**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

# MONITORING REPORT

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| **Title of the project activity** | "N2O Emission Reduction in ONSAN, REPUBLIC OF KOREA" |
| **Reference number of the project activity** | UNFCCC 0099 |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 27/11/2012 |
| **Registration date of the project activity** | 27/11/2005 |
| **Monitoring period number and duration of this monitoring period** | Monitoring period #66:<br>01/11/2012 to 23/11/2012 (23 days) |
| **Project participant(s)** | KEMCO (Korea Energy Management Corporation)<br>Rhodia Energy Korea Co, Ltd,<br>Solvay Energy Services SAS<br>Rhodia Energy GHG SAS<br>Rhodia Japan Ltd,<br>ORBEO<br>NATIXIS, Natixis Environnment and Infrastructures,<br>Noble Carbon Credits |
| **Host Party(ies)** | The Republic of Korea |
| **Sectoral scope(s) and applied methodology(ies)** | Scope 5<br>Methodology AM0021, Version 1 |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 576,405 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 853,222 $tCO_2e$ |

## SECTION A. Description of project activity

### A.1. Purpose and 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 GWP is large (GWP=310 in the IPCC 2nd Assessment Report). 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, a thermal decomposition process equipment has been added to the adipic acid manufacturing plant. This installation reduces the GHG emissions, which would otherwise be released to the atmosphere if the project was not implemented.

The thermal decomposition facility was installed and commissioned in the manufacturing site of Onsan Rhodia Poliamide Co. Ltd. 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.

In this monitoring period #66 the destruction unit has been operated continuously. No disconnection of the N2O effluent gas and by-pass of the destruction unit occurred . Other events have no impact on destruction unit.
The emission reductions achieved in this period are: 853,222 $tCO_2e$

### 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 participant(s)

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as Project participant |
|---|---|---|
| Republic of Korea (host) | Public entity : KEMCO (Korea Energy Management Corporation)<br>Private entity : Rhodia Energy Korea Co, Ltd | No |
| France | Private entity: Solvay Energy Services SAS<br>Private entity: Rhodia Energy GHG SAS<br>Private entity:ORBEO<br>Private entity: NATIXIS | No |
| Japan | Private entity: Rhodia Japan Ltd | No |

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|---|---|---|
| United Kingdom of Great Britain and Northern Ireland | Private entity:NATIXIS Environnement & Infrastructures,<br>Private entity: NATIXIS,<br>Private entity: ORBEO,<br>Private entity: Noble Carbon Credits Limited | No |
| Netherlands | Private entity: ORBEO | No |
| Switzerland | Private entity: ORBEO;<br>Private entity: Rhodia Energy GHG SAS,<br>Private entity: Rhodia Japan Ltd. | No |

### A.4. Reference of applied methodology

AM0021/version 1 – "Baseline Methodology for decomposition of N2O from existing adipic acid production plants"

"Tool for the demonstration and assessment of additionality" agreed by the Executive Board (Annex 1, EB16),

### A.5. Crediting period of project activity

The first crediting period (on-going) is from 01/09/2006 to 31/08/2013 (renewable).

## SECTION B. Implementation of project activity

### B.1. Description of implemented registered 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 N2O at the Rhodia Onsan site.

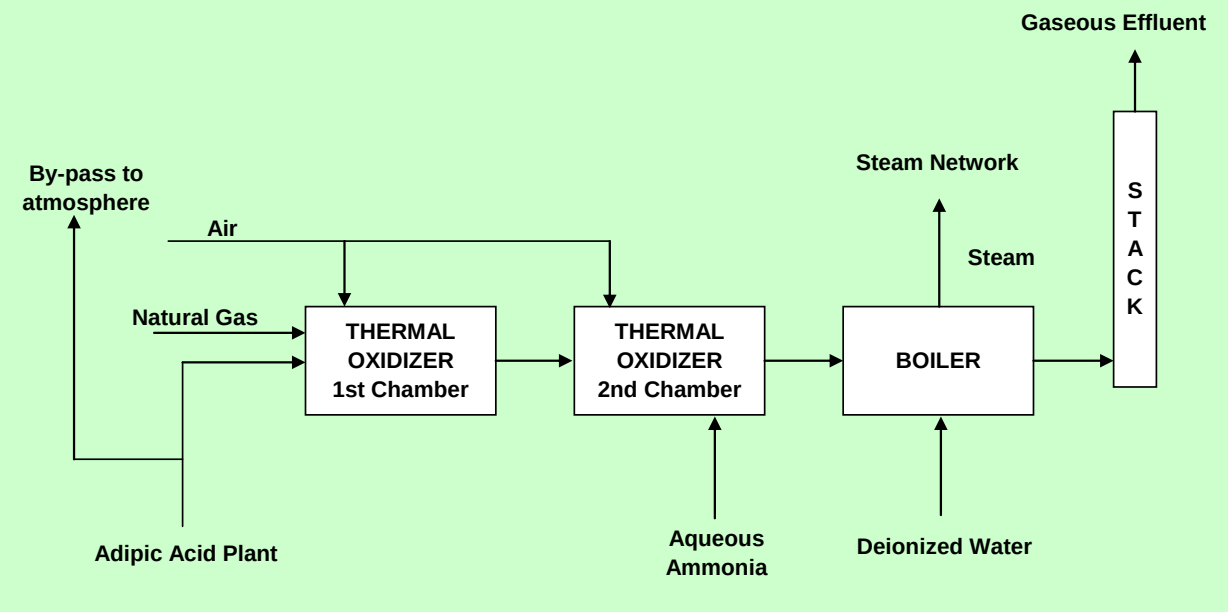
Natural gas is fed with the off gas from the adipic acid production containing N2O and a controlled amount of air in a reduction chamber, where it burns (oxidizes) to carbon dioxide ($CO_2$) and water vapour. N2O is used as an oxidizer. Being oxygen deficient, the oxidation is not complete and carbon 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 1300°C and under fuel rich conditions, so as to promote the complete decomposition of N2O while minimizing the formation of unwanted combustion by-products such as NO and NO2.

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 NO2.

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.




During this monitoring period #66 no particular event occurred that could impact the applicability of the methodology.
In this period the N2O destruction unit has been fully operational.

## B.2. Post registration changes

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

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. Permanent changes from registered monitoring plan or applied methodology

A permanent change from registered monitoring plan was approved prior to the upload of this monitoring report for global stakeholder comments (02/09/2012 reference PRC-0099-001).

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

A permanent change to project design of registered project activity was approved prior to the upload of this monitoring report for global stakeholder comments (02/09/2012 reference PRC-0099-001).

### B.2.5. Changes to start date of crediting period

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

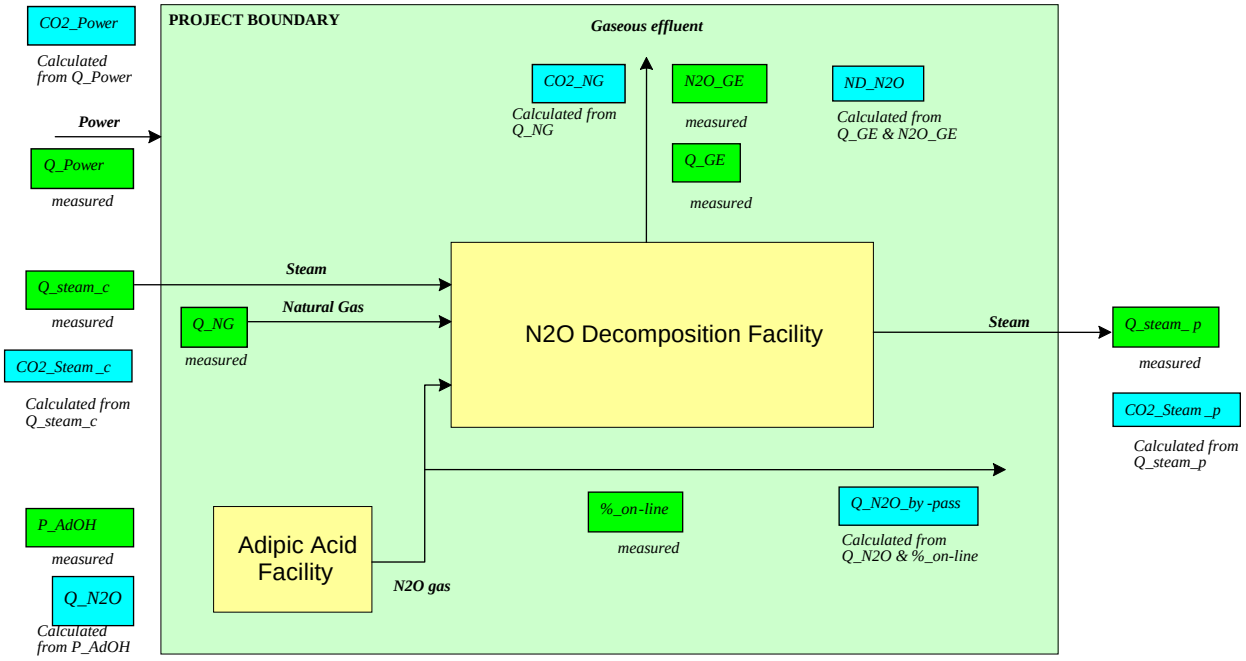
### B.2.6. Types of changes specific to afforestation or reforestation project activity

Not applicable

## SECTION C. Description of monitoring system

The project boundary related to the baseline methodology is shown below with the measured parameters in green color.

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 Rhodia Quality System. Rhodia 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 Rhodia Energy GHG 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.

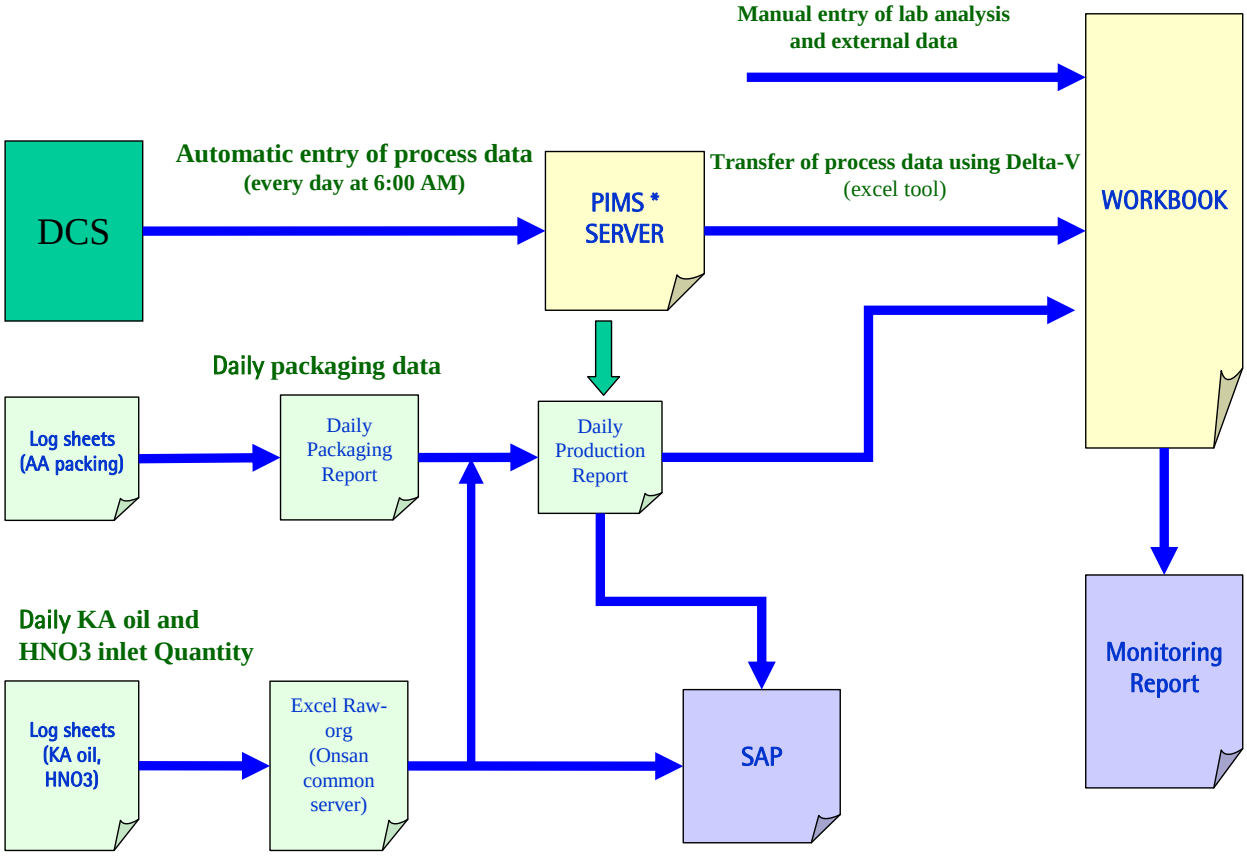
The calculation of the daily production of adipic acid is carried out using the data stored in PIMS and daily packing report, and the daily nitric acid consumption quantity is calculated by using the data stored in PIMS and raw data stored in an excel sheet called Raw-org.The results obtained are collected 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 Rhodia 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:




* PIMS = Plant Information Management System (Supplier: OSI)

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

| | |
|---|---|
| **Data / Parameter :** | **GWP_N2O** |
| **Unit :** | $tCO_2e$ per $tN_2O$ |
| **Description :** | Global Warming Potential of N2O |
| **Source of data :** | Kyoto Protocol (Decision 2/CP.3) and IPCC |
| **Value(s) applied :** | 310 |
| **Purpose of data :** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks;<br>(b)Calculation of project emissions or actual net GHG removals by sinks; |
| **Additional Comment :** | |

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|---|---|
| **Data / Parameter :** | **KE_N2O** |
| **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 |
| **Purpose of data :** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; |
| **Additional Comment :** | Cap value for N2O_/AdOH emission factor for baseline emissions |

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|---|---|
| **Data / Parameter :** | **ΔH** |
| **Unit :** | kcal/t of steam |
| **Description :** | Enthalpy of vaporization of water |
| **Source of data :** | Steam table for boiler feed water temperature 100°C and 6 $kg/cm^2$ steam production |
| **Value(s) applied :** | 557,960 |
| **Purpose of data :** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; |
| **Additional Comment :** | Use to calculate E_Steam |

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|---|---|
| **Data / Parameter :** | η |
| **Unit :** | % |
| **Description :** | Operational efficiency of the boiler for steam production |
| **Source of data :** | Monitoring Plan Section 6.3 |
| **Value(s) applied :** | 97 |
| **Purpose of data :** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; |
| **Additional Comment :** | Use to calculate E_Steam |

**D.2. Data and parameters monitored**

| | | | | | |
|---|---|---|---|---|---|
| **Data / Parameter:** | **P_AdOH** | | | | |
| **Unit:** | tonnes | | | | |
| **Description:** | Amount of adipic acid production | | | | |
| **Measured /Calculated /Default:** | Measured value.<br>Several instruments are used | | | | |
| **Source of data:** | DCS data and packaging log sheets | | | | |
| **Value(s) of monitored parameter:** | | From | To | P_AdOH Produced | P_AdOH Eligible * |
| | Period Value: | 01/11/2012 | 23/11/2012 | 10,198.000 | 10,198.000 |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 10,198.000 | 10,198.000 |
| | P_AdOH Current year: | | 37,005 | | |
| | P_AdOH Annual Cap: | | 142,551 | | |
| | * Adipic acid production for baseline emission calculation, after cap application | | | | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Small bags and bags balance (W42811) Serial Number: 96C208 | Load cell weighing indicator | +/- 0.03 kg | Annually | Last Calibration<br>06/04/2012<br>Valid Until<br>05/04/2013 |
| | Big bags and bags balance (W43741) Serial Number: 2003105 | Load cell weighing indicator | +/- 0.3 kg | Annually | Last Calibration<br>06/04/2012<br>Valid Until<br>05/04/2013 |
| | Big bags and bags balance (W43742) Serial Number: 044134 | Load cell weighing indicator | +/- 0.3 kg | Annually | Last Calibration<br>06/04/2012<br>Valid Until<br>05/04/2013 |
| | SILO R42500 (W42505) Serial Number: 9009132 | Load cell weighing indicator | +/- 3 t | Annually | Last Calibration<br>28/02/2012<br>Valid Until<br>27/02/2013 |

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|---|---|
| **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 Executive Board has confirmed on EB36 the application of a yearly Adipic acid production cap as required by the methodologies (issue 1of the Request for review for the Monitoring Period #9 08/08/2007 ~ 31/08/2007).<br><br>The cumulated production of Adipic acid over the current year (starting last September 1st and ending with the last day of this period) is 37,005 t. This production is below the cap clarified in the EB48.<br><br>Following EB48 clarification, the cap is 142,551 t/y calculated as 415 t/d x 365 x 94.109 % (information available in the Excel Workbook "ER ONSAN", sheet BE, submitted to UNFCCC). The operational rate is given by the hours of plant operation in 2004 divided by the total hours in 2004. As verified in the monitoring period #26 (see Verification Report No. 1279748 issued on 23 July 2009) the adipic acid plant was operational for 8266.5 hours in 2004 taking out the annual maintenance shut down in November and the other unplanned shutdowns (hours verified with the help of daily data from "Daily AA operation rate 2004" and the daily production reports of 2004).<br>The resulting operational rate is 8266.5/8784 = 94.109%.<br>The Executive Board has confirmed on EB36 the application of a yearly Adipic acid production cap as required by the methodology. This approach is consistent with the definitions and requirements of the "Guidance on accounting eligible HFC-23" AM0001 (EB39 Annex 8): the year of the crediting period is defined on the basis of the starting date of the crediting period of a project activity (September 1st); the current period ends on August 31st, which is the end date of the year of the crediting period. |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks;<br>(b)Calculation of project emissions or actual net GHG removals by sinks; |
| **Additional Comment:** | |

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|---|---|---|---|---|
| **Data / Parameter:** | **Nitric acid consumption (HNO3_consumption)** | | | |
| **Unit:** | tonnes | | | |
| **Description:** | Nitric acid consumption for the calculation of HNO3 chemical | | | |
| **Measured /Calculated /Default:** | Measured<br>Several instruments are used | | | |
| **Source of data** | DCS data and log sheets | | | |
| **Value(s) of monitored parameter:** | | | HNO3_consumption | |
| | Rolling Year | 23/11/2012 | 122,945 | |
| | From | To | | |
| | 01/11/2012 | 23/11/2012 | 8,757 | |

| | | | | | |
|---|---|---|---|---|---|
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Fresh nitric acid HANWHA (FT6C069) Serial Number: F407E902000 | Mass flow meter | +/- 0.65% | Annually | Last Calibration<br>24/05/2012<br>Valid Until<br>23/05/2013 |
| | Fresh nitric acid HANWHA (FT760CD) Serial Number: 760CDF02000 | Mass flow meter | +/- 0.65% | Annually | Last Calibration<br>10/04/2012<br>Valid Until<br>09/04/2013 |
| | Fresh nitric acid tank (LT92005) Serial Number: 90A-15477 | Flash type level transmitter | +/- 2% | Annually | Last Calibration<br>09/04/2012<br>Valid Until<br>08/04/2013 |
| | Fresh nitric acid tank (LT92015) Serial Number: 12B900530-232 | Flash type level transmitter | +/- 2% | Annually | Last Calibration<br>09/04/2012<br>Valid Until<br>08/04/2013 |
| | Truck scale (W90000) Serial Number: '03-07 | Load cell weighing indicator | +/- 10 kg | Annually | Last Calibration<br>25/08/2012<br>Valid Until<br>24/08/2013 |
| **Measuring/ Reading/ Recording frequency:** | Measured continuously, read every second and recorded daily.<br>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 Hu-chems, 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:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks;<br>(b)Calculation of project emissions or actual net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

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|---|---|
| **Data / Parameter:** | **Physical losses in the adipic acid production process (HNO3_physical)** |
| **Unit:** | tonnes |

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|---|---|---|---|---|---|
| **Description:** | Physical losses in the adipic acid production process data required for calculation of HNO3 chemical and the N2O emission factor N2O_/AdOH | | | | |
| **Measured /Calculated /Default:** | Measured<br>Several instruments are used | | | | |
| **Source of data** | DCS data and laboratory analysis data | | | | |
| **Value(s) of monitored parameter:** | | | HNO3_physical | | |
| | Rolling Year | 23/11/2012 | 2,495 | | |
| | From | To | | | |
| | 01/11/2012 | 23/11/2012 | 161 | | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Potentiometric Titrator | Potentio mettic | 0.10% | Weekly | Last Calibration<br>19/11/2012<br>Valid Until<br>Following week |
| | HPLC | Chromato graphy | < 0.3% RSD | Daily | Last Calibration<br>23/11/2012<br>Valid Until<br>Following day |
| | NOx gas DCN inlet (AYA51526) Serial Number: W0625001 | NDIR (Non Dispersive Infrared) | +/- 3% | 4/year | Last Calibration<br>15/11/2012<br>Valid Until<br>14/02/2013 |
| | LNOX E56010 to A56020 (AYA-56026) Serial Number: W0624984 | NDIR (Non Dispersive Infrared) | +/- 5% | 4/year | Last Calibration<br>15/11/2012<br>Valid Until<br>14/02/2013 |
| | KAOP to Oxidation (FT12701) Serial Number: 45012E02000 | Mass flow meter | +/- 1% | Annually | Last Calibration<br>20/02/2012<br>Valid Until<br>19/02/2013 |
| | LNOX D51500 to E55030 (FQ51525) Serial Number: 91EC29665 551 | Orifice type flow transmitter | +/- 5% | Annually | Last Calibration<br>02/12/2011<br>Valid Until<br>01/12/2012 |
| | LNOX D52400 to E56030 | Orifice type flow transmitter | +/- 5% | Annually | Last Calibration |

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|---|---|---|---|---|---|
| | (FQ52428) Serial Number: 12B605179-224 | | | | 02/12/2011<br>Valid Until<br>01/12/2012 |
| | HPCE R61380 to K83160 (FQ61782) Serial Number: 0870135449 | Magnetic Flow Meter | +/- 1% | Annually | Last Calibration<br>20/02/2012<br>Valid Until<br>19/02/2013 |
| | DBA to F81200 (FQ81115) Serial Number: 0870152709 | Magnetic Flow Meter | +/- 1.50% | Annually | Last Calibration<br>20/02/2012<br>Valid Until<br>19/02/2013 |
| | DBA R81100 to K83300 (FQ82351) Serial Number: 91K906367 036 | Magnetic Flow Meter | +/- 1% | Annually | Last Calibration<br>27/02/2012<br>Valid Until<br>26/02/2013 |
| | Waste water to R83200 (FQ83401) Serial Number: 26B401923 217 | Magnetic Flow Meter | +/- 1% | Annually | Last Calibration<br>27/02/2012<br>Valid Until<br>26/02/2013 |
| **Measuring/ Reading/ Recording frequency:** | Measured continuously, read every second and recorded daily.<br>Lab equipments: Measured and read when used, recorded daily. | | | | |
| **Calculation method (if applicable):** | Nitric acid physical losses (HNO3_physical) in the aqueous wastes, the off gases, the adipic acid and the by-product are monitored.<br>Those physical losses are substracted from the nitric acid consumption (HNO3_consumption) to get the chemical consumption. | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks;<br>(b)Calculation of project emissions or actual net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

| **Data / Parameter:** | **HNO3_Chemical** | | | |
|---|---|---|---|---|
| **Unit:** | tonnes | | | |
| **Description:** | Chemical consumption of Nitric acid required for the calculation of the N2O emission factor N2O_/AdOH | | | |
| **Measured /Calculated /Default:** | Calculated | | | |
| **Source of data** | Excel Workbook based on the raw material consumption, DCS data and lab data | | | |
| **Value(s) of monitored parameter:** | | HNO3_consumption | HNO3_physical | HNO3_chemical |

| | | | | | |
|---|---|---|---|---|---|
| | Rolling Year | 23/11/2012 | 122,945 | 2,495 | 120,450 |
| | From | To | | | |
| | 01/11/2012 | 23/11/2012 | 8,757 | 161 | 8,596 |
| **Monitoring equipment** | Not Applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated and recorded monthly and yearly | | | | |
| **Calculation method (if applicable):** | To obtain the chemical consumption (HNO3_chemical), the physical losses are deducted from the nitric acid consumption.<br>HNO3_chemical = HNO3_consumption - HNO3_physical | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks;<br>(b)Calculation of project emissions or actual net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Data / Parameter:** | **N2O_/AdOH** | | | | |
| **Unit:** | t N2O/t adipic acid | | | | |
| **Description:** | Actual N2O emission factor for adipic acid production | | | | |
| **Measured /Calculated /Default:** | Calculated | | | | |
| **Source of data:** | Not applicable | | | | |
| **Value(s) of monitored parameter:** | Period or Month | N2O_/AdOH (Calculated for month/period) | N2O_/AdOH (Calculated for rolling year) | N2O_/AdOH (Applied for baseline emissions) | N2O_/AdOH (Applied for project emissions) |
| | 01/11/2012<br>23/11/2012 | 0.283 | 0.283 | 0.270 | 0.283 |
| | The calculation of the by-pass emissions uses the monthly values applied for project<br>emissions. The by-pass emissions for the period are calculated as the sum of the monthly values, and do not use the N2O_/AdOH value of the period, given here for information only. | | | | |
| | P_AdOH Rolling Year (t) | 142,720 | | | |
| | HNO3_Chemical Rolling Year (t) | 120,450 | | | |
| | N2O_/AdOH capped at | 0.270 | | | |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated and recorded monthly | | | | |

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| **Calculation method (if applicable):** | The N2O emission factor is calculated in two ways:<br>(1) with the month/period values of HNO3_chemical and P_AdOH<br>(2) using the rolling year cumulated data of HNO3_chemical and P_AdOH<br>The formula used according to AM0021/version 1 equation (4) is:<br>N2O_AdOH = HNO3_chemical / P_AdOH / 63 /2 x 0.96 x 44<br>For Baseline Emissions, the lowest among the 2 above calculated values and 0.27 is used conservatively, as specified in the PDD table D.2.1.3 and required by the methodology AM0021/version 1 (page 4).<br>To be conservative, the highest value of the three (two calculated values and 0.27) is applied to calculate Q_N2O_by-pass (see this parameter for details) |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks;<br>(b)Calculation of project emissions or actual net GHG removals by sinks; |
| **Additional Comment:** | |

| | | | | | |
|---|---|---|---|---|---|
| **Data / Parameter:** | **Q_N2O** | | | | |
| **Unit:** | kg | | | | |
| **Description:** | Quantity of $N_2O$ produced | | | | |
| **Measured /Calculated /Default:** | Calculated value | | | | |
| **Source of data:** | Calculated from P_AdOH and N2O_/AdOH data | | | | |
| **Value(s) of monitored parameter:** | | From | To | Q_N2O | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 2,753,460 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 2,753,460 | |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated and recorded monthly | | | | |
| **Calculation method (if applicable):** | Q_N2O = P_AdOH x N2O_/AdOH<br>Only the adipic acid production after cap application is used to define the baseline emission | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

| | |
|---|---|
| **Data / Parameter:** | **Q_N2O reg** |
| **Unit:** | kg |
| **Description:** | Allowed N2O emissions |
| **Measured /Calculated /Default:** | Default value |
| **Source of data:** | South Korean legislation |

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| **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:** | Rhodia follows the evolution of Korean legislation about N2O emissions that could affect the project Emission Reduction through the parameters N2O_reg / AdOH, Q_N2O reg, or ry as part of its RCMS (Rhodia Care Management System), RCMS+ is covering ISO14000 standard which requires to follow any update on Environmental regulations. For the monitoring of the new HSE (Hygiene, Safety and Environment) local and national regulations, Rhodia Korea has joined two committees: "Onsan Environment Management Society" and "Korea Environmental Engineers Federation".<br>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.<br>There is no applicable limitation from this new regulation on the N2O emissions of the Onsan Adipic plant. |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; |
| **Additional Comment:** | |

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| **Data / Parameter:** | **N2O reg/AdOH** |
| **Unit:** | kg/kg |
| **Description:** | Allowed N2O emission / kg of adipic acid 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:** | ARecorded at date of the regulatory value introduction or change of the regulation |
| **Calculation method (if applicable):** | Not applicable |
| **QA/QC procedures applied:** | Rhodia follows the evolution of Korean legislation about N2O emissions that could affect the project Emission Reduction through the parameters N2O_reg / AdOH, Q_N2O reg, or ry as part of its RCMS (Rhodia Care Management System), RCMS+ is covering ISO14000 standard which requires to follow any update on Environmental regulations. For the monitoring of the new HSE (Hygiene, Safety and Environment) local and national regulations, Rhodia Korea has joined two committees: "Onsan Environment Management Society" and "Korea Environmental Engineers Federation". |

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| | 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.<br>There is no applicable limitation from this new regulation on the N2O emissions of the Onsan Adipic plant. |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; |
| **Additional Comment:** | |

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| **Data / Parameter:** | $\mathbf{r_y}$ |
| **Unit:** | % |
| **Description:** | % of N2O emissions 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:** | Rhodia follows the evolution of Korean legislation about N2O emissions that could affect the project Emission Reduction through the parameters N2O_reg / AdOH, Q_N2O reg, or ry as part of its RCMS (Rhodia Care Management System), RCMS+ is covering ISO14000 standard which requires to follow any update on Environmental regulations. For the monitoring of the new HSE (Hygiene, Safety and Environment) local and national regulations, Rhodia Korea has joined two committees: "Onsan Environment Management Society" and "Korea Environmental Engineers Federation".<br><br>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.<br>There is no applicable limitation from this new regulation on the N2O emissions of the Onsan Adipic plant. |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; |
| **Additional Comment:** | |

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| **Data / Parameter :** | **P N2O** |
| **Unit :** | €/t |
| **Description :** | Market price of N2O |
| **Measured /Calculated /Default :** | Estimated |
| **Source of data :** | Market Survey (last update September 2012) |
| **Value(s) of monitored parameter:** | Zero (0) (there is no $N_2O$ market for the $N_2O$ produced as by-product of adipic acid in Onsan plant) |
| **Monitoring equipment** | Not applicable |
| **Measuring/ Reading/ Recording frequency :** | Estimated and recorded yearly (up-date based on permanent market survey) |
| **Calculation method (if applicable) :** | Not applicable |
| **QA/QC procedures applied :** | Not applicable |
| **Purpose of data :** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; |
| **Additional Comment :** | |

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|---|---|---|---|---|---|
| **Data / Parameter :** | **Q_Steam_p** | | | | |
| **Unit :** | kg | | | | |
| **Description :** | Amount of steam produced by the decomposition process | | | | |
| **Measured /Calculated /Default :** | Measured | | | | |
| **Source of data :** | The data are automatically and continuously acquired by DCS and stored in the PIMS. | | | | |
| **Value(s) of monitored parameter:** | | From | To | Q_Steam_p | |
| | Period Value : | 01/11/2012 | 23/11/2012 | 14,487,275 | |
| | Monthly values : | 01/11/2012 | 23/11/2012 | 14,487,275 | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Steam production by N2O system (FIQ58213) Serial Number: 294795/003/01 | Vortex flow meter | +/- 1% | Annually | Last Calibration 08/03/2012 Valid Until 07/03/2013 |
| | Boiler feed water flow rate (FIQ58204) Serial Number: 294795/002/01 | Vortex flowmeter (Back up for FIQ58213) | +/- 0.3% | Annually | Last Calibration 07/03/2012 Valid Until 06/03/2013 |
| | Boiler continuous purge flow rate | Orifice type flowmeter (Back up for | +/- 0.6% | Annually | Last Calibration 21/02/2012 |

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|---|---|---|---|---|---|
| | (FIQ58303) Serial Number: 91L946629 139 | FIQ58213) | | | Valid Until 20/02/2013 |
| **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:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

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|---|---|---|---|---|---|
| **Data / Parameter:** | **E_Steam** | | | | |
| **Unit:** | kg CO2/kg of steam | | | | |
| **Description:** | CO2 emission factor of steam produced by facility | | | | |
| **Measured /Calculated /Default:** | Calculated | | | | |
| **Source of data:** | Excel workbook | | | | |
| **Value(s) of monitored parameter:** | 0.122 | | | | |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Not Applicable/each monitoring period | | | | |
| **Calculation method (if applicable):** | The rolling year value of E_Steam is calculated with the data available for the year prior to the end of the period in order to assure to have the data. The emission factor is obtained by the formula below:<br>$E\_Steam = (QNG\_tsteam/1{,}000) * E\_NG_y$<br>$QNG\_tsteam = \Delta H$ (kcal/t) / (HHV (kcal/Nm3) x η (%))<br>Where:<br>QNG_tsteam: amount of natural gas required to generate steam (Nm3/t)<br>The HHV data is the yearly average value for the gas supplied by KYUNG DONG City Gas Ltd.<br>The yield η (%) of the boiler is conservatively taken as 97%, while the yield is generally below 90%<br>$E\_NG_y$: yearly average value for the gas supplied by KYUNG DONG City Gas Ltd. (kg CO2/Nm3)<br><br>Year ending on: 31/10/2012 | | | | |
| | HHV Kcal/Nm3 | △H kcal/t | η % | QNG_tsteam Nm3/t of steam | $E\_NG_y$ kg-CO2/Nm3 |
| | 10,383 | 557,960 | 97 | 55.40 | 2.206 |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

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|---|---|---|---|---|---|
| **Data / Parameter:** | **CO2_Steam_p** | | | | |
| **Unit:** | t CO2e | | | | |
| **Description:** | CO2 Emissions from Steam Production | | | | |
| **Measured /Calculated /Default:** | Calculated | | | | |
| **Source of data:** | Calculated from Q_Steam_p and E_Steam data | | | | |
| **Value(s) of monitored parameter:** | | From | To | CO2_Steam_p | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 1,767 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 1,767 | |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated and recorded monthly | | | | |
| **Calculation method (if applicable):** | Calculated monthly and expressed in tonnes, using Q_Steam_p and E_Steam CO2_Steam_p = Q_Steam_p x E_Steam | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (a)Calculation of baseline emissions or baseline net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

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|---|---|---|---|---|---|
| **Data / Parameter:** | **Q_GE** | | | | |
| **Unit:** | Nm3 | | | | |
| **Description:** | Volume of effluent gas leaving the stack | | | | |
| **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:** | | From | To | Q_GE | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 11,440,443 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 11,440,443 | |
| | | | | | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Effluent gas (FIQ58407) Serial Number: 104F-105 | Pitot tube differential pressure flow meter | +/- 3% | Annually | Last Calibration 03/09/2012 Valid Until 02/09/2013 |
| **Measuring/ Reading/ Recording frequency:** | Measured continuously, read every second and recorded daily. | | | | |

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| **Calculation method (if applicable):** | Not applicable |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 |
| **Purpose of data:** | (b)Calculation of project emissions or actual net GHG removals by sinks; |
| **Additional Comment:** | |

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|---|---|---|---|---|---|---|
| **Data / Parameter:** | **N2O_GE** | | | | | |
| **Unit:** | vppm | | | | | |
| **Description:** | Concentration of N2O 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:** | | From | To | N2O_GE | | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 15.7 | | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 15.7 | | |
| | | | | | | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** | |
| | Stack N2O analyzer (AIT58408) Serial Number: 17005 | Gas analyzer, type in-situ and laser diode on wet basis | +/- 1 vppm | 2/year | Last Calibration | |
| | | | | | 16/08/2012 | |
| | | | | | Valid Until | |
| | | | | | 15/02/2013 | |
| | Stack N2O analyzer (AI58418) Serial Number: W01894257 | NDIR (Non Dispersive Infrared) | +/- 1 vppm | weekly | Last Calibration | |
| | | | | | 23/11/2012 | |
| | | | | | 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 in the DCS as the flow averaged value of concentration values measured every 10 sec: $N2O\_GE = \frac{\int (Q\_GE \times N2O\_GE)\ dt}{Q\_GE}$ | | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | | |
| **Purpose of data:** | (b)Calculation of project emissions or actual net GHG removals by sinks; | | | | | |
| **Additional Comment:** | | | | | | |

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|---|---|---|---|---|---|
| **Data / Parameter:** | **ND_N2O** | | | | |
| **Unit:** | kg | | | | |
| **Description:** | Quantity of N2O in the effluent gas leaving the stack | | | | |
| **Measured /Calculated /Default:** | Calculated | | | | |
| **Source of data:** | Data are automatically acquired continuously by the DCS and stored in the PIMS data base. | | | | |
| **Value (s) of monitored parameter:** | | From | To | ND_N2O | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 354 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 354 | |
| | | | | | |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated and recorded daily. | | | | |
| **Calculation method (if applicable):** | The daily value of non destroyed N2O (ND_N2O) is calculated on-line in the DCS using 10 second data of the concentration of N2O and the flow rate of the gaseous effluent, both measured on a wet basis (Equivalent to method C of EB61 "Tool to determine the mass flow of a greenhouse gas in a gaseous stream"):<br>ND_N2O = Q_GE * N2O_GE * Specific_gravity_of_N2O<br>The specific_gravity_of_N2O = 44/22.414 x $10^{-6}$ is used to transform vppm in kg/ Nm3<br>When the instant value indicated by AIT58408 is lower than 5 vppm (detection limit), the value of 5 vppm is used in the equation above. | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (b)Calculation of project emissions or actual net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

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|---|---|---|---|---|---|
| **Data / Parameter:** | **Q_NG** | | | | |
| **Unit:** | **Nm3** | | | | |
| **Description:** | Amount of natural gas used 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 parameter:** | | From | To | Q_NG | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 848,105 | |
| | Monthly values : | 01/11/2012 | 23/11/2012 | 848,105 | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Natural Gas burning | Turbine flow meter | +/- 0.3% | Annually | Last |

| | | | | | |
|---|---|---|---|---|---|
| | (FQ91485A) Serial Number: 80067664/2005 | | | | Calibration<br>20/02/2012<br>Valid Until<br>19/02/2013 |
| | Natural Gas burning (FQ91485B) (Back up flow meter) Serial Number: 80093966 | Turbine flow meter | +/- 0.3% | Annually | Last Calibration<br>21/05/2012<br>Valid Until<br>20/05/2013 |
| **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:** | (b)Calculation of project emissions or actual net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

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|---|---|
| **Data / Parameter:** | **E_NGy** |
| **Unit:** | kg $CO_2$/Nm3 |
| **Description:** | Emissions coefficient for natural gas combustion |
| **Measured /Calculated /Default:** | Calculated |
| **Source of data:** | Data provided by natural gas supplier (KYUNG DONG City Gas Ltd.) |
| **Value (s) of monitored parameter:** | 2.206 |
| **Monitoring equipment** | Not applicable |
| **Measuring/ Reading/ Recording frequency:** | Calculated monthly, recorded at each monitoring period |
| **Calculation method (if applicable):** | The emissions coefficient is calculated according to the PDD Monitoring Plan. For the 12 months preceding the monitoring period, the CO2 quantity emitted by the combustion of the natural gas from all the gas boilers is summed up and divided by the total quantity of natural gas consumed in Nm3 over the same 12 months period. The CO2 quantity emitted is obtained by multiplying the emission factor of the month (based on the gas composition of the month) by the quantity of natural gas burned in the same month, using the formulae described in section E1 of the PDD. |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 |
| **Purpose of data:** | (b)Calculation of project emissions or actual net GHG removals by sinks; |
| **Additional Comment:** | |

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|---|---|
| **Data / Parameter:** | **NGC** |
| **Unit:** | % vol |

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|---|---|
| **Description:** | Natural gas composition required for the calculation of E_NG |
| **Measured /Calculated /Default:** | Measured |
| **Source of data:** | Data provided by natural gas supplier (KYUNG DONG City Gas Ltd.) |
| **Value (s) of monitored parameter:** | See table below |
| **Monitoring Equipment** | NGC is use to calculate the E_NG 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 CO2 specific gravity in standard state is 1.965.<br><br>For this monitoring period, natural gas composition from November 2012 are not yet available, so to be conservative, the NGC of the month of November 2006 was used for November as it gives the highest E_NG value since the beginning of the crediting period (01/09/2006). |
| **Measuring/ Reading/ Recording frequency:** | Provided by supplier and recorded monthly |
| **Calculation method (if applicable):** | E_NG = 1.965 x (average number of C)<br>1.965 is the specific gravity of CO2 in standard conditions in kg/Nm3 |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 |
| **Purpose of data:** | (b)Calculation of project emissions or actual net GHG removals by sinks; |
| **Additional Comment:** | |

| Component | **Number of C** | **Nov-12** | | |
|---|---|---|---|---|
| CH4 (Methane) | 1 | 90.51 | | |
| C2H6 (Ethane) | 2 | 5.74 | | |
| C3H8 (Propane) | 3 | 2.55 | | |
| I-C4H10 (I-Butane) | 4 | 0.51 | | |
| N-C4H10 (N-Butane) | 4 | 0.51 | | |
| I-C5H12 (I-Pentane) | 5 | 0.02 | | |
| N-C5H12 (N-Pentane) | 5 | 0.00 | | |
| N2 (Nitrogen) | 0 | 0.16 | | |
| CO2 (Carbon dioxide) | 1 | 0.00 | | |
| T O T A L | | 100.00 | | |
| Average number of C | | 1.138 | | |
| E_NGm (kg-CO2/Nm3) | | 2.237 | | |

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|---|---|
| **Data / Parameter:** | **CO2_NG** |
| **Unit:** | t CO2 |
| **Description:** | CO2 Emissions for Natural Gas |
| **Measured /Calculated /Default:** | Calculated |

| | | | | | |
|---|---|---|---|---|---|
| **Source of data:** | Calculated in the excel workbook from Q_NG and E_NG data | | | | |
| **Value (s) of monitored parameter:** | | From | To | CO2_NG | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 1,898 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 1,898 | |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated and recorded monthly | | | | |
| **Calculation method (if applicable):** | CO2_NG is calculated monthly using the monthly values of Q_NG and E_NG $CO2\_NG_m = Q\_NG_m \times E\_NG_m$ | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (b)Calculation of project emissions or actual net GHG removals by sinks; | | | | |
| **Additional Comment:** | | | | | |

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|---|---|---|---|---|---|
| **Data / Parameter:** | **%_on-line** | | | | |
| **Unit:** | % of production time | | | | |
| **Description:** | % of production time that the N2O is sent to the decomposition facility. | | | | |
| **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:** | | From | To | %_on-line | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 100.00% | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 100.00% | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | By-pass valves position detectors (HV57001) Serial Numbers: 603100335 | Butterfly type On-off valve | below 1% relative accuracy on %_on-line | Annually | Last Calibration 01/08/2012 Valid Until 31/07/2013 |
| | By-pass valves position detectors (HV57003) Serial Numbers: 603100337 | Butterfly type On-off valve | below 1% relative accuracy on %_on-line | Annually | Last Calibration 01/08/2012 Valid Until 31/07/2013 |

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| **Measuring/ Reading/ Recording frequency:** | Measured continuously, read every second and recorded daily and monthly |
| **Calculation method (if applicable):** | The %_on-line is recorded on a daily basis and is the ratio between the time of production of adipic acid while the unit is connected to the N2O destruction facility and the time of production. The opening/closing time of the high integrity by-pass valves is recorded every second in the PI system.<br>At the end of the month/period (y), %_on-line is calculated as:<br>$\%\_on\text{-}line_y = 1 - (Q\_N2O\_by\text{-}pass_y/(P\_AdOH_y \times N2O\_/AdOH))$ |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 |
| **Purpose of data:** | (b)Calculation of project emissions or actual net GHG removals by sinks; |
| **Additional Comment:** | |

| | | | | | |
|---|---|---|---|---|---|
| **Data / Parameter:** | **Q_N2O_by-pass** | | | | |
| **Unit:** | kg | | | | |
| **Description:** | $N_2O$ by passing the decomposition facility | | | | |
| **Measured /Calculated /Default:** | Calculated | | | | |
| **Source of data:** | Data are automatically acquired continuously by the DCS and stored in the PIMS data base. | | | | |
| **Value (s) of monitored parameter:** | | From | To | Q_N2O_by-pass | N2O_/AdOH Calculated (Actual) |
| | Period Value: | 01/11/2012 | 23/11/2012 | 0 | 0.283 |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 0 | 0.283 |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated continuously and recorded daily. | | | | |
| **Calculation method (if applicable):** | The quantity of N2O that by-pass the facility is calculated daily (d) following AM0021/version1 page 4<br><br>· $Q\_N_2O\_by\text{-}pass_d = Q\_N_2O_d \times (1 - \%\_on\text{-}line)_d$ for each day (d)<br>$Q\_N_2O_d = P\_AdOH_d \times N_2O\_/AdOH$ with $N_2O\_/AdOH$ is the actual value (considering that it is higher than 0.27) following the final ruling regarding the request for issuance of CERs "N2O decomposition project of PetroChina Company Limited Liaoyang Petrochemical Company" (EB61)<br><br>· $Q\_N_2O\_by\text{-}pass_d = P\_AdOH_d \times N_2O\_/AdOH \times (1 - \%\_on\text{-}line)_d$<br>At the end of the period the quantity of $N_2O$ that by-passed the facility is summed for all days:<br><br>· $Q\_N_2O\_by\text{-}pass_y = \Sigma (Q\_N_2O\_by\text{-}pass_d)$ | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |

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| **Purpose of data:** | (b)Calculation of project emissions or actual net GHG removals by sinks; |
| **Additional Comment:** | |

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|---|---|---|---|---|---|
| **Data / Parameter:** | **Q_Power** | | | | |
| **Unit:** | kWh | | | | |
| **Description:** | Electric consumption of the decomposition facility | | | | |
| **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:** | | From | To | Q_Power | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 115,495 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 115,495 | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Electricity meter (LV22WH) Serial Number: 0465812 | Incremental Electricity meter | +/- 15 kWh | 7 years | Last Calibration 30/01/2012 Valid Until 29/01/2019 |
| **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:** | (c) Calculation of leakage | | | | |
| **Additional Comment:** | | | | | |

| | |
|---|---|
| **Data / Parameter:** | **E_Power** |
| **Unit:** | kg $CO_2$/kWh |
| **Description:** | CO2 intensity for electric generation |
| **Measured /Calculated /Default:** | Calculated |
| **Source of data:** | KEPCO data make publicly available by the Korean Energy Economics Institute (KEEI) for 2011 |
| **Value (s) of monitored parameter:** | 0.715 |
| **Monitoring equipment** | Not applicable |
| **Measuring/ Reading/ Recording frequency:** | Calculated and up-dated yearly |

| | |
|---|---|
| **Calculation method (if applicable):** | Calculated using the combined margin (CM) approach according to ACM0002 version 2 in the file (Grid_EF_SouthKorea 2011 rev3.xls). AM00021 version 1 requires calculation of E_Power as "the highest of the operating margin and the build margin according to ACM0002 version 2 for the grid connected to the facility". The way the emission factor is calculated follows exactly the requirement of the methodology for the following reasons:<br>(i) "according to ACM0002" means among other things to follow the combined margin CM approach (CM is the weighted average of OM and BM, with default weights of 50%/50%),<br>(ii) "the highest of the operating margin" means the simple OM as it is the highest operating margin of all alternatives listed in ACM0002 for calculation of the OM since the simple OM excludes all low-operating costs and must-run power plants which are nuclear power plants, hydro power plants and all renewable energy power plants, and<br>(iii) "the build margin" means the build margin (option 2 updated annually ex post) as required to be calculated following ACM0002 version 2. |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 |
| **Purpose of data:** | (c) Calculation of leakage |
| **Additional Comment:** | |

| | | | | | |
|---|---|---|---|---|---|
| **Data / Parameter:** | **CO2_Power** | | | | |
| **Unit:** | t $CO_2e$ | | | | |
| **Description:** | $CO_2$ Emissions from Electricity consumption | | | | |
| **Measured /Calculated /Default:** | Calculated | | | | |
| **Source of data:** | Excel Workbook based on Q_Power and E_Power data | | | | |
| **Value(s) of monitored parameter:** | | From | To | CO2_Power | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 83 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 83 | |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated and recorded monthly. | | | | |
| **Calculation method (if applicable):** | Calculated monthly and expressed in tonnes, using Q_Power and E_Power<br>CO2_Power= Q_Power x E_Power | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (c) Calculation of leakage | | | | |
| **Additional Comment:** | | | | | |

| | |
|---|---|
| **Data / Parameter:** | **Q_Steam_c** |
| **Unit:** | kg |
| **Description:** | Amount of steam consumed by the decomposition facility |

| | | | | | |
|---|---|---|---|---|---|
| **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:** | | From | To | Q_Steam_c | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 79,459 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 79,459 | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Steam import to N2O system (FIQ58082) Serial Number: S5F206714 609 | Vortex flow meter | +/- 1.0% | Annually | Last Calibration 08/03/2012 Valid Until 07/03/2013 |
| **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:** | (c) Calculation of leakage | | | | |
| **Additional Comment:** | | | | | |

| | |
|---|---|
| **Data / Parameter:** | **E_Steam_c** |
| **Unit:** | kg $CO_2$/kg of steam |
| **Description:** | $CO_2$ intensity for steam consumed in the facility |
| **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.<br>a) an external supplier KZC which produced steam from coal<br>b) existing boilers on site which produced steam from natural gas<br>As a conservative approach, if external supplier has been used over the period, we use the highest of the 2 emission coefficients.<br>For the external supplier, the annual report gives the CO2 emission factor for steam from KZC annual report in t CO2 / GJ, Efh.<br>E_Steam_c_KZC = Efh x 4.1868 Gcal/GJ x 822 Mcal/t of steam / 1000<br>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.<br>Q_NG_tsteam in Nm3/t of steam is obtained from the ratio of annual natural gas consumption over the annual steam production.<br>E_Steam_c_ONSAN = E_NGy x Q_NG_tsteam<br>E_Steam_c = MAX (E_Steam_c_ONSAN, E_Steam_c_KZC) |

| Year ending | Q_NG_tsteam Nm3/t of steam | E_NG kg CO2/Nm3 | E_Steam_c_ONSAN kg CO2/kg steam | E_Steam_c_KZC kg CO2/kg steam |
|---|---|---|---|---|
| 01/11/2012 | 61.432 | 2.206 | 0.136 | 0.326 |

| | |
|---|---|
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 |
| **Purpose of data:** | (c) Calculation of leakage |
| **Additional Comment:** | |

| | | | | | |
|---|---|---|---|---|---|
| **Data / Parameter:** | **CO2_Steam_c** | | | | |
| **Unit:** | t $CO_2e$ | | | | |
| **Description:** | $CO_2$ Emissions from Steam consumption | | | | |
| **Measured /Calculated /Default:** | Calculated | | | | |
| **Source of data:** | Calculated from Q_Steam_c and E_Steam_c | | | | |
| **Value(s) of monitored parameter:** | | From | To | CO2_Steam_c | |
| | Period Value: | 01/11/2012 | 23/11/2012 | 26 | |
| | Monthly values: | 01/11/2012 | 23/11/2012 | 26 | |
| **Monitoring equipment** | Not applicable | | | | |
| **Measuring/ Reading/ Recording frequency:** | Calculated and recorded monthly. | | | | |
| **Calculation method (if applicable):** | Calculated monthly and expressed in tonnes, using Q_Steam_c and E_Steam_c<br>CO2_Steam_c= Q_Steam_c x E_Steam_c | | | | |
| **QA/QC procedures applied:** | Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | (c) Calculation of leakage | | | | |
| **Additional Comment:** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Data / Parameter:** | **NOx** | | | | |
| **Unit:** | **vppm** | | | | |
| **Description:** | $NO + NO_2$ concentration in the stack gas required by Korean legislation. | | | | |
| **Measured /Calculated /Default:** | Measured | | | | |
| **Source of data:** | On-line analyser | | | | |
| **Value (s) of monitored parameter:** | Parameter | Unit | Limit | Analytical results in this period | |
| | NOx | vppm | 200 max at least 95% of time | Average of 81.7 and less than 200 for 100% of time | |
| **Monitoring equipment** | Equipment | **Type** | **Accuracy class** | **Calibration frequency** | **Calibration Information** |
| | Stack NOx analyzer (AT58401) Serial Number: N1- U2- 0176 | NDIR (Non Dispersive Infrared) | +/- 1.0% | Weekly | Last Calibration<br>23/11/2012<br>Valid Until<br>30/11/2012 |
| **Measuring/ Reading/ Recording frequency:** | Measured continuously, read every second and recorded daily and monthly. According to local government environmental law, NOx 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 N2O 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)<br>Data Handling Protocol - RP-Q1-706-30 | | | | |
| **Purpose of data:** | Compliance with local regulation on NOx | | | | |
| **Additional Comment:** | | | | | |

### D.3. Implementation of sampling plan

Not applicable: AM0021 methodology version 1 does not specify any requirement on sampling

**SECTION E. Calculation of emission reductions or GHG removals by sinks**
**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The amount of baseline emissions in the given period y is calculated using the following formula according to AM0021/version 1 equation (1):

$BE_y = Q\_N2O_y \times GWP\_N2O + Q\_Steam\_p_y \times E\_Steam_y$

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 (see D.2.1.4. in the PDD).

The quantity Q_N2Oy of $N_2O$ emitted over the period can then be calculated by:

$Q\_N2O_y = P\_AdOH_y$ x N2O_/AdOH

Over the period of reference the emission factor of the adipic acid plant was above the capped value of 0.27 kg N2O/kg AdOH. So the capped value is being used according to AM 0021/version 1.

| **Parameter** | **Value** | **Unit** |
|---|---|---|
| $Q\_N2O_y$ | 2,753,460 | kg |
| $P\_AdOH_y$ (eligible) | 10,198.000 | t |
| N2O_/AdOH | 0.270 | kg N2O/kg AdOH |
| GWP_N2O (1) | 310 | kgCO2e/kg N2O |
| $Q\_steam\_p_y$ | 14,487.275 | t of steam |
| $E\_steam_y$ | 0.122 | tCO2/t of Steam |
| **$BE_y$** | **855,340** | **tCO2e** |

(1) Kyoto Protocol Rule, Decision 2/CP.3 and IPCC

The Baseline Emissions over this monitoring period are calculated as:

BEy = P_AdOH×N2O_/AdOH× GWP_N2O + Q_Steam_py × E_Steamy
= 10,198.000 x 0.270 x 310 +14,487.275 x 0.122
= 853,572.6 + 1,767.4
= **855,340 tCO2e**

BEy is rounded down in t CO2e to be conservative in the final calculation of ER
(See Section D2 for details)

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

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

According to AM0021, version 1, the project emissions $PE_y$ are the emissions in the period y due to:

- the N2O that has not been sent to the decomposition process (i.e. the N2O that by-passed the decomposition facility)
- the N2O non-destroyed by the decomposition process
- the emissions due to the use of natural gas.

$PE_y$ is calculated as follows:

$PE_y = (Q\_N2O\_by\text{-}pass_y + ND\_N2O_y) \times GWP\_N2O + Q\_NG_y \times E\_NG_y$ (AM0021/version 1 equation (5))

With $CO2\_NG_y = Q\_NG_y \times E\_NG_y$ (PDD section E.1) we get:

$PE_y = (Q\_N2O\_by\text{-}pass_y + ND\_N2O_y) \times GWP\_N2O + CO2\_NG_y$, where:

$Q\_N2O\_by\text{-}pass_y = P\_AdOH_y \times (1 - \%\_on\text{-}line_y) \times N2O\_/AdOH_y$

As a conservative interpretation of the methodology $Q\_N2O\_by\text{-}pass_y$ is calculated using the actual value of $N2O\_/AdOH_y$

$ND\_N2O_y = Q\_GE_y \times N2O\_GE_y \times$ Specific gravity of_N2O $\times 10^{-6}$

| Parameter | Value | Unit |
|---|---|---|
| $P\_AdOH_y$ | 10,198.000 | t |
| $N2O\_/AdOH_y$ | 0.283 | t N2O/t AdOH |
| %_on-line | 100.00 | % |
| $ND\_N2O_y$ | 0.354 | t $N2O_y$ |
| GWP_N2O (1) | 310 | tCO2e/t N2O |
| $Q\_NG_y$ | 848,105 | $Nm^3$ |
| $E\_NG_y$ | 2.237E-03 | $tCO2e/Nm^3$ |
| **$PE_y$** | **2,008** | **tCO2e** |

(1) Kyoto Protocol Rule, Decision 2/CP.3 and IPCC

The Project Emissions over this monitoring period are calculated as:

PEy = (P_AdOHy×(1-%_on-liney)×N2O_/AdOHy)+ND_ N2O y)× GWP_N2O + CO2_NGy
= ((10,198.000 x (1- 1.00) x 0.283) + 0.354) x 310 + (848,105 x 0.002237)
= 0,110 + 1,897
= **2,008 tCO2e**

PEy is rounded up in t CO2e to be conservative in the final calculation of ER

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

## E.3. Calculation of leakage

Leakage emissions in a given period y comprise the emissions associated with the energy sources used to generate any steam and electricity used by the decomposition plant.

Leakage is calculated according to AM0021/version 1, equation (7):

| Parameter | Value | Unit |
|---|---|---|
| $Q\_Power_y$ | 115,495 | kWh |
| E_Power | 0.715 | kg CO2/kWh |
| $Q\_Steam\_c_y$ | 79,459 | kg |
| $E\_Steam\_c_y$ | 0.326 | kg CO2e/kg of steam |
| **$L_y$** | **109** | **tCO2e** |

The Leakage Emissions over this monitoring period are calculated as:

Ly = Q_Powery x E_Power + Q_Steam_ cy x E_Steam_cy
= (115,495 x 0.715) + (79,459 x 0.326)
= 82,579 kg + 25,904 kg
= **109 tCO2e**

Ly is rounded up in t CO2e to be conservative in the final calculation of ER

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

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

Following the methodology AM0021/version 1 and the PDD section D.2.4, the total emission reductions achieved by this project activity during this monitoring period is:

$$\mathbf{ER_y = BE_y – PE_y – L_y}$$

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_2e$) | Leakage (tCO2e) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| 01/10/2012 31/10/2012 | 855,339 | 2,008 | 109 | 853,222 |

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

In the PDD section E the emission reduction is estimated to be 9,147,301 $tCO_2e$. So the PDD-estimated emission reduction relative to the monitoring period of 23 days is 576,405 tCO2e lower than the emission reductions of the current monitoring period.

| Item | Values applied in ex-ante calculation of registered PDD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | **576,405** | **853,222** |

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

For the sake of clarity, the amount of Emission Reductions can exceed the amount calculated in a year period in the PDD as all data in the PDD were conservative, in particular the performance of the N2O abatement unit (in fact, the actual efficiency has been > 85%, and the destruction rate > 99%).

| **BE:** | |
|---|---|
| **PDD value (tCO2e):** 686,772 | **Period (tCO2e):** 855,339 |
| Variance | Explanation |
| 167,920 | The adipic acid production used for the ex-ante emission reduction was conservatively taken as 130,000 t/y (356.2 t/d) which is lower than the nameplate capacity of 151 475 t/y (415 t/d x 365) mentioned in the PDD.When a capacity investment is made, there are design margins (10 to 20%) taken by engineering.<br><br>During this period the average production quantity is 443.39 t/d on average during this period to meet the market demand. |
| 647 | Slight impact of the steam production |
| **168,567** | **Total BE variance** |

It is important to note that according to the methodology AM0021/version 1, the eligible adipic acid production that can be used in the baseline is yearly capped, so it limits on a yearly basis the emission reduction calculation claimed for CERs. Please refer to item E.1 for details.

| **PE:** | |
|---|---|
| **PDD value (tCO2e):** 110,220 | **Period (tCO2e):** 2,008 |
| Variance | Explanation |
| 102,848 | The significant higher performance of the N2O abatement unit (the actual %_online of 100.00% in this period is significantly higher than the value of 85% estimated in the PDD due to excellent operational performance).<br><br>The estimate of 85% in the PDD assumed a low performance rate of the destruction equipment due to the lack of experience with such equipment. |
| 5,750 | A higher destruction rate of the N2O which is in excess of 99.99 % during this period versus 99 % taken conservatively in the PDD. |
| -386 | Difference in the natural gas consumption estimate and actual in the period |
| **108,212** | **Total PE variance** |

| **L** | |
|---|---|
| **PDD value (tCO2e):** 147 | **Period (tCO2e):** 109 |
| Variance | Explanation |
| 38 | Difference mainly due to the quantity of steam consumed |
| **38** | **Total L variance** |

The actual emission reductions determined in this monitoring period are higher than the *pro rata* estimation based on the *ex-ante* calculation made in the PDD, as explained above. This is to be expected because, given the general experiences with constant overestimation of CER volumes in the first years of CDM project development, Rhodia wanted to set the CER estimates in the PDD in a conservative fashion, especially regarding performance of the abatement equipment

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**History of the document**

| Version | Date | Nature of revision |
|---|---|---|
| 02.0 | EB 66<br>13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20). |
| 01 | EB 54, Annex 34<br>28 May 2010 | Initial adoption. |
| **Decision Class**: Regulatory<br>**Document Type**: Form<br>**Business Function**: Issuance | | |

Annex 1. Table of Equipments/General Information

| Related PDD parameter | Instrument Location | Tag number | Periodicity | Reference for calibration frequency | Done by | Previous calibration date | Last calibration date |
|---|---|---|---|---|---|---|---|
| %_online | By-pass Valves Integrity Check | HV-57001 | Annually | Section D.3 of PDD | Rhodia | 08/08/2011 | 01/08/2012 |
| %_online | By-pass Valves Integrity Check | HV-57003 | Annually | Section D.3 of PDD | Rhodia | 26/08/2011 | 01/08/2012 |
| P_AdOH | Small bags and bags Balance | W42811 | Annually | - Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287) | Third party | 21/04/2011 | 06/04/2012 |
| P_AdOH | Big bags and bags Balance | W43741 | Annually | - Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287) | Third party | 21/04/2011 | 06/04/2012 |
| P_AdOH | Big bags and bags Balance | W43742 | Annually | - Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287) | Third party | 21/04/2011 | 06/04/2012 |
| Q_steam_c | 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 | 25/03/2011 | 08/03/2012 |
| Q_steam_p | Steam production by N2O system | FIQ-58213 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:296) | Third party | 25/03/2011 | 08/03/2012 |
| Q_steam_P | 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 | 24/03/2011 | 07/03/2012 |
| Q_steam_p | Boiler continuous purge flow rate | FIQ58303 | Annually | Standards rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292) | Rhodia | 15/03/2011 | 21/02/2012 |
| N2O_GE | 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) | Rhodia | 27/02/2012 | 16/08/2012 |
| N2O_GE | Stack N2O analyzer (extractive infrared) | AI58418 | Weekly | Section 7.2 of instruction manual (90002929, 07/2005) from vender | Rhodia | 25/10/2012<br>02/11/2012<br>09/11/2012<br>16/11/2012 | 23/11/2012 |
| Q_NG | Natural Gas burning | FQ91485A | Annually | Standards rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:296) | Third party | 09/03/2011 | 20/02/2012 |
| Q_NG | Natural Gas burning (Back up flow meter) | FQ91485B | Annually | Standards rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:296) | Third party | 31/05/2011 | 21/05/2012 |
| Q_GE | Effluent Gas | FIQ-58407 | Annually | - National Environmental regulation | Third party | 06/01/2012 | 03/09/2012 |
| Q_Power | Electricity meter | LV22WH | Every 7 years | Table 13 of the Korean law on electricity measurement | Third party | 21/10/2008 | 30/01/2012 |

| Related PDD parameter | Instrument Location | Tag number | Periodicity | Reference for calibration frequency | Done by | Previous calibration date | Last calibration date |
|---|---|---|---|---|---|---|---|
| Nitric physical | Potentiometric titrator | Lab analyzer | weekly | Calibration ferquency by vendor recommendation | Rhodia | 29/10/2012<br>05/11/2012<br>12/11/2012 | 19/11/2012 |
| Nitric physical | HPLC | Lab analyzer | Daily | Calibration ferquency by vendor recommendation | Rhodia | Daily | 23/11/2012 |
| Nitric Cons | Truck Scale | W-90000 | Annually | - Article 32 of the Korean law on weighing<br>- Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287) | Third party | 10/09/2011 | 25/08/2012 |
| Nitric Cons | FRESH NIITRIC ACID HANWHA | FT6C069 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295) | Third party | 04/08/2011 | 24/05/2012 |
| Nitric Cons | FRESH NIITRIC ACID HANWHA | FT760CD | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295) | Third party | 17/10/2011 | 10/04/2012 |
| Nitric Cons | FRESH NIITRIC ACID TANK R92000 | LT-92005 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292) | Rhodia | 13/04/2011 | 09/04/2012 |
| Nitric Cons | FRESH NIITRIC ACID TANK R92010 | LT-92015 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292) | Rhodia | 13/04/2011 | 09/04/2012 |
| Nitric physical | NOX GAS DCN INLET | AYA-51526 | 4 / year | Section 4.2 of the reference book of Instructions 015-556383-K from Beckman Industrial. | Rhodia | 19/10/2012<br>01/11/2012 | 15/11/2012 |
| Nitric physical | LNOX E56010 TO A56020 | AYA-56026 | 4 / year | Section 4.2 of the reference book of Instructions 015-556383-K from Beckman Industrial. | Rhodia | 19/10/2012<br>01/11/2012 | 15/11/2012 |
| Nitric physical | KAOP TO OXIDATION | FT-12701 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295) | Third party | 08/03/2011 | 20/02/2012 |
| Nitric physical | LNOX D51500 TO E55030 | FQ-51525 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292) | Rhodia | 06/12/2010 | 02/12/2011 |
| Nitric physical | LNOX D52400 TO E56030 | FQ-52428 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292) | Rhodia | 06/12/2010 | 02/12/2011 |
| Nitric physical | 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 | 08/03/2011<br>19/09/2011 | 20/02/2012 |
| Nitric physical | DBA TO F81200 | FQ-81115 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:295) | Third party | 08/03/2011 | 20/02/2012 |
| Nitric physical | 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 | 10/03/2011 | 27/02/2012 |
| Nitric physical | 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 | 08/03/2011 | 27/02/2012 |
| Reference | KA OIL TANK R92100 | LT-92106 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292) | Rhodia | 06/05/2011 | 02/05/2012 |
| Reference | KA OIL TANK R92200 | LT-92206 | Annually | Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:292) | Rhodia | 06/05/2011 | 02/05/2012 |
| P_AdOH | SILO R42500 | W-42505 | Annually | - Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287) | Rhodia | 22/08/2011 | 28/02/2012 |
| Not in the PDD | NOx N2O unit stack | AT58401 | Weekly | Section 3.6 of instruction manual (C79000-G5276-C143-07) from vender(Emvironment management corporation) | Rhodia | 25/10/2012<br>02/11/2012<br>09/11/2012<br>16/11/2012 | 23/11/2012 |