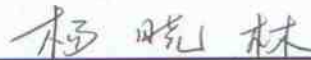


**CDM**  
**MONITORING REPORT #10**  
**Version 1**

**“N<sub>2</sub>O decomposition project of  
PetroChina Company Limited Liaoyang Petrochemical Company”  
UNFCCC 1238**

**From: December 1<sup>st</sup>, 2009  
To: March 13<sup>th</sup>, 2010**

Authorized Signatory on behalf of the Project owner,  
who is in charge of this Monitoring Report



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Date: April 28<sup>th</sup>, 2010

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## 1. Introduction

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

This monitoring report covers the activity from December 1<sup>st</sup>, 2009 to March 13<sup>th</sup>, 2010 as the 10<sup>th</sup> period, which is the last monitoring period of the second crediting year (14/03/2009 – 13/03/2010).

### Duration of the project activity period

The starting date of the operation of the project as well as of the crediting period is defined as March 14<sup>th</sup>, 2008.

Note: In the PDD the original starting date of the operation of the project activity and of the first crediting period is 01/01/2008. A demand to the UNFCCC to change the start up of the crediting period to 14/03/2008 was made and approved. The new starting date has been updated on the UNFCCC website.

## 2. Reference

### Approved Baseline methodology:

Baseline Methodology for decomposition of N<sub>2</sub>O from existing adipic acid production plants (AM0021-Version 01, 25 February 2005)

### Approved Monitoring methodology:

Monitoring Methodology for decomposition of N<sub>2</sub>O from existing adipic acid production plants (AM0021-Version 01, 25 February 2005)

### Project Design Document:

N<sub>2</sub>O decomposition project of PetroChina Company Limited Liaoyang Petrochemical Company  
Version number of the document: 3  
Date: April 6<sup>th</sup>, 2007

### CDM registration number:

“N<sub>2</sub>O decomposition project of PetroChina Company Limited Liaoyang Petrochemical Company” – UNFCCC ref number 1238

## 3. Definition

y : Monitoring period (in this report, from December 1<sup>st</sup>, 2009 to March 13<sup>th</sup>, 2010)  
PDD : Project Design Document of this project “N<sub>2</sub>O decomposition project of PetroChina Company Limited Liaoyang Petrochemical Company” Version number of the document: 3, issued on April 6<sup>th</sup>, 2007

## 4. General description of project

### Project activity

Nitrous oxide ( $\text{N}_2\text{O}$ ) is a by-product of adipic acid production, and has been recognized as one of the six greenhouse gases (“GHGs”) under the Kyoto Protocol. It is of low toxicity but is a greenhouse gas (GHG), whose GWP is large (GWP=310 in the IPCC 2nd Assessment Report). There are however no national or regional regulations or restrictions on the emission of  $\text{N}_2\text{O}$  in China.

In this project, PetroChina Company Limited Liaoyang Petrochemical Company (“LYPC”) additionally installed a  $\text{N}_2\text{O}$  catalytic 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 was not implemented.

The decomposition facility was installed in the factory site of  $\text{N}_2\text{O}$  decomposition project of LYPC. The destruction of  $\text{N}_2\text{O}$  was started on March 14<sup>th</sup>, 2008. The starting date of the operation of the project as well as of the crediting period is 14/03/2008.

This project activity was registered at UNFCCC on November 30<sup>th</sup>, 2007 with the number 1238.

### Technical description of the project

#### **Location of the project activity**

The decomposition facility was installed in the factory site of PetroChina Company Limited Liaoyang Petrochemical Company.

#### **Technology employed by the project activity**

The project activity installed a catalytic decomposition plant to decompose the  $\text{N}_2\text{O}$  emissions from the production of adipic acid.

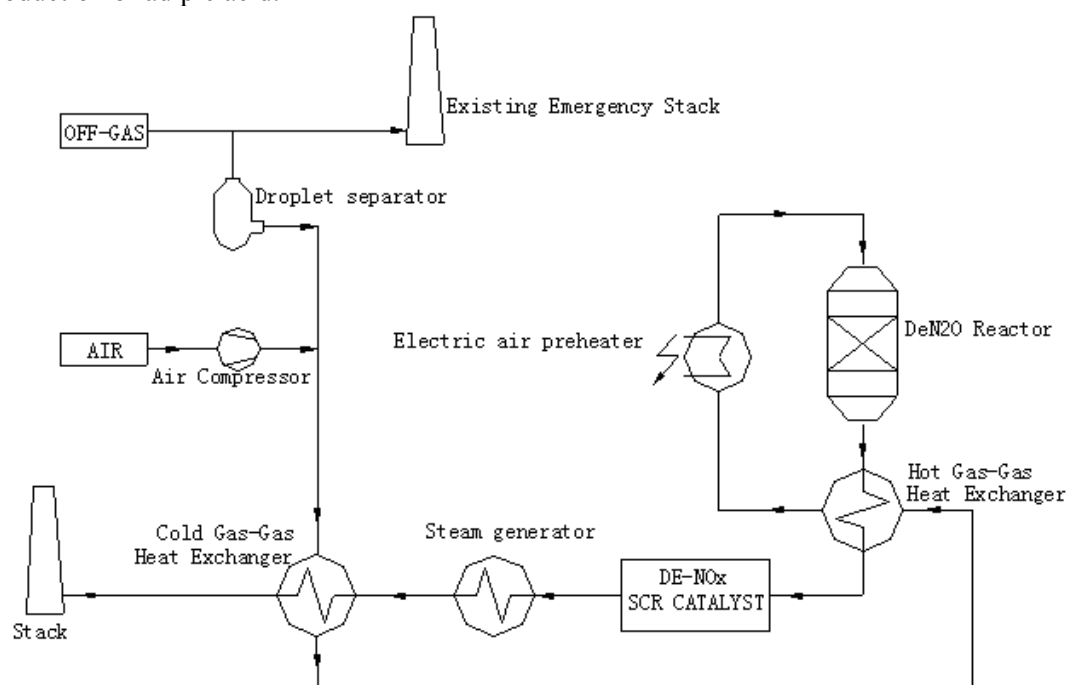


Figure:  $\text{N}_2\text{O}$  catalytic decomposition process

1. The main facilities in the process include the Air Compressor, the DeN<sub>2</sub>O Reactor, the Cold Gas-Gas Heater Exchanger, the Hot Gas-Gas Heat Exchanger, the DeNO<sub>x</sub> Reactor, the Steam Generator, the Electric Air Pre-heater, the Droplet Separator and the Stack.
2. The description of the process is as follows:

The N<sub>2</sub>O rich off-gas from the adipic acid plant is sent into the droplet separator in which the droplet and aerosols is separated, then the gas stream is diluted by compressed air coming from the air compressor, and the N<sub>2</sub>O concentration shall be controlled at an appropriate range to avoid overheating the catalyst and debasing the activity of the catalyst since the reaction is highly exothermic. The mixed gas is preheated in the cold gas-gas heat exchanger to the temperature of 180~190 deg C around, then exchanges the heat with outlet gas of the reactor in the hot gas-gas exchanger, then sent into the electric air pre-heater, in which the gas is heated to a temperature about 480 deg C, and then the gas stream is sent into the DeN<sub>2</sub>O reactor in which N<sub>2</sub>O is converted into N<sub>2</sub> and O<sub>2</sub> over proprietary catalyst operated at mildly elevated pressure and temperature. The gas off the reactor is sent into the hot gas-gas exchanger and then into the DeNO<sub>x</sub> reactor, in which the NO<sub>x</sub> is converted to N<sub>2</sub> and H<sub>2</sub>O, and then the gas off the DeNO<sub>x</sub> reactor is sent into the steam generator and produce the 0.55~0.7 MPa (A) steam, then the off gas is fed into the cold gas-gas exchanger for further cooling, then the off-gas is emitted to the atmosphere through the final stack.

## 5. Baseline methodology

Approved baseline methodology AM 0021 - version 1: "Baseline methodology for decomposition of N<sub>2</sub>O 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.

### Description of the sources and gases included in the project boundary

	Emission source	GHG types	Included or not?(Yes/No)	Reason / explanation
<b>Baseline</b>	Adipic acid production	CO <sub>2</sub>	No	
		CH <sub>4</sub>	No	
		N <sub>2</sub> O	Yes	Off gas of the production of Adipic Acid.
	Steam produced during the decomposition	CO <sub>2</sub>	Yes	The steam generated from the project activity will partly substitute the steam which is bought.
		CH <sub>4</sub>	No	
		N <sub>2</sub> O	No	
<b>Project activity</b>	The off gas passing the decomposition facility but not 100% decomposed	CO <sub>2</sub>	No	
		CH <sub>4</sub>	No	
		N <sub>2</sub> O	Yes	The actual decomposition efficiency of the decomposition facility.
	Off gas by-passing the decomposition facility	CO <sub>2</sub>	No	
		CH <sub>4</sub>	No	
		N <sub>2</sub> O	Yes	The gas by-passing the decomposition facility.

<b>Leakage</b>	Electricity consumed during the decomposition process	CO <sub>2</sub>	Yes	According to the latest data provided by the Chinese DNA of CDM, NDRC, and the power consummated by the project activity.
		CH <sub>4</sub>	No	
		N <sub>2</sub> O	No	

## 6. Applicability of the methodology

Approved monitoring methodology AM0021 - version 1 is applied to this project.

This methodology is applicable to projects which decomposes N<sub>2</sub>O from an adipic acid production plant under the following conditions:

- Either catalytic or thermal decomposition of the N<sub>2</sub>O 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.

## 7. Monitored Parameters

According to the methodology AM0021 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	Flow meter	Nm <sup>3</sup>	Monthly	Appendix 1
N <sub>2</sub> O_GE	Concentration of N <sub>2</sub> O in the effluent gas	Online Gas Chromatography	ppm <sup>1</sup>	Monthly	Appendix 2
%_on-line	% of production time the position switch on the bypass valve is closed	Position switch on bypass valve	% of production time	Monthly	Appendix 4
P_AdOH	Amount of adipic acid production	The production record of adipic acid	t	Monthly	Appendix 6
HNO <sub>3</sub> _consumption	Nitric acid consumption in the adipic acid production process	Excel workbook based on the raw material consumption	t	Monthly	Appendix 7
HNO <sub>3</sub> _physical	Nitric acid physical losses in the adipic acid production	Excel workbook based on the monitoring data	t	Monthly	Appendix 8

<sup>1</sup> For calculation of the decomposition rate of N<sub>2</sub>O will be transformed in kg/Nm<sup>3</sup> according to the requirements of AM0021.

	process	and analysis			
Q_N <sub>2</sub> O <sub>reg</sub>	Per Chinese regulation allowed N <sub>2</sub> O emissions	Chinese regulation	kg/yr	Date When relevant legislation is in place	Appendix 10
N <sub>2</sub> O <sub>reg</sub> / AdOH	Per Chinese regulation allowed N <sub>2</sub> O emissions per kg of adipic acid produced	Chinese regulation	kg/kg	Date When relevant legislation is in place	Appendix 10
r <sub>y</sub>	Per Chinese regulation required share of N <sub>2</sub> O emissions to be destroyed	Chinese regulation	%	Date When relevant legislation is in place	Appendix 10
P_N <sub>2</sub> O	Market price of N <sub>2</sub> O	Market Survey	\$/t	Yearly	Appendix 11
Q_Steam_p	Amount of steam produced by the decomposition process	Steam meter	t	Monthly	Appendix 12
Steam supplier data	All data required for calculation of E_Steam	The steam supplier	-	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	China Electric Almanac, and China Energy Statistical Yearbook	kg-CO <sub>2</sub> /kWh	Yearly	Appendix 15

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

### 8.1. Quality Management System

The Catalytic decomposition plant is operated by LYPC operating personnel, and the personnel have been trained by LYPC engineers, and the engineers have been trained by the technology supplier, BASF.

LYPC was certified being compliance with the quality management system of GB/T 19001-2000 idt ISO 9001:2000 Standard on 12/01/2009, the valid period will be expired on 11/01/2012 (Cer. No.: 01009Q10049R3L), the environmental management system of GB/T 24001-2004 idt ISO14001:2004 on 12/01/2009, the valid period will be expired on 11/01/2012 (Cer. No.: 01009E10010R3L) and the health and safety management system of GB/T28001-2001 on 12/01/2009, the valid period will be expired on 11/01/2012 (Cer. No.: 01009S10008R2L). All these management systems are incorporated into the internal systems and procedures regarding Quality, Health, Safety & Environment (QHSE). The operation, data transfer and reporting procedures of the project are incorporated into the quality management system.

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

LYPC conducts the QA & QC procedures to the project activity as required by the documentation of QHSE procedure.

The technology and analytical methods used in this project activity are provided by the technology supplier, BASF, and some of them are supplied by LYPC itself.

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

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

Data	Uncertainty level of data (High/Medium/ Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Q_GE	Low	This flow is measured with an Averaging Pitot tube (the Annubar flow meter). This instrument is considered as a critical instrument in the QA/QC procedure.
N <sub>2</sub> O_GE	Low	Is measured with an Online Gas Chromatograph, and existing procedures are applied to this analyzer for QA & QC.
P_AdOH	Low	Is obtained from production records of the adipic acid plant where the N <sub>2</sub> O waste originates. A QA/QC procedure is implemented. Production quantity is measured by the counting mechanism during the production package of the adipic acid.
%_on-line	Low	Use high integrity performance bypass valve to limit leaks. Procedures to periodically check its tightness and assure its good operation. They have been added to the QA/QC existing procedures.
Q_Steam_p	Low	Steam meter is considered as a critical instrument in the QA/QC procedure.
Q_Power	Low	Electricity meter. Standard procedures are used. They have been added to the QA/QC existing procedures.

### **8.3. Calibration/Maintenance of Measuring and Analytical Instruments**

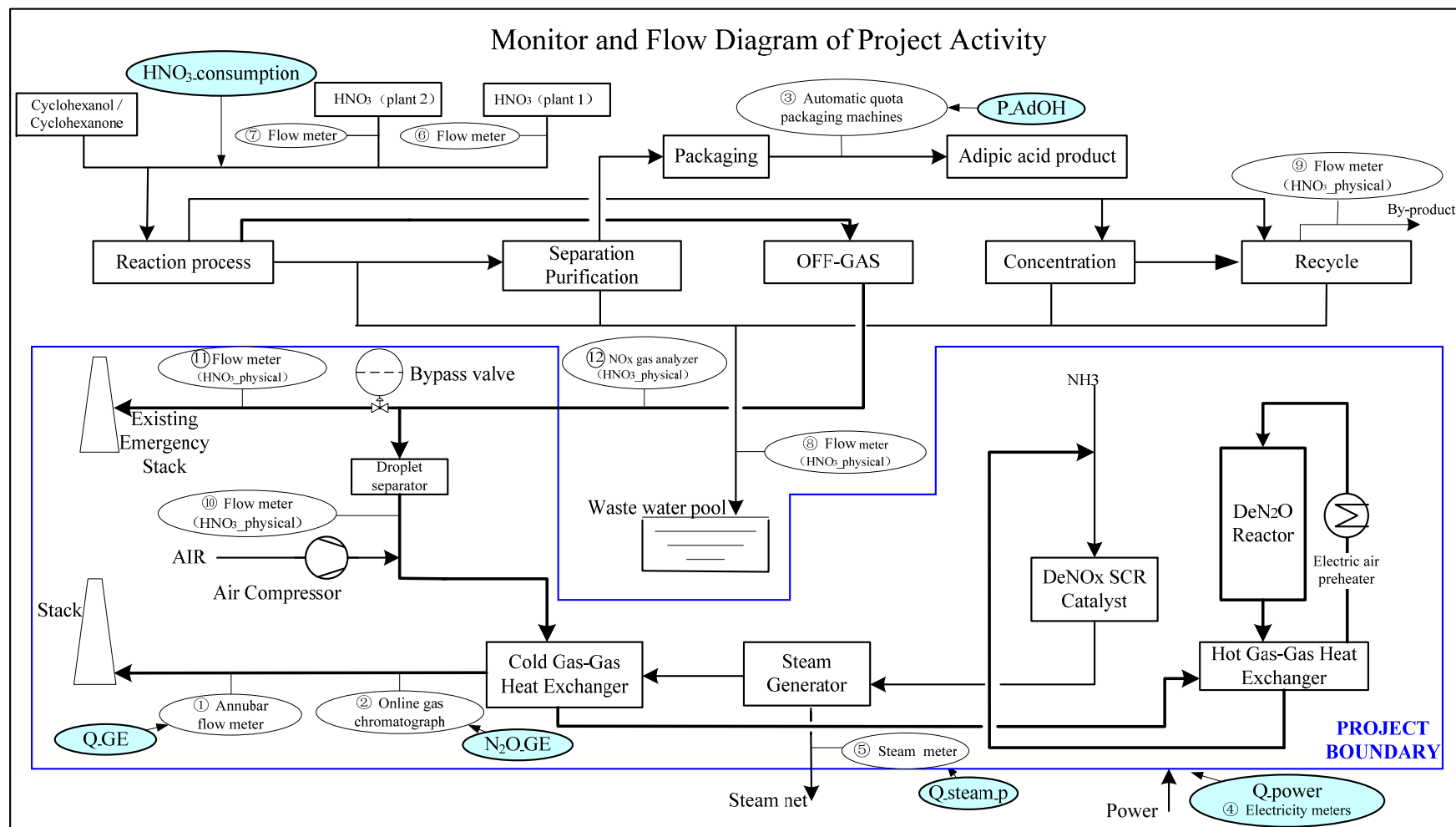
All measuring and analytical instruments are being calibrated as per the applicable standards by the officially accredited & qualified entities.

The maintenance methods and procedures have been incorporated as part of the QHSE procedures and form an integral part of the systems and procedures for LYPC.

In this monitoring period, most of the measuring and analytical instruments were recalibrated or replaced due to the coming expiry of the previous calibrations, the details in the below table.



As required by the DOE, a line diagram of the project activity has been included into the monitoring report as below:



This is a line diagram of the project activity including project boundary and location of monitoring instruments. The serial numbers of the monitoring instruments are numbered only in the diagram due to the room limit, and they are detailed in the below table.

Paramet er	Instrument	Serial number		Previous calibration			Calibration in this monitoring period		
				Calibration Date	Valid Period (months)	Certificate No.	Calibration Date	Valid Period (months)	Certificate No.
Q_GE	Annubar flow mete (stopped use from 08/01/2010)	①	4989886	19/01/2009	12	0068713	---	---	---
	Annubar flow meter (put into use from 08/01/2010)		4924020	---	---	---	15/12/2009	12	CE10406
	Temperature transmitter(stopped use from 08/01/2010)		0606/b842589937	19/01/2009	12	Liaoji 09011902502	---	---	---
	Temperature transmitter(put into use from 08/01/2010)		b427668837	---	---	---	29/12/2009	12	Liaoji 09122902513
	Pressure transmitter(stopped use from 08/01/2010)		CF610UR252135	13/01/2009	12	Liaoji 09011302713	---	---	---
	Pressure transmitter(put into use from 08/01/2010)		CzzB075453	---	---	---	28/12/2009	12	Liaoji 09122802709
N <sub>2</sub> O_GE	Online gas chromatograph (stopped use from 21/01/2010)	②	5500120010 (AT-2307)	06/03/2009	12	Liaoji 09030606303	---	---	---
	Online gas chromatograph (put into use from 21/01/2010)		5500570010 (AT-2307)	---	---	---	21/01/2010	12	Liaoji 10030506601
P_AdOH	Automatic quota packaging machines (four)	③	04042001-U; 04042002-U ; U84Z404A; U84Z404B	10/07/2009	6	04200904320; 04200904319; 04200904321; 04200904322	06/01/2010	6	04201000014; 04201000015; 04201000012; 04201000013
Q Power	Electricity meters	④	08010050001	16/01/2008	36	DC820005	---	---	---

	(three)		08020130041; 08020130040	03/03/2008	36	DC820013; DC820014	---	---	---
Q_Steam _p	Steam meter	⑤	HVS71025	23/02/2009	24	Liaoji 09022302101	---	---	---
HNO <sub>3</sub> _ consump tion	Flow meter (stopped use from 16/12/2009)	⑥	413105/3032717	24/12/2008	12	Liaoji 08122402202	---	---	---
	Flow meter (put into use from 16/12/2009)		413106/3032737	---	---	---	16/12/2009	12	Liaoji 09121602201
	Flow meter	⑦	C40E4C02000	20/11/2009	12	Liaoji 09112002201			
HNO <sub>3</sub> _ physical	Flow meter	⑧	080306	06/03/2008	24	Liaoji 08030608106	04/03/2010	24	Liaoji 10030402122
	Flow meter (stopped use from 02/12/2009)	⑨	AE0605535	24/12/2008	12	Liaoji 08122402201	---	---	---
	Flow meter (put into use from 02/12/2009)		AE0404094	---	---	---	20/11/2009	12	Liaoji 09112002103
	Flow meter	⑩	0054302/4924022	20/01/2009	24	Liaoji 09012002112	---	---	---
	Flow meter (stopped use from 03/02/2010)	⑪	FE2564	10/03/2008	24	Liaoji 08031008103	---	---	---
	Flow meter (put into use from 03/02/2010)		FE2564A	---	---	---	01/02/2010	24	Liaoji 10020102104
	Gas analyzer	⑫	VD-887(AT-2306)	06/03/2009	12	Liaoji 09030606302	21/01/2010	12	Liaoji 10030506602
	Electronic balances (three)		D450000836; D432311092; D432311087	16/02/2009	12	01200900239; 01200900241; 01200900247	13/02/2010	12	01201000190; 01201000187; 01201000186
	Spectrophotometers (two)		A11024531130CS	06/01/2009	12	03200900085	05/01/2010	12	03201000269
			A11024130206CS	04/12/2008	12	HX810082	03/12/2009	12	03200907245

#### 8.4. Environmental Impact

The catalytic decomposition plant has been installed with online analyzers to monitor constantly the concentration of NO<sub>x</sub> that are required by China legislation. Starting from 14/03/2008, the parameter will be transmitted to the local government environmental agency periodically---- Liaoyang Environmental Monitoring Station of Liaoyang Environmental Protection Bureau, who can check such parameter through sampling and analysis.

The monitored values were under the control specification limit of the China environmental regulation and the average value and the highest value of those results is shown in the table below.

Table showing analysis Gaseous Emission for catalytic decomposition plant

Parameter	Unit	The Cap of the Integrated Air Pollutant Emission Standard (GB16297-1996)	Average value in this monitoring period by Liaoyang Environmental Monitoring Station	Highest value in this monitoring period by Liaoyang Environmental Monitoring Station
NO <sub>x</sub>	mg/m <sup>3</sup>	240 Max	119	131

#### 9. GHG Calculations

Statement of GHG emissions reduction in the tenth monitoring period.

As suggested by the methodology (AM0021 - Version 1), the GHG emissions reduction, (ER<sub>y</sub>), achieved by the project activity for a given period y is

$$ER_y = BE_y - PE_y - L_y$$

##### 9.1. Calculation of baseline emissions

The amount of baseline emissions in the given period y (measured in t CO<sub>2</sub> eq.) is calculated by

$$BE_y = Q_{N_2O_y} \times GWP_{N_2O} + Q_{Steam_p_y} \times E_{Steam_y}$$

##### Calculation of Q<sub>N<sub>2</sub>O<sub>y</sub></sub>

It has been checked that there is no Chinese regulation in place that would limit the quantity of N<sub>2</sub>O emitted that can be taken into account for the calculation of the baseline emissions.

The quantity of N<sub>2</sub>O actually produced, N<sub>2</sub>O<sub>produced</sub>, emitted over the period can then be calculated by:

$$N_2O_{produced} = P_{AdOH} \times Actual\ N_2O_{/AdOH}$$

Where, Actual N<sub>2</sub>O<sub>/AdOH</sub> (kgN<sub>2</sub>O/kg AdOH) is the actual N<sub>2</sub>O emission factor for adipic acid production, calculated as:

$$N_2O_{/AdOH} = HNO_3_{chemical} / P_{AdOH} / 63 / 2 \times 0.96 \times 44$$

HNO<sub>3</sub><sub>chemical</sub> is obtained from the measured consumption of HNO<sub>3</sub> (HNO<sub>3</sub><sub>consumption</sub>) and the physical losses of HNO<sub>3</sub> (HNO<sub>3</sub><sub>physical</sub>). The formula is:

$$HNO_3_{chemical} = HNO_3_{consumption} - HNO_3_{physical}$$

The quantity of N<sub>2</sub>O to be credited, Q<sub>N<sub>2</sub>O<sub>y</sub></sub>, emitted over the period can then be calculated by:

$$Q_{N_2O_y} = P_{AdOH} \times N_2O_{/AdOH}$$

Where, N<sub>2</sub>O<sub>/AdOH</sub> (kgN<sub>2</sub>O/kg AdOH) is the N<sub>2</sub>O emission factor for adipic acid production, capped by the emission factor of 0.27 kgN<sub>2</sub>O/kg AdOH, as specified by the IPCC Good Practice Guidance, i.e., should be the lower of Actual N<sub>2</sub>O<sub>/AdOH</sub> and 0.27 kgN<sub>2</sub>O/kg AdOH. Over the tenth monitoring period, the actual emission factor, as shown in Appendix 9, from the adipic acid plant is above the capped value of 0.27 kg N<sub>2</sub>O /kg AdOH. So the capped value of 0.27 kgN<sub>2</sub>O/kg AdOH is being used according to AM0021.

As required by the Executive Board members on 29/08/2008, “The monitoring methodology requires monthly recording frequency of N<sub>2</sub>O produced and N<sub>2</sub>O emission factor for adipic acid production” (please refer to the website of <http://cdm.unfccc.int/Projects/DB/DNV-CUK1184240745.87/iProcess/SGS-UKL1213087483.29/view>), as response to the minor correction requested, the monthly monitored results of the two parameters have been recorded in Appendix 9 to the monitoring reports since MR#2 version 2, dated August 19, 2008.

Parameter	Value	Reference
Q <sub>N<sub>2</sub>O<sub>y</sub></sub>	12,093.840t	Appendix 9
P <sub>AdOH</sub>	44,792.000t	Appendix 6
N <sub>2</sub> O <sub>/AdOH</sub>	0.27 kgN <sub>2</sub> O/kg AdOH	Appendix 9
Q <sub>N<sub>2</sub>O<sub>reg</sub></sub>	No limit	Appendix 10
N <sub>2</sub> O <sub>reg/AdOH</sub>	No limit	Appendix 10
r <sub>y</sub>	0	Appendix 10

The methodology AM0021 version 1 and the registered PDD and validation report of this project did not identify the cap of the adipic acid production. SGS submitted a request for clarification to secure guidance on the cap (AM\_CLA\_0148). The Board clarified at EB48 that the cap on adipic acid production of the facilities shall be the validated maximum daily production of adipic acid multiplied by 365 days multiplied by the operational rate. The validated maximum daily production of adipic acid shall be achieved by the end of year 2004 (For detailed information, please refer to <http://cdm.unfccc.int/EB/048/eb48rep.pdf>). As follow formula:

Cap = validated maximum daily production of adipic acid × 365 × operational rate

The cap on the adipic acid production is determined as blow as per the EB48's guidance:

The validated maximum daily production of adipic acid that achieved by the end of year 2004 is 477 t/d, as shown in the registered PDD (Page 5), DNV's validation report of the project (Page 14, 53) and DNV's response to the request for review at registration (available on the website of <http://cdm.unfccc.int/Projects/DB/DNV-CUK1184240745.87/history>), the production log in December 2004 has been provided to DOE and UN for cross checking the validation outcome.

The adipic acid plant's operational rate is a result of the total operational hours divided by the total hours, as per the industrial common practice. Considering the daily production of 477 t/d was achieved on 9 Dec 2004, the operational rate of 91.23% (= (8760-768.5) h /8760h × 100% = 7991.5h/8760h × 100%)<sup>2</sup> from 2004 was adopted to determine the cap on adipic acid production as per the guidance provided by the Board in its 48<sup>th</sup> meeting to be consistent with the required year for determination of the maximum daily production achieved by the AdOH plant.

Although 2004 was a leap year and had 366 days, 365 days are used as the days in 2004 for the

<sup>2</sup> If the operational rate were to be calculated based on the actual 366 days, the actual operational rate would be calculated as: (366\*24-768.5)/(366\*24)×100% = 91.25%.

calculation to be conservative, i.e., total hours in the year 2004 for the calculation was 8760h (= 365d × 24h/d). As shown in the 2004 shutdown statistics of the adipic acid plant, the accumulated shutdown time of the adipic acid plant in 2004 was 768.5 hours, which includes the periodic repair and maintenance within the year and the unplanned shutdowns. The supporting documentation on the 2004 shutdown statistics of the adipic acid plant have been provided to DOE and UN.

By applying this operational rate following the guidance provided by the Board during its 48<sup>th</sup> meeting, the P\_AdOH cap totals 158,835.992 t/y(=477t/d\*365\*91.23%). For detailed information, please refer to <http://cdm.unfccc.int/Projects/DB/DNV-CUK1184240745.87/iProcess/SGS-UKL1248257972.07/view>.

This is the last monitoring period in the second crediting year (14/03/2009 - 13/03/2010). By the end of this monitoring period, the accumulated P\_AdOH in the second crediting year (14/03/2009 - 13/03/2010), 156,290.000t, is below the cap of adipic acid production, 158,835.992t, which is calculated according to the clarification made in EB48. Hence, the P\_AdOH in this monitoring period can be fully credited.

### **Calculation of $Q_{\text{Steam}_y} \times E_{\text{Steam}_y}$**

The flow of the steam generated from this project activity is monitored constantly, and the emission factor  $E_{\text{Steam}_y}$  is provided by the steam supplier of LYPC's adipic acid plant.

Parameter	Value	Reference
$Q_{\text{Steam}_y}$	10,712.636t	Appendix 12
$E_{\text{Steam}_y}$	0.2624 kg-CO <sub>2</sub> /kg-steam	Appendix 13

### **Calculation of baseline emissions**

The amount of baseline emissions in the given period y (measured in t CO<sub>2</sub> eq.) is rounded down in t CO<sub>2</sub> eq. to get conservative consistency of final calculation of emission reductions formula.

Parameter	Value	Reference
$BE_y$	3,751,901t CO <sub>2</sub> eq.	Calculated
$Q_{\text{N}_2\text{O}_y}$	12,093.840t	Appendix 9
$GWP_{\text{N}_2\text{O}}$	310 kgCO <sub>2</sub> /kg N <sub>2</sub> O	Kyoto Protocol Decision 2/CP.3
$Q_{\text{Steam}_y}$	10,712.636t	Appendix 12
$E_{\text{Steam}_y}$	0.2624 kg-CO <sub>2</sub> /kg-steam	Appendix 13

## **9.2. Calculation of project emissions**

The emissions due to the decomposition process  $PE_y$  are the sum of the emissions due to the N<sub>2</sub>O that has not been sent to the decomposition process and the emissions due to the N<sub>2</sub>O non destroyed by the decomposition process.

$$PE_y = Q_{\text{N}_2\text{O}_{\text{by-pass}_y}} \times GWP_{\text{N}_2\text{O}} + ND_{\text{N}_2\text{O}_y} \times GWP_{\text{N}_2\text{O}}$$

$$PE_y = (Q_{\text{N}_2\text{O}_{\text{by-pass}_y}} + ND_{\text{N}_2\text{O}_y}) \times GWP_{\text{N}_2\text{O}}$$

### **Calculation of $Q_{\text{N}_2\text{O}_{\text{by-pass}_y}}$**

The close time of the position switch on the bypass valve and the production time of the adipic acid

are monitored and the quantity of N<sub>2</sub>O that by-pass the decomposition facility is registered daily:

$$Q_{N_2O\_by-pass_d} = (Q_{N_2O} \times (1 - \%_{on-line}))_d$$

The quantity of N<sub>2</sub>O that by-passed the decomposition facility over the period is:

$$Q_{N_2O\_by-pass_y} = \sum Q_{N_2O\_by-pass_d}$$

The %<sub>on-line</sub><sub>y</sub> equivalent over the period is calculated as:

$$\%_{on-line}_y = 1 - (Q_{N_2O\_by-pass_y} / Q_{N_2O_y})$$

Parameter	Value	Reference
Q <sub>N<sub>2</sub>O by-pass<sub>y</sub></sub>	67.501t	Appendix 5
Q <sub>N<sub>2</sub>O<sub>y</sub></sub>	12,093.840t	Appendix 9
% <sub>on-line<sub>y</sub></sub>	99.44%	Appendix 4

### Calculation of ND<sub>N<sub>2</sub>O<sub>y</sub></sub>

The non-destroyed N<sub>2</sub>O (ND<sub>N<sub>2</sub>O<sub>y</sub></sub>) is constantly monitored and obtained from the constant monitoring of the flow (Q<sub>GE</sub>) and the concentration of N<sub>2</sub>O (N<sub>2</sub>O<sub>GE</sub>) of the effluent gas:

$$ND_{N_2O_i} = Q_{GE_i} \times N_{2O\_GE_i} \times \text{Specific\_gravity\_of\_N}_2\text{O}$$

The quantity of N<sub>2</sub>O that non-destroyed by the decomposition facility over the period is:

$$ND_{N_2O_y} = \sum ND_{N_2O_i}$$

The N<sub>2</sub>O<sub>GE</sub> equivalent over the period is calculated as:

$$N_{2O\_GE} = ND_{N_2O_y} / Q_{GE} / \text{Specific\_gravity\_of\_N}_2\text{O}^3$$

Parameter	Value	Reference
Q <sub>GE</sub>	60,140,905Nm <sup>3</sup>	Appendix 1
N <sub>2</sub> O <sub>GE</sub>	289ppm	Appendix 2
ND <sub>N<sub>2</sub>O</sub>	34.142t	Appendix 3

### Calculation of project emissions

The emissions due to the decomposition process PE<sub>y</sub> is rounded up in t CO<sub>2</sub> eq. to get conservative consistency in final calculation of emission reductions formula.

Parameter	Value	Reference
PE <sub>y</sub>	31,510t CO <sub>2</sub> eq.	Calculated
Q <sub>N<sub>2</sub>O by-pass<sub>y</sub></sub>	67.501 t	Appendix 5
ND <sub>N<sub>2</sub>O</sub>	34.142t	Appendix 3
GWP <sub>N<sub>2</sub>O</sub>	310 kgCO <sub>2</sub> /kg N <sub>2</sub> O	Kyoto Protocol Decision 2/CP.3

### 9.3. Calculation of leakage

<sup>3</sup> The specific<sub>gravity\_of\_N<sub>2</sub>O</sub> = 44 / 22.414 × 10<sup>-6</sup> is used to transform ppm in kg/Nm<sup>3</sup>.

Leak emissions comprise the emissions associated with electricity used by the decomposition plant.

Leakage amounts to:

$$L_y = Q\_Power \times E\_Power$$

The  $Q\_Power$  consumed by this project activity is monitored constantly, and the emission factor  $E\_Power$  is obtained according to the latest data provided by the Chinese DNA of CDM, NDRC.

$L_y$  is rounded up in tCO<sub>2</sub> eq. to get conservative consistency in final calculation of emission reductions formula.

Parameter	Value	Reference
$L_y$	1,982t CO <sub>2</sub> eq.	Calculated
$Q\_Power$	1,577,577kWh	Appendix 14
$E\_Power$	1.2561 kg-CO <sub>2</sub> /kWh	Appendix 15

#### 9.4. Calculation of emission reduction

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

$$ER_y = BE_y - PE_y - L_y$$

Or,

$$ER_y = 3,751,901 \text{ t CO}_2 \text{ eq.} - 31,510 \text{ tCO}_2 \text{ eq.} - 1,982 \text{ tCO}_2 \text{ eq.}$$

Or,

$$ER_y = 3,718,409 \text{ t CO}_2 \text{ eq.}$$

The above emission reduction covers the period from December 1<sup>st</sup>, 2009 to March 13<sup>th</sup>, 2010.

#### 9.5. Compared with the ERs estimated in the registered PDD

The accumulated emission reductions achieved by this project in this second crediting year (14/03/2009- 13/03/2010) is recorded as:

Monitoring Periods	Emission reductions achieved in each monitoring period (t CO <sub>2</sub> eq.)	The accumulated emission reductions achieved in this crediting year (t CO <sub>2</sub> eq.)
March 14 <sup>th</sup> , 2009–August 31 <sup>st</sup> , 2009	5,983,756	5,983,756
September 1 <sup>st</sup> , 2009–November 30 <sup>th</sup> , 2009	3,194,801	9,178,557
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	3,718,409	12,896,966

As shown in the above table, the accumulated emission reductions achieved by this project in this crediting year (14/03/2009- 13/03/2010), 12,896,966t CO<sub>2</sub> eq., is above the annual estimation of emission reductions of 10,017,235 t CO<sub>2</sub> eq. as shown in section A.4.4 of the registered PDD.

It is because conservative values were applied to estimate the emission reductions in the registered PDD in " Section B.6.3 Ex-ante calculation of emission reductions", in particular the amount of adipic acid, %\_on-line, and the destruction rate (performance efficiency) of the N<sub>2</sub>O abatement unit.



- (1) The accumulated P\_AdOH credited for the second crediting year (14/03/2009-13/03/2010) , (156,290.000t, as stated in Section 9.1 and Appendix 6 of this monitoring report) is greater than the conservative value of 140,000 t applied in Section B.6.3 of the registered PDD;
- (2) The actual % on-line for the second crediting year (99.59%) and for this monitoring period (99.44%, see Appendix 4 to this monitoring report) are above the conservative value of 90% applied in Section B.6.3 of the registered PDD; and
- (3) The actual average destruction rate achieved for the second crediting year (99.09%) and for this monitoring period (99.75%) are above the conservative value of 95% applied in Section B.6.3 of the registered PDD.

Details as below:

Item	Annual values applied in ex-ante calculation of Section B.6.3 of the registered PDD	Credited values in the second crediting year (14/03/2009-13/03/2010)	Comments
P_AdOH (t)	140,000	156,290.000	Parameters associated with Baseline Emissions (BE)
Q_Steam (t)	31,152	37,131	
E_Steam (CO <sub>2</sub> e/t-steam)	0.27	0.2641 (14/03/2009-31/08/2009) 0.2624 (01/09/2009-13/03/2010)	
% on-line	90%	99.59%	Parameters associated with Project Emissions (PE)
Q_N <sub>2</sub> O_by-pass (t)	3,780	174.453	
Destruction Rate (%)	95%	99.09%	
ND_N <sub>2</sub> O (t)	1,701	430.088	Parameters associated with Leakage (L)
Q_power (kwh)	8,400,000	5,467,357	
E_power (kgCO <sub>2</sub> /kWh)	1.1983	1.2561	
Emission Reductions (t CO <sub>2</sub> e)	10,017,235	12,896,966	

As stated in Section 9.1 of this monitoring report, this monitoring period is the last monitoring period in the second crediting year (14/03/2009-13/03/2010). The accumulated P\_AdOH by the end of this monitoring period in the second crediting year, 156,290.000 t, is below the cap of adipic acid production, 158,835.992 t/y, which is calculated according to the clarification made in EB48 (see Section 9.1 and Appendix 6). Hence, both P\_AdOH and emission reductions achieved in this monitoring period can be fully credited.

**Appendix 1**

Name of item	Q_GE
Description	Volume of effluent gas
Value in period	60,140,905Nm <sup>3</sup>
Method of monitoring	Annubar flow meter
Recording frequency	Monthly
Background data	Data Acquisition System (DAS)/ Log sheet record / Annubar flow meter

This parameter is measured continuously by an Annubar flow meter, the readings of the Annubar flow meter is the flow under standard temperature and pressure (STP) (0°C and 1 atm) after technological processing, temperature and pressure supplementary. The Distributed Control System (DCS) and DAS are recording every reading of the flow rate.

The DAS records the accumulated volume per second and the difference of the two adjacent accumulated volume as the actual volume in the same second is then multiplied with the corresponding N<sub>2</sub>O concentration (N<sub>2</sub>O\_GE) and the specific gravity of N<sub>2</sub>O to get the ND\_N<sub>2</sub>O in the said interval, the latter is then accumulated, giving the periodic ND\_N<sub>2</sub>O.

Hence, the reporting of monthly total of Q\_GE is only for information as it is the values of each second are actually used in the data processing for ND\_N<sub>2</sub>O, the constant calculation of ND\_N<sub>2</sub>O is more accurate.

<b>Period</b>	<b>Q_GE (Nm<sup>3</sup>)</b>
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	17,067,930
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	19,052,563
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	16,136,840
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	7,883,572
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	60,140,905

**Appendix 2**

Name of item	N <sub>2</sub> O_GE
Description	Concentration of N <sub>2</sub> O in the effluent gases
Value in period	289ppm
Method of monitoring	Online Gas Chromatography
Recording frequency	Monthly
Background data	DAS / Log sheet record
Calculation method	<p>This parameter is measured continuously by an online gas chromatograph (GC). The DCS and DAS are recording every analysis of the online GC. The DAS records concentration per second, and the concentration (N<sub>2</sub>O_GE) in the same second is then multiplied with the corresponding N<sub>2</sub>O volume (Q_GE) and the specific gravity of N<sub>2</sub>O to get the ND_N<sub>2</sub>O in the said interval, i.e.:</p> $ND\_N_2O_i = Q\_GE_i \times N_2O\_GE_i \times \text{Specific\_gravity\_of\_} N_2O$ <p>The analyzer has a detection limit of 10ppm, which is used as a default value when the measured is below the detection limit.</p> <p>The specific_gravity_of_ N<sub>2</sub>O = 44 / 22.414 × 10<sup>-6</sup> is used to transform ppm in kg/Nm<sup>3</sup>.</p> <p>ND_ N<sub>2</sub>O<sub>i</sub> is then accumulated, giving the periodic ND_N<sub>2</sub>O.</p> <p>At the end of the month/period, based upon the flow Q_GE (see Appendix 1) and ND_ N<sub>2</sub>O (see Appendix 3), the concentration of N<sub>2</sub>O equivalent for the month/period is calculated.</p> <p>Hence, the reporting of monthly total of monthly N<sub>2</sub>O_GE is only for information as it is the values of each second interval are actually used in the data processing for ND_N<sub>2</sub>O, the constant calculation of ND_N<sub>2</sub>O is more accurate.</p>

Period	ND_N <sub>2</sub> O (t)	Q_GE (Nm <sup>3</sup> )	N <sub>2</sub> O_GE in average (ppm)
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	10.302	17,067,930	307
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	12.440	19,052,563	333
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	7.361	16,136,840	232
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	4.039	7,883,572	261
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	34.142	60,140,905	289

**Appendix 3**

Name of item	ND_N <sub>2</sub> O
Description	Quantity of non-destroyed N <sub>2</sub> O emitted by the decomposition facility
Value in period	34.142t
Method of monitoring	calculation
Recording frequency	Monthly
Background data	DAS / Log sheet record
Calculation method	<p>The DAS records the accumulated volume (as shown in Appendix 1) and the concentration (ppm) (as shown in Appendix 2) at an interval of one second, and the difference of the two adjacent accumulated volume as the actual volume (Q_GE) in this interval is then multiplied with the corresponding N<sub>2</sub>O concentration (N<sub>2</sub>O_GE) and the specific gravity of N<sub>2</sub>O to get the ND_N<sub>2</sub>O in the said interval, i.e.:</p> $ND\_N_2O = Q\_GE \times N_2O\_GE \times \text{Specific\_gravity\_of\_}N_2O$ <p>The specific_gravity_of_N<sub>2</sub>O = <math>44 / 22.414 \times 10^{-6}</math> is used to transform ppm in kg/Nm<sup>3</sup>.</p> <p>ND_N<sub>2</sub>O<sub>i</sub> is then accumulated, giving the periodic ND_N<sub>2</sub>O. The accumulated ND_N<sub>2</sub>O is recorded.</p>

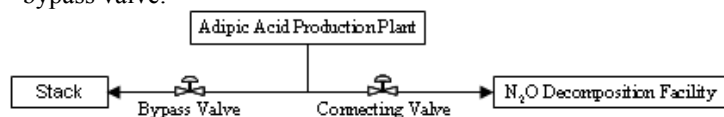
Period	ND_N <sub>2</sub> O (t)
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	10.302
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	12.440
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	7.361
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	4.039
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	34.142

**Appendix 4**

Name of item	%_on-line
Description	% of production time the position switch on the bypass valve is closed
Value in period	99.44%
Method of monitoring	Position switch on bypass valve <sup>4</sup>
Recording frequency	Monthly
Background data	DAS / Log sheet record
Calculation method	Based upon the position of the position switch on the bypass valve of the decomposition facility, the % of time that the close time of the position switch (TIME002) in the production time of adipic acid (TIME001) is counted, TIME001 and TIME002 are counted and archived in the DAS. It is set in the DAS that the counting of TIME002 can only be active when the TIME001 is running. The daily %_on-line <sub>y</sub> is recorded and used to calculate daily Q_ N <sub>2</sub> O _by-pass as $Q_{N_2O\_by-pass_d} = (Q_{N_2O} \times (1 - \%_{on-line}))_d$ $Q_{N_2O\_by-pass_d}$ is then accumulated, giving the periodic Q_ N <sub>2</sub> O _by-pass (See Appendix 5). At the end of the period, %_on-line for the period is calculated as: $\%_{on-line}_y = 1 - (Q_{N_2O\_by-pass}_y / Q_{N_2O}_y)$ Hence the reporting of monthly equivalent %_on-line is only for information as it is the daily values which are actually used in the data processing for Q_ N <sub>2</sub> O _by-pass.

Period	Q_ N <sub>2</sub> O _by-pass <sub>y</sub> (t)	P_ AdOH <sub>y</sub> (t)	%_on-line <sub>y</sub> (%)
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	67.501	12,943.000	98.07
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	0.000	13,665.000	100.00
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	0.000	12,321.500	100.00
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	0.000	5,862.500	100.00
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	67.501	44,792.000	99.44

<sup>4</sup> There is only one flow connecting to the N<sub>2</sub>O decomposition facility and one flow by-passing the decomposition facility (as shown in the below figure), during certain situation of the operation of the project activity, the connecting valve and the bypass valve may be opened together; on the other hand, it is interlocked set that when the connecting valve is closed, the bypass valve is open, which means the close time of the bypass valve is shorter than or equal to the open time of the connecting valve. Therefore, it gives a less %\_on-line through monitoring the close time of the bypass valve as the operation time of the decomposition facility, therefore, it is more appropriate to monitor the close time of the position switch on the bypass valve.



**Appendix 5**

Name of item	Q_N <sub>2</sub> O_by-pass
Description	N <sub>2</sub> O by-passing the decomposition facility
Value in period	67.501t
Method of monitoring	Production record and %_on-line DCS monitoring
Recording frequency	Monthly
Background data	Production & %_on-line log sheet record
Calculation method	<p>The close time of the position switch on the bypass valve and the production time of the adipic acid are monitored by Distributed Control System (DCS), and are recorded daily in DAS, and the quantity of N<sub>2</sub>O that by-pass the decomposition facility, see Appendix 4, is registered daily:</p> $Q_{N_2O\_by-pass_d} = (Q_{N_2O} \times (1 - \%_{on-line}))_d$ <p>The quantity of N<sub>2</sub>O that by-passed the decomposition facility over the period is:</p> $Q_{N_2O\_by-pass_y} = \sum Q_{N_2O\_by-pass_d}$

Period	Q_N <sub>2</sub> O_by-pass <sub>y</sub> (t)
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	67.501
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	0.000
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	0.000
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	0.000
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	67.501

**Appendix 6**

Name of item	P_AdOH
Description	Adipic acid production
Value in period	44,792.000t
Method of monitoring	The production record of adipic acid
Recording frequency	Monthly
Background data	log sheet record
	The production of adipic acid is measured by the Automatic quota packaging machine.

<b>Period</b>	<b>P_AdOH (t)</b>
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	12,943.000
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	13,665.000
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	12,321.500
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	5,862.500
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	44,792.000

The accumulated adipic acid produced in this second crediting year (14/03/2009–13/03/2010) is recorded as:

<b>Monitoring Period</b>	<b>P_AdOH in each monitoring period (t)</b>	<b>Accumulated P_AdOH in this crediting year (t)</b>
March 14 <sup>th</sup> , 2009–August 31 <sup>st</sup> , 2009	73,046.000	73,046.000
September 1 <sup>st</sup> , 2009–November 30 <sup>th</sup> , 2009	38,452.000	111,498.000
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	44,792.000	156,290.000

This monitoring period is the last monitoring period in the second crediting year (14/03/2009-13/03/2010). By the end of this monitoring period, the accumulated P\_AdOH in the second crediting year, 156,290.000 t, is below the cap of adipic acid production, 158,835.992 t/y, which is calculated according to the clarification made in EB48. Hence, P\_AdOH achieved in this monitoring period can be fully credited.

**Appendix 7**

Name of item	HNO <sub>3</sub> _consumption
Description	Nitric acid consumption in the adipic acid production process
Value in period	41,496.483t
Method of monitoring	Using measuring equipment to measure the amount of HNO <sub>3</sub> consumed during the production.
Recording frequency	Monthly
Background data	<p>DAS / Log sheet record</p> <p>The HNO<sub>3</sub> consumed in the AdOH production process is supplied by two separate HNO<sub>3</sub> plants of LYPC (Plant 1 and Plant 2 in following text).</p> <p>Aiming at better monitor, the monitoring method of HNO<sub>3</sub> from plant 2 became the same with the monitoring method of HNO<sub>3</sub> from plant 1 from the very beginning of eighth monitoring period.</p> <p>HNO<sub>3</sub> from Plant 1 and Plant 2 are both measured through flow meter for the gross mass and through standard titration instruments for the concentration. The daily flow data of HNO<sub>3</sub> (t) is recorded in DAS, it is then multiplied with the corresponding daily concentration to get the daily pure HNO<sub>3</sub>_consumption (t).</p> <p>The daily quantity of the two plants is summed up and aggregate monthly. Cumulated value for HNO<sub>3</sub>_consumption is recorded.</p>

<b>Period</b>	<b>HNO<sub>3</sub>_consumption(t)</b>
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	12,114.859
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	12,452.025
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	11,533.591
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	5,396.008
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	41,496.483



**Appendix 8**

Name of item	HNO <sub>3</sub> _physical
Description	Nitric acid physical losses in the adipic acid production process
Value in period	1,275.478t
Method of monitoring	Excel workbook based on the monitoring data and analysis
Recording frequency	Monthly
Background data	DAS /Log sheet record
	HNO <sub>3</sub> _physical is the sum of the following losses:
	<ul style="list-style-type: none"> <li>• nitrates contained in the aqueous waste (monitored for waste water regulation);</li> <li>• nitrates in the by-products (glutaric acid, succinic acid) (monitored for quality);</li> <li>• nitrates in the adipic acid production (monitored for quality control);</li> <li>• NOx in the reaction off gases (monitored for air regulation)</li> </ul>
	<p>The flow of the aqueous waste, the production of the by-products and the flow of the reaction off gases are measured by the flow meters;</p> <p>The production of the adipic acid is measured by the counting mechanism during the production package of the adipic acid; the concentration of the nitrates contained in the aqueous waste, the concentration of the nitrates in the by-products and the concentration of the nitrates in the adipic acid production are analyzed in lab daily;</p> <p>The concentration of the NOx in the reaction off gases is analyzed by infra-red online analyzer.</p> <p>The daily flow data is recorded in DAS, it is then multiplied with the corresponding daily concentration data and converted to the daily HNO<sub>3</sub> loss equivalent to calculate the HNO<sub>3</sub>_physical daily.</p> <p>Cumulated value for HNO<sub>3</sub>_physical is recorded.</p>

Period	HNO <sub>3</sub> _physical (t)
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	290.479
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	422.094
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	389.014
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	173.891
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	1,275.478

**Appendix 9**

Name of item	N <sub>2</sub> O _/AdOH
Description	N <sub>2</sub> O emission factor for adipic acid production
Value in period	0.27 kg N <sub>2</sub> O / kg AdOH
Method of monitoring	Adipic acid production, nitric acid consumption and physical losses
Recording frequency	Monthly
Background data	log sheet record
Calculation method	Nitric acid physical losses (HNO <sub>3</sub> _physical) in the aqueous waste, the off gases, the adipic acid and the by-product are monitored. Those losses are deducted from the nitric acid consumption (HNO <sub>3</sub> _consumption) to get the chemical consumption (HNO <sub>3</sub> _chemical).

The actual N<sub>2</sub>O emission factor is then calculated over the period:  

$$N_2O\_AdOH = HNO_3\_chemical / P\_AdOH / 63 / 2 \times 0.96 \times 44$$

This value is capped by a value of KE\_N<sub>2</sub>O = 0.27, as specified in the PDD table B.6.1 and required by the methodology AM0021.

Period	HNO <sub>3</sub> _consumption (t)	HNO <sub>3</sub> _physical (t)	N <sub>2</sub> O_produced <sup>5</sup> (t)	P_AdOH (t)	Actual N <sub>2</sub> O _/AdOH (kg N <sub>2</sub> O/ kg AdOH)	KE_N <sub>2</sub> O (kg N <sub>2</sub> O/kg AdOH)	N <sub>2</sub> O _/AdOH (kg N <sub>2</sub> O/kg AdOH)	Q_N <sub>2</sub> O <sup>6</sup> (t)
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	12,114.859	290.479	3,963.983	12,943.000	0.306	0.27	0.27	3,494.610
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	12,452.025	422.094	4,032.891	13,665.000	0.295	0.27	0.27	3,689.550
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	11,533.591	389.014	3,736.087	12,321.500	0.303	0.27	0.27	3,326.805
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	5,396.008	173.891	1,750.652	5,862.500	0.299	0.27	0.27	1,582.875
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	41,496.483	1,275.478	13,483.613	44,792.000	0.301	0.27	0.27	12,093.840

<sup>5</sup> N<sub>2</sub>O\_produced = P\_AdOH × Actual N<sub>2</sub>O \_/AdOH = P\_AdOH × (HNO<sub>3</sub>\_chemical / P\_AdOH / 63 / 2 × 0.96 × 44).

<sup>6</sup> The quantity of N<sub>2</sub>O to be credited, Q\_N<sub>2</sub>O = P\_AdOH × N<sub>2</sub>O \_/AdOH

**Appendix 10**

Name of item	Q_N <sub>2</sub> O reg , N <sub>2</sub> O_reg / AdOH and r <sub>y</sub>
Description	Evolution of Chinese legislation that may require limitation of N <sub>2</sub> O emissions using one of the following criteria: - Q_N <sub>2</sub> O reg : allowed N <sub>2</sub> O emissions - N <sub>2</sub> O_reg / AdOH : allowed N <sub>2</sub> O emissions per kg of adipic acid produced - r <sub>y</sub> : share of N <sub>2</sub> O emissions required to be destroyed
Value in period	not applicable
Method of monitoring	Survey
Recording frequency	When relevant
Background data	Chinese legislation The department of LYPC, which governing the environmental protection, consults the local government departments in charge of the environment periodically, and surveys the official websites of National Development and Reform Commission, Ministry of Environmental Protection of People's Republic of China and the other authorities, it is found that no evolution of legislation since PDD issued.

Period	Q_N <sub>2</sub> O reg (kg)	N <sub>2</sub> O_reg / AdOH (kg)	r <sub>y</sub> (%)
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	No limit	No limit	0

**Appendix 11**

Name of item	P_N <sub>2</sub> O
Description	Market price of N <sub>2</sub> O in waste gas
Value in period	0 \$/t
Method of monitoring	Market Survey
Recording frequency	Yearly
Background data	It needs a very high investment cost in a purification-concentration-liquefaction unit to extract the N <sub>2</sub> O from the exhaust flow of the adipic acid plant, and neither the process nor the product will get the necessary certifications for pharmaceutical and food markets, there is no economic feasibility to do so. And there is no market for this low level of N <sub>2</sub> O concentration. Therefore, it can be concluded that there is no N <sub>2</sub> O market for the N <sub>2</sub> O produced as by-product of adipic acid.

<b>Period</b>	<b>P_N<sub>2</sub>O (\$/t)</b>
<b>2009</b>	0
<b>2010</b>	0

**Appendix 12**

Name of item	Q_Steam_p
Description	Amount of steam produced by the decomposition facility
Value in period	10,712.636t
Method of monitoring	Flowmeter
Recording frequency	Monthly
Background data	DAS / Log sheet record
	The parameter is measured continuously by steam meter and accumulated data is recorded in the DAS.

<b>Period</b>	<b>Q_Steam_p (t)</b>
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	2,952.548
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	3,128.416
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	3,028.400
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	1,603.272
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	10,712.636

**Appendix 13**

Name of item	E_Steam
Description	CO <sub>2</sub> emission factor for steam produced by the facility
Value in period	0.2624 kg-CO <sub>2</sub> /kg-steam
Method of monitoring	Supplier data
Recording frequency	Yearly
Background data	the data of Liaoyang Petrochemical Company Thermal Power Plant
Calculation method	<p>Calculated according to the PDD.</p> <p>The standard coal consumption in 2009 according to the data of Liaoyang Petrochemical Company Thermal Power Plant is: 0.0911kg-ce/kg-steam;</p> <p>Coal equivalent (standard coal): 29.3 MJ (The national standard of the people's republic of China—General principles for calculation of total production energy consumption (GB2589-90));</p> <p>GHG Emission Factor: 0.0983 kg-CO<sub>2</sub>/MJ (IPCC default, IPCC publication 1997).</p> <p>Thus, <math>E_{\text{Steam}_y} = 0.0911 \times 29.3 \times 0.0983 = 0.2624</math> (kg-CO<sub>2</sub>/ kg-steam)</p> <p>The yearly value of E_Steam is calculated with the latest data provided by the steam supplier.</p>

Period	Standard coal consumption (kg-ce/kg-steam)	Coal equivalent (standard coal) (MJ)	GHG Emission Factor (kg-CO <sub>2</sub> /MJ)	E_Steam <sub>y</sub> (kg-CO <sub>2</sub> /kg-steam)
2009	0.0911	29.3	0.0983	0.2624

**Appendix 14**

Name of item	Q_Power
Description	Electricity consumption by the decomposition facility
Value in period	1,577,577kWh
Method of monitoring	Electricity meter
Recording frequency	Monthly
Background data	Log sheet record/ counter
	This parameter is measured continuously by electricity meters and accumulated data is recorded in the DAS.

<b>Period</b>	<b>Q_Power (kWh)</b>
December 1 <sup>st</sup> –December 31 <sup>st</sup> , 2009	459,378
January 1 <sup>st</sup> –January 31 <sup>st</sup> , 2010	475,322
February 1 <sup>st</sup> –February 28 <sup>th</sup> , 2010	436,177
March 1 <sup>st</sup> –March 13 <sup>th</sup> , 2010	206,700
December 1 <sup>st</sup> , 2009 –March 13 <sup>th</sup> , 2010	1,577,577

**Appendix 15**

Name of item	E_ Power
Description	CO <sub>2</sub> intensity for electric generation
Value in period	1.2561 kg-CO <sub>2</sub> /kWh
Method of monitoring	Survey of data publication
Recording frequency	Yearly
Background data	Chinese Electric Almanac and Chinese Energy Statistical Yearbook.
Calculation method	The Chinese DNA of CDM, NDRC (National Development and Reform Commission), has calculated the operating margin (OM) and the build margin (BM) according to ACM0002 for all the grids in China, and published the data.

NDRC updated the emissions factors for the Grids in China on 02/07/2009, which is shown on the website of <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2333.pdf>. For North East China Grid, OM=1.1293 kg-CO<sub>2</sub>/kWh, BM=0.7242 kg-CO<sub>2</sub>/kWh.  
OM is applied as E\_ Power for this project out of conservative.

Nevertheless, the previous value of E\_ Power is still applied for this project out of conservative due to the new value is lower than the previous one, which is 1.2561 kg-CO<sub>2</sub>/kWh.

<b>Period</b>	<b>E_ Power (kg-CO<sub>2</sub>/kWh)</b>
December 1 <sup>st</sup> , 2009 – March 13 <sup>th</sup> , 2010	1.2561