MONITORING REPORT FORM (CDM-MR)
Version 01 - in effect as of: 28/09/2010

CONTENTS

MONITORING REPORT
VERSION 1.1 – 03/01/2012

"N2O EMISSION REDUCTION IN ONSAN, REPUBLIC OF KOREA"
UNFCCC 0099
MONITORING REPORT #55 (from 01/12/2011 to 31/12/2011)

SECTION A. General description of the project activity

A.1. Brief description of the 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 #55 the destruction unit has been operated continuously. The emission reductions achieved in this period are: 858,725 tCO2e

A.2. Project Participants

KEMCO (Korea Energy Management Corporation)
Rhodia Energy Korea Co, Ltd,
Rhodia Energy SAS, Rhodia Energy GHG SAS
Rhodia Japan Ltd,
ORBEO
NATIXIS, Natixis Environnment and Infrastructures,
Société Generale
Noble Carbon Credits

A.3. Location of the project activity:

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

A.4. Technical description of the project

A thermal oxidizer with 2 chambers is the technology used to decompose N2O at the Rhodia Onsan site.

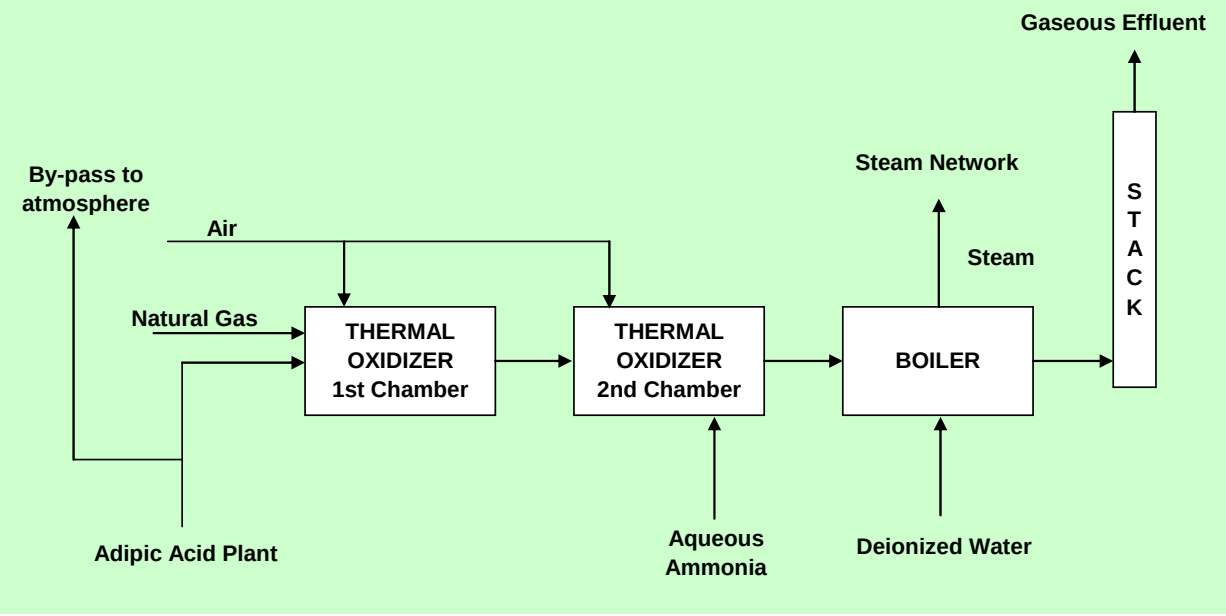
Natural gas is fed with the off gas from the adipic acid production containing N2O and a controlled amount of air in a reduction chamber, where it burns (oxidizes) to carbon dioxide (CO2) and water vapour. N2O is used as an oxidizer. Being oxygen deficient, the oxidation is not complete and carbon monoxide and hydrogen are present.

$CH4 + 4\ N2O \rightarrow CO2 + 2\ H2O + 4\ N2$

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.



A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

Approved baseline and monitoring methodology:
AM0021/version 1 – "Baseline Methodology for decomposition of N2O from existing adipic acid production plants"

Referenced Tool(s):
- EB 61 Annex 11 "Tool to determine the mass flow for GHG gaseous streams" version 2, 03/06/2011
- ACM0002/version 2 – "Consolidated methodology for Grid-Connected electricity generation from renewable resources" – Calculation of the CO2 emission factor of the power generation

Project Design Document:
N2O Emission Reduction in Onsan, Republic of South Korea.
Version number of the document: 8
Date: 01/09/2005

EB guidance directly related to adipic acid production:
EB45 Annex13 "Guidance to calculate adipic acid production in cases where it cannot be measured directly" version 1, 13/02/2009

A.6. Registration date of the project activity:

The project was registered by the UNFCCC on 27/11/2005.

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

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

A.8. Name of responsible person(s)/entity(ies):

Philippe Kehren, Rhodia Energy GHG
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92977 Paris La Defense, France
TEL : +33 1 53 56 61 02
FAX : +33 1 53 56 61 10

SECTION B. Implementation of the project activity

B.1. Implementation status of the 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.

During this monitoring period #55 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. Revision of the monitoring plan

No revision to the monitoring plan has been sought since the beginning of project activity.

B.3. Request for deviation applied to this monitoring period

No request for deviation of the approved methodology was applied to this monitoring period.

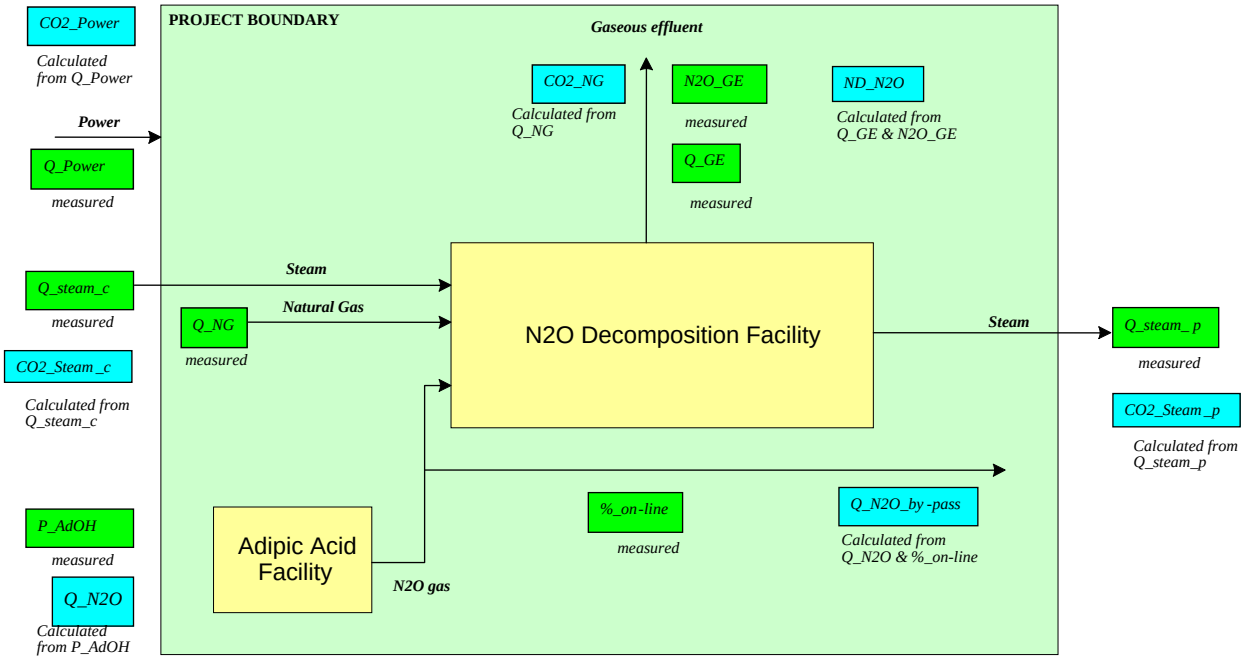
B.4. Notification or request of approval of changes

No changes to the project activity as described in the registered CDM-PDD have been requested.

SECTION C. Description of the monitoring system

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

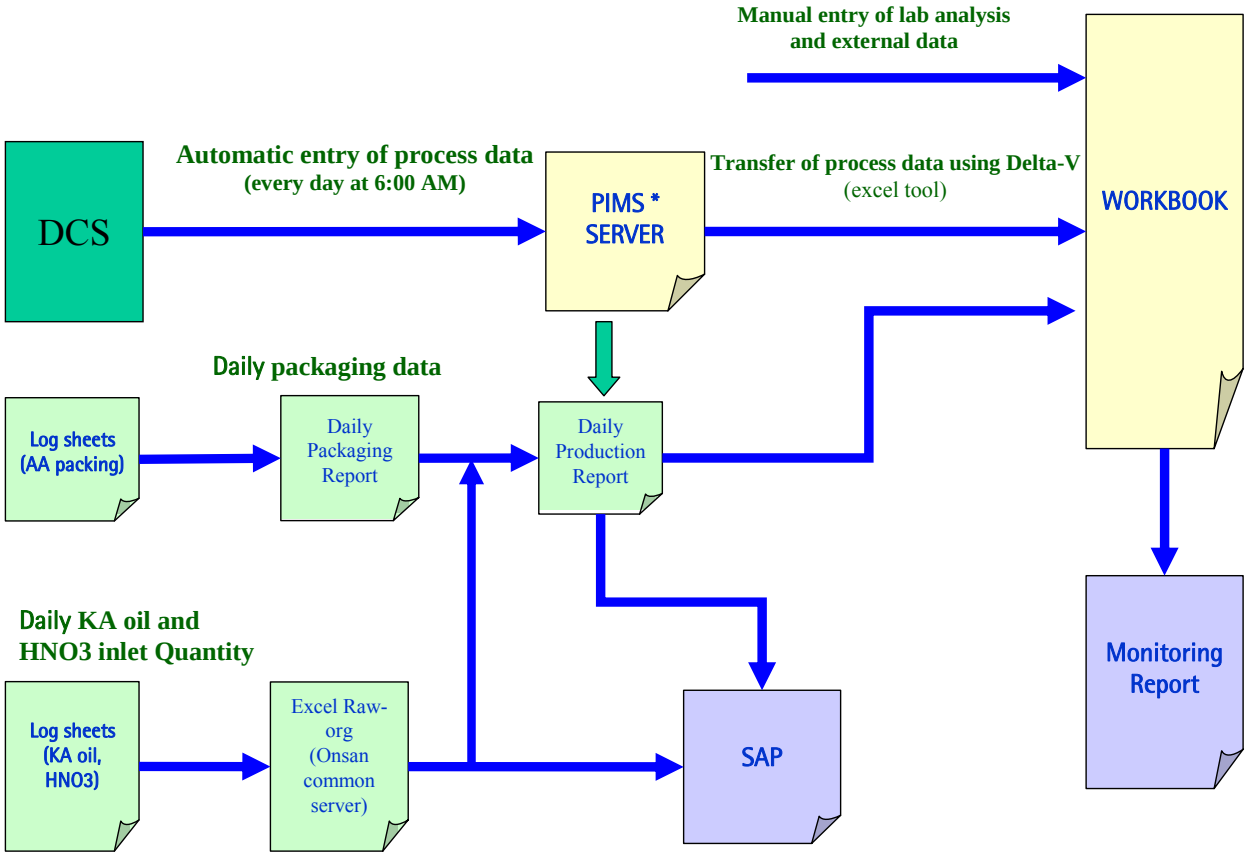
Potential sources of anthropogenic emissions by sources of GHG within the project boundary and emissions which are not included in the project boundary are also shown in below and the details of the parameters are informed in the section D.



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 in the PIMS (Plant Information Management System). Two types of data are stored in the PIMS:
(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 PIMS 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 determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	**GWP_N2O**
Data unit:	tCO_2e per tN_2O
Description:	Global Warming Potential of N2O
Source of data used:	Kyoto Protocol (Decision 2/CP.3) and IPCC
Value (s):	310
Data used for:	Baseline and Project Emissions
Additional Comment:	Not applicable

Data / Parameter:	**KE_N2O**
Data unit:	t N_2O per tonne of adipic acid produced
Description:	N_2O Emission factor
Source of data used:	IPCC Good Practice Guidance
Value (s):	0.27
Data used for:	Baseline Emissions
Additional Comment:	Cap value for N2O_/AdOH emission factor

Data / Parameter:	**ΔH**
Data unit:	kcal/t of steam
Description:	Enthalpy of vaporization of water
Source of data used:	Steam table for boiler feed water temperature 100°C and 6kg/cm^2 steam production
Value (s):	557,960
Data used for:	Baseline Emissions
Additional Comment:	Use to calculate E_Steam

Data / Parameter:	**η**
Data unit:	%
Description:	Operational efficiency of the boiler for steam production
Source of data used:	Monitoring Plan Section 6.3
Value (s):	97
Data used for:	Baseline Emissions
Additional Comment:	Use to calculate E_Steam

D.2 Data and parameters monitored

Data / Parameter:	**P_AdOH**				
Data unit:	tonnes				
Description:	Amount of adipic acid production				
Measured /Calculated /Default:	Measured value. 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:	01/12/2011	31/12/2011	10,263.500	10,263.500
	Monthly values:	01/12/2011	31/12/2011	10,263.500	10,263.500
	P_AdOH Current year:		47,432		
	P_AdOH Annual Cap:		142,551		
	* Adipic acid production for baseline emision calculation, after cap application				
Data used for:	Baseline and Project Emissions				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**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 21/04/2011 Valid Until 20/04/2012
	Big bags and bags balance (W43741) Serial Number: 2003105	Load cell weighing indicator	+/- 0.3 kg	Annually	Last Calibration 21/04/2011 Valid Until 20/04/2012
	Big bags and bags balance (W43742) Serial Number: 044134	Load cell weighing indicator	+/- 0.3 kg	Annually	Last Calibration 21/04/2011 Valid Until 20/04/2012
	SILO R42500 (W42505) Serial Number: 9009132	Load cell weighing indicator	+/- 3 t	Annually	Last Calibration 22/08/2011 Valid Until 21/08/2012
Measuring/ Reading/ Recording frequency:	Measured daily, aggregated 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). The cumulated production of Adipic acid over the current year (starting last September 1st and ending with the last day of this period) is 47,432 t. This production is below the cap clarified in the EB48. 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). The resulting operational rate is 8266.5/8784 = 94.109%. 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. The relative accuracy of P_AdOH for the monitoring period is calculated in the Workbook (sheet IC AdOH) and was found to be around 0.1% for this period, in line with the PDD requirement of +/- 1%
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30

Data / Parameter:	**Nitric acid consumption (HNO3_consumption)**			
Data unit:	tonnes			
Description:	Nitric acid consumption for the calculation of HNO3 chemical			
Measured /Calculated /Default:	Measured Several instruments are used			
Source of data	DCS data and log sheets			
Value(s) of monitored parameter:			HNO3_consumption	
	Rolling Year	31/12/2011	131,929	
	From	To		
	01/12/2011	31/12/2011	8,926	
Data used for:	Baseline and Project Emissions			

	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	Fresh nitric acid HANWHA (FT6C069) Serial Number: 6C069602000	Mass flow meter	+/- 0.65%	Annually	Last Calibration 04/08/2011 Valid Until 03/08/2012
	Fresh nitric acid HANWHA (FT760CD) Serial Number: 760CDF02000	Mass flow meter	+/- 0.65%	Annually	Last Calibration 17/10/2011 Valid Until 16/10/2012
	Fresh nitric acid tank (LT92005) Serial Number: 90A-15477	Flash type level transmitter	+/- 2%	Annually	Last Calibration 13/04/2011 Valid Until 12/04/2012
	Fresh nitric acid tank (LT92015) Serial Number: 12B900530-232	Flash type level transmitter	+/- 2%	Annually	Last Calibration 13/04/2011 Valid Until 12/04/2012
	Truck scale (W90000) Serial Number: '03-07	Load cell weighing indicator	+/- 10 kg	Annually	Last Calibration 10/09/2011 Valid Until 09/09/2012
Measuring/ Reading/ Recording frequency:	Measured continuously, recorded daily. Aggregated monthly and yearly				
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				

Data / Parameter:	**Physical losses in the adipic acid production process (HNO3_physical)**
Data unit:	tonnes
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 Several instruments are used				
Source of data	DCS data and laboratory analysis data				
Value(s) of monitored parameter:			HNO3_physical		
	Rolling Year	31/12/2011	3,122		
	From	To			
	01/12/2011	31/12/2011	196		
Data used for:	Baseline and Project Emissions				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**Equipment**	**Type**	**Accuracy class**	**Calibration frequency**	**Calibration Information**
	Potentiometric Titrator	Potentio mettic	0.10%	Weekly	Last Calibration 26/12/2011 Valid Until Following week
	HPLC	Chromato graphy	< 0.3% RSD	Daily	Last Calibration 31/12/2011 Valid Until Following day
	NOx gas DCN inlet (AYA51526) Serial Number: W0625001	NDIR (Non Dispersive Infrared)	+/- 3%	4/year	Last Calibration 27/12/2011 Valid Until 26/03/2012
	LNOX E56010 to A56020 (AYA-56026) Serial Number: W0624984	NDIR (Non Dispersive Infrared)	+/- 5%	4/year	Last Calibration 27/12/2011 Valid Until 26/03/2012
	KAOP to Oxidation (FT12701) Serial Number: D1073D02000	Mass flow meter	+/- 1%	Annually	Last Calibration 08/03/2011 Valid Until 07/03/2012
	LNOX D51500 to E55030 (FQ51525) Serial Number: 91EC29665 551	Orifice type flow transmitter	+/- 5%	Annually	Last Calibration 02/12/2011 Valid Until 01/12/2012

	LNOX D52400 to E56030 (FQ52428) Serial Number: 12B605179-224	Orifice type flow transmitter	+/- 5%	Annually	Last Calibration 02/12/2011 Valid Until 01/12/2012
	HPCE R61380 to K83160 (FQ61782) Serial Number: 0870161133	Magnetic Flow Meter	+/- 1%	Annually	Last Calibration 19/09/2011 Valid Until 18/09/2012
	DBA to F81200 (FQ81115) Serial Number: 0870152709	Magnetic Flow Meter	+/- 1.50%	Annually	Last Calibration 08/03/2011 Valid Until 07/03/2012
	DBA R81100 to K83300 (FQ82351) Serial Number: 91K906367 036	Magnetic Flow Meter	+/- 1%	Annually	Last Calibration 08/03/2011 Valid Until 07/03/2012
	Waste water to R83200 (FQ83401) Serial Number: 26B401923 217	Magnetic Flow Meter	+/- 1%	Annually	Last Calibration 08/03/2011 Valid Until 07/03/2012
Measuring/ Reading/ Recording frequency:	Measured continuously, recorded daily. Aggregated monthly and yearly				
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. 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				

Data / Parameter:	**HNO3_Chemical**
Data 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	31/12/2011	131,929	3,122	128,807
	From	To			
	01/12/2011	31/12/2011	8,926	196	8,730
Data used for:	Baseline and Project Emissions				
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. HNO3_chemical = HNO3_consumption - HNO3_physical				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				

Data / Parameter:	**N2O_/AdOH**				
Data 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:		From	To	N2O_/AdOH Calculated	N2O_/AdOH Applied
	Period Value:	01/12/2011	31/12/2011	0.283	0.270
	Monthly values:	01/12/2011	31/12/2011	0.283	0.270
	P_AdOH Rolling Year (t)		152,518		
	HNO3_Chemical Rolling Year (t)		128,807		
	N2O_/AdOH capped at		0.270		
Data used for:	Baseline and Project Emissions				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Calculated and recorded monthly				

Calculation method (if applicable):	The N2O emission factor is calculated monthly using the rolling year data (AM0021/version 1 equation (4)): N2O_/AdOH = HNO3_chemical / P_AdOH / 63 /2 x 0.96 x 44 The calculated value for this period is above 0.270 and is then capped by the value of KE_N2O, as specified in the PDD table D.2.1.3 and required by the methodology AM0021/version 1 referring to the IPCC Good Practice Guidance.
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30

Data / Parameter:	**Q_N2O**				
Data unit:	kg				
Description:	Quantity of N2O 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:	01/12/2011	31/12/2011	2,771,145	
	Monthly values:	01/12/2011	31/12/2011	2,771,145	
Data used for:	Baseline Emissions				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Calculated and recorded monthly				
Calculation method (if applicable):	Q_N2O = P_AdOH x N2O_/AdOH 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				

Data / Parameter:	**Q_N2O reg**
Data unit:	kg
Description:	Allowed N2O emissions
Measured /Calculated /Default:	Default value
Source of data:	South Korean legislation
Value(s) of monitored parameter:	Not applicable
Data used for:	Baseline Emissions
Monitoring equipment	Not applicable

Measuring/ Reading/ Recording frequency:	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". 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 N2O emissions of the Onsan Adipic plant.

Data / Parameter:	**N2O reg/AdOH**
Data 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
Data used for:	Baseline Emissions
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	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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Data / Parameter:	r_y
Data unit:	%
Description:	Share 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
Data used for:	Baseline Emissions
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	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". 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 N2O emissions of the Onsan Adipic plant.

Data / Parameter:	**P N2O**
Data unit:	€/t
Description:	Market price of N2O
Measured /Calculated /Default:	Estimated
Source of data:	Market Survey (last update September 2011)
Value(s) of monitored parameter:	Zero (0) (there is no N2O market for the N2O produced as by-product of adipic acid in Onsan plant)
Data used for:	Baseline Emissions
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Annual up-date based on permanent market survey
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Not applicable

Data / Parameter:	**Q_Steam_p**				
Data 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:	01/12/2011	31/12/2011	15,327,915	
	Monthly values:	01/12/2011	31/12/2011	15,327,915	
Data used for:	Baseline Emissions				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**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 25/03/2011 Valid Until 24/03/2012
	Boiler feed water flow rate (FIQ58204) Serial Number: 294795/002/01	Vortex flowmeter (Back up for FIQ58213)	+/- 0.3%	Annually	Last Calibration 24/03/2011 Valid Until 23/03/2012

	Boiler continuous purge flow rate (FIQ58303) Serial Number: 91K713049 027	Orifice type flowmeter (Back up for FIQ58213)	+/- 0.6%	Annually	Last Calibration 15/03/2011 Valid Until 14/03/2012
Measuring/ Reading/ Recording frequency:	Measured continuously, recorded daily and aggregated monthly				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				

Data / Parameter:	**E_Steam**
Data 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
Data used for:	Baseline Emissions
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: $E\_Steam = (QNG\_tsteam/1{,}000) * E\_NG_y$ $QNG\_tsteam = \Delta H$ (kcal/t) / (HHV (kcal/Nm3) x η (%)) Where: QNG_tsteam: amount of natural gas required to generate steam (Nm3/t) The HHV data is the yearly average value for the gas supplied by KYUNG DONG City Gas Ltd. The yield η (%) of the boiler is conservatively taken as 97%, while the yield is generally below 90% E_NG_y: yearly average value for the gas supplied by KYUNG DONG City Gas Ltd. (kg CO2/Nm3)

	Year ending on: 30/11/2011				
	HHV Kcal/Nm3	△H kcal/t	η %	QNG_tsteam Nm3/t of steam	E_NG_y kg-CO2/Nm3
	10,404	557,960	97	55.29	2.206
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				

Data / Parameter:	**CO2_Steam_p**				
Data 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:	01/12/2011	31/12/2011	1,870	
	Monthly values:	01/12/2011	31/12/2011	1,870	
Data used for:	Baseline Emissions				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Calculated 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				

Data / Parameter:	**Q_GE**				
Data 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:	01/12/2011	31/12/2011	12,686,494	
	Monthly values:	01/12/2011	31/12/2011	12,686,494	
Data used for:	Project Emissions				

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**Equipment**	**Type**	**Accuracy class**	**Calibration frequency**	**Calibration Information**
	Effluent gas (FIQ58407) Serial Number: GMF-104F(080421-1)	Pitot tube differential pressure flow meter	+/- 3%	Annually	Last Calibration 28/02/2011 Valid Until 27/02/2012
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily, aggregated monthly				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				

Data / Parameter:	**N2O_GE**				
Data 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:	01/12/2011	31/12/2011	11.0	
	Monthly values:	01/12/2011	31/12/2011	11.0	
Data used for:	Project Emissions				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**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 06/09/2011 Valid Until 05/03/2012
	Stack N2O analyzer (AI58418) Serial Number: W01894257	NDIR (Non Dispersive Infrared)	+/- 1 vppm	weekly	Last Calibration 30/12/2011 Valid Until Following week
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily, aggregated monthly				

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

Data / Parameter:	**ND_N2O**			
Data 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:	01/12/2011	31/12/2011	274
	Monthly values:	01/12/2011	31/12/2011	274
Data used for:	Project Emissions			
Monitoring equipment	Not applicable			
Measuring/ Reading/ Recording frequency:	Calculated and recorded daily, aggregated monthly			
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"): ND_N2O = Q_GE * N2O_GE * Specific_gravity_of_N2O The specific_gravity_of_N2O = $44/22.414 \times 10^{-6}$ is used to transform vppm in kg/ Nm3 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			

Data / Parameter:	**Q_NG**
Data 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:	01/12/2011	31/12/2011	914,442	
	Monthly values:	01/12/2011	31/12/2011	914,442	
Data used for:	Project Emissions				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**Equipment**	**Type**	**Accuracy class**	**Calibration frequency**	**Calibration Information**
	Natural Gas burning (FQ91485A) Serial Number: 80067664/2005	Turbine flow meter	+/- 0.3%	Annually	Last Calibration 09/03/2011 Valid Until 08/03/2012
	Natural Gas burning (FQ91485B) (Back up flow meter) Serial Number: 80093966	Turbine flow meter	+/- 0.3%	Annually	Last Calibration 31/05/2011 Valid Until 30/05/2012
Measuring/ Reading/ Recording frequency:	Measured continuous, recorded daily and aggregated monthly				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				

Data / Parameter:	**E_NGy**
Data unit:	kg CO2/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
Data used for:	Project Emissions
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Up-dated 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

Data / Parameter:	**NGC**				
Data unit:	% vol				
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:	**Component**	**Number of C**	**Dec-11**		
	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		
Data used for:	Project Emissions				
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. For this monitoring period, natural gas composition from December 2011 are not yet available, so to be conservative, the NGC of the month of November 2006 was used for December as it gives the highest E_NG value since the beginning of the crediting period (01/09/2006).				

Measuring/ Reading/ Recording frequency:	Recorded monthly
Calculation method (if applicable):	E_NG = 1.965 x (average number of C) 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

Data / Parameter:	**CO2_NG**				
Data 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:	01/12/2011	31/12/2011	2,046	
	Monthly values:	01/12/2011	31/12/2011	2,046	
Data used for:	Project Emissions				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Calculated 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				

Data / Parameter:	**%_on-line**				
Data 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:	01/12/2011	31/12/2011	100.00%	
	Monthly values:	01/12/2011	31/12/2011	100.00%	
Data used for:	Project Emissions				

	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	By-pass valves position detectors (HV57001) Serial Numbers: 603100335	Butterfly type On-off valve	below 1% relative accuracy on %_on-line	Annually	Last Calibration 08/08/2011 Valid Until 07/08/2012
	By-pass valves position detectors (HV57003) Serial Numbers: 603100337	Butterfly type On-off valve	below 1% relative accuracy on %_on-line	Annually	Last Calibration 26/08/2011 Valid Until 25/08/2012
Measuring/ Reading/ Recording frequency:	Measured continuous, recorded daily and aggregated 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. At the end of the month/period (y), %_on-line is calculated as: $\%\_on\text{-}line_y = 1 - (Q\_N2O\_by\text{-}pass_y/(P\_AdOH_y \times N2O\_/AdOH))$				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				

Data / Parameter:	**Q_N2O_by-pass**				
Data unit:	kg				
Description:	N2O 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	
	Period Value:	01/12/2011	31/12/2011	0	
	Monthly values:	01/12/2011	31/12/2011	0	
Data used for:	Project Emissions				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Measured continuously, recorded daily and aggregated monthly				

Calculation method (if applicable):	The quantity of N2O that by-pass the facility is calculated daily (d) following AM0021/version1 page 4 · $Q\_N_2O\_by\text{-}pass_d = Q\_N_2O_d$ x $(1 - \%\_on\text{-}line)_d$ for each day (d) $Q\_N_2O_d = P\_AdOH_d$ x $N_2O\_/AdOH$ 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) · $Q\_N_2O\_by\text{-}pass_d = P\_AdOH_d$ x $N_2O\_/AdOH$ x $(1 - \%\_on\text{-}line)_d$ At the end of the period the quantity of N_2O that by-passed the facility is summed for all days: · $Q\_N_2O\_by\text{-}pass_y = \Sigma\ (Q\_N_2O\_by\text{-}pass_d)$
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30

Data / Parameter:	**Q_Power**				
Data 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:	01/12/2011	31/12/2011	74,682	
	Monthly values:	01/12/2011	31/12/2011	74,682	
Data used for:	Leakage				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**Equipment**	**Type**	**Accuracy class**	**Calibration frequency**	**Calibration Information**
	Electricity meter (LV22WH) Serial Number: 0216021	Incremental Electricity meter	+/- 15 kWh	7 years	Last Calibration 21/10/2008 Valid Until 20/10/2015
Measuring/ Reading/ Recording frequency:	Measured continuously, recorded daily and aggregated monthly				
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				

Data / Parameter:	**E_Power**
Data unit:	kg CO2/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 2010
Value (s) of monitored parameter:	0.708
Data used for:	Leakage
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 2010 rev0.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: (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%), (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 (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

Data / Parameter:	**CO2_Power**				
Data unit:	t CO2e				
Description:	CO2 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:	01/12/2011	31/12/2011	53	
	Monthly values:	01/12/2011	31/12/2011	53	
Data used for:	Leakage				

Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Calculated monthly
Calculation method (if applicable):	Calculated monthly and expressed in tonnes, using Q_Power and E_Power CO2_Power= Q_Power x E_Power
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30

Data / Parameter:	**Q_Steam_c**				
Data 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:	01/12/2011	31/12/2011	107,251	
	Monthly values:	01/12/2011	31/12/2011	107,251	
Data used for:	Leakage				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**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 25/03/2011 Valid Until 24/03/2012
Measuring/ Reading/ Recording frequency:	Measured continuous, recorded daily and aggregated monthly				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30				

Data / Parameter:	**E_Steam_c**
Data unit:	kg CO2/kg of steam
Description:	CO2 intensity for steam consumed in the facility
Measured /Calculated /Default:	Calculated
Source of data:	Excel Workbook based on natural gas and steam data

Value (s) of monitored parameter:	0.139

Data used for:	Leakage
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Calculated and up-dated at each monitoring period
Calculation method (if applicable):	The steam consumed in the facility is supplied by existing boilers on site. 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. The E_Steam_c is obtained from: $E\_Steam\_c = E\_NG_y \times Q\_NG\_tsteam$

Year ending	Q_NG_tsteam Nm3/t of steam	E_NG kg CO2/Nm3	E_Steam_c kg CO2/kg steam
01/12/2011	62.816	2.207	0.139

QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30

Data / Parameter:	**CO2_Steam_c**
Data unit:	t CO2e
Description:	CO2 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:	01/12/2011	31/12/2011	15
Monthly values:	01/12/2011	31/12/2011	15

Data used for:	Leakage
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Calculated monthly
Calculation method (if applicable):	Calculated monthly and expressed in tonnes, using Q_Steam_c and E_Steam_c CO2_Steam_c= Q_Steam_c x E_Steam_c
QA/QC procedures applied:	Data Handling Protocol - RP-Q1-706-30

Data / Parameter:	**NOx**				
Data unit:	**vppm**				
Description:	NO + NO2 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 81.0 and less than 200 for 100% of time	
Data used for:	Compliance with local regulation on NOx				
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of Last Calibration, validity)	**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 30/12/2011 Valid Until 06/01/2012
Measuring/ Reading/ Recording frequency:	Continuous/Daily and monthly According to local government environmental low, 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) Data Handling Protocol - RP-Q1-706-30				

For other additional informations about the equipments cited above consult the Annex 1.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

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 N2O 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. The baseline emissions in this monitoring period are calculated in the table below using the values detailed in section D.2 above:

Parameter	Value	Unit
Q_N2O_y	2,771,145	kg
P_AdOH_y (eligible)	10,263.500	t
N2O_/AdOH	0.270	kg N2O/kg AdOH
Q_N_2O reg	No limit	
N_2O_reg / AdOH	No limit	
r_y	NA	
GWP_N2O (1)	310	kgCO2e/kg N2O
$Q\_Steam\_p_y$	15,327,915	kg of Steam
E_Steam_y	0.122	kg CO2/kg of Steam
BE_y	**860,924**	**tCO2e**

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

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

E.2. Project emissions calculation

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 $CO2\_NG = Q\_NG \times E\_NG$ (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 $\times 10^{-6}$

The project emissions in this monitoring period are calculated in the table below using the values presented in detail in section D:

Parameter	Value	Unit
P_AdOH_y	10,263.500	t
N2O_/AdOH	0.283	kg N2O/kg AdOH
$\%\_on\text{-}line_y$	100.00	%
$Q\_N2O\_by\text{-}pass_y$	0	kg
Q_GE_y	12,686,494	Nm3
$N_2O\_GE_y$	11.0	vppm
Specific gravity of_N2O	1.963	kg/Nm3
ND_ N2O y	274	kg N2O
GWP_N2O (1)	310	kgCO2e/kg N2O
CO2_NGy	2,046	tCO2e
PE_y	**2,131**	tCO2e

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

Q_N2O_by-pass and ND_N2O in kg need to be divided by 1,000 to get PE in t CO2e

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

E.3. Leakage calculation

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):

$L_y = Q\_Power_y \times E\_Power + Q\_steam\_c_y \times E\_steam\_c_y$

The leakage emissions in this monitoring period are calculated in the table below using the values presented in the detail in section D:

Parameter	Value	Unit
Q_Power_y	74,682	kWh
E_Power	0.708	kg CO2/kWh
$Q\_Steam\_ c_y$	107,251	kg
$E\_Steam\_c_y$	0.139	kg CO2/kg of steam
L_y	**68**	tCO2e

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. Emission reductions calculation / table

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:

$$\mathbf{ER_y = BE_y – PE_y – L_y}$$

Thus:

ER_y **= (860,924– 2,131 –68)** tCO2e

ER_y =858,725 tCO2e

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

In the PDD section E the emission reduction is estimated to be 9,147,301 tCO2e. So the PDD-estimated emission reduction relative to the monitoring period of 31 days is 776,894 tCO2e lower than the emission reductions of the current monitoring period.

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
BE_y (tCO_2e)	925,650	860,924
PE_y (tCO_2e)	148,557	2,131
L_y (tCO_2e)	199	68
Emission reductions (tCO_2e)	**776,894**	**858,725**

E.6. Remarks on difference from estimated value

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): 925,650	**Period (tCO2e):** 860,924
Variance	Explanation
-65,086	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. The average daily production was 331.08t/d during this period to meet the market demand. This lower value than the PDD value resulted in a decrease of BE by 65,086 tCO2e
360	Slight impact of the steam production
-64,726	**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): 148,557	**Period (tCO2e):** 2,131
Variance	Explanation
138,621	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). 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.
7,814	A higher destruction rate of the N2O which is in excess of 99.99 % during this period versus 99 % taken conservatively in the PDD.
-8	Difference in the natural gas consumption estimate and actual in the period
146,426	**Total PE variance**

L	
PDD value (tCO2e): 199	**Period (tCO2e):** 68
Variance	Explanation
131	Difference mainly due to the quantity of steam consumed
131	**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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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	08/03/2011	08/08/2011
%_online	By-pass Valves Integrity Check	HV-57003	Annually	Section D.3 of PDD	Rhodia	08/03/2011	26/08/2011
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	28/04/2010	21/04/2011
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	28/04/2010	21/04/2011
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	28/04/2010	21/04/2011
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	30/03/2010	25/03/2011
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	31/03/2010	25/03/2011
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	30/03/2010	24/03/2011
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	30/03/2010	15/03/2011
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	10/03/2011	06/09/2011
N2O_GE	Stack N2O analyzer (extractive infrared)	AI58418	Weekly	Section 7.2 of instruction manual (90002929, 07/2005) from vender	Rhodia	25/11/2011 02/12/2011 09/12/2011 16/12/2011 23/12/2011	30/12/2011
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	17/03/2010	09/03/2011
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	29/09/2010	31/05/2011
Q_GE	Effluent Gas	FIQ-58407	Annually	- National Environmental regulation	Third party	22/03/2010	28/02/2011
Q_Power	Electricity meter	LV22WH	Every 7 years	Table 13 of the Korean law on electricity measurement	Third party	N/A	21/10/2008

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	28/11/2011 05/12/2011 12/12/2011 19/12/2011	26/12/2011
Nitric physical	HPLC	Lab analyzer	Daily	Calibration ferquency by vendor recommendation	Rhodia	Daily	31/12/2011
Nitric Cons	Truck Scale	W-90000	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	11/09/2010	10/09/2011
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	16/09/2010	04/08/2011
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	21/10/2010	17/10/2011
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	16/04/2010	13/04/2011
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	16/04/2010	13/04/2011
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	07/11/2011 02/12/2011	27/12/2011
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	07/11/2011 02/12/2011	27/12/2011
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	30/03/2010	08/03/2011
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	10/03/2010 08/03/2011	19/09/2011
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	12/03/2010	08/03/2011
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	12/03/2010	08/03/2011
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	10/03/2010	08/03/2011
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	13/05/2010	06/05/2011
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	13/05/2010	06/05/2011
P_AdOH	SILO R42500	W-42505	Annually	- Standard rule of calibration & maintenance guide book from Korea association of standards & testing organization (Page:287)	Rhodia	28/03/2011	22/08/2011
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	25/11/2011 02/12/2011 09/12/2011 16/12/2011 23/12/2011	30/12/2011