CDM
MONITORING REPORT #8
of
"N2O Emission Reduction in Paulinia, SP, Brazil "
UNFCCC 0116

From: September 10, 2007
To: October 3, 2007

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1 Introduction

The purpose of this monitoring report is to calculate and clarify GHG emission reduction quantity achieved by this project for periodic verification.

This monitoring report covers the activity from September 10^{th}, 2007 to October 3^{rd}, 2007 as the 8^{th} period.

Duration of the project activity period
The starting date of the project is defined as 11/19/2006.
Note: In the PDD the original starting date of the project activity is 01/01/2007. A demand to the UNFCCC for anticipating the actual start up of the project activity to 11/19/2006 was made and approved. The new starting date of the project activity has been updated on the UNFCCC website.

2. Reference

Approved Baseline methodology :
Baseline Methodology for decomposition of N2O from existing adipic acid production plants (AM0021)

Approved Monitoring methodology :
Monitoring Methodology for decomposition of N2O from existing adipic acid production plants (AM0021)

Project Design Document :
N2O Emission Reduction in Paulinia, SP, Brazil.
Version number of the document : 4
Date : October 12^{th}, 2005

CDM registration number :
"N2O Emission Reduction in Paulinia, SP, Brazil" – UNFCCC ref number 0116

3. Definition

y	: Monitoring period (in this report, see dates § 1)
PDD	: Project Design Document of this project "N2O Emission Reduction in Paulinia, SP, Brazil." Version number of the document: 4, issued on October, 12^{th}, 2005

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4. General description of project

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 will be controlled under the Kyoto Protocol. As far as we are aware, there are however no national or regional regulations or restrictions on the emission of N2O in Brazil. There are in fact no governmental regulations with quantified emission limits in any non-Annex I countries at this point.

In this project, Rhodia Poliamida e Especialidades Ltda. additionally installed N2O collection and a thermal decomposition process equipment to the currently operating adipic acid manufacturing plant. This installation reduces the GHG emissions, which would otherwise be released to the atmosphere if the project were not implemented.
The decomposition facility was installed in the factory site of Paulinia Rhodia Poliamida e Especialidades Ltda. in October 2006 and destruction of N2O was started in November 2006. The starting date of the project as well as the starting date of the first crediting period are defined as November 19th, 2006. It should be noted that the original starting date of the project activity is 01/01/2007 according to the PDD. However the start up of the project activity was anticipated to 11/19/2006, as formalized to and approved by the UNFCCC.

This project activity was registered at UNFCCC on December 25th, 2005 with the number 0116.

Technical description of the project

Location of the project activity
The decomposition facilities were installed in the factory site Rhodia Poliamida e Especialidades Ltda in Paulínia, SP, Brazil in October, 2006.

Technology employed by the project activity
A thermal oxidizer with 2 chambers is the technology used to decompose N2O.

Natural gas is fed with the off gas adipic acid production containing N2O and some 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.

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

The temperature in the furnace is kept at about 1300°C and under fuel rich conditions, so as to promote the complete decomposition of N2O while minimizing the formation of unwanted combustion by-products such as NO and NO2.

The gas is then quenched with air to complete the combustion of carbon monoxide and hydrogen at a temperature of about 950°C in a second chamber. 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.

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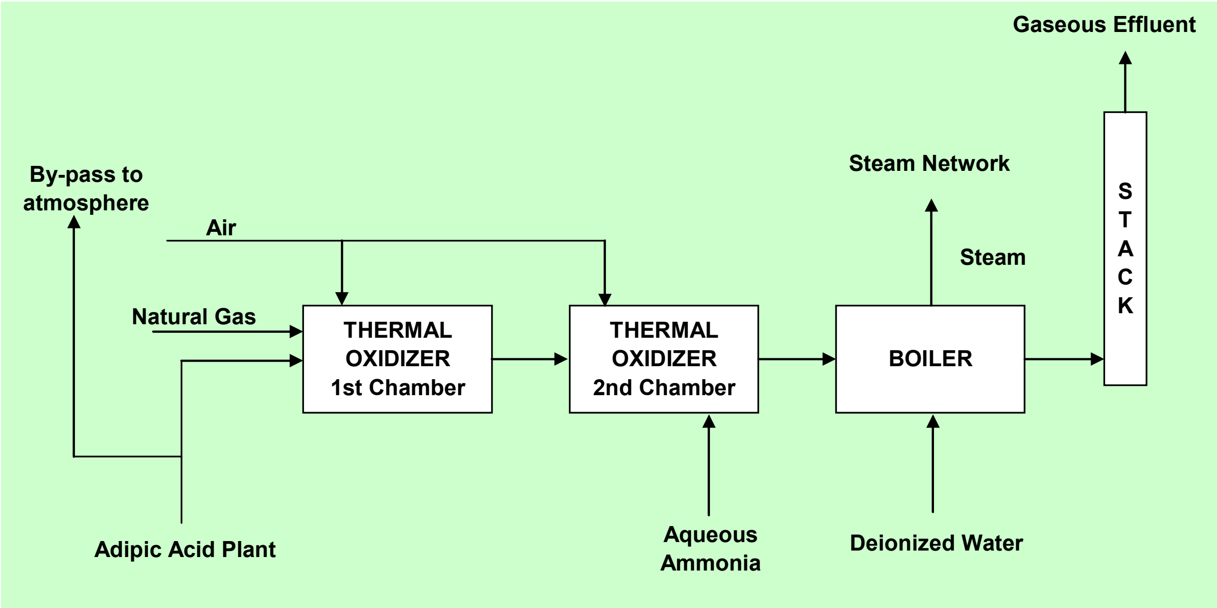
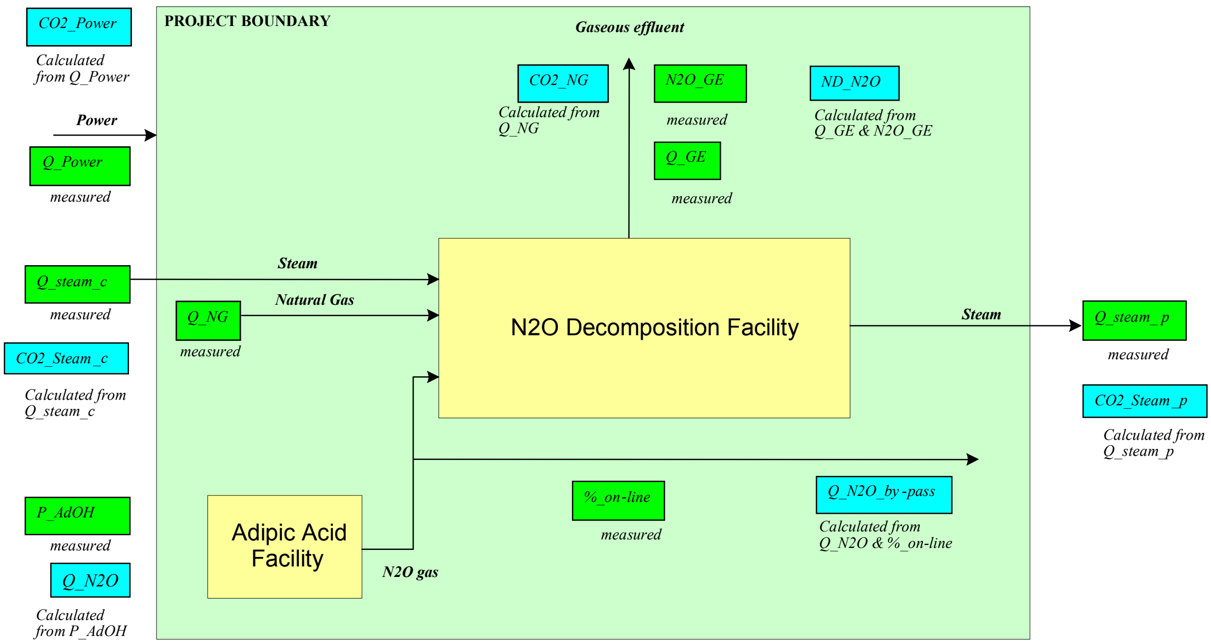


5. Baseline methodology

Approved baseline methodology AM 0021: "Baseline methodology for decomposition of N2O from existing adipic acid production plants" (AM0021), is applied to this project

The project boundary related to the baseline methodology is shown below and this project boundary is used and explained in the PDD.
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.



6. Applicability of the methodology

Approved monitoring methodology AM 0021 / version 1 is applied to this project.
This methodology is applicable to projects which decompose N2O from an adipic acid production plant under the following conditions:

- either catalytic or thermal decomposition of the N2O by-product of adipic acid production at existing production plants
- The methodology is spatially generic, being applicable across regions where the data (both related and project activity as well) exist to undertake the assessment
- The methodology is applicable only for installed capacity (measured in tonnes of adipic acid per year) that exists by the end of the year 2004.

The present project satisfies these conditions as:

- Thermal decomposition of the N2O by-product of adipic acid production was implemented in an existing production plant
- All required data (see following paragraph) are available and used
- The production of adipic acid within the current year is below the installed capacity that exists by the end of the year 2004 as defined in the PDD.

For the sake of clarity, the amount of Emission Reductions can exceed the amount calculated in a year period in the PDD in "SECTION E. Estimation of GHG emissions by sources" 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%).

7. **Monitored Parameters**

According to the methodology AM 0021 and the Monitoring Plan, the data being collected to monitor the GHG reduction are given in the table below:

ID	**Data variable**	**Source of data**	**Data unit**	**Recording frequency**	**Reference**
Q_GE	Volume of effluent gas leaving the stack	Flow meter	Nm^3	Monthly	Appendix 1
N_2O_GE	Concentration of N_2O in the effluent gas	Laser diode online analyzer	ppm	Monthly	Appendix 2
ND_N2O	Quantity of N_2O in the effluent gas leaving the stack	Calculated from Q_GE and N_2O_GE	kg	Monthly	Appendix 3
Q_NG	Amount of natural gas burned	Natural gas meter	Nm^3	Monthly	Appendix 4
NGC	Natural gas composition required for calculation of E_NG	Gas supplier	-	Monthly	Appendix 5
%_on-line	% of production time the position switch on the by-pass valve is closed	Position switches on bypass valve	% of production time	Monthly	Appendix 6
Q_N2O_by-pass	N2O by passing the decomposition facility	Calculated from Q_N2O and %_on-line	kg	Monthly	Appendix 7

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ID	Data variable	Source of data	Data unit	Recording frequency	Reference
P_AdOH	Amount of adipic acid production	Excel workbook for calculation of nylon salt production, AA slurry production and dry AA production	ton	Monthly	Appendix 8
Nitric acid consumption ($HNO3$_consumption) & physical losses in the adipic acid production process (HNO_3_physical)	All data required for calculation of HNO_3 chemical and the N2O emission factor N2O_AdOH	Excel workbook based on the raw material consumption, DCS data and Lab data	ton	Monthly	Appendix 9
Q N_2O reg	Per Brazilian regulation allowed N_2O emissions	Brazilian regulation	kg/a	Date when relevant legislation is in place	Appendix 10
N_2O reg/AdOH	Per Brazilian regulation allowed N_2O emissions per kg of adipic acid produced	Brazilian regulation	kg/kg	Date when relevant legislation is in place	Appendix 10
r_y	Per Brazilian regulation required share of N_2O emissions to be destroyed	Brazilian regulation	%	Date when relevant legislation is in place	Appendix 10
P N_2O	Market price of N_2O	Estimated	€/t	Yearly	Appendix 11
Q_Steam_p	Amount of steam produced by the decomposition process	Steam meter	kg	Monthly	Appendix 12

ID	Data variable	Source of data	Data unit	Recording frequency	Reference
Steam supplier data	All data required for calculation of E_Steam	Rhodia Industrial Platform of Paulínia	-	Yearly	Appendix 13
Q_Power	Electric consumption of the decomposition facility	Electricity meter	kWh	Monthly	Appendix 14
Electricity grid data	All data required for calculation of E_Power according to ACM0002	Brazilian ONS (Operador Nacional do Sistema Elétrico)	-	Yearly	Appendix 15
Q_Steam_c	Amount of steam consumed by the decomposition facility	Steam meter	kg	Monthly	Appendix 16
Steam suppliers data	All data required for calculation of E_Steam_c	Rhodia Industrial Platform of Paulínia	-	Yearly	Appendix 17

8. Quality Control (QC) and Quality Assurance (QA)

8.1. Quality Management System

The thermal oxidation plant is operated by Rhodia operating personnel. Rhodia has assigned the responsibility for operating, monitoring and reporting to the Adipic Acid Plant Manager.

The operation, data transfer and reporting procedures are incorporated into the ISO 9001 procedures of the Paulínia Adipic Acid plant

The personnel have been trained by Rhodia engineers who have been trained by the technology supplier i.e. John Zink Company LLC, USA.

8.2. Quality control (QC) and quality assurance (QA) procedures that are being undertaken for data monitored

The Paulínia adipic acid plant is certified according to ISO9001 and applies appropriate QA & QC procedures.

The equipment and analytical methods given by the technology supplier John Zink Company LLC, USA as well as those supplied by Rhodia are done according to internationally accepted standards.

The QA & QC procedures are set and implemented in order to:

1. Secure a good consistency through planning to implementation of this CDM project and,
2. Stipulate who has responsibility for what and,
3. Avoid any misunderstanding between people and organization involved.

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/ Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
2a.1. (D.2.1.1) Q_GE	*Low*	*This flow rate is measured with an Averaging Pitot tube. This instrument is a critical instrument in the QA/QC procedure.*
2a.2. (D.2.1.1) N_2O_GE	*Low*	*Measured using Laser Diode technology Specific procedures are applied to this analyzer for QA & QC following the manufacturer's recommendation.*
2a.4. (D.2.1.1) Q_NG	*Low*	*Is measured using natural gas meter from the supplier and as such is part of a regular procedure control between the Natural Gas supplier and Rhodia.*
2b.1. (D.2.1.3) P_AdOH	*Low*	*Is obtained from production records of the Paulínia Adipic Acid plant where the N2O waste originates. A QA/QC procedure is implemented. Production quantity is based on the packaged product plus slurry production used for the Nylon Salt production. Both dry adipic acid and nylon salt are weighed.*
2a.5. (D.2.1.1) %_on-line	*Low*	*Use high integrity performance by-pass valve to limit leaks. Procedures currently in place in Chalampé for monitoring N_2O emissions have been implemented in Paulinia to periodically check their tightness and assure their good operation. They have been added to the QA/QC existing procedures.*
2b.7. (D.2.1.3) Q_Steam_p	*Low*	*Steam meter placed on the list of critical instrument data in the QA/QC procedures*
3.1. (D.2.3.1) Q_Power	*Low*	*Electricity meter. Standard procedures are used. No QA/QC procedures implemented as this flow represents less than 0.01% of the baseline emissions.*
3.4. (D.2.3.1) Q_Steam_c	*Low*	*Steam meter placed on the list of critical instrument data in the QA/QC procedures.*

8.3. Calibration/Maintenance of Measuring and Analytical Instruments

All measuring and analytical instruments are being calibrated as per the methodology AM0021 using either existing or specifically created protocols in Paulínia's Quality Management System procedures.

The maintenance methods and procedures have been incorporated as part of the ISO 9001 procedures and form an integral part of the systems and procedures for the organization.

8.4. Environmental Impact

After commissioning the thermal oxidation plant, online analysis of the NOx content in the gaseous effluents is carried out to verify such discharge from the plant. Monitoring of the NOx 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. NOx 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.

Table showing analysis of Gaseous Emission for Thermal Oxidation plant

Parameter		Value as per applicable standard	Actual analysis
NOx	ppm	300 max	Less than 300

9. GHG Calculations

Statement of GHG emission reduction in this monitoring period.

As suggested by the methodology (AM0021/Version 1), the GHG emission reduction, (ERy), achieved by the project activity for the period is
ERy = BEy - PEy - Ly

9.1. Calculation of Q_N2Oy

It has been checked that there are no Brazilian regulation into 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_N2Oy = P_AdOH x N2O_/AdOH

Over the period of reference the emission factor from the adipic acid plant was above the capped value of 0.27 kg N2O/kg AdOH (see Appendix 9). So the capped value is being used according to AM 0021.

Parameter	Value	Reference
Q_N2Oy	1 573 598 kg	Calculated
P_AdOH	5 828 t	Appendix 8
N2O_/AdOH	0.27 kg N2O/kg AdOH	Appendix 9
Q_N_2O reg	No limit	Appendix 10
N_2O_reg / AdOH	No limit	Appendix 10
r_y	NA	Appendix 10

The total production of adipic acid over the year ending with the last day of this period is below the nameplate capacity of the adipic acid plant, therefore the total production of this period can be used as such.

9.2. Calculation of baseline emissions

The amount of baseline emissions in the given period y (measured in t CO2 eq.) is calculated by

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

and rounded down in t CO2 eq. to get conservative consistency of final calculation of emission reductions formula.

Parameter	Value	Reference
BEy	**488 647 t CO2 eq.**	Calculated
Q_$N2O_y$	1 573 598 kg	Calculated in 9.1
GWP_N2O	310 kg CO2 eq./ kg N_2O	Kyoto Protocol Rule. Decision 2/CP.3
Q_Steam_p_y	5 819 600 kg of steam	Appendix 12
E_$Steam_y$	0.143 kg-CO_2/kg of steam	Appendix 13

9.3. Calculation of (Q_N2O x (1-%_on-line))y

The quantity of N2O that has by-passed the decomposition facility is calculated from the adipic acid production made while by-passing the decomposition facility.

The quantity of adipic acid produced while by-passing the destruction facility is monitored and the quantity of N2O that by-pass the decomposition facility is registered daily:

$$Q\_N2O\_by\text{-}pass = P\_AdOH \times (1\text{-}\%\_on\text{-}line) \times N2O\_/AdOH$$

This value is a value by excess as during each connection/ disconnection phases the production is counted as completely by-passed.

The quantity of N2O that by-passed the decomposition facility over the period is:

$$(Q\_N2O \times (1\text{-}\%\_on\text{-}line))y = Q\_N2O\_by\text{-}pass_y$$

The $\%\_on\text{-}line_y$ equivalent over the period is calculated as:

$$\%\_on\text{-}line_y = 1 - (Q\_N2O\_by\text{-}pass_y / Q\_N2O_y)$$

Parameter	Value	Reference
$Q\_N2O\_by\text{-}pass_y$	83 247 kg	Appendix 7
P_AdOH	5 828 t	Appendix 8
N2O _/AdOH	0.27 kg N2O/kg AdOH	Appendix 9
$\%\_on\text{-}line_y$	94.710 %	Appendix 6

9.4. Calculation of project emissions

The emissions due to the decomposition process PEy are the emissions due to the N2O that has not been sent to the decomposition process, the N2O non destroyed by the decomposition process and the emissions due to the use of natural gas.

$$PEy = ((Q\_ N_2O \text{ x } (1\text{-}\%\_on\text{-}line))y + (Q\_GE \text{ x } N_2O\ \_GE)y) \text{ x } GWP\_\ N_2O + Q\_NGy \text{ x } E\_NGy$$

$$PEy = (Q\_N2O\_by\text{-}pass_y + (Q\_GE \text{ x } N_2O\ \_GE)y) \text{ x } GWP\_\ N_2O + Q\_NGy \text{ x } E\_NGy$$

The non-destroyed N_2O (ND_ N_2O y) is constantly monitored and obtained from the constant monitoring of the flow (Q_GE) and the concentration of N_2O (N_2O _GE) of the effluent gas:
$ND\_\ N_2O = Q\_GE \text{ x } N_2O\ \_GE$

$$PEy = (Q\_N2O\_by\text{-}pass_y + ND\_\ N_2O_y) \text{ x } GWP\_\ N_2O + Q\_NGy \text{ x } E\_NGy$$

PEy is rounded up in t CO2 eq. to get conservative consistency in final calculation of emission reductions formula.

Parameter	Value	Reference
PEy	**26 867 t CO2 eq.**	Calculated
$Q\_N2O\_by\text{-}pass_y$	83 247 kg	Appendix 7
Q_GE	7 076 416 Nm^3	Appendix 1
N_2O_GE	5 ppm	Appendix 2
ND_ N_2O_y	70 kg N_2O	Appendix 3
GWP_ N_2O	310 kg CO2 eq./ kg N_2O	Kyoto Protocol Rule. Decision 2/CP.3
Q_NG_y	474 521 Nm^3	Appendix 4
E_NG_y	2.191 kg CO2 eq./ Nm^3	Appendix 5

Note: The value of E_NGy shown above is the yearly moving average of E_NG as required by the PDD for calculation of E_Steam. The project emissions are more accurately calculated using the monthly values of E_NG shown in Appendix 5, following methodology AM0021 and the Monitoring Plan.

9.5. Calculation of leakage

Leak emissions comprise the emissions associated with the energy sources used to generate any steam and electricity used by the decomposition plant.

Leakage amounts to:

L_y = Q_Power x E_Power + Q_steam_c_y x E_steam_c_y

Ly is rounded up in tCO2 eq. to get conservative consistency in final calculation of emission reductions formula.

Parameter	value	Reference
Ly	**44 t CO2 eq.**	Calculated
Q_Power	35 777 kWh	Appendix 14
E_Power	0.927 kg CO_2/kWh	Appendix 15
Q_Steam_ c_y	45 000 kg	Appendix 16
E_Steam_c_y	0.219 kg CO_2 / kg of steam	Appendix 17

9.6. Calculation of emission reduction

The total emission reduction achieved by this project activity during this monitoring period is therefore,

ERy = BEy – PEy – Ly

Or,

ERy = **488 647 t CO2 eq. – 26 867 t CO2 eq. – 44 t CO2 eq.**

Or,

ERy = 461 736 t CO2 eq.

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The above emission reduction covers the generation of N2O during this period.

Appendix 1

Name of item	Q_GE
Description	Volume of effluent gas leaving the stack
Value in period	7 076 416 Nm3
Method of monitoring	Annubar flow meter
Recording frequency	Monthly
Background data	Log sheet record / flowmeter

Period	Quantity of gaseous effluent Nm^3
September 10th – September 30th, 2007	6 170 304
October 1st – October 3rd, 2007	906 112

Appendix 2

Name of item	N2O_GE
Description	Concentration of N_2O in the effluent gas
Value in period	5 ppm
Method of monitoring	Laser diode online analyzer
Recording frequency	Monthly
Background data	Log sheet record
Calculation method	The instant values of the on-line analyzer are used to calculate the quantity of ND_N2O every 10 sec: ND_N2O = Q_GE * N2O_GE * Specific_gravity_of_N2O The analyzer has a range of 0-500 ppm with a detection limit of 5 ppm (1% of range). We use 5 ppm as a default value when the measured value is below the detection limit. Cumulated value for ND_N2O is recorded (see appendix 3). At the end of the month/period based upon the flow Q_GE, and ND_N2O the concentration of N2O equivalent for the month/period is calculated. This value is for information as the constant calculation of ND_N2O is more accurate.

Period	ND_N2O kg	Quantity of gaseous effluent Nm^3	Average concentration of N_2O_GE ppm
September 10th – September 30th, 2007	61	6 170 304	5
October 1st – October 3rd, 2007	9	906 112	5

Appendix 3

Name of item	ND_N2O
Description	Quantity of non-destroyed N2O emitted by the decomposition facility
Value in period	70 kg N_2O
Method of monitoring	On-line DCS calculation
Recording frequency	Monthly
Background data	Log sheet record
Calculation method	Actual quantity of non destroyed N2O is calculated on-line in the DCS from the concentration of N2O and the flow rate of the gaseous effluent: ND_N2O = Q_GE * N2O_GE * Specific_gravity_of_N2O

Period	ND_N2O kg
September 10th – September 30th, 2007	61
October 1st – October 3rd, 2007	9

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Appendix 4

Name of item	Q_NG
Description	Amount of natural gas used by the decomposition process
Value in period	474 521 Nm3
Method of monitoring	Natural gas consumption data
Recording frequency	Monthly
Background data	Log sheet record / flowmeter

Period	Q_NG Nm^3
September 10th – September 30th, 2007	411 953
October 1st – October 3rd, 2007	62 569

.Note: the direct sum of the above values is 474 522 Nm3 which is sligthly different from 474 521 Nm3 given by the Workbook due to a rounding effect. The total value is more accurately calculated in the Workbook.

Appendix 5

Name of item	E_NGy with NGC
Description	Emissions coefficient for natural gas combustion Natural gas composition (NGC) is informed by the natural gas supplier
Value in period for E_NG	2.191 kg CO_2/Nm^3
Method of monitoring	Natural Gas Composition (NGC)
Recording frequency	Monthly
Background data	Composition data received from COMGAS, the natural gas supplier
Calculation method	The average number of C in a mole of NG is calculated from the composition = $\sum$ (number of C in each mole) x (volume ratio) Following monthly data are used to calculate monthly project emissions due to the consumption of Natural Gas. As data for the month of October are not yet available, September data have been used for this monitoring period. . The yearly value is calculated with the data available for the year prior to the beginning of the period and is used for the calculation of E_Steam.

Component	**September** Natural Gas Composition	Number of C
CH4 (Methane)	88.84	1
C2H6 (Ethane)	6.16	2
C3H8 (Propane)	1.81	3
I-C4H10 (I-Butane)	0.26	4
N-C4H10 (N-Butane)	0.40	4
I-C5H12 (I-Pentane)	0.11	5
N2 (Nitrogen)	0.71	0
CO2 (Carbon dioxide)	1.54	1
Average number of C	1.115	
E_NG	**2.188**	

The CO2 specific gravity in standard state is 1.965
E_NG = 1.965 x (average number of C in a mole of NG)

Appendix 6

Name of item	%_on-line
Description	% of production time that the N2O is sent to the decomposition facility
Value in period	94.710 %
Method of monitoring	Position of limit switch on the valve allowing to by-pass the decomposition facility
Recording frequency	Monthly
Background data	Log sheet record
Calculation method	Based upon the position of the limit switch on the valve by-passing the decomposition facility, the % of time that the production is connected to the facility is continuously counted and used to calculate Q_ N2O_by-pass (See Appendix 7).

At the end of the period, %_on-line for the period is calculated as:

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

Period	$Q\_N2O\_by\text{-}pass_y$ kg	P_AdOH_y t	$\%\_on\text{-}line_y$ %
September 10th – September 30th, 2007	83 247	5 052	93.897
October 1st – October 3rd, 2007	0	776	100

Appendix 7

Name of item	Q_N2O_by-pass
Description	N2O by-passing the decomposition facility
Value in period	83 247 kg
Method of monitoring	Production record and %_on-line DCS monitoring
Recording frequency	Monthly
Background data	Production & %_on-line log sheet record
Calculation method	The quantity of adipic acid produced while by-passing the destruction facility is first calculated:

AdOH_by-pass = P_AdOH x (1 - %_on-line)

The quantity of N2O that by-pass the facility is then recorded daily.

$$Q\_N2O\_by\text{-}pass_d = P\_AdOH_d \times N2O\_/AdOH \times (1 - \%\_on\text{-}line)$$

At the end of the period the quantity of N2O that by-passed the facility is :

$$Q\_N2O\_by\text{-}pass_y = \Sigma\ (Q\_N2O\_by\text{-}pass_d)$$

Period	$Q\_N2O\_by\text{-}pass_y$ kg
September 10th – September 30th, 2007	83 247
October 1st – October 3rd, 2007	0

Appendix 8

Name of item	P_AdOH
Description	Adipic acid production
Value in period	**5 828 t**
Method of monitoring	Packaged production and slurry used to nylon salt production
Recording frequency	Monthly
Background data	Log sheet record The production of adipic acid over the year ending with the last day of this period is below the capped value defined in the PDD. The quantity of adipic acid produced during this period can then be fully used as such.

Month - year	Adipic acid production t
September 10th – September 30th, 2007	5 052
October 1st – October 3rd, 2007	776

The details of the calculation of the production amount are as follows:

The adipic acid production in Paulínia is determined in accordance with the PDD, based on the production of adipic acid both as a dry product and as a slurry. The total daily adipic acid made by the nitric oxydation reaction is the sum of two terms (Equation (1)):

Total Production [P_AdOH] = [Finished Product] + [Variation of the In-Process Product]	(1)

The finished adipic acid production is obtained by adding the production of dry and slurry adipic acid, according to Equation (2).

[Finished Product] = [Dry Adipic Acid] + [Slurry Adipic Acid]	(2)

Only the product that has actually left the plant is considered as finished product. In this case:

- Dry adipic acid: is the product which was actually packaged (determined by weigh scales).
- Slurry Adipic Acid: is the product actually used to react with HMD and make nylon salt. Nylon salt truck loads are very accurately weighed, analyzed and its inventory variation is taken into account to determine the adipic acid consumed by means of a stoechiometric equivalence.

The in-process adipic acid is obtained by adding the amount of adipic acid contained in all process equipment where adipic acid is present at different concentrations.

The variation of the In-Process Product inventory of day N is obtained by subtracting the total In-Process Product of day N minus In-Process Product of day (N-1) as in Equation (3):

[Variation of the In-Process Product] = [In-process Product of day N] – [In-process Product of day (N-1)]	(3)

Therefore, according to described in the sections above, the total production of adipic acid is the sum of the following terms described in Equation (4), after rewriting Equation (1) using Equation (2):

Total Production [P_AdOH] = [Dry Adipic Acid] + [Slurry Adipic Acid] + [Variation of the In-Process Product]	(4)

The total production is normally different from the finished product on a daily basis since the in-process product is always varying. The total production can be higher or lower than the finished product. On a long term basis however those differences compensate each other and the accumulated total production will of course approach the sum of dry + slurry.

For the purpose of determining the daily amount of N_2O generated by the nitric oxydation of the raw materials, it must be used the total production, not the finished adipic acid production, since N_2O is generated by the reaction and is independent of the finished production for a limited time (up to 1 or 2 days). In fact during such limited time the adipic acid made at the reaction can be accumulated in the process equipments awaiting to be processed through purification and drying.

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Appendix 9

Name of item	N2O_AdOH
Description	N2O emission factor for adipic acid production
Value in period	0.270 kg N2O/ kg AdOH
Method of monitoring	Adipic acid production, nitric acid consumption and physical losses
Recording frequency	Yearly
Background data	Log sheet records
Calculation method	Nitric acid physical losses (HNO3_physical) in the aqueous wastes, the off gases, the adipic acid and the by-product are monitored. Those losses are deducted from the nitric acid consumption, (HNO3_consumption) to get the chemical consumption, (HNO3_chemical).

The N2O emission factor is then calculated over the period:

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 = 0.27, as specified in the PDD table D.2.1.3 and required by the methodology AM0021. The calculated value is in the Excel Workbook of this period which is a confidential document communicated to the DOE and to the CDM Executive Board.

Year ending	Value calculated kg N2O/kg AdOH	KE_N20 kg N2O/kg AdOH	N2O_AdOH kg N2O/kg AdOH
October 3rd, 2007	> 0.270	0.270	0.270

Appendix 10

Name of item	Q_N_2O reg , N_2O_reg / AdOH and r_y
Description	Evolution of Brazilian legislation that may require limitation of N_2O emissions using one of the following criteria: - Q_N_2O reg : allowed N_2O emissions - N_2O_reg / AdOH : allowed N_2O emissions per kg of adipic acid produced - r_y : share of N_2O emissions required to be destroyed
Value in period	not applicable
Method of monitoring	Survey
Recording frequency	When relevant
Background data	Brazilian legislation No evolution of legislation since PDD emission.

Period	Q_N_2O reg kg	N_2O_reg / AdOH kg	r_y %
September 10th, 2007 – October 3rd, 2007	No limit	No limit	0

Appendix 11

Name of item	P_N_2O
Description	Market price of N_2O in waste gas
Value in period	0 €/t
Method of monitoring	Market survey
Recording frequency	Yearly
Background data	No market for this low level of N2O concentration

Year	P_N_2O
2007	0

Appendix 12

Name of item	Q_Steam_p
Description	Amount of steam produced by the decomposition facility
Value in period	5 819 600 kg
Method of monitoring	Flowmeter
Recording frequency	Monthly
Background data	Log sheet record

Period	Q_Steam_p kg
September 10th – September 30th, 2007	5 038 200
October 1st – October 3rd, 2007	781 400

Appendix 13

Name of item	E_Steam
Description	CO_2 emission factor for steam produced by the facility
Value in period	0.143 kg CO_2/kg of steam
Method of monitoring	Supplier data
Recording frequency	Yearly
Background data	Data supplied by the Rhodia Paulínia Industrial Platform
Calculation method	The calculation is made according to the monitoring plan. We first calculate the amount of natural gas required to generate steam in Nm3/t of steam in a very efficient boiler QNG_steam = △H (kJ/t) / (LHV (kJ/Nm3) x ɳ (%)) The LHV data is the yearly average value for the gas supplied by COMGAS. E_NG_y is the yearly average value for the gas supplied by COMGAS (see appendix 5). The yearly value of E_Steam is calculated with the data available for the year prior to the beginning of the period in order to assure to have the data.
Comment	LHV data is supplied by COMGAS in kcal/m3 at 20 oC. Data were converted to kJ/Nm3.

Year ending	LHV kJ/Nm^3	△H kJ/t	ɳ %	QNG_tsteam Nm3/t of steam	E_NG_y kg-CO_2/Nm3	E_Steam kg-CO_2/ kg of steam
October 3rd, 2007	38750	2624000	97	65.69	2.191	0.143

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Appendix 14

Name of item	Q_Power
Description	Electricity consumption by the decomposition facility
Value in period	35 777 kWh
Method of monitoring	Power consumption data
Recording frequency	Monthly
Background data	Log sheet record / counter

Period	Q_Power kWh
September 10th – September 30th, 2007	31 163
October 1st – October 3rd, 2007	4 614

Appendix 15

Name of item	E_Power
Description	CO_2 intensity for electric generation
Value in period	0.927 **kg CO_2/kWh**
Method of monitoring	Survey of data publication
Recording frequency	Yearly
Background data	Latest data made publicly available by the Brazilian Operador Nacional do Sistema Elétrico, ONS, are for 2005.
Calculation method	Calculated according to the PDD, conservative value used.

Date (year)	E_Power kg CO_2/kWh
2007	0.927

Appendix 16

Name of item	Q_Steam_c
Description	Amount of steam consumed by the decomposition facility
Value in period	45 000 kg
Method of monitoring	Mass flowmeter
Recording frequency	Monthly
Background data	Log sheet record

Period	Q_Steam_c kg
September 10th – September 30th, 2007	39 000
October 1st – October 3rd, 2007	6 000

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Appendix 17

Name of item	E_Steam_c
Description	CO_2 intensity for steam consumed in the facility
Value in period	0.219 kg CO_2/kg of steam
Method of monitoring	Calculated from steam supplier data
Recording frequency	Yearly
Background data	Data supplied by the Rhodia Paulínia Industrial Platform
Calculation method	This steam is supplied by existing boilers on site. Steam production, natural gas, fuel oil and by-products consumptions are monitored. From the monthly consumption of all fuels, the monthly value of E_NG and of the carbon content of each liquid fuel, monthly emissions of CO2 for steam production are calculated and cumulated over the year. E_Steam_c is obtained from the ratio of yearly CO2 emission over the yearly steam production.

According to the PDD we calculate E_steam_c as a weighted average of the coefficients E_steam_c_NG (emission factor of steam produced by the boilers running on natural gas) and and E_steam_c_chem&oil (emission factor of the steam produced by the boilers running on byproducts and fuel oil) with the real share of the steam generated with each type of fuel.

E_steam_c = E_steam_c_NG x %_gen_NG +
+ E_steam_c_chem&oil x %_gen_chem&oil
where %_gen_chem&oil = 100% - %gen_NG

The yearly value of E_Steam_c is calculated with the data available for the year prior to the beginning of the period in order to assure to have the data.

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 Share of steam generated using natural gas	E_Steam_c kg CO_2/ kg of steam
August 31st, 2007	0.214	0.317	95.3	0.219