

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

CONTENTS

- A. General description of the project activity
 - A.1. Brief description of the project activity
 - A.2. Project participants
 - A.3. Location of the project activity
 - A.4. Technical description of the project
 - A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity
 - A.6. Registration date of the project activity
 - A.7. Crediting period of the project activity and related information
 - A.8. Name and responsible person(s)/entity(ies)
- B. Implementation of the project activity
 - B.1. Implementation status of the project activity
 - B.2. Revision of the monitoring plan
 - B.3. Request for deviation applied to this monitoring period
 - B.4. Notification or request of approval of changes
- C. Description of the monitoring system
- D. Data and parameters monitored
 - D.1. Data and parameters used to calculate baseline emissions
 - D.2. Data and parameters used to calculate project emissions
 - D.3. Data and parameters used to calculate leakage emissions
 - D.4. Other relevant data and parameters
- E. Emission reductions calculation
 - E.1. Baseline emissions calculation
 - E.2. Project emissions calculation
 - E.3. Leakage calculation
 - E.4. Emission reductions calculation
 - E.5. Comparison of actual emission reductions with estimates in the registered CDM-PDD
 - E.6. Remarks on difference from estimated value

MONITORING REPORT
VERSION 1.1 – 02/08/2011
“N₂O EMISSION REDUCTION IN PAULÍNIA, SP, BRAZIL”
UNFCCC 0116
MONITORING REPORT # 47 (from 15/06/2011 to 31/07/2011)

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 Brazil.

In this project, the 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 factory site of Paulinia Rhodia Poliamida e Especialidades Ltda. during October and November 2006 and the destruction of N₂O was started in 19/11/2006. 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 the monitoring period #47 the emission reductions achieved are: 947,301 tCO₂e

A.2. Project Participants

Rhodia Energy Brazil Ltda
Rhodia Energy SAS
Rhodia Energy GHG SAS
Société Générale
ORBEO
NATIXIS
NATIXIS Environnement & Infrastructures
Noble Carbon Credits Limited
Rhodia Japan Ltd

A.3. Location of the project activity:

The N₂O decomposition unit is located in the Rhodia site at the municipality of Paulínia, state of São Paulo, Brazil.

GPS coordinates: -22.753611 -47.158889

A.4. Technical description of the project

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

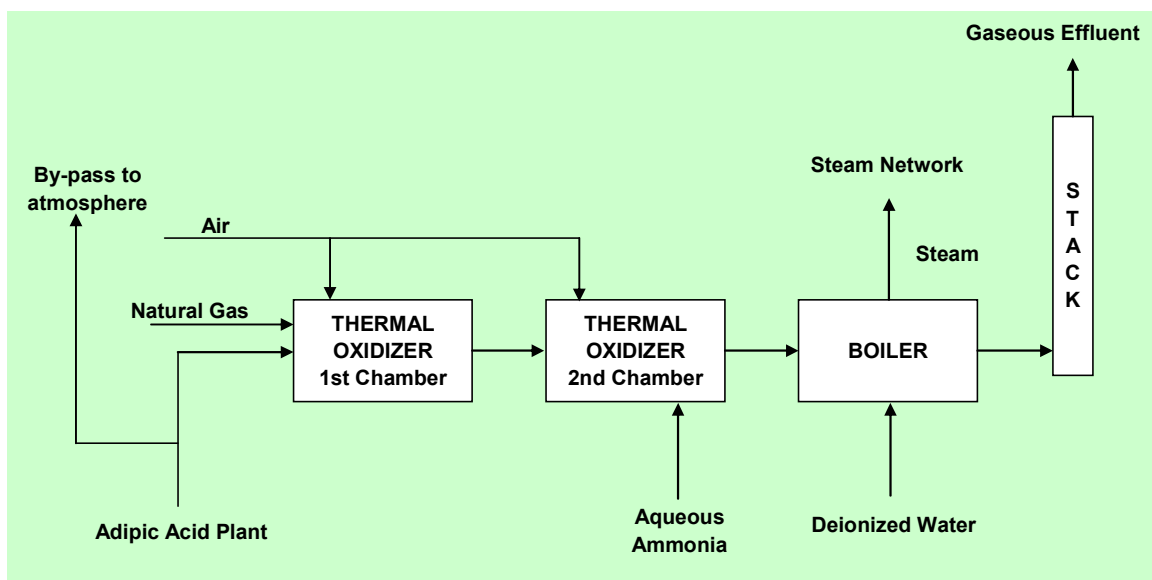
Natural gas is fed with the off gas from the adipic acid production containing N₂O and a controlled amount of air in a reduction chamber, where it burns (oxidizes) to carbon dioxide (CO₂) and water vapour. N₂O is used as an oxidizer. Being oxygen deficient, the oxidation is not complete and carbon monoxide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



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. Aqueous ammonia is 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 superheated 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 Tools:

- 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 (PDD):

N₂O Emission Reduction in Paulinia, SP, Brazil. Version number of the document: 4

Date: 12/10/2005

Related EB guidance:

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 25/12/2005.

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 19/11/2006 to 18/11/2013 (renewable).

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

Philippe Kehren, Rhodia Energy GHG
Tour La Pacific. 11, cours Valmy La Defense 7
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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 19/11/2006.

During this monitoring period # 47 no particular event occurred that could impact the applicability of the methodology.

In this period, the N2O unit was disconnected as planned on 28/06/2011 at 13:19 and the reconnection was performed on 29/06/2011 at 21:53 (so, 30/06/2011) after the AA plant start-up (start-up at 20:04). Therefore, the % online was lower than 100%.

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 monitoring plan 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.

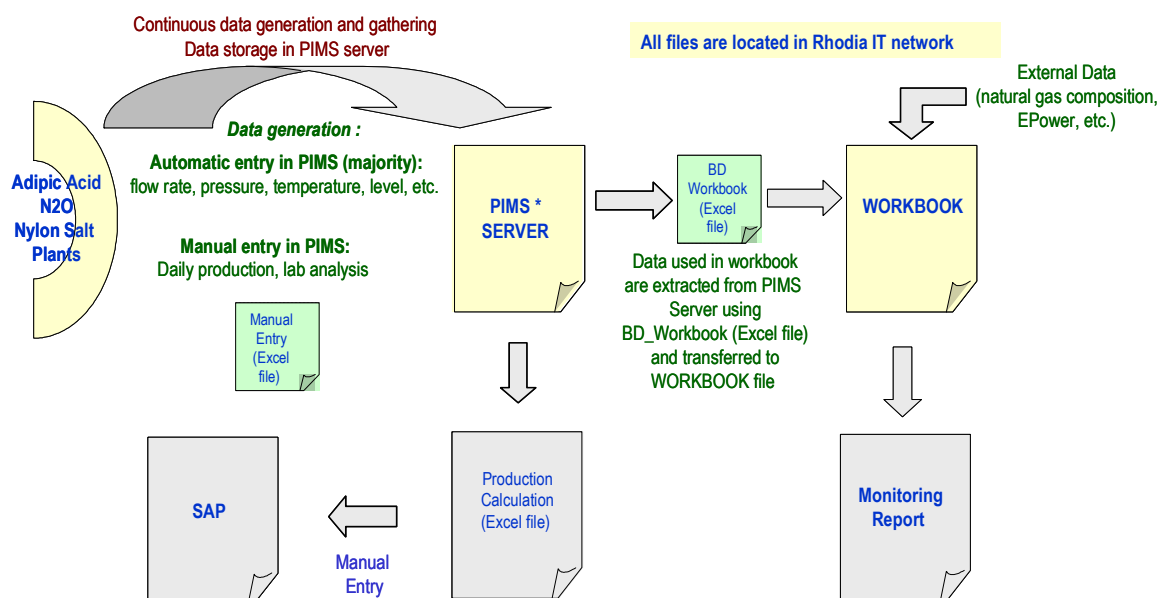
(b) Packaged dry adipic acid production, slurry production and laboratory analysis used for daily production calculation are obtained from dedicated excel files and are manually entered into the PIMS database every working day by the authorized staff.

The calculation of the daily production of adipic acid and of the nitric acid consumption is carried out using the data stored in PIMS. The results obtained are transferred to the SAP (System, Applications and products for Data Processing) system which is the official system used by Rhodia for production management and accounting purposes.

The emission reductions calculations are performed in a dedicated excel Workbook. Data are periodically extracted from PIMS using an excel tool and transferred to the Workbook. Some external data are input 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 System (Supplier: OSI)

Figure 2. Data Flow Diagram

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 ₂ e per tN ₂ O
Description:	Global Warming Potential of N ₂ O
Source of data used	Kyoto Protocol (Decision 2/CP.3) and IPCC
Value(s) :	310
Data used for:	Baseline and Project Emissions
Additional comment:	

Data / Parameter:	KE_N₂O
Data unit:	tN ₂ O per tonne of adipic acid produced
Description:	Lowest emission factor
Source of data used	IPCC Good Practice Guidance
Value(s) :	0.27
Data used for:	Baseline Emissions
Additional comment:	Cap value for N ₂ O /AdOH emission factor

Data / Parameter:	ΔH
Data unit:	kJ/t of steam
Description:	Enthalpy of super heated steam at a pressure level of 40 Bar
Source of data used	Monitoring Plan Section B.3
Value(s) :	2,624,000
Data used for:	Baseline Emissions
Additional comment:	Not Applicable

Data / Parameter:	η
Data unit:	%
Description:	Operational efficiency of the natural gas steam boiler
Source of data used	Monitoring Plan Section B.3
Value(s) :	97
Data used for:	Baseline Emissions
Additional comment:	Not Applicable

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 9

D.2 Data and parameters monitored					
Data / Parameter:	P_AdOH				
Data unit:	tonnes				
Description:	Amount of adipic acid production				
Measured /Calculated /Default:	Measured				
	Several instruments are used				
Source of data:	DCS data and Production log sheets				
Value(s) of monitored parameter:		From	To	P_AdOH Produced	P_AdOH Eligible*
	Period Value:	15/06/2011	31/07/2011	11,332.756	11,332.756
	Monthly Values:	15/06/2011	30/06/2011	3,638.470	3,638.470
		01/07/2011	31/07/2011	7,694.286	7,694.286
	P_AdOH Current year		64,329		
	P_AdOH Annual Cap:		87,308		
	* Adipic acid production for baseline emission calculation, after cap application				
Data used for:	Baseline and Project Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity):	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Packaging machine (Z-3110) Serial Number 6046	Load cell 50 kg	+/- 0.02 kg	1/month	Last calibration
					07/07/2011
					Valid until
					06/08/2011
	Weigh scale (G-2532) Serial Number 10869A	Load cell 100 kg	+/- 0.02 kg	1/month	Last calibration
					07/07/2011
					Valid until
					06/08/2011
	Weigh scale (Z-3120) Serial Number 104BA4	Load cell 1,000 kg	+/- 0.5 kg	4/year	Last calibration
					07/07/2011
					Valid until
					06/10/2011
	Truck weigh scale (BB-0090) Serial Number 7597	Load cell 80,000 kg	+/- 15 kg	2/year	Last calibration
					08/05/2011
					Valid until
					07/11/2011
	Truck weigh scale (BB-0335) Serial Number 28812	Load cell 80,000 kg	+/- 15 kg	2/year	Last calibration
					15/05/2011
					Valid until
					14/11/2011

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 10

	Level tank R-5300 (LT-4500) Serial Number B11781	Pressure bubbling level – differential. Pressure	+/- 0.25 %	1/year	Last calibration
					14/07/2011
					Valid until
					13/07/2012
	Level tank R-5310 (LT-4509) Serial Number 195802-4	Pressure bubbling level – differential Pressure	+/- 0.075 %	1/year	Last calibration
					03/03/2011
					Valid until
					02/03/2012
	Lab equipment RFM-340 Serial Number BT9934	Refractometer	+/- 0.02 %	1/week (Rhodia verification)	Last calibration
					28/07/2011
					Valid until
					following week
				2/year (Third party calibration)	Last calibration
					09/03/2011
					Valid until
					08/09/2011
Level tank RE-2422 (LI-2422) Serial Number 6/341921001	Radar level device	+/- 0.3 %	1/year	Last calibration	
				10/09/2010	
				Valid until	
				09/09/2011	
Measuring/ Reading/ Recording frequency:	Measured and recorded daily/Aggregated monthly and yearly				

Calculation method (if applicable):	<p>The daily adipic acid production is the sum of the dry adipic acid + slurry adipic acid used in the Nylon salt production + the in-process inventory variation. This calculation is automatically performed in the PIMS every day at 5:00 p.m. From the PIMS data bank the daily production is automatically extracted using an Excel file and is manually input into the SAP.</p> <p>The dry adipic acid is the product packed determined by weigh scales.</p> <p>The slurry adipic acid cannot be measured directly. In accordance with the EB guidance issued in the 45th EB meeting the production of slurry adipic acid is obtained by multiplying the Nylon Salt produced by the ratio 0.55748 between adipic acid and Nylon Salt, consistent with the steady composition of the Nylon Salt (reflected by a constant and precise value of the pH).</p> <p>The cumulated production of Adipic acid over the current year (starting last November 19th and ending with the last day of this period) is below the cap value of 87,308 tonnes as stated by the EB 47th meeting decision.</p> <p>The value of 87,308 tonnes was calculated in the Validation Report as the maximum daily production in 2004 x 365 x the operational rate (260 t/day x 365 x 92%) which is consistent with the clarification of EB 48th meeting report §24 of 17/07/2009.</p> <p>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 (November 19th); the current period ends on November 18th, which is the end date of the year of the crediting period.</p>
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007

Data / Parameter:	Nitric acid consumption (HNO₃_consumption)		
Data unit:	tonnes		
Description:	Nitric acid consumption for the calculation of HNO ₃ chemical		
Measured /Calculated /Default:	Measured Several instruments are used		
Source of data	DCS data and Production log sheets		
Value(s) of monitored parameter:			HNO ₃ _consumption
	Rolling year	31/07/2011	80,012
	From	To	
	15/06/2011	30/06/2011	3,201
	01/07/2011	31/07/2011	6,592

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 12

Data used for:	Baseline and Project Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity):	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Nitric acid mass flow meter (FQ-2179) Serial number 12000364 3748161	Mass flow meter	+/- 0.1 %	2 years	Last calibration
					21/07/2010
					Valid until
					20/07/2012
	Fresh nitric acid concentration analyzer (AI-2179) Serial number 12000364 3748161	Device integrated to mass flow meter FQ-2179	+/- 0.5 %	2 years	Last calibration
					03/08/2010
					Valid until
					02/08/2012
	Level of nitric acid storage tank F-1769 (LI-3350) Serial number 91F345787-611	Air bubble gauge (back-up from FQ-2179)	+/- 0.065 %	1/year	Last calibration
					18/07/2011
					Valid until
					17/07/2012
	Flow meter of fresh nitric acid to storage (FQ-3318) Serial number 07FM-C203 (Flow meter) 07TM-C203 (Transmitter)	Magnetic Flow Meter (back-up from FQ-2179)	+/- 1 %	1/year	Last calibration
					06/07/2011
					Valid until
05/07/2012					
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/Aggregated monthly and yearly				
Calculation method (if applicable):	The nitric acid consumption is based upon the quantity of nitric acid fed to the adipic acid plant during given period and the holding volume and concentration of the process storage tanks (mother acid tank, Oxidation acid tank, Concentration acid tank), which is obtained directly from the DCS and stored at PIMS data base.				
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007				

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 13

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 HNO ₃ chemical and the N ₂ O emission factor N ₂ O_AdOH				
Measured /Calculated /Default:	Measured Several instruments are used				
Source of data	DCS data and lab data				
Value(s) of monitored parameter:			HNO ₃ _physical		
	Rolling year	31/07/2011	1,546		
	From	To			
	15/06/2011	30/06/2011	70		
	01/07/2011	31/07/2011	133		
Data used for:	Baseline and Project Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity):	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Flow meter of effluent to biological WWT (FQ-2973) Serial number 91F321071-608	Orifice plate flow - Differential pressure	+/- 0.60 %	1/year	Last calibration
					21/07/2011
					Valid until
					20/07/2012
	Flow meter of effluent to neutralization (FQ-2974) Serial Number 91F321074-608	Orifice plate flow - Differential pressure	+/- 0.85 %	1/year	Last calibration
					21/07/2011
					Valid until
					20/07/2012
	Waste gas flow meter (FQ-3450) Serial Number 91G511075-720	Orifice plate flow - Multivariable transmitter	+/- 1.6 %	1/year	Last calibration
					08/12/2010
					Valid until
					07/12/2011
	Waste gas flow meter (FIC-3401) Serial Number JEJAAR772-625	Pitot tube flow meter - Differential pressure (back-up from FQ-3450)	+/- 1.45 %	1/year	Last calibration
					18/10/2010
					Valid until
17/10/2011					

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 14

	Nitric analyzer on effluent to neutralization (AI-2974) Serial Number 45201	pHmeter	+/- 0.05 %	2/month	Last calibration
					28/07/2011
					Valid until
					Following 15 days
	Nitric analyzer on effluent to neutralization (AI-2974B) Serial number 39237	pHmeter (back-up from AI-2974)	+/- 0.07 %	2/month	Last calibration
					21/07/2011
					Valid until
					Following 15 days
	NOx Analyzer (AI-2195AB) Serial Number 400561459533	Gas Analyzer - infrared and ultraviolet NOx measurement Sum of AI-2195A (NO) and AI-2195B (NO ₂)	+/- <1 %	1/week	Last calibration
					28/07/2011
					Valid until
					Following week
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/Aggregated monthly and yearly				
Calculation method (if applicable):	Physical losses (HNO ₃ _physical) are calculated as the sum of the losses of nitric acid or its derivatives in the aqueous wastes, the off gases, the adipic acid product (impurity) and the by-products				
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007				

Data / Parameter:	HNO₃_Chemical				
Data unit:	tonnes				
Description:	Chemical consumption of Nitric acid required for the calculation of the N ₂ O emission factor N ₂ O_AdoH				
Measured /Calculated /Default:	Calculated				
Source of data	Excel Workbook based on HNO ₃ _consumption and HNO ₃ _physical				
Value(s) of monitored parameter:			HNO ₃ _consumption	HNO ₃ _physical	HNO ₃ _chemical
	Rolling year	31/07/2011	80,012	1,546	78,466
	From	To			
	15/06/2011	30/06/2011	3,201	70	3,131
	01/07/2011	31/07/2011	6,592	133	6,459

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 15

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 (HNO ₃ _chemical), the physical losses are deducted from the nitric acid consumption. HNO ₃ _chemical = HNO ₃ _consumption - HNO ₃ _physical
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007

Data / Parameter:	N ₂ O_/AdOH				
Data unit:	t N ₂ O/t adipic acid				
Description:	Actual N ₂ O emission factor for adipic acid production				
Measured /Calculated /Default:	Calculated				
Source of data:	Excel Worbook based on HNO ₃ chemical and P_AdOH				
Value(s) of monitored parameter:		From	To	N ₂ O_/AdOH Calculated (Actual)	N ₂ O_/AdOH Applied
	Period Value:	15/06/2011	31/07/2011	0.287	0.270
	Monthly Values:	15/06/2011	30/06/2011	0.288	0.270
		01/07/2011	31/07/2011	0.287	0.270
	P_AdOH Rolling Year (t)		91,704		
	HNO ₃ _Chemical Rolling Year (t)		78,466		
	N ₂ O_/AdOH capped at		0.270		
Data used for:	Baseline Emissions				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Recorded monthly and yearly				

Calculation method (if applicable):	The N ₂ O emission factor is calculated monthly using the rolling year data (AM0021/version 1 equation (4)): $N_2O_AdOH = HNO_3_chemical / P_AdOH / 63 / 2 \times 0.96 \times 44$ The calculated value for this period is above 0.270 and is then capped by the value of KE_N ₂ O = 0.27, as specified in the PDD table D.2.1.3 and required by the methodology AM0021/version 1 (page 4).
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007

Data / Parameter:	Q_N₂O			
Data unit:	kg			
Description:	Quantity of N ₂ O produced			
Measured /Calculated /Default:	Calculated value			
Source of data:	Excel Workbook based on P_AdOH and N ₂ O_/AdOH data			
Value(s) of monitored parameter:		From	To	Q_N ₂ O
	Period Value:	15/06/2011	31/07/2011	3,059,843
	Monthly Values:	15/06/2011	30/06/2011	982,386
		01/07/2011	31/07/2011	2,077,457
Data used for:	Baseline Emissions			
Monitoring equipment	Not applicable			
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Recorded monthly			
Calculation method (if applicable):	$Q_N_2O = P_AdOH \times N_2O_/AdOH$ Only the adipic acid production after cap application is used to determine the baseline emission			
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007			

Data / Parameter:	Q_N₂O reg
Data unit:	kg
Description:	Allowed N ₂ O emission
Measured /Calculated /Default:	Default value
Source of data:	Brazilian 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 Brazilian legislation about N ₂ O emissions that could affect the project Emission Reduction through the parameters N ₂ O _{reg} / AdOH, Q _{N₂O} reg, or ry as part of the ISO 14000 requirements. Experts on environmental matters from Rhodia Brazil follow closely any project or change in the laws and regulations. They participate in external organizations such as ABIQUIM (Brazilian Association of Chemical Industries) and CETESB (local environmental agency).

Data / Parameter:	N₂O reg/AdOH
Data unit:	kg/kg
Description:	kg of allowed N ₂ O emission / kg of adipic acid produced
Measured /Calculated /Default:	Default value
Source of data:	Brazilian 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 Brazilian legislation about N ₂ O emissions that could affect the project Emission Reduction through the parameters N ₂ O _{reg} / AdOH, Q _{N₂O} reg, or ry as part of the ISO 14000 requirements. Experts on environmental matters from Rhodia Brazil follow closely any project or change in the laws and regulations. They participate in external organizations such as ABIQUIM (Brazilian Association of Chemical Industries) and CETESB (local environmental agency).
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Data / Parameter:	r_y
Data unit:	%
Description:	Share of N ₂ O emissions required to be destroyed
Measured /Calculated /Default:	Default value
Source of data:	Brazilian 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 Brazilian legislation about N ₂ O emissions that could affect the project Emission Reduction through the parameters N ₂ O _{reg} / AdOH, Q _{N₂O} reg, or ry as part of the ISO 14000 requirements. Experts on environmental matters from Rhodia Brazil follow closely any project or change in the laws and regulations. They participate in external organizations such as ABIQUIM (Brazilian Association of Chemical Industries) and CETESB (local environmental agency).

Data / Parameter:	P N₂O
Data unit:	€/t
Description:	Market price of N ₂ O
Measured /Calculated /Default:	Estimated
Source of data:	Market Survey (last up-date September 2010)

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 19

Value(s) of monitored parameter:	Zero (0) (there is no N ₂ O market for the N ₂ O produced as by-product of adipic acid in Paulinia)
Data used for:	Baseline Emissions
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Annual update 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 of steam				
Description:	Amount of steam produced by the decomposition process				
Measured /Calculated /Default:	Measured				
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS.				
Value(s) of monitored parameter:		From	To	Q_Steam_p	
	Period Value:	15/06/2011	31/07/2011	12,683,600	
	Monthly Values:	15/06/2011	30/06/2011	3,965,500	
		01/07/2011	31/07/2011	8,718,100	
Data used for:	Baseline Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity):	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	40 bar steam flow meter (FQ-3470) Serial number 7072986	Orifice plate flow – Multi variable transmitter	+/- 1.2 %	1/year	Last calibration
					05/10/2010
					Valid until
					04/10/2011
	Boiler feed water flow meter (FQ-3410) Serial number 91F348990612	Orifice plate flow - Differential pressure (back-up from FQ-3470)	+/- 0.65 %	1/year	Last calibration
					04/10/2010
					Valid until
					03/10/2011

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 20

Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/Aggregated monthly
Calculation method (if applicable):	Not applicable
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007

Data / Parameter:	E_Steam
Data unit:	kg CO ₂ /kg of steam
Description:	CO ₂ emission factor of steam produced by facility
Measured /Calculated /Default:	Calculated
Source of data:	Excel Workbook based on QNG_tsteam and E_NG
Value(s) of monitored parameter:	0.145
Data used for:	Baseline Emissions
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity):	Not applicable
Measuring/ Reading/ Recording frequency:	Measuring not applicable/ Updated for each monitoring period

Calculation method (if applicable):	<p>The rolling year value of E_Steam is calculated with the data available for the 12 months prior to the beginning of the period in order to assure to have the data. The emission factor is obtained by the formula below:</p> $E_Steam = (QNG_tsteam/1,000) * E_NGy$ $QNG_steam = \Delta H \text{ (kJ/t)} / (LHV \text{ (kJ/Nm}^3\text{)} \times \eta \text{ (\%)})$ <p>Where:</p> <p>QNG_steam: amount of natural gas required to generate steam (Nm³/t)</p> <p>The LHV data is the yearly average value for the gas supplied by COMGAS.</p> <p>The yield η (%) of the boiler is conservatively taken as 97%, while the yield is generally below 90%</p> <p>E_NGy: yearly average value for the gas supplied by COMGAS (kg CO₂/Nm³)</p> <p>Year Ending on: 01/06/2011</p>				
	LHV kJ/Nm ³	ΔH kJ/t	η %	QNG_tsteam Nm ³ /t of steam	E_NGy kg-CO ₂ /Nm ³
	38,552	2,624,000	97	66.02	2.197
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007				

Data / Parameter:	CO₂_Steam_p				
Data unit:	t CO ₂ e				
Description:	CO ₂ Emissions from Steam Production				
Measured /Calculated /Default:	Calculated				
Source of data:	Excel Workbook based on Q_Steam_p and E_Steam data				
Value(s) of monitored parameter:		From	To	CO ₂ _Steam_p	
	Period Value:	15/06/2011	31/07/2011	1,838	
	Monthly Values:	15/06/2011	30/06/2011	574	
		01/07/2011	31/07/2011	1,264	
Data used for:	Baseline Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity):	Not applicable				
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Calculated monthly				

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 22

Calculation method (if applicable):	Calculated monthly and expressed in tonnes, using Q_Steam_p and E_Steam $CO2_Steam_p = Q_Steam_p \times E_Steam$
QA/QC procedures applied:	Data Handling Protocol - ISAL-ADOH-QA-007

Data / Parameter:	Q_GE				
Data unit:	Nm ³				
Description:	Volume of effluent gas leaving the stack				
Measured /Calculated /Default:	Measured				
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS				
Value (s) of monitored parameter:		From	To	Q_GE	
	Period Value:	15/06/2011	31/07/2011	15,119,074	
	Monthly Values:	15/06/2011	30/06/2011	5,903,102	
		01/07/2011	31/07/2011	9,215,972	
Data used for:	Project Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity):	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Gas flow meter (FQ-3490) Serial number 7072985	Annubar gas flow meter-Multivariable transmitter on wet basis	+/- 2.5 %	1/year	Last calibration
					08/10/2010
					Valid until
					07/10/2011
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/Aggregated monthly				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	N₂O_GE
Data unit:	vppm
Description:	Concentration of N ₂ O in the effluent gas
Measured /Calculated /Default:	Measured
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 23

Value (s) of monitored parameter:		From	To	N ₂ O_GE	
	Period Value:	15/06/2011	31/07/2011	11.3	
	Monthly Values:	15/06/2011	30/06/2011	10.7	
		01/07/2011	31/07/2011	11.7	
Data used for:	Project Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity):	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	N ₂ O analyzer (AI-3490B) Serial number 17007/17008	Gas analyzer, type in-situ and laser diode on wet basis	+/- 5 % of reading	2/year	Last calibration
					06/04/2011
					Valid until
					05/10/2011
	N ₂ O analyzer (AI-3490G) Serial number 450561464363	Back-up Analyzer Gas analyzer, type extractive and infrared	+/- <1.0 %	1/week	Last calibration
					28/07/2011
					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 instantaneous concentration values measured every 10 sec: N ₂ O_GE = Σ (Q_GE x N ₂ O_GE) / Q_GE				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	ND_N₂O				
Data unit:	kg				
Description:	Quantity of N ₂ O in the effluent gas leaving the stack				
Measured /Calculated /Default:	Calculated				
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS				
Value (s) of monitored parameter:		From	To	ND_N ₂ O	
	Period Value:	15/06/2011	31/07/2011	336	
	Monthly Values:	15/06/2011	30/06/2011	124	
		01/07/2011	31/07/2011	212	
Data used for:	Project Emissions				

Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity)	Not applicable
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/Aggregated monthly
Calculation method (if applicable):	<p>The daily value of non destroyed N₂O (N₂O_ND) is calculated on-line in the DCS by integrating the product of the instantaneous concentration of N₂O by the flow rate of the gaseous effluent, both measured on a wet basis (Method C of EB61 – “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”) :</p> $ND_N_2O = Q_GE \times N_2O_GE \times Specific_gravity_of_N_2O$ <p>The specific gravity of N₂O = 44/22.414 x 10⁻⁶ is used to transform vppm in kg/Nm³</p> <p>When the instant value indicated by AI-3490B is lower than 5 vppm (detection limit), the value of 5 vppm is used in the equation above.</p>
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007

Data / Parameter:	Q_NG				
Data unit:	Nm ³				
Description:	Amount of natural gas used by the decomposition process				
Measured /Calculated /Default:	Measured				
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS.				
Value (s) of monitored parameter:		From	To	Q_NG	
	Period Value:	15/06/2011	31/07/2011	975,880	
	Monthly Values:	15/06/2011	30/06/2011	306,680	
		01/07/2011	31/07/2011	669,200	
Data used for:	Project Emissions				

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 25

Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity)	Equipment	Type	Accuracy class	Calibration frequency	Date of last calibration
	Gas flow meter (FQ-3408) Serial number IB-2298	Gas flow meter	+/- 0.5 %	2 years	Last calibration
					19/03/2010
					Valid until
					18/03/2012
	Gas flow meter (FQ-3460) (back-up from FQ-3408) Serial number CG3425026 K4258702,01	Gas flow meter	+/- 0.5 %	2 years	Last calibration
					03/03/2010
					Valid until
02/03/2012					
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/Aggregated monthly				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	E_NGy
Data unit:	kg CO ₂ /Nm ³
Description:	Emissions coefficient for natural gas combustion
Measured /Calculated /Default:	Calculated
Source of data:	Excel Workbook based on NGC
Value (s) of monitored parameter:	2.197
Data used for:	Project Emissions
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity)	Not applicable

Measuring/ Reading/ Recording frequency:	Measuring not applicable/Updated each 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 CO ₂ 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 Nm ³ over the same 12 months period. The CO ₂ 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 ISAL-ADOH-QA-007

Data / Parameter:	NGC				
Data unit:	% vol				
Description:	Natural gas composition required for the calculation of E_NG				
Measured /Calculated /Default:	Measured				
Source of data:	Natural gas supplier COMGAS				
Value (s) of monitored parameter:	Component	Number of C	Jun-11	Jul-11	
	CH ₄ (Methane)	1	89.13	88.30	
	C ₂ H ₆ (Ethane)	2	5.89	6.35	
	C ₃ H ₈ (Propane)	3	1.82	1.99	
	I-C ₄ H ₁₀ (i-Isobutane)	4	0.28	0.29	
	N-C ₄ H ₁₀ (n-Butane)	4	0.40	0.42	
	C ₅ H ₁₂ (i-Pentane)	5	0.12	0.12	
	C ₅ H ₁₂ (n-Pentane)	5	0.09	0.08	
	C ₆ H ₁₄ (Hexane)	6	0.08	0.10	
	N ₂ (Nitrogen)	0	0.64	0.76	
	CO ₂ (Carbon dioxide)	1	1.55	1.58	
	Average number of C		1.12	1.13	

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 27

	E_NG_m (kg CO₂/Nm³)		2.204	2.222	
Data used for:	Project Emissions				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Recorded monthly				
Calculation method (if applicable):	<p>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 = Σ (number of C in each mole) x (volume ratio). The CO₂ specific gravity in normal conditions is 1.965 kg/Nm³. $E_NG = 1.965 \times (\text{average number of C})$</p> <p>For this monitoring period, natural gas composition from July 2011 is not yet available, so to be conservative, the NGC of the month of August 2008 was used for July as it gives the highest E_NG value since the beginning of the crediting period (19/11/2006).</p>				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	CO ₂ _NG				
Data unit:	t CO ₂				
Description:	CO ₂ Emissions for Natural Gas				
Measured /Calculated /Default:	Calculated				
Source of data:	Excel Workbook calculated from Q_NG and E_NG				
Value (s) of monitored parameter:		From	To	CO ₂ _NG	
	Period Value:	15/06/2011	31/07/2011	2,163	
	Monthly values:	15/06/2011	30/06/2011	676	
		01/07/2011	31/07/2011	1,487	
Data used for:	Project Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity)	Not applicable				
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Calculated monthly				

Calculation method (if applicable):	CO ₂ _NG is calculated monthly and expressed in tonnes using the monthly values of Q_NG and E_NG $\text{CO}_2_NG_m = Q_NG_m \times E_NG_m$ The value of the period is the sum of the monthly values of the period
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007

Data / Parameter:	%_on-line				
Data unit:	% of production time				
Description:	% of production time the position switch on the by-pass valve is closed				
Measured /Calculated /Default:	Measured				
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS.				
Value (s) of monitored parameter:		From	To	%_on-line	
	Period Value:	15/06/2011	31/07/2011	99.928	
	Monthly Values:	15/06/2011	30/06/2011	99.775	
		01/07/2011	31/07/2011	100.000	
Data used for:	Project Emissions				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity)	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	By-pass valve (HV-3402) Serial number not applicable	Butterfly valve	Not applicable	1/year	Last calibration
					02/03/2011
					Valid until
					01/03/2012
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/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 N ₂ O destruction facility and the time of production. At the end of the month/period (y), %_on-line is calculated as: %_on-line _y = 1 - (Q_N ₂ O_by-pass _y /(P_AdOH _y x N ₂ O_/AdOH _y) where N ₂ O_/AdOH _y is the actual value of the month/period				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	Q_N₂O_by-pass
Data unit:	kg
Description:	N ₂ O by passing the decomposition facility

Measured /Calculated /Default:	Calculated				
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS.				
Value (s) of monitored parameter:		From	To	Q_N ₂ O_bypass	N ₂ O_/AdOH Calculated (Actual)
	Period Value:	15/06/2011	31/07/2011	2,351	0.287
	Monthly Values:	15/06/2011	30/06/2011	2,351	0.288
		01/07/2011	31/07/2011	0	0.287
Data used for:	Project Emissions				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Calculated and recorded daily/Aggregated monthly				
Calculation method (if applicable):	<p>The quantity of N₂O that by-pass the facility is calculated following AM0021/version1:</p> <p>· $Q_{N_2O_by-pass_d} = Q_{N_2O_d} \times (1 - \%_{on-line})$ for each day (d)</p> <p>$Q_{N_2O_d} = P_{AdOH_d} \times N_2O_ /AdOH$ where N₂O_/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).</p> <p>· $Q_{N_2O_by-pass_d} = P_{AdOH_d} \times N_2O_ /AdOH \times (1 - \%_{on-line})_d$</p> <p>At the end of the period the quantity of N₂O that by-passed the facility is summed for all days:</p> <p>· $Q_{N_2O_by-pass_y} = \sum (Q_{N_2O_by-pass_d})$</p>				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	Q_Power				
Data unit:	kWh				
Description:	Electric consumption of the decomposition facility				
Measured /Calculated /Default:	Measured				
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS.				
Value (s) of monitored parameter:		From	To	Q_Power	
	Period Value:	15/06/2011	31/07/2011	71,789.4	
	Monthly Values:	15/06/2011	30/06/2011	26,038.7	
		01/07/2011	31/07/2011	45,750.7	

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 30

Data used for:	Leakage				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity)	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	Electricity meter (JI-3461)	Electricity meter	+/- 0.20 %	2 years	Last calibration
	Serial number				27/07/2010
	40072320-4				Valid until
					26/07/2012
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/Aggregated monthly				
Calculation method (if applicable):	The daily values are automatically generated in the DCS, the monthly values are obtained in the workbook by the sum of the daily values				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	E_Power
Data unit:	kg CO ₂ /kWh
Description:	CO ₂ intensity for electric generation
Measured /Calculated /Default:	Calculated
Source of data:	Excel Workbook based on the data provided by Department of Utilities from Paulínia Site, considering the two sources of data obtained with: 1. ONS (Operador Nacional do Sistema Elétrico) http://www.ons.com.br/biblioteca_virtual/publicacoes_operacao_sin.aspx 2. Brazilian Ministry of Mines and Energy (MME) http://www.mme.gov.br/mme/menu/todas_publicacoes.html
Value (s) of monitored parameter:	1.084
Data used for:	Leakage
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Calculated and recorded yearly

Calculation method (if applicable):	The E_Power was done using the latest available data from 2009. It is calculated according to the PDD monitoring plan based on ACM0002 version 2. E_Power is calculated by taking into account only the emission factors of the fossil-fuel electricity generation (simple OM). As explained in the PDD Monitoring Plan, ONS still does not supply the plant-specific data required for BM (build margin) calculation. This is a very conservative approach since only around 3% of the total electricity supplied to the grid is generated using fossil fuels in 2009 (97% of Hydro and Nuclear). The detailed calculation is available in the Excel file “Workbook ER Paulinia” of this period (in the worksheet “E_Power”) which is a confidential document communicated to the DOE and to the CDM Executive Board.
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007

Data / Parameter:	CO ₂ _Power				
Data unit:	t CO ₂				
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	CO ₂ _Power	
	Period Value:	15/06/2011	31/07/2011	79	
	Monthly Values:	15/06/2011	30/06/2011	29	
		01/07/2011	31/07/2011	50	
Data used for:	Leakage				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Calculated monthly				
Calculation method (if applicable):	Calculated monthly and expressed in tonnes, using Q_Power and E_Power CO ₂ _Power= Q_Power x E_Power				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	Q_Steam_c
Data unit:	kg
Description:	Amount of steam consumed by the decomposition facility
Measured /Calculated /Default:	Measured

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 32

Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS.				
Value (s) of monitored parameter:		From	To	Q_Steam_c	
	Period Value:	15/06/2011	31/07/2011	43,700	
	Monthly Values:	15/06/2011	30/06/2011	15,200	
		01/07/2011	31/07/2011	28,500	
Data used for:	Leakage				
Monitoring equipment (type, accuracy class, calibration frequency, date of last calibration, validity)	Equipment	Type	Accuracy class	Calibration frequency	Calibration Information
	6,5 bar steam flow meter (FQ-3409)	Orifice plate flow - Multivariable transmitter	+/- 1.25 %	1/year	Last calibration
	Serial number				05/01/2011
	6270424				Valid until
					04/01/2012
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily/Aggregated monthly				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	E_Steam_c
Data unit:	kg CO ₂ /kg of steam
Description:	CO ₂ intensity for steam consumed in the facility
Measured /Calculated /Default:	Calculated
Source of data:	Excel workbook based on the E_Steam_c_NG, %GEN_NG, and E_Steam_c_chem&oil supplied by the Rhodia Paulinia Industrial Platform
Value (s) of monitored parameter:	0.214
Data used for:	Leakage
Monitoring equipment	Not applicable
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Updated for each period

Calculation method (if applicable):	<p>The steam consumed in the facility is supplied by existing boilers on site. E_Steam_c is calculated on a rolling year basis following the PDD in three steps. First we calculate E_Steam_c_NG, the CO₂ emission per kg of steam produced by the natural gas boilers. Second we calculate E_Steam_c_chem&oil, which is the CO₂ emission per kg of steam produced by the boilers running on by-products and fuel oil. Finally E_Steam_c is calculated by weighting E_Steam_c_NG and E_Steam_c_chem&oil with their real share in the total steam production The E_Steam_c is obtained by rounding up the following calculation: $E_Steam_c = E_Steam_c_NG \times \%GEN_NG + E_Steam_c_chem\&oil \times (1 - \%GEN_NG)$</p>				
	Year ending	E_Steam_c_NG kg CO ₂ / kg of steam	E_Steam_c_chem&oil kg CO ₂ / kg of steam	%GEN_NG	E_Steam_c kg CO ₂ / kg of steam
	01/06/2011	0.210	0.268	95.0	0.214
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	CO₂_Steam_c				
Data unit:	t CO ₂				
Description:	CO ₂ Emissions from Steam consumption				
Measured /Calculated /Default:	Calculated				
Source of data:	Calculated from Q_Steam_c and E_Steam_c data				
Value(s) of monitored parameter:		From	To	CO ₂ _Steam_c	
	Period Value:	15/06/2011	31/07/2011	11	
	Monthly Values:	15/06/2011	30/06/2011	4	
		01/07/2011	31/07/2011	7	
Data used for:	Leakage				
Monitoring equipment	Not applicable				
Measuring/ Reading/ Recording frequency:	Measuring not applicable/Calculated monthly				
Calculation method (if applicable):	Calculated monthly and expressed in tonnes, using Q_Steam_c and E_Steam_c $CO_2_Steam_c = Q_Steam_c \times E_Steam_c$				
QA/QC procedures applied:	Data Handling Protocol ISAL-ADOH-QA-007				

Data / Parameter:	NO_x				
Data unit:	vppm				
Description:	<p>NO + NO₂ concentration in the stack gas</p> <p>Monitoring of the NO_x content in the waste gas is required by local environmental legislation stated in the Commitment Agreement (TAC) signed with the Public Attorney of the State of São Paulo. NO_x in the gaseous effluent can be randomly checked by the environmental agency Cetesb through sampling and analysis by an external laboratory. Analytical data show that the plant complies with the established environmental standard.</p>				
Measured /Calculated /Default:	Measured				
Source of data:	The data are automatically acquired continuously by DCS and stored in the PIMS.				
Value (s) of monitored parameter:	Parameter	Unit	Limit	Analytical results in this period	
	NO _x	vppm	300 max at least 95% of time	Average of 25 and less than 300 for 100 % of time	
Data used for:	Compliance with local regulation on NO _x				
Monitoring equipment (type, accuracy class, Calibration frequency, date of last calibration, validity)	Equipment	Type	Accuracy Class	Calibration frequency	Calibration information
	AI-3490A (NO) serial number 450561464363	3490A (Infrared)	+/- <1 %	1/week	Last calibration
					28/07/2011
					Valid until following week
	AI-3490F (NO ₂) serial number 450561464363	3490F (Ultraviolet)	+/- <1 %	1/week	Last calibration
					28/07/2011
					Valid until following week
					following week
Measuring/Recording frequency:	Measured continuously and recorded daily/Aggregated monthly				
Calculation method (if applicable):	Not applicable				
QA/QC procedures applied:	Procedure UQP-3-ADO-QA-006				

SECTION E. Emission reductions calculation
E.1. Baseline emissions calculation

The amount of baseline emissions in the given period y (measured in tCO_2e) is calculated using the following formula according to AM0021/version 1, equation (1):

$$\text{BE}_y = Q_{\text{N}_2\text{O}_y} \times \text{GWP}_{\text{N}_2\text{O}} + Q_{\text{Steam}_y} \times E_{\text{Steam}_y}$$

It has been checked that there are no Brazilian 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 $Q_{\text{N}_2\text{O}_y}$ of N_2O emitted over the period can then be calculated by (AM0021/version 1 equation (2)):

$$Q_{\text{N}_2\text{O}_y} = P_{\text{AdOH}_y} \times \text{N}_2\text{O}_{\text{AdOH}_y}$$

Over the period of reference the emission factor of the adipic acid plant was above the capped value of $0.27 \text{ kg N}_2\text{O/kg AdOH}$ (see: D.2). 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.1 and D.2 above:

Parameter	Value	Unit
$Q_{\text{N}_2\text{O}_y}$	3,059,843	kg
P_{AdOH_y} (eligible)	11,332.756	t
$\text{N}_2\text{O}_{\text{AdOH}}$	0.27	kg $\text{N}_2\text{O/kg AdOH}$
$Q_{\text{N}_2\text{O reg}}$	No limit	
$\text{N}_2\text{O}_{\text{reg}} / \text{AdOH}$	No limit	
r_y	NA	
$\text{GWP}_{\text{N}_2\text{O}} (1)$	310	$\text{kgCO}_2\text{e/kg N}_2\text{O}$
Q_{Steam_y}	12,683,600	kg of Steam
E_{Steam_y}	0.145	kg $\text{CO}_2/\text{kg of Steam}$
BE_y	950,388	tCO₂e

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

By manual calculation of BE_y 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 N_2O that has not been sent to the decomposition process (i.e. the N_2O that by-passed the decomposition facility)
- the N_2O non-destroyed by the decomposition process
- the emissions due to the use of natural gas.

PE_y is calculated as follows:

$$PE_y = (Q_{N_2O_by-pass_y} + ND_{N_2O_y}) \times GWP_{N_2O} + Q_{NG_y} \times E_{NG_y} \text{ (AM0021/version 1 equation (5))}$$

With $CO_2_NG = Q_{NG} \times E_{NG}$ (PDD section E.1) we get:

$$PE_y = (Q_{N_2O_by-pass_y} + ND_{N_2O_y}) \times GWP_{N_2O} + CO_2_NG_y, \text{ where:}$$

$$Q_{N_2O_by-pass_y} = P_{AdOH_y} \times (1 - \%_{on-line_y}) \times N_2O_/AdOH$$

Where $N_2O_/AdOH$ is the actual value for this period, following the outcome of the Request for Review for project 1238 (Monitoring Period 01/12/2009 to 13/03/2010).

$$ND_{N_2O_y} = Q_{GE_y} \times N_2O_GE_y \times \text{Specific gravity of } N_2O \times 10^{-6}$$

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}	11,332.756	t
$N_2O_/AdOH_y$ (actual value)	0.287	kg N_2O /kg AdOH
$\%_{on-line_y}$	99.928	%
$Q_{N_2O_by-pass_y}$	2,351	kg
Q_{GE_y}	15,119,074	Nm^3
$N_2O_GE_y$	11.3	vppm
Specific gravity of N_2O	1.963	kg/ Nm^3
$ND_{N_2O_y}$	336	kg N_2O
GWP_{N_2O} (1)	310	kg CO_2e /kg N_2O
$CO_2_NG_y$	2,163	t CO_2e
PE_y	2,997	t CO_2e

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

$Q_{N_2O_by-pass}$ and ND_{N_2O} in kg need to be divided by 1,000 to get PE in t CO₂e

By manual calculation of PE_y 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 L_y 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}	71,789.4	kWh
E_{Power}	1.084	kg CO ₂ /kWh
$Q_{Steam_c_y}$	43,700	kg
$E_{Steam_c_y}$	0.214	kg CO ₂ /kg of steam
L_y	90	tCO ₂ e

By manual calculation of L_y 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:

$$ER_y = BE_y - PE_y - L_y$$

where:

- $BE_y = Q_{N_2O_y} \times GWP_{N_2O} + Q_{Steam_py} \times E_{Steam_y}$
- $PE_y = (Q_{N_2O_by-pass_y} + ND_{N_2O_y}) \times GWP_{N_2O} + CO_{2_NG_y}$
- $L_y = Q_{Power_y} \times E_{Power} + Q_{steam_c_y} \times E_{steam_c_y}$

For this project activity, during this monitoring period, was achieved:

$$ER_y = (950,388 - 2,997 - 90) \text{ tCO}_2\text{e}$$

$$ER_y = 947,301 \text{ tCO}_2\text{e}$$

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 5,961,165 tCO₂e. So the PDD-estimated emission reduction relative to the monitoring period of 47 days is around 767,598 tCO₂e.

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
BEy (tCO ₂ e)	918,028	950,388
PEy (tCO ₂ e)	150,272	2,997
Ly (tCO ₂ e)	158	90
Emission reductions (tCO₂e)	767,598	947,301

E.6. Remarks on difference from estimated value

BE: PDD value = 918,028 tCO ₂ e Period = 950,388 tCO ₂ e	
Variance	Explanation
32,437	The adipic acid production used for the ex-ante emission reduction was conservatively taken as 85,000 t/y (232.8 t/d) which is only 89.6% of the nameplate capacity (260 t/d). The daily average production was higher (around 241 t/d) than the estimate of the PDD during this period thanks to better operational performance to supply the market demand
-77	Steam produced in period was lower than in PDD estimate
32,360	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 = 150,272 tCO ₂ e Period = 2,997 tCO ₂ e	
Variance	Explanation
136,709	The significant higher performance of the N ₂ O abatement unit (the actual %_on-line of 99.928% 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.
9,795	A higher destruction rate of the N ₂ O which is above of 99.99% during this period versus 99% taken conservatively in the PDD.
771	Difference in the natural gas consumption estimate and actual in the period
147,275	Total PE variance

MONITORING REPORT FORM (CDM – MR)



CDM – Executive Board

page 39

L:	PDD value = 158 tCO ₂ e	Period = 90 t CO ₂ e
Variance	Explanation	
68	Difference mainly due to the quantity of steam consumed	
68	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.