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CDM
MONITORING REPORT #1
of
"N2O Emission Reduction in Onsan, Republic of Korea"
UNFCCC 0099

From: Sep. 1, 2006
To: Oct. 22, 2006

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Date: Oct. 24th, 2006

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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 1st 2006 to October 22nd 2006 as the 1st period.

Duration of the project activity period
The starting date of the project as well as the starting date of the crediting period is defined as 01/09/2006.

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 Onsan, Republic of Korea.
Version number of the document : 8
Date : September, 1st 2005

CDM registration number :
"N2O Emission Reduction in Onsan, Republic of Korea" – UNFCCC ref number 0099

3. Definition

y	: Monitoring period (in this report, September 1st 2006 to October 22nd 2006.)
PDD	: Project Design Document of this project "N2O Emission Reduction in Onsan, Republic of Korea." Version number of the document: 8, issued on September, 1st 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 South Korea. There are in fact no governmental regulations with quantified emission limits in any non-Annex I countries at this point.

In this project, Rhodia Polyamide Co. Ltd 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 was not implemented.
The decomposition facilities was installed in the factory site of Onsan Rhodia Polyamide Co., Ltd. in May 2006 and destruction of N2O was started in September 2006.
The starting date of the project as well as the starting date of the crediting period is defined as 01/09/2006.
This project activity was registered at UNFCCC on November 27th 2005 with the number 0099.

Technical description of the project

Location of the project activity
The decomposition facilities were installed in the factory site of Onsan Rhodia Polyamide Co. Ltd, in May 2006. The surrounding area is the Onsan industrial estate.

Technology to be 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. Steam and ammonia are injected to control the emission of NO and NO2.

Before release to the stack, the flue gas coming from the thermal oxidizer is used to produce saturated steam, which is fed into the existing on-site steam network.

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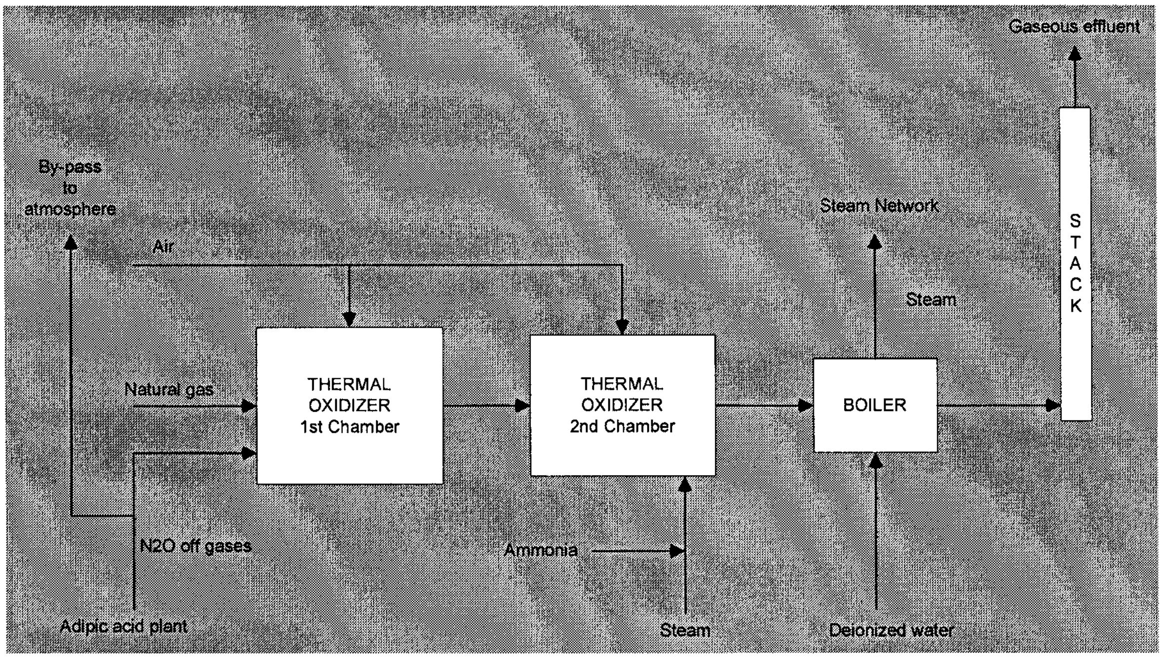
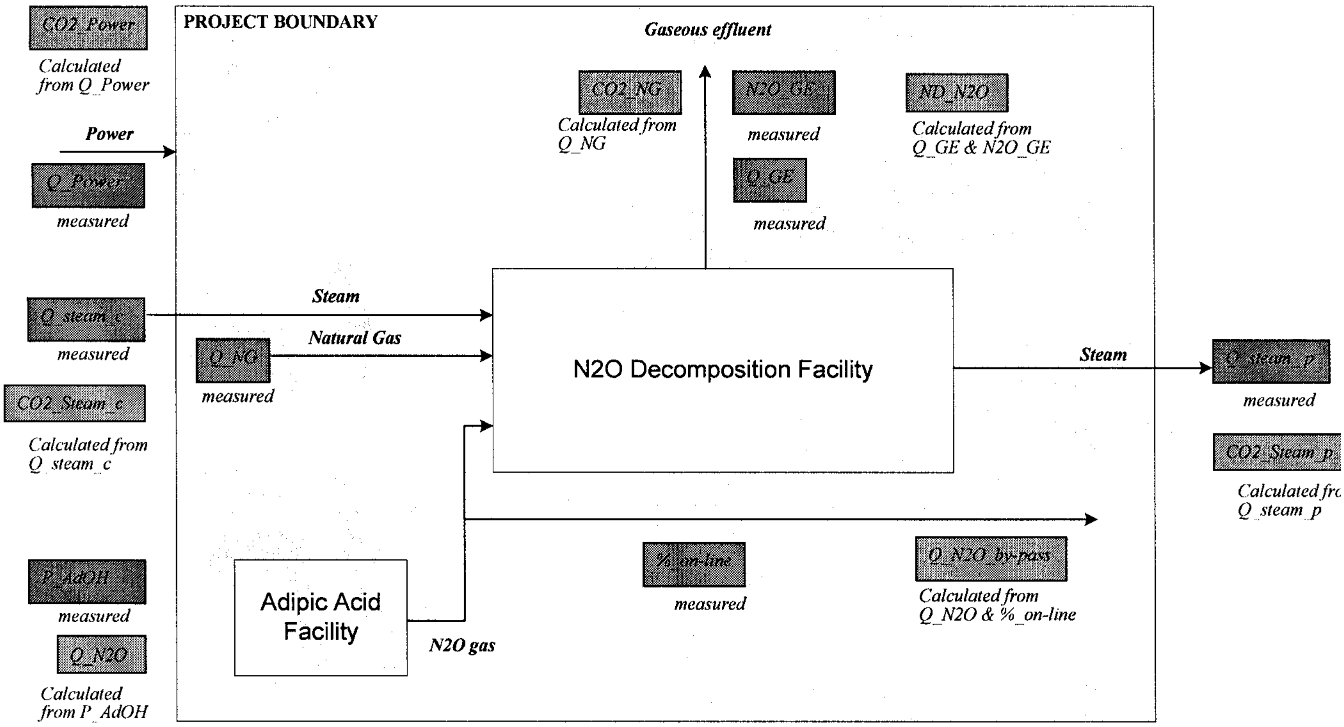


5. Baseline methodology

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. Monitoring methodology and plan

Approved monitoring methodology AM 0021 / version 1 is applied to this project

This methodology is applicable to projects which decomposes 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.

Data being collected to monitor the GHG reduction is 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/h	Monthly	Appendix 1
N_2O_GE	Concentration of N_2O in the effluent gas	Infra –Red 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- N_2O	Monthly	Appendix 3
Q_NG	Amount of natural gas burned	Natural gas meter	Nm^3	Monthly	Appendix 4
E_NG	Natural gas composition required for calculation of E_NG	Gas supplier	Kg-CO2/Nm3	Yearly	Appendix 5
%_on-line	% of production time the position switches on the by-pass valves are open	Position switches on bypass valves	% 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
P_AdOH	Amount of adipic acid production	Log sheet for packaged product and DCS for silo inventory	t	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	Excel workbook based on the raw material consumption, DCS data and Lab data	-	Monthly	Appendix 9
Q N_2O reg	Per Korean regulation allowed N_2O emissions	Korean regulation	kg	Date when relevant legislation is in place	Appendix 10

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ID	Data variable	Source of data	Data unit	Recording frequency	Reference
N_2O reg/AdOH	Per Korean regulation allowed N_2O emissions per kg of adipic acid produced	Korean regulation	kg	Date when relevant legislation is in place	Appendix 10
r_y	Per Korean regulation required share of N_2O emissions to be destroyed	Korean 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
Steam supplier data	All data required for calculation of E_Steam	External steam supplier and steam properties	-	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 AM0002	Korean Energy Economics Institute	-	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	Internal & External steam suppliers	-	Yearly	Appendix 17

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

7.1. 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 Onsan Adipic Acid plant

The personnel have been trained by the technology supplier i.e. M/s John Zink International Luxembourg.

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

The Onsan plant is certified according to ISO9001 and applies appropriate QA & QC procedures.

The equipment and analytical methods given by the technology supplier M/s John Zink International Luxembourg 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 meter is measured with an Averaging Pitot tube. This instrument is considered as a critical instrument in the QA/QC procedure.*
2a.2. (D.2.1.1) N_2O_GE	*Low*	*Existing procedures are applied to this analyzer for QA & QC.*
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 ONSAN adipic acid plant where the N_2O waste originates. A QA/QC procedure is implemented. Production quantity is based on the packaged product plus silo volume.*
2a.5. (D.2.1.1) %_on-line	*Low*	*Use opening of high integrity performance connecting valves to limit leaks. Procedures currently in place in Chalampé for monitoring N_2O emissions have be implemented in ONSAN 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.*

7.3. Calibration/Maintenance of Measuring and Analytical Instruments

All measuring and analytical instruments are being calibrated as per the methodology AM0021 and created as a protocol in Onsan'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.

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7.4. Environmental Impact

The Thermal oxidation plant has been installed with on line analyzers to monitor constantly some parameters that are required by Korean legislation. Starting on July 1st 2007, those parameters will be transmitted automatically to the local government environmental agency as part of the Telemonitoring System (TMS) required by a revised environmental law. Until that date regular checking by government agencies can be made.

A National Institute of Environment Research (NIER) representative came on September 28th to carry out an analysis of the gaseous releases discharged from the N2O stack. As evident from this independent data that confirm actual on-line analyzers data, the plant operation has been within compliance of the environmental standards.

Table showing analysis Gaseous Emission for Thermal Oxidation plant

Parameter		Value as per applicable standard	Typical on-line analysis	Actual analysis on September 28th 2006
CO	ppm	50 max	< 10ppm	4.1 ppm
NOx	ppm	200 max	< 100 ppm	37.3 ppm
NH3	ppm	50 max	< 10 ppm	

8. GHG Calculations

Statement of GHG emission reduction in 1st monitoring period.

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

8.1. Calculation of Q_N2Oy

It has been checked that there are no Korean 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. So the capped value is being used according to AM 0021.

Parameter	value	Reference
Q_N2Oy	5349510 kg	Calculated
P_AdOH	19813 t	Appendix 8

%_on-line$_y$	75.66 %	Appendix 6

8.4. 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 x (1-%_on-line))y + (Q_GE x N_2O _GE)y) x GWP_ N_2O + Q_NGy 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 x N_2O _GE

PEy = ((Q_ N_2O x (1-%_on-line))y + ND_ N_2Oy) x GWP_ N_2O + Q_NGy x E_NGy

Parameter	value	Reference
PEy	**406 916 t CO2 eq.**	Calculated
(Q_ N_2O x (1-%_on-line))y	1 301 898 kg	Appendix 6
Q_GE	16 620 313 Nm^3	Appendix 1
N_2O_GE	9.47 ppm	Appendix 2
ND_ N_2O y	309.09 kg N_2O	Appendix 3
GWP_ N_2O	310 kg CO2 eq./ kg N_2O	Kyoto Protocol Rule. Decision 2/CP.3
Q_NGy	1 442 549 Nm^3	Appendix 4
E_NGy	2.240 kg CO2 eq./ Nm^3	Appendix 5

8.5. 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

Parameter	value	Reference
Ly	**170.8 t CO2 eq.**	Calculated
Q_Power	233 395 kWh	Appendix 14
E_Power	0.649 kg-CO_2/kWh	Appendix 15
Q_Steam_ c_y	140 723 kg	Appendix 16
E_Steam_c_y	0.137 kg-CO_2 / kg of steam	Appendix 17

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 production of adipic acid during the year starting on October 23rd 2005 that includes this period is below the nameplate capacity of the adipic acid plant, and as such the total production of this period can be used as such.

8.2. Calculation of baseline emissions

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

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

Parameter	value	Reference
BEy	**1 661 370 t CO2 eq.**	Calculated
Q_$N2O_y$	5349510 kg	Calculated in 8.1
GWP_N2O	310	Kyoto Protocol Rule. Decision 2/CP.3
Q_Steam_p_y	24 768 597 kg of steam	Appendix 12
E_$Steam_y$	0.122 kg-CO_2/kg of steam	Appendix 13

8.3. 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-line equivalent over the period is calculated as :

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

Parameter	Value	Reference
(Q_N2O x (1-%_on-line))y	1 301 898 kg	Appendix 7
P_AdOH	19813 t	Appendix 8
N2O_/AdOH	0.27 kg N2O/kg AdOH	Appendix 9

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8.6. Calculation of emission reduction

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

ERy = BEy – PEy – Ly

Or,

ERy = **1 661 370 t CO2 eq. – 406 916 t CO2 eq. – 170.8 t CO2 eq.**

Or,

ERy = 1,254,283 t CO2 eq.

The above emission reduction covers the generation of N2O during the period from September 1st 2006 to October 22nd 2006.

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Appendix 1

Name of item	Q_GE
Description	Volume of effluent gas leaving the stack
Value in period	16 620 313 Nm3
Method of monitoring	Annubar flow meter
Recording frequency	Monthly
Background data	Log sheet record / flowmeter

Period	Quantity of gaseous effluent Nm^3
Sept 1st – Oct 22nd	16 620 313

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Appendix 2

Name of item	N2O_GE
Description	Concentration of N_2O in the effluent gas
Value in period	9.47 ppm
Method of monitoring	Infra-Red online analyzer
Recording frequency	Monthly
Background data	Log sheet record
Calculation method	The on-line analyzer values are used to calculate every 10 sec the quantity of ND_N2O. Cumulated value is recorded (see appendix 3). Weighted average over the period based upon continuous online measures of the flow Q_GE and the concentration of N2O is calculated. The analyzer has a range of 0-200 ppm with a detection limit of 5 ppm, which is used as a default value when the measured value is below the detection limit.

Period	ND_N2O kg	Quantity of gaseous effluent Nm^3	Weighted average concentration of N_2O_GE ppm
Sept 1st – Oct 22nd	309.09	16 620 313	9.47

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Appendix 3

Name of item	ND_N2O
Description	
Value in period	309.09 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
Sept 1st – Oct 22nd	309.09

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<u>Appendix 4</u>

Name of item	Q_NG
Description	Amount of natural gas used by the decomposition process
Value in period	1 442 549 Nm3
Method of monitoring	Natural gas consumption data
Recording frequency	Monthly
Background data	Log sheet record / flowmeter

Period	Q_NG Nm^3
Sept 1st – Oct 22nd	1 442 549

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Appendix 5

Name of item	E_NG
Description	CO_2 emission factor for natural gas burning
Value in period	2.240 kg CO_2/Nm^3
Method of monitoring	Composition of natural gas
Recording frequency	Monthly
Background data	Composition data received from Kyung Dong City Gas Ltd, 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) The CO2 specific gravity in standard state is 1.965 E_NG = 1.965 x (average number of C in a mole of NG)

Period	E_NG
Sept 1st – Oct 22nd	2.240

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Appendix 6

Name of item	%_on-line
Description	% of production time that the N2O is sent to the decomposition facility
Value in period	75.66 %
Method of monitoring	Position of limit switches on the valves allowing to by-pass the decomposition facility
Recording frequency	Monthly
Background data	Log sheet record
Calculation method	Based upon the position of the limit switches on the valves 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	$N2O\_by\text{-}pass_y$ kg	P_AdOH_y t	$\%\_on\text{-}line_y$ %
Sept 1st – Oct 22nd	1 301 898	19813.000	75.66323

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Appendix 7

Name of item	Q_N2O_by-pass
Description	N2O by-passing the decomposition facility
Value in period	**1 301 898 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.

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

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

$N2O\_by\text{-}pass_y = \Sigma\ (N2O\_by\text{-}pass_d)$

Period	Q_N2O_by-pass kg
Sept 1^{st} – Oct 22^{nd}	1 301 898

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Appendix 8

Name of item	P_AdOH
Description	Adipic acid production
Value in period	19813 t
Method of monitoring	Packaged production and silo inventory
Recording frequency	Monthly
Background data	Log sheet record

Month - year	Adipic acid production t
Sept 1st – Oct 22nd	19813

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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	Period
Background data	Log sheet records
Calculation method	Nitric acid physical losses (HNO3_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 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 / 44

Year ending	Value calculated kg N2O/kg AdOH	N2O_AdOH kg N2O/kg AdOH
Oct 22nd 06	> 0.270	0.270

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Appendix 10

Name of item	Q_N_2O reg , N_2O_reg / AdOH and r_y
Description	Evolution of Korean 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	Korean legislation

Period	Q_N_2O reg t N_2O	N_2O_reg / AdOH t N_2O / t adipic acid	r_y %
Sept 1st – Oct 22nd	No limit	No limit	0.

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Appendix 11

Name of item	P_N_2O
Description	Market price of N_2O
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
2005	0

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Appendix 12

Name of item	Q_Steam_p
Description	Amount of steam produced by the decomposition facility
Value in period	24 768 597 kg
Method of monitoring	Flowmeter
Recording frequency	Monthly
Background data	Log sheet record

Period	Q_Steam_p kg
Sept 1st – Oct 22nd	24 768 597

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Appendix 13

Name of item	E_Steam
Description	CO_2 emission factor for steam produced by the facility
Value in period	**0.122 kg-CO_2/kg of steam**
Method of monitoring	Supplier data
Recording frequency	Yearly
Background data	Monthly external natural gas data from supplier
Calculation method	As we cannot get the data from the supplier, 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_tsteam = $\triangle$H (kcal/t) / (LHV (kcal/Nm3) x η (%)) The LHV data is the yearly average value for the gas supplied by Kyung Dong City Gas Co,Ltd

Year ending	LHV kcal/Nm^3	$\triangle$H kcal/t	η %	QNG_tsteam Nm3/t of steam	E_NG kg-CO_2/Nm3	E_Steam kg-CO_2/ kg of steam
Sept 30th 2006	10522	557960	97	54.669	2.240	0.122

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Appendix 14

Name of item	Q_Power
Description	Electricity consumption by the decomposition facility
Value in period	233 395 kWh
Method of monitoring	Power consumption data
Recording frequency	Monthly
Background data	Log sheet record / counter

Period	Q_Power kWh
Sept 1st – Oct 22nd	233 395

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Appendix 15

Name of item	E_Power
Description	CO2 intensity for electric generation
Value in period	0.649 **kg-CO_2/kWh**
Method of monitoring	Survey of data publication
Recording frequency	Yearly
Background data	KEPCO data make publicly available by the Korean Energy Economics Institute (KEEI) for 2003, 2004 & 2005.
Calculation method	Calculated using the combined margin (CM) approach according to ACM0002. Conservative value used.

Date (year)	E_Power kg-CO_2/kWh
Sept 1^{st} – Oct 22^{nd}	0.649

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Appendix 16

Name of item	Q_Steam_c
Description	Amount of steam consumed by the decomposition facility
Value in period	140 723 kg
Method of monitoring	Mass flowmeter
Recording frequency	Monthly
Background data	Log sheet record

Period	Q_Steam_c kg
Sept 1st – Oct 22nd	140 723

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Appendix 17

Name of item	E_Steam_c
Description	CO2 intensity for steam consumed in the facility
Value in period	0.137 kg-CO_2/kg of steam
Method of monitoring	Calculated from steam supplier data
Recording frequency	Yearly
Background data	Log sheet records / Composition from Kyung Dong City Gas Ltd, the natural gas supplier
Calculation method	This steam is supplied by existing boilers on site. Steam production and natural gas consumption are monitored. They are used to calculate the natural gas consumption Q_NG_steam in Nm3/t of steam. E_Steam is obtained by using the CO2 emission factor E_NG (see appendix 4) E_Steam = QNG_steam x E_NG

Year ending	Q_NG_steam Nm3/t of steam	E_NG kg-CO_2/Nm3	E_Steam kg-CO_2/ kg of steam
Oct 22nd 2006	60.87	2.240	0.137