,093,734.2**	**915,696.3**	**942,574.3**
$Q_{N2O,y}$ = MIN option A, B	tonne	**30,715.0**	3,132.5	2,775.0	2,249.1	3,670.2	3,072.8	3,163.0
GWP_{N2O}	tCO_2e/ t N_2O	298						

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
$BE_{N2O,y}$	**t CO_2e**	**9,153,059.3**	**973,382.7**	**908,933.1**	**884,840.7**	**897,719.2**	**105,495.0**	**-**
$Q_{N2O,y}$ = MIN option A, B	tonne	**30,715.0**	3,266.4	3,050.1	2,969.3	3,012.5	354.0	-
GWP_{N2O}	tCO_2e/ t N_2O	298						

<u>Steam generated in the project activity using waste heat of N_2O destruction process</u>

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$BE_{STEAM,y}$	**t CO_2e**	**21,931.4**	**1,941**	**1,712**	**1,459**	**2,155**	**1,849**	**1,901**
$Q\_Steam_{p,y}$	tonne	181,251.3	16,040.8	14,152.7	12,061.6	17,808.5	15,284.2	15,710.9
$EF_{CO2,steam,y}$	tCO_2/ tonne steam	0.12						

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
$BE_{STEAM,y}$	**t CO_2e**	**21,931.4**	**1,976**	**1,856**	**1,765**	**1,759**	**1,688**	**1,869**
$Q\_Steam_{p,y}$	tonne	181,251.3	16,328.3	15,341.9	14,583.8	14,539.4	13,953.6	15,445.8
$EF_{CO2,steam,y}$	tCO_2/ tonne steam	0.12						

N2O destroyed in the project activity

Option A: Based on the consumption of HNO_3

$$Q_{N2O,y} = P_{AdOH,y} \times EF_{N2O,BL,y} \quad (2)$$

$$P_{AdOH,y} = \text{minimum}\{P_{AdOH,pr,y}, P_{AdOH,bl}\} \quad (3)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$Q_{N2O,y}$ (option A)	**tonne**	**31,268.7**	**3,175.3**	**2,775.0**	**2,249.1**	**3,670.2**	**3,142.2**	**3,333.7**
$P_{AdOH,y}$ (capped)	tonne	121,431.1	12,327.9	11,289.4	8,625.1	14,423.5	12,368.1	12,347.1
$P_{AdOH,pr,y}$ (real)	tonne	144,279.8	12,327.9	11,289.4	8,625.1	14,423.5	12,368.1	12,347.1

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
$Q_{N2O,y}$ (option A)	**tonne**	**31,268.7**	**3,307.6**	**3,209.0**	**3,003.9**	**3,044.7**	**357.8**	**-**
$P_{AdOH,y}$ (capped)	tonne	121,431.1	12,941.4	12,030.2	11,773.4	11,901.3	1,403.8	-
$P_{AdOH,pr,y}$ (real)	tonne	144,279.8	12,941.4	12,030.2	11,773.4	11,901.3	11,401.9	12,850.7

$$EF_{N2O,BL,y} = \frac{Q_{HNO3,cheml}}{P_{AdOH,y}} * \frac{63}{2} \times R_{N2O\text{-}N2,y} \times 44 \quad (4)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$EF_{N2O,BL,y}$ (Min)	**tonne N_2O/tonne AA**	-	**0.258**	**0.246**	**0.261**	**0.254**	**0.254**	**0.270**
$EF_{N2O,BL,y}$	tonne N_2O/tonne AA		0.270	0.270	0.270	0.270	0.270	0.270
$EF_{N2O,BL,y}$	tonne N_2O/tonne AA	-	0.258	0.246	0.261	0.254	0.254	0.271
$R_{N2O\text{-}N2,y}$	ratio	-	86.699%	86.660%	86.671%	86.653%	86.650%	91.399%

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
$EF_{N2O,BL,y}$ (Min)	**tonne N_2O/tonne AA**	-	**0.256**	**0.267**	**0.255**	**0.256**	**0.255**	**0.255**
$EF_{N2O,BL,y}$	tonne N_2O/tonne AA		0.270	0.270	0.270	0.270	0.270	0.270
$EF_{N2O,BL,y}$	tonne N_2O/tonne AA	-	0.256	0.267	0.255	0.256	0.255	0.255
$R_{N2O\text{-}N2,y}$	ratio	-	86.918%	90.172%	86.721%	86.656%	86.650%	86.650%

$$Q_{HNO3,Cheml} = Q_{HNO3,cons,y} - (Q_{HN03,ww,y} + Q_{HNO3,by-p,y} + Q_{HNO3,AdOH,y} + Q_{NOX,offgases,y}) \quad (5)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$Q_{HNO3,cheml}$	**tonne**	**121,592.1**	**10,487.8**	**9,169.7**	**7,431.2**	**12,129.1**	**10,384.5**	**10,499.7**
$Q_{HNO3,cons,y}$	tonne	123,951.0	10,713.0	9,376.0	7,582.0	12,386.0	10,600.0	10,698.0
$Q_{HNO3,AdOH,y}$	tonne	0.143	0.013	0.012	0.010	0.018	0.012	0.013
$Q_{HNO3,ww,y}$	tonne	2,034.9	180.9	169.1	121.1	210.4	180.1	174.4
$Q_{HNO3,by\text{-}p,y}$	tonne	235.3	37.3	31.2	24.7	38.9	28.8	15.7
$Q_{NOx,offgases,y}$	tonne	88.5	6.9	6.0	4.9	7.6	6.5	8.2

Parameter	Unit	Accumulated value	01/03/2018 31/03/2018	01/04/2018 30/04/2018	01/05/2018 31/05/2018	01/06/2018 30/06/2018	01/07/2018 31/07/2018	01/08/2018 31/08/2018
$Q_{HNO3,chem}$	**tonne**	**121,592.1**	**10,897.4**	**10,191.0**	**9,919.4**	**10,061.7**	**9,604.1**	**10,816.4**
$Q_{HNO3,cons,y}$	tonne	123,951.0	11,100.0	10,370.0	10,097.0	10,242.0	9,787.0	11,000.0
$Q_{HNO3,AdOH,y}$	tonne	0.143	0.013	0.011	0.010	0.010	0.010	0.012
$Q_{HNO3,ww,y}$	tonne	2,034.9	181.8	164.4	164.2	161.9	165.3	161.4
$Q_{HNO3,by-p,y}$	tonne	235.3	11.7	6.9	5.5	10.3	10.4	13.9
$Q_{NOx,offgases,y}$	tonne	88.5	9.1	7.7	7.9	8.1	7.3	8.3

N2O destroyed in the project activity
Option B: Direct measurement of N_2O entering destruction facility

$$Q_{N2O,y} = Q_{N2O,m,y} \times 0.95 \times f \quad (6)$$

$$f = \frac{P_{AdOH,y}}{P_{AdOH,Pr,y}} \quad (7)$$

Parameter	Unit	Accumulated value	01/09/2017 30/09/2017	01/10/2017 31/10/2017	01/11/2017 30/11/2017	01/12/2017 31/12/2017	01/01/2018 31/01/2018	01/02/2018 28/02/2018
$Q_{N2O,y}$ (option B)	**tonne**	**30,787.3**	**3,132.5**	**2,805.9**	**2,284.8**	**3,675.9**	**3,072.8**	**3,163.0**
$Q_{N2O,m,y}$	tonne	**38,481.3**	3,297.4	2,953.6	2,405.1	3,869.4	3,234.5	3,329.5
$Q_{N2O,m,y}$ - NVR1	tonne	**6,671.1**	467.6	416.4	256.6	224.7	527.2	411.8
$Q_{N2O,m,y}$ - NVR2	tonne	**31,810.2**	2,829.8	2,537.2	2,148.4	3,644.7	2,707.4	2,917.7
f		0.8	1.0	1.0	1.0	1.0	1.0	1.0

Parameter	Unit	Accumulated value	01/03/2018 31/03/2018	01/04/2018 30/04/2018	01/05/2018 31/05/2018	01/06/2018 30/06/2018	01/07/2018 31/07/2018	01/08/2018 31/08/2018
$Q_{N2O,y}$ (option B)	**tonne**	**30,787.3**	**3,266.4**	**3,050.1**	**2,969.3**	**3,012.5**	**354.0**	**-**
$Q_{N2O,m,y}$	tonne	**38,481.3**	3,438.3	3,210.6	3,125.5	3,171.0	3,026.6	3,419.7
$Q_{N2O,m,y}$ - NVR1	tonne	**6,671.1**	839.2	713.1	744.3	599.5	723.4	747.3
$Q_{N2O,m,y}$ - NVR2	tonne	**31,810.2**	2,599.1	2,497.5	2,381.2	2,571.6	2,303.1	2,672.4
f		0.8	1.0	1.0	1.0	1.0	0.1	-

$$Q_{N2O,m,y} = \sum_h NCG_h \times VSG_h \times h_y \quad (8)$$

Parameter	Unit	Accumulated value	01/09/2017 30/09/2017	01/10/2017 31/10/2017	01/11/2017 30/11/2017	01/12/2017 31/12/2017	01/01/2018 31/01/2018	01/02/2018 28/02/2018
NCG_h - NVR1	tonne N_2O/Nm^3	-	0.0004519	0.0004941	0.0005071	0.0004201	0.0005165	0.0004719
NCG_h - NVR2	tonne N_2O/Nm^3	-	0.0007827	0.0007983	0.0007556	0.0007538	0.0007626	0.0008555
VSG_h - NVR1	Nm^3/h	-	1,444.0	1,462.9	1,021.8	718.9	1,386.8	1,298.5
VSG_h - NVR2	Nm^3/h	-	5,044.7	5,516.5	5,740.5	6,498.4	4,824.7	5,075.3
h_y AA plant	hours	8,346.0	716.6	576.1	495.3	744.0	735.9	672.0

Parameter	Unit	Accumulated value	01/03/2018 31/03/2018	01/04/2018 30/04/2018	01/05/2018 31/05/2018	01/06/2018 30/06/2018	01/07/2018 31/07/2018	01/08/2018 31/08/2018
NCG_h - NVR1	tonne N_2O/Nm^3	-	0.0005502	0.0005140	0.0004966	0.0004895	0.0005097	0.0005124
NCG_h - NVR2	tonne N_2O/Nm^3	-	0.0008214	0.0008429	0.0007888	0.0007820	0.0007713	0.0007922
VSG_h - NVR1	Nm^3/h	-	2,050.3	1,926.9	2,040.7	1,700.8	1,908.9	1,960.2
VSG_h - NVR2	Nm^3/h	-	4,253.2	4,115.5	4,110.3	4,567.1	4,015.7	4,534.4
h_y AA plant	hours	8,346.0	744.0	720.0	734.5	720.0	743.6	744.0

Procedure for adjusting baseline N_2O emissions for regulations

It has been checked that there are no South Korean regulation in place that would limit the quantity of N_2O emitted that can be taken into account for the calculation of the baseline emissions.

$$Q_{N2O,y} = \text{minimum of } \{Q_{N2O,y}, Q_{N2Oreg}\} \quad (9)$$

$$Q_{N2O,y} = \text{minimum } \{Q_{N2O,y}, P_{AdOH,y} x EF_{N2O,reg}\} \quad (10)$$

$$Q_{N2O,y} = Q_{N2O,y}(1 - r_y) \quad (11)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$Q_{N2O\ reg}$	tonne	-	-	-	-	-	-	-
$EF_{N2O,reg}$	tonne N_2O/tonne AA		-	-	-	-	-	-
r_y	%	0%	0%	0%	0%	0%	0%	0%

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
$Q_{N2O\ reg}$	tonne	-	-	-	-	-	-	-
$EF_{N2O,reg}$	tonne N_2O/tonne AA		-	-	-	-	-	-
r_y	%	0%	0%	0%	0%	0%	0%	0%

E.2. Calculation of project emissions or actual net removals

The amount of project emissions PE_y in the given period y is calculated using the following formulas according to AM0021/version 3.

- Emissions due to N_2O not sent to decomposition process (N_2O,by-pass) and due to N_2O not destroyed by the decomposition process (ND_N_2O)
- Emissions due to the use of natural gas
- Emissions due to the use of electricity

By manual calculation of PE_y the result may differ slightly from the more accurate value of the workbook due to rounding up effects to remain conservative.

$$PE_y = PE_{N2O,y} + PE_{FC,j,y} + PE_{EC,y} + PE_{NH3,y} + PE_{HCE,y} \quad (12)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
PE_y	**t CO_2e**	**29,126.0**	**2,263.7**	**2,026.1**	**2,239.1**	**3,767.8**	**2,229.5**	**3,067.1**
$PE_{N2O,y}$	t CO_2e	1,208.4	91.8	101.7	67.3	136.5	114.7	95.2
$PE_{FC,NG,y}$	t CO_2e	26,220.8	2,028.8	1,765.9	2,057.6	3,454.1	1,994.1	2,823.1
$PE_{EC,y}$	t CO_2e	1,696.7	143.1	158.5	114.3	177.1	120.7	148.7

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
PE_y	**t CO_2e**	**29,126.0**	**2,468.0**	**2,215.6**	**2,180.4**	**2,194.9**	**2,124.7**	**2,349.0**
$PE_{N2O,y}$	t CO_2e	1,208.4	98.4	100.1	99.0	99.6	95.9	108.1
$PE_{FC,NG,y}$	t CO_2e	26,220.8	2,230.0	1,986.0	1,958.9	1,950.9	1,896.4	2,075.1
$PE_{EC,y}$	t CO_2e	1,696.7	139.6	129.5	122.6	144.4	132.4	165.8

Emissions due to N_2O not sent to decomposition process (N_2O,by-pass) and N_2O not destroyed by the decomposition process (ND_N_2O)

$$PE_{N2O,y} = (Q_{N2O,by\text{-}pass,y} + Q_{ND\_N2O,y}) \times GWP_{N2O} \quad (13)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$PE_{N2O,y}$	**t CO_2e**	**1,208.4**	**91.8**	**101.7**	**67.3**	**136.5**	**114.7**	**95.2**
$Q_{N2O,\ by\text{-}pass,y}$	tonne	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$Q_{ND\_N2O\ ,y}$	tonne	4.06	0.31	0.34	0.23	0.46	0.39	0.32
GWP_{N2O}	tCO_2e/ t N_2O	298						

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
$PE_{N2O,y}$	**t CO_2e**	**1,208.4**	**98.4**	**100.1**	**99.0**	**99.6**	**95.9**	**108.1**
$Q_{N2O,\ by\text{-}pass,y}$	tonne	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$Q_{ND\_N2O\ ,y}$	tonne	4.06	0.33	0.34	0.33	0.33	0.32	0.36
GWP_{N2O}	tCO_2e/ t N_2O	298						

$$Q_{ND\_N2O,y} = Q_{GE,y} \times C_{N2O\_GE,y} \quad (14)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$Q_{ND\_N2O,y}$	**tonne**	**4.06**	**0.31**	**0.34**	**0.23**	**0.46**	**0.39**	**0.32**
$Q_{GE,y}$	tonne/h		21.9	23.4	21.4	23.3	21.5	22.1
$Q_{GE,y}$	Nm3/h	-	17,736.9	18,936.8	17,340.4	18,835.9	17,422.4	17,880.8
$C_{N2O\_GE,y}$	tonne N_2O/Nm^3	-	0.0000000242	0.0000000296	0.0000000279	0.0000000327	0.0000000299	0.0000000266
hours N2O destruction unit	hours	8,357	718	609	466	744	738	672

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
$Q_{ND\_N2O,y}$	**tonne**	**4.06**	**0.33**	**0.34**	**0.33**	**0.33**	**0.32**	**0.36**
$Q_{GE,y}$	tonne/h		21.3	21.1	20.6	21.2	20.0	22.0
$Q_{GE,y}$	Nm3/h	-	17,247.6	17,058.4	16,690.2	17,173.2	16,201.6	17,807.0
$C_{N2O\_GE,y}$	tonne N_2O/Nm^3	-	0.0000000257	0.0000000274	0.0000000270	0.0000000270	0.0000000267	0.0000000274
hours N2O destruction unit	hours	8,357	744	720	738	720	744	744

Min	Average	Max	Mol mass
9.0%	9.7%	10.3%	44
17.7%	18.8%	19.8%	18
68.7%	70.3%	71.8%	28
1.2%	1.3%	1.3%	32
1.2		**kg/Nm^3**	

$$Q_{N2O,by\text{-}pass,y} = Q_{N2O,m,y} \times T_{open,y} \quad (15)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
$Q_{N2O,\ by\text{-}pass,y}$	**tonne**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
$Q_{N2O,m,y}$	tonne	38,481.3	3,297.4	2,953.6	2,405.1	3,869.4	3,234.5	3,329.5
$T_{open,y}$	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
$Q_{N2O,\ by\text{-}pass,y}$	**tonne**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
$Q_{N2O,m,y}$	tonne	38,481.3	3,438.3	3,210.6	3,125.5	3,171.0	3,026.6	3,419.7
$T_{open,y}$	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Emissions due to the use of natural gas

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Parameter	Unit	Accumulated value	01/09/2017 30/09/2017	01/10/2017 31/10/2017	01/11/2017 30/11/2017	01/12/2017 31/12/2017	01/01/2018 31/01/2018	01/02/2018 28/02/2018
$PE_{FC,NG,y}$	**t CO_2e**	**26,220.8**	**2,028.8**	**1,765.9**	**2,057.6**	**3,454.1**	**1,994.1**	**2,823.1**
$FC_{NG,y}$	Nm^3	12,259,080.5	949,359.2	827,133.2	961,509.2	1,618,619.9	930,072.4	1,306,382.6
$COEF_{NG,y}$	tCO_2/Nm^3	-	0.00214	0.00214	0.00214	0.00213	0.00214	0.00216

Parameter	Unit	Accumulated value	01/03/2018 31/03/2018	01/04/2018 30/04/2018	01/05/2018 31/05/2018	01/06/2018 30/06/2018	01/07/2018 31/07/2018	01/08/2018 31/08/2018
$PE_{FC,NG,y}$	**t CO_2e**	**26,220.8**	**2,230.0**	**1,986.0**	**1,958.9**	**1,950.9**	**1,896.4**	**2,075.1**
$FC_{NG,y}$	Nm^3	12,259,080.5	1,038,666.7	934,125.6	920,955.6	911,628.4	888,233.4	972,394.3
$COEF_{NG,y}$	tCO_2/Nm^3	-	0.00215	0.00213	0.00213	0.00214	0.00214	0.00213

Emissions due to the use of electricity

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

Parameter	Unit	Accumulated value	01/09/2017 30/09/2017	01/10/2017 31/10/2017	01/11/2017 30/11/2017	01/12/2017 31/12/2017	01/01/2018 31/01/2018	01/02/2018 28/02/2018
$PE_{EC,y}$	**t CO_2e**	**1,696.7**	**143.1**	**158.5**	**114.3**	**177.1**	**120.7**	**148.7**
$EC_{PJ,EL,y}$	kWh	1,087,644.3	91,718.6	101,591.8	73,241.7	113,544.2	77,375.0	95,350.9
EFEL,j/k/l,y = EFgrid,CM,y	tCO_2/MWh	1.3						
$TDL_{j,y}$	%	20%						

Parameter	Unit	Accumulated value	01/03/2018 31/03/2018	01/04/2018 30/04/2018	01/05/2018 31/05/2018	01/06/2018 30/06/2018	01/07/2018 31/07/2018	01/08/2018 31/08/2018
$PE_{EC,y}$	**t CO_2e**	**1,696.7**	**139.6**	**129.5**	**122.6**	**144.4**	**132.4**	**165.8**
$EC_{PJ,EL,y}$	kWh	1,087,644.3	89,495.5	83,023.8	78,574.3	92,550.8	84,865.4	106,312.2
EFEL,j/k/l,y = EFgrid,CM,y	tCO_2/MWh	1.3						
$TDL_{j,y}$	%	20%						

E.3. Calculation of leakage emissions

The amount of leakage emissions L_y in the given period y is calculated using the following formula according to AM0021/version 3.

- Emissions associated with the energy sources used to generate any steam used by the decomposition plant

By manual calculation of L_y the result may differ slightly from the more accurate value of the workbook shown due to rounding up effects to remain conservative.

$$L_y = Q_{St,c,y} \times EF_{St,c,y} \quad (17)$$

Parameter	Unit	Accumulated value	01/09/2017	01/10/2017	01/11/2017	01/12/2017	01/01/2018	01/02/2018
			30/09/2017	31/10/2017	30/11/2017	31/12/2017	31/01/2018	28/02/2018
L_y	t CO_2e	334.6	27.5	27.6	25.8	29.5	29.3	25.9
$Q_{St,c,y}$	tonne	1,026.4	84.5	84.7	79.3	90.6	89.8	79.4
$EF_{St,c,y}$	tCO_2/ tonne steam	0.33						

Parameter	Unit	Accumulated value	01/03/2018	01/04/2018	01/05/2018	01/06/2018	01/07/2018	01/08/2018
			31/03/2018	30/04/2018	31/05/2018	30/06/2018	31/07/2018	31/08/2018
L_y	t CO_2e	334.6	28.6	27.6	28.5	27.5	28.4	28.3
$Q_{St,c,y}$	tonne	1,026.4	87.7	84.7	87.4	84.4	87.0	86.8
$EF_{St,c,y}$	tCO_2/ tonne steam	0.33						

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	**9,174,979.0**	**29,144.0**	**340.0**	**0**	**9,145,495.0**	**9,145,495.0**

By manual calculation the results may differ slightly due to rounding effects to remain conservative.

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
9,145,495.0	**9,738,994.0**

E.6. Remarks on increase in achieved emission reductions

The actual emission reductions achieved during this monitoring period are lower compared to the estimated value stated in the registered PDD. Further explanation is provided in the table below:

BE:	
PDD value (tCO2e): 9,795,564	**Period (tCO2e): 9,174,979**
Variance	Explanation
-617,283	Cap value PAdOH,BL,y was achieved before end of monitoring period.
-3,291	Slight impact of the steam production
-620,574	**Total BE variance**

PE:	
PDD value (tCO2e): 56,157	**Period (tCO2e): 29,144**
Variance	Explanation
-25,884	No by-pass hours occured during the period.
-820	Difference in natural gas consumption estimate and actual period
-326	Difference in electricity consumption estimate and actual period
-27,031	**Total PE variance**

L:	
PDD value (tCO2e): 413	**Period (tCO2e): 340**
Variance	Explanation
-78	Difference mainly due to the quantity of steam consumed
-78	**Total L variance**

- - - - -

Document information

Version	*Date*	*Description*
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
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 GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, 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).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: monitoring report