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Verification Report

Rhodia Polyamide Co. Ltd.

Sixth Periodic Verification of the registered CDM project

"N2O Emission Reduction in Onsan, Republic of Korea"

UNFCCC 0099-CDMP

Report No. 953337-PV06, Revision 01

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TÜV SÜD Industrie Service GmbH
Carbon Management Service
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Subject:	Periodic Verification of a CDM Project
Executing Operational Unit:	TÜV SÜD Industrie Service GmbH Carbon Management Service Westendstr. 199 - 80686 Munich, Federal Republic of Germany
Client:	Rhodia Energy SAS (Rhodia) Tour La Pacific Cours Valmy La Defense 7 92977 Paris La Defense – France
Contract approved by:	Werner Betzenbichler
Report Title:	Period Verification #6 of the registered CDM Project: "N2O Emission Reduction in Onsan, Republic of Korea"
Number of pages	16 (excluding cover page and annexes)

Summary:

TÜV SÜD Industrie Service GmbH has performed the fourth periodic verification of the registered CDM project: "N2O Decomposition Project in Onsan, Republic of Korea". The verification is based on requirements of the UN Framework Convention on Climate Change (UNFCCC). In this context, the relevant documents are the "Marrakech Accords" and relevant guidance provided by the EB (Executive Board of the CDM).

The management of Rhodia Polyamide Co. Ltd in Onsan, Republic of Korea is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project Monitoring and Verification Plan indicated in the final PDD version dated Sept 01, 2005.

The verifier can confirm that the GHG emission reductions are calculated without material misstatements. Our opinion refers to the project's GHG emissions and resulting GHG emissions reductions reported both determined due to the valid and registered project's baseline, its monitoring plan and its associated documents.

Based on the information we have seen and evaluated we confirm the following statement:

Reporting period: From 2007-04-01 to 2007-05-06

Verified emission in the above reporting period:

Baseline emissions:	1.231.361	t CO_2 equivalents
Project emissions:	136.233	t CO_2 equivalents
Leakage emissions:	171	t CO_2 equivalents
Emission reductions:	1.094.957	t CO_2 equivalents

Work carried out by:	**Internal Quality Control by:**
• Werner Betzenbichler (project manager) • Nikolaus Kröger (ghg lead auditor, technical expert) • Stefan Reis (ghg auditor) • Jung-Ho Yoon (ghg auditor trainee)	• Javier Castro

Abbreviations

AA	Adipic Acid
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH4	Methane
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CR	Clarification Request
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
ER	Emission reduction
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
KEEI	Korean Energy Economics Institute
KP	Kyoto Protocol
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
N2O	Nitrous oxide
PDD	Project Design Document
RHODIA	Rhodia Polyamide Co. Ltd.
TÜV SÜD	TÜV SÜD Industrie Service GmbH
UNFCCC	United Nations Framework Convention on Climate Change
VVM	Validation and Verification Manual

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1 INTRODUCTION

1.1 Objective

Rhodia Energy Services has commissioned an independent verification by TÜV SÜD Industrie Service GmbH (TÜV SÜD) of its registered CDM project: "N2O Emission Reduction in Onsan, Republic of Korea". Verification is the periodic independent review and ex post determination by the Designated Operational Entity (DOE) of the monitored reductions in GHG emissions during the defined verification period.

The objective of verification can be divided in Initial Verification and Periodic Verification:

- **Initial Verification**: The objective of an initial verification is to verify that the project is implemented as planned, to confirm that the monitoring system is in place and fully functional, and to assure that the project will generate verifiable emission reductions. A separate initial verification prior to the project entering into regular operations is not a mandatory requirement.
- **Periodic Verification**: The objective of the periodic verification is to verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan; furthermore the periodic verification evaluates the GHG emission reduction data and express a conclusion with a high, but not absolute, level of assurance about whether the reported GHG emission reduction data is "free" of material misstatements; and verifies that the reported GHG emission data is sufficiently supported by evidence, i.e. monitoring records.

The verification shall consider both quantitative and qualitative information on emission reductions. Quantitative data comprises the monitoring reports submitted to the verifier by the project entity. Qualitative data comprises information on internal management controls, calculation procedures, and procedures for transfer, frequency of emissions reports, review and internal audit of calculations/data transfers.

The verification follows UNFCCC criteria refer to the Kyoto Protocol criteria and the CDM rules and modalities as agreed in the Bonn Agreement and the Marrakech Accords.

The Initial Verification had been carried out by TÜV SÜD Industrie Service GmbH on-site in July 2006 and included the review of documented procedures, interviews with project participants, collection of measurements, observation of established practices and testing of the accuracy of monitoring equipment. The results of the Initial Verification are described in detail in Report No. 869640 Revision 04 dated 06 November 2006.

The results of the Periodic Verifications are reported as follows:

Periodic Verification #1	Report No. 869640 Revision 01 dated 07 November 2006
Periodic Verification #2	Report No. 869640-PV02, Revision 00 dated 27 November 2006.
Periodic Verification #3	Report No. 869640-PV03, Revision 00 dated 05 February 2007
Periodic Verification #4	Report No. 869640-PV04, Revision 03 dated 16 February 2007
Periodic Verification #5	Report No. 869640-PV05, Revision 01 dated 14 April 2007

The Periodic Verification #6 was performed with all TÜV SÜD audit team Mr Kröger, Mr Reis and Mr Yoon on-site in Onsan/Korea and included the review of documented procedures, interviews with project participants, collection of measurements, observation of established practices, testing of the accuracy of monitoring equipment. During this Periodic Verification #6 no Live Meeting technology had been used for need of TÜV SÜD. Mr Kröger from TÜV SÜD

Branchoffice Hamburg/Germany personally conducted the on-site-mission as lead auditor in Onsan/Korea. A full presence of the all - means european headquarter based and korean local based - TÜV SÜD audit team will be scheduled in regular sequences (minimum once the year). Nevertheless during on-site-mission Rhodia's offices in Paris/France and Lyon/Paris had been backed up by telephone conference.

1.2 Scope

Verification scope is defined as an independent and objective review and ex-post determination by the Designated Operational Entity of the monitored reductions in GHG emissions. The verification is based on the submitted monitoring report and the validated project design documents including its monitoring plan. These documents are reviewed against Kyoto Protocol requirements, UNFCCC rules and associated interpretations. TÜV SÜD has, based on the recommendations in the Validation and Verification Manual employed a risk-based approach in the verification, focusing on the identification of significant risks and reliability of project monitoring and generation of CERs.

The verification is not meant to provide any consulting towards the client. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the monitoring activities.

The audit team has been provided with a Monitoring Report and underlying data records on May 09, 2007, covering the period #06 from April 01, 2007 to May 06, 2007 which has been made publicly available on the UNFCCC website (see: http://cdm.unfccc.int/Projects/DB/DNV-CUK1127672024.44/iProcess/TUEV-SUED1178793246.71/view).

Based on this documentation, a document review and a fact finding on-site-mission in Rhodia's facilities Onsan/Korea at May 14, 2007 has taken place. The on-site-audit was conducted personally by Lead auditor Mr Nikolaus Kröger during his visit in Onsan/Korea.

Studying the existing documentation belonging to this project, it was obvious that the competence and capability of the audit team performing the verification has to cover at least the following aspects:

- Knowledge of Kyoto Protocol and the Marrakech Accords
- Environmental and Social Impact Assessment
- Skills in environmental auditing (ISO 14000, EMAS)
- Quality assurance
- Production process for adipic acid
- Business environment in the acid industry
- Monitoring concepts
- Political, economical and technical framework conditions in host country

According to these requirements TÜV SÜD has composed a project team in accordance with the appointment rules of the TÜV SÜD certification body "climate and energy":

Werner Betzenbichler is physicist and head of the department "TÜV Carbon Management Service" located in the head office of TÜV SÜD Industrie Service in Munich. Furthermore he is appointed as head of the certification body "Climate and Energy", which is accredited at UNFCCC as Designated Operational Entity. As project manager and ghg lead auditor he participated in numerous assessments of CDM and JI projects. Before entering this department he worked as expert on air quality measurements and emissions inventories as well as on environmental auditing within the environmental branch of the company.

Nikolaus Kröger is environmental engineer and expert for emissions monitoring and quality assurance at the department "TÜV Carbon Management Service". He is located in the TÜV SÜD Hamburg office and is also engaged as personally accredited verifier in the EU-ETS serving the Northern German market. Being auditor for CDM projects he has already been involved in several CDM activities with a special focus on industrial non-CO2 projects. Constitutive on 13 years experience at the department "Environmental Service" he verified many metallurgical plants, refineries, chemical plants, waste treatment and power plants and process engineering in many types of facilities. One of his former focal points had been implementation and calibration of complex automatic Environment-Data-Systems.

Stefan Reis is quality management auditor and heading the branch office of TÜV SÜD Korea Ltd. in Seoul in multiple responsibilities. He is living since more than 13 years in Korea and is familiar with local laws and regulations. Being auditor for CDM projects he has already been involved in several CDM activities. He assisted Mr Kröger during the on-site inspections by evaluating documents and data records submitting in Korean language.

Jung-Ho Yoon is based in the branch office of TÜV SÜD Korea Ltd. in Seoul. He has an academic background of Engineering in Chemical Technology with a degree as bachelor. He joined the project being a trainee auditor for CDM projects. He assisted Mr Kröger during the on-site inspections by evaluating documents and data records submitted in Korean language.

The audit team covers the above mentioned requirements as follows:

- Knowledge of Kyoto Protocol and the Marrakech Accords (All)
- Environmental and Social Impact Assessment (All)
- Skills in environmental auditing (Betzenbichler, Kröger)
- Quality assurance (All)
- Production process for adipic acid (Betzenbichler, Kröger, Yoon)
- Business environment in the acid industry (Betzenbichler, Kröger, Reis)
- Monitoring concepts (All)
- Political, economical and technical framework conditions in host country (Reis, Yoon)

In order to have an internal quality control of the project, a team of the following persons has been composed by the certification body "climate and energy":

- Javier Castro (deputy head of the certification body "climate and energy")

1.3 GHG Project Description

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).
In this project, Rhodia Polyamide Co. Ltd additionally installed N2O collection and thermal decomposition process equipment to the currently operating adipic acid manufacturing plant.

Technical description of the project

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.

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

The temperature in the furnace is kept at about 1300°C and under fuel rich conditions, so as to promote the complete decomposition of N2O while minimizing the formation of unwanted combustion by-products such as NO and NO2. The gas is then quenched with air to complete the combustion of carbon monoxide and hydrogen at a temperature of about 950°C in a second chamber. Steam and ammonia are injected to control the emission of NO and NO2. Before release to the stack, the flue gas coming from the thermal oxidizer is used to produce saturated steam, which is fed into the existing on-site steam network.

The project has been registered as CDM activity on 27 Nov 2005 and has the reference number CDMP 0099 (see: http://cdm.unfccc.int/Projects/DB/DNV-CUK1127672024.44/view.html).

2 METHODOLOGY

The project assessment aims at being a risk based approach and is based on the methodology developed in the Validation and Verification Manual (for further information see www.vvmanual.info), an initiative of all Applicant Entities and Designated Operational Entities, which aims to harmonize the approach and quality of all such assessments.

In order to ensure transparency, a verification protocol was customized for the project, according to the Validation and Verification Manual. The protocol shows, in a transparent manner, criteria (requirements), means of verification and the results. The verification protocol serves the following purposes:

- It organizes, details and clarifies the requirements a CDM/JI project is expected to meet;
- It ensures a transparent verification process where the verifier will document how a particular requirement has been proved and the result of the verification.

The verification protocol consists of four tables. The different columns in these tables are described in Figure 1.

Periodic Verification Checklist Table 1: Data Management System/Controls		
Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests*)
The project operator's data management system/controls are assessed to identify reporting risks and to assess the data management system's/control's ability to mitigate reporting risks. The GHG data management system/controls are assessed against the expectations detailed in the table.	A score is assigned as follows: **Full** all best-practice expectations are implemented. **Partial** a proportion of the best practice expectations is implemented **Limited** this should be given if little or none of the system component is in place.	*Description of circumstances and further commendation to the conclusion. This is either acceptable based on evidence provided (**OK**), or a **Corrective Action Request (CAR)** of risk or non-compliance with stated requirements. The corrective action requests are numbered and presented to the client in the Verification report. The Initial Verification has additional Forward Action Requests (FAR). FAR indicates essential risks for further periodic verifications*

Periodic Verification Checklist Table 2: GHG calculation procedures and management control testing		
Identification of potential reporting risk	Identification, assessment and testing of management controls	Areas of residual risks
Identification of potential reporting risks based on an assessment of the emission estimation procedures. Identification of key source data. Focus on those risks that impact the accuracy, completeness and consistency of the reported data.	Identification of the key controls for each area with potential reporting risks. Assessment of adequacy of the key controls and eventually test that the key controls are actually in operation. Internal controls include, Understanding of responsibilities and roles, Reporting, reviewing and formal management approval of data; Procedures for ensuring data completeness, conformance with reporting guidelines, maintenance of data trails etc.	*Identification of areas of residual risks, i.e. areas of potential reporting risks where there are no adequate management controls to mitigate potential reporting risks* *Areas where data accuracy, completeness and consistency could be improved are highlighted.*

Periodic Verification Checklist Table 3: Detailed audit testing of residual risk areas and random testing		
Areas of residual risks	**Additional verification testing performed**	**Conclusions and Areas Requiring Improvement (including *FAR*s)**
List of residual areas of risks of Periodic Verification Checklist Table 2 where detailed audit testing is necessary. *In addition, other material areas may be selected for detailed audit testing.*	*The additional verification testing performed is described. Testing may include:* ▪ *Sample cross checking of manual transfers of data* ▪ *Recalculation* ▪ *Spreadsheet 'walk throughs' to check links and equations* ▪ *Inspection of calibration and maintenance records for key equipment* ▪ *Check sampling analysis results* *Discussions with process engineers who have detailed knowledge of process uncertainty/error bands.*	*Having investigated the residual risks, the conclusions are noted here. Errors and uncertainties are highlighted.*

Figure 1 Verification Protocol Tables

2.1 Review of Documents

The monitoring report submitted by the client and additional background documents related to the project performance were reviewed. *

A detailed review of any excel spreadsheet of Rhodia's Workbook "ER ONSAN" in it's latest revision including multiple detailed cross checks had been carried out on-site. Any key parameters had been focused in special awareness. Any automatic raw data entry and a proper use of correct default data form external data sources had been proved. Any so called "Daily Event" - such as facility shut downs or turn away from standard production procedures – had been detected and analyzed with a special focus.

2.2 Follow-up Interviews

A sixth on-site inspection took place in the korean AA plant installations on May 14. The sixth audit session included reviews of performance records, interviews with representatives of Rhodia Polyamide Co. Ltd. and Rhodia Energy SAS, collection of measurement data, observation of established practices and testing of the accuracy of monitoring equipment. The main topics of the interviews are summarized in Table 1.

Table 1 Interview topics

Interviewed organization	Interview topics
Rhodia Polyamide Co. Ltd. Onsan, Republic of Korea; Rhodia Energy SAS, France; Rhodia Recherchés et Technologie, France	➢ Project design and implementation ➢ Technical equipment and operation ➢ Monitoring plan ➢ Quality assurance and quality control ➢ Industrial activities ➢ Monitored data ➢ Data uncertainty and residual risks ➢ GHG calculation ➢ Data archiving ➢ Compliance with national laws and regulations ➢ Data uncertainty ➢ Data transfer and reporting procedures ➢ Quality management ➢ Performance of maintenance work

* A further revision has been submitted dated May 26, 2007. This revision corrected some typos without any impact on the assessment work already finalized.

2.3 Resolution of Corrective and Forward Action Requests

The objective of this phase of the verification was to resolve the requests for corrective actions and any other outstanding issues which needed to be clarified for TÜV SÜD`s positive conclusion on the GHG emission reduction calculation.

3 VERIFICATION FINDINGS

In the following sections the findings of the verification are stated. The verification findings for each verification subject are presented as follows:

The findings from the desk review of the final monitoring report and the findings from interviews during the on-site visit are summarized. A more detailed record of these findings can be found in the Verification Protocol in annex 1.

1) Where TÜV SÜD had identified issues that needed clarification or that represented a risk to the fulfilment of the project objectives, a Clarification or Corrective Action Request, respectively, have been issued. The Clarification and Corrective Action Requests are stated, where applicable, in the following sections and are further documented in the Verification Protocol in annex 1. The verification of the project resulted in four Clarification Requests.
2) Where Clarification or Corrective Action Request has been issued, the exchanges between the Client and TÜV SÜD to resolve these Clarification or Corrective Action Request are summarized.
3) In the context of Forward Action Requests (FAR), risks have been identified, which may endanger the delivery of high quality CERs in the future, i.e. by deviations from standard procedures as defined by the MP. As a consequence, such aspects should receive a special focus during the next consecutive verification. A FAR may originate from lack of data sustaining claimed emission reductions. Forward Action Requests are understood as recommendation for future project monitoring; they are stated, where applicable, in the following sections and are further documented in the Verification Protocol in annex 1. The verification of the project resulted in two Forward Action Requests.
4) The final conclusions for verification subject are presented.

The verification findings relate to the project implementation as documented and described in the final monitoring report.

Periodic Verification Findings

3.1 Remaining issues, CARs, FARs from previous periodic verification

3.1.1 Discussion

There were no pending Forward Action Requests from the previous Verification Report. The results of responses to the Clarification Request No. 1 had been controlled. The envisioned action based on CR1 of the last verification report is not completed yet, i.e. training of staff, up-date of operating procedure and installation of IA purge line in the pilot burner is not finished yet. The audit team crosschecked all on-site available references documents such as i.e. Training #1 & #2, ANGEKO operating procedure and PM_AA07096 Installation of the IA purge line as submitted by Rhodia Polyamid Co. Ltd. Onsan plant management and maintenance department. Announced arrangements will be finished as soon as possible during annual shut down in June 2007. The results will be controlled in detail again during Periodic Verification #7. Nonetheless as these activities are resulting from voluntary commitments by the project participants there is no requirement to issue a further request this time.

Further on beyond the aforementioned CR1 from last report there are no remaining issues from the previous periodic verification. The project participant has solved all the issues mentioned in the fifth verification report and the same have been accepted by the assessment team.

3.1.2 Findings

None

3.1.3 Conclusion

The project complies with the requirements.

3.2 Completeness of Monitoring

3.2.1 Discussion

The reporting procedures, which are described in the monitoring report and which were examined during the on-site visit, were found to reflect the ones defined by the monitoring plan. In general all parameters were monitored and determined as prescribed.

- The Workbook ER ONSAN had been updated to Revision 6 for Monitoring Period #6. The date of revision was April 24, 2007.

Description of Revision	Revision sheet
1) Improve the global protection of data by adding few passwords for opening the file for reading only, reading and modifying (entering new data). Existing sheet protection used for keeping control of structural changes and formula updates.	Workbook
2) All cells that need to be checked are coloured in green in "Cover"; the one that are automatically updated are coloured in pink. No more need to access to structural code to update the data.	"Cover"

3) Updated the formula in cell F28 of "EC" for consistency with cells G28 and H28.	"EC"
4) In "AV_HNO3,KA oil" add a test on the date to avoid having #value# in cells B546 to B548, E546 to E548 and AC546 to AF548 when there is no 2nd, 3rd or 4th month in the credit period	"AV_HNO3,KA oil"
5) In "AV_Emission" add a test to avoid having #value# in cells C549 to B551, and F549 to F551 when there is no 2nd, 3rd or 4th month in the credit period	"AV_Emission"

- A system of simultaneous availability of DCS Remote Control had been established using Live-Meeting software. The Live-Meetings are backed up with telephone conferences Korea-Europe. Using these IT-tools any PI system data extraction same like any manual change of datas – done in Onsan/Korea - could have seen live and in time in any participating office of Rhodia in France and TÜV SÜD in Germany. For joining Live Meeting special authorizations are needed. These authorizations are limited by time. For finding estimated limits of live-meeting-technology several pre-tests had been carried out. Several signals of parameter had been cut off charge on-site in Onsan/Korea what became immediately viewable live and in time in all participating offices in Korea, France and Germany. These tests had been reported with printscreens repeated times in past during Periodic Verifications #3, #4 and #5 in TÜV SÜD offices in Hamburg/Germany, Munich/Germany, Paris/France and Lyon/Paris (See: Periodic Verification #3, #4 and #5 as aforementioned in item 1.1 and submitted on UNFCCC homepage).

Based on a detailed analyze of daily events from previous reporting period (see Workbook ER ONSAN Rev 6 excel-spreadsheet DE) an intense research for accordance and nonconformities of DE based on graphic reviews of PI system data extractions had been done. Any identified DE was found doubtless and clear in DCS documentation as reviewed on-site (and as using Live-Meetings-technology for linking Rhodia's offices in France). The DCS data had been handed over automatic to the Workbook ER Onsan file as anticipated.

3.2.2 Findings

Clarification Request No 1:

In the monitoring period the N2O unit was shut down on April 28, 2007, because electric power failure (KEPCO). On April 28, 2007 the N2O unit was 47% online.

Response

Regarding to the shut down because of electric failure responsible by KEPCO a failure investigation was conducted by Rhodia system engineers. Outcome of this failure investigation was that the inverters had been too sensitive. Like corrective and preventive action after the shut down Rhodia will change the inverter during the next annual shut down period (probably end of June 2007) because the present inverters are too sensitive.

Clarification Request No 2:

On April 30, 2007 Rhodia has a temperature sensor failure on reduction chamber of the N2O unit. On April 30, 2007 the N2O unit was 63% online.

Response

Regarding to the temperature failure sensor a failure investigation was conducted by Rhodia system engineers. Like corrective and preventive action Rhodia replaced the sensor TX58044 in the re-oxidation chamber with spare transmitter. The gain setting is changed.
Furthermore the transmitter was condensated inside of the signal element. The temperature sensor is changed from S-type to K-type. Additional a) use the redundancy temperature indicators, b) alarm setting for critical items and c) PID tuning had been taken place.

Clarification Request No 3:

On May 4, 2007 the N2O unit stopped due to steam leakage thorough the gasket on the inspection hole of the waste heat boiler. On May 3, 2007 the N2O unit was 91% online, on May 4&5, 2007 the N2O unit was 0% online and on May 6, 2007 the N2O unit was 17% online.

Response

Regarding to the shut down because steam leakage thorough the gasket on the inspection hole of the waste heat boiler a failure investigation was conducted by Rhodia system engineers.
At the border line from the reduction chamber to the quench chamber some bricks damaged and fall down. As an intermediate corrective action the following was done.

1.) Welding of the hole
2.) Leak check and rebolting
3.) Installation of the air spry nozzle
4.) Permanent record of the casing temperature in the damaged area

During the next annual shut down during the next annual shut down period (probably end of June) the bricks will be replaced.

Clarification Request No 4:

On page 13/30 of the Rhodia Monitoring Report #6 submitted by Rhodia on May 09, 2007 the value of Parameter Ly is published with one digit after the comma. To be consistent with the other parameter such as ERy, BEy and PEy there should be no digit after the comma.

Response

Rhodia agrees and will eliminate the comma in future Monitoring Reports.

3.2.3 Conclusion

The requests indicated above are considered as being resolved. The project is in compliance with the requirements. The action resulting from the response of CR 1 and CR 3 is pending and will be resolved as soon as possible during the next annual shut down. The results of maintenance will be crosschecked in audit of the future monitoring report #7.

3.3 Accuracy of Emission Reduction Calculations

The emission reductions are determined by subtraction of baseline emissions BEy minus project emissions PEy minus leakage Ly. Therefore several Emissions coefficients such E_NG for CO2 intensity of natural gas consumption, E_Steam for CO2 intensity of steam produced by the facility, E_Steam_c for CO2 intensity of steam consumed in the facility and E_Power for CO2 intensity of electric generation are used.

Every calculation is based on the underlying approved methodology AM0021. Rhodia implements a document and file named "Angeko Monitoring of Emissions Data accuracy rationale" which describes the accuracy of the elements and their importance in the process of monitoring the N2O emissions. It supports and justifies the "calibration and maintenance protocol" being implemented by the project. As mentioned in the PDD and initial verification report the sensitive factors are the adipic acid production and the emission coefficient. All data are stored in Workbook "ER ONSAN" where calculation of GHG reduction also is applied. Flanking the Workbook an additional data-handling-protocol describes details on any necessary procedures for data-handling under all relevant conditions (including emergency routines in case of meter- or analyser-failing).

The data for the import of key parameters from internal sources such as DCS, meters and laboratory and from external sources of supplier for natural gas, electricity and steam had been provided to the audit team and are available in a highly structured manner as part of the Workbook. All these data and sources are part of a daily consistency check. All figures in the monitoring plan were cross-checked by the audit team using copies of the Workbook's excel spreadsheet. All emission reduction calculations were repeated by hand and in the forenamed excel spreadsheet copies and found to be correct.

3.4 Quality of Evidence to Determine Emission Reductions

The crucial parameter for the determination of GHG emissions are the produced amount of adipic acid production (see: item 8.1 of monitoring report) which has a material impact to baseline emissions BEy and the percentage of production time when the position switches on the bypass valves are opened (see: item 8.3 and 8.4 of monitoring report) which influences the production emission PEy.

These aforementioned critical parameters P_AdOH and %_online require a special focus during reporting and verification.

Along the reporting period #6 the emission factor from the AA plant was above the capped value of 0,270 kgN2O/kgAdOH. So the capped value is being used according to AM0021.

Among many others the following evidences have been used by the audit team during the verification process.

- Online-Review and Printouts of the DCS
- Protocols of adipic acid production
- Protocols of nitric acid consumption
- Protocols of LNG analysis

All data is in compliance with the figures stated in the monitoring report.

3.5 Management System and Quality Assurance

Quality assurance procedures are in place as for example the joint meter reports and respective billings are reviewed for accuracy and correctness by a staff member before submission. Staff is made aware of the quality assurance procedures.

A data handling protocol explains every detail of meters and data handling, adjustment and maintenance inclusive emergency routines. There is also a documented internal procedure in sense of kind of "GHG Internal Audits" which defines the roles and responsibilities as well as the methods for reviewing the monitored figures. It also defines the corrective actions that need to be carried out in case discrepancies or inconsistencies are discovered in the generation, export and import figures and/or in the operation of the plant.

Any key parameters are measured by adjusted and/or calibrated meters.

Two disciplinarian and persons-in-charge – Mr Ki-Hwan Son, Rhodia PI Onsan process engineer and Mr Jerome Cho, Rhodia PI Onsan AA plant manager - are involved in data protection measures, and the verification team feels confident with the same.

The IT system is based on standard PC and MS office solutions. Additional Rhodia established the capacity of live-meeting-technology for to be able to review live and in time any parameter of Rhodia's PI system in Onsan/Korea via DCS remote control at any other legal project participant's workstation. A detailed DCS testing has been carried out and the systems functionality has been checked. Hence the verification team feels confident about its use.

4 PROJECT SCORECARD

The conclusions on this scorecard are based on the revised monitoring report.

Risk Areas		Conclusions			Summary of findings and comments
		Baseline Emissions	Project Emissions	Emission Reductions	
Completeness	Source coverage/ boundary definition	✓	✓	✓	All relevant sources are covered by the monitoring plan and the boundaries of the project are defined correctly and transparently.
Accuracy	Physical Measurement and Analysis	✓	✓	✓	State-of-the-art technology is applied in an appropriate manner.
	Data calculations	✓	✓	✓	Emission reductions are calculated correctly.
	Data management & reporting	✓	✓	✓	An eligible data management system is in place.
Consistency	Changes in the project	✓	✓	✓	Results are consistent to underlying raw data.

5 VERIFICATION STATEMENT

TÜV SÜD Industrie Service GmbH has performed periodic verification #6 of the registered CDM project: "N2O Decomposition Project in Onsan, Republic of Korea" due to requirements of the Client set as part of the MP for this specific project.

The management of Rhodia Polyamide Co. Ltd in Onsan, Republic of Korea is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project Monitoring and Verification Plan indicated in the final PDD version dated Sept 01, 2005.

The verifier can confirm that the GHG emission reductions are calculated without material misstatement. Our opinion relates to the project's GHG emissions and resulting GHG emissions reductions reported and related to the valid and registered project baseline and monitoring, and its associated documents.

Based on the information we have seen and evaluated TÜV SÜD confirms the following statement:

Reporting period: From 2007-04-01 to 2007-05-06

Verified emission in the above reporting period:

Baseline emissions:	1.231.361	t CO_2 equivalents
Project emissions:	136.233	t CO_2 equivalents
Leakage emissions:	171	t CO_2 equivalents
Emission reductions:	1.094.957	t CO_2 equivalents

Munich, June 21, 2007

Javier Castro

Deputy Head of the Certification Body "Climate and Energy"

Munich, June 21, 2007

Werner Betzenbichler

Project Manager

Industrie Service

Annex 1: Periodic Verification Protocol

1 PERIODIC VERIFICATION CHECKLIST

Table 1: Data Management System/Controls

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests* or *Corrective Action Requests*)
1. Defined organizational structure, responsibilities and competencies		
1.1. Position and roles	Full	The responsibility for compiling and consolidating data as well as for preparing the monitoring report is given to the Rhodia Recherchés et Technologies, France process engineer Mr Gilles Brossier and Rhodia Korea Onsan AA process engineer Mr Ki-Hwan Son, whom are serving as focal contact point for the CDM activity. Continuous data processing as performed will be controlled by Rhodia Korea Onsan AA Plant manager Mr Jerome Cho and Rhodia Korea industrial manager Mr Thierry Mante. A full second level of redundant responsibilities had been installed in case of illness or holidays of any CDM team member. The second level team member are Young-Jae Kim and Patrick Rossiny. The internal data collection underlies sufficient quality assurance routines. A clear scheme of responsibilities between Monitoring Engineers, Process Engineers and AA Plant Manager is established. Process Engineers and AA Plant Management will have a daily meeting to analyse process and process data and will start if necessary adjustment and troubleshooting procedures. The personnel of Rhodia's AA Plant perform tasks with sensitivity for the monitoring of emission reductions. All relevant personnel will have access and knowledge of documented instructions and will act in act accordance to the project's management system. The personnel is qualified in any case and well trained. All relevant personnel will have the appropriate competences, capabilities and qualifications to ensure the required data quality. Daily internal online-measurement results, Lab analysis results and Production Inventory will be collected by Process Engineer. The Process Engineer cares for a daily consistency check. In case the consistency check will be not OK and if possible a Data ad-

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests* or *Corrective Action Requests*)
		justment takes place. If a data adjustment is not possible the Process Engineer together with the AA Plant Manger will have to decide to correct or abandon the data. In case a correction is possible an adjustment method had to be defined and the data had to be corrected.
1.2. Responsibilities	Full	The overall responsibility of the project is with Mr Pascal Siegwart (CO2 Operations Director) located in Paris, France. The responsibilities of all other persons dealing with information and data required to prepare the monitoring report are clearly indicated and ruled by the internal quality management system and relevant service contracts respectively.
1.3. Competencies needed	Full	All competences and capabilities are covered by the persons working on directly on the CDM activities with relationship to the CDM activity
2. Conformance with monitoring plan		
2.1. Reporting procedures	Full	The data management system and all reporting procedures reflect the monitoring plan completely. (see: initial verification checklist of initial verification report, version 4, submitted November 06, 2006 by TÜV SÜD Industrie Service GmbH)
2.2. Necessary Changes	Full	No necessity on changes has been identified.
3. Application of GHG determination methods		
3.1. Methods used	Full	The calculation procedures reflect the monitoring plan completely. All algorithms as given by AM0021, which are required to calculate the emission reductions, are correctly applied by Excel spreadsheets and are implemented as stated by the PDD. For each month consolidated emission reduction figures are delivered. For reporting issues for the complete reported period – not necessarily monthly - emis-

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests* or *Corrective Action Requests*)
		sion reductions are linked or copied to separate Excel files summarizing the emission reductions as derived above.
3.2. Information/process flow	Full	Input data is kept in retraceable form in multiple paper copies as well as a computer data base (production figures). The calculation spreadsheets are integral part of the Workbook ER ONSAN of that database not allowing any overwriting to this raw data. All other data coming from external sources such as Natural Gas Composition from Kyung Dong City Gas Ltd. Or yearly Electric Grid calculations from KEPCO make publicity by KEEI are collected by specifically developed paper forms, which are available in copies at the data management staff. This information is inserted to the excel files manually. Implausible data is re-checked interactively and documented by the comment function of MS Excel. The same procedure is applied for analysis results coming from the Rhodia Onsan laboratory and any raw data coming from Rhodia digital AA plant process management which are not automatically transferred as file entry to the Workbook ER ONSAN,.
3.3. Data transfer	Full	Besides the information flow indicated above no further data transfer (e.g. by on-line connection to meters or external data sources) is required.
3.4. Data trails	Full	In principle there is a consistent system concerning the reference to data trails and the administration right concerning reading and writing of data. The data trails comply with the requirements. Rhodia established a Data Handling Protocol RP-Q1-706-30 Revision 05 with definitions of data collection procedure, data processing procedure, data archiving procedure and data back-up procedure and Data Review Protocol RP-Q1-706-31 Revision 01 with definitions of data collection procedure Both protocols are a part of Rhodia's quality management procedure. Both protocols are flanking the proceeding of the Workbook ER ONSAN.
4. Identification and maintenance of key process parameters		

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests* or *Corrective Action Requests*)
4.1. Identification of key parameters	Full	The critical parameters for the determination of GHG emissions are the produced amount of adipic acid production (see: item 8.1 of monitoring report) which has a material impact to baseline emissions BEy and the percentage of production time when the position switches on the by-pass valves are opened (see: item 8.3 and 8.4 of monitoring report) which has a material impact to project emissions PEy. Note: It is very important for accuracy of calculation to use more than 2 digits after comma for the parameter %_online (i.e. use 5 or 6 digits). These aforementioned critical parameters P_AdOH and %_online should ever be focused with intense awareness!
4.2. Calibration/maintenance	Full	Calibration sheets and related calibration documents as per list in following document pages had been submitted by Rhodia Recherchés et Technologie June 21, 2006; The calibration and/or adjustment sheets are stored on-site. A calibration of the flow meter required for determining the emission reductions by the aerobic treatment system has not been necessary during the monitoring period, as this system went into operation in 2004 only, relying on the original calibration of the manufacturer. No further calibration activities are required for this CDM activity. Daily standard maintenance is handled by Rhodia's AA plant staff. Periodic maintenance of metering systems is contracted to meter provider and/or external service providers having clear advice/duties to use the forms and procedures developed for quality and data management purposes.
5. GHG Calculations		
5.1. Use of estimates and default data	Full	No estimates have to be used.
5.2. Guidance on checks and reviews	Full	Rhodia has developed several documented procedure which are as aforementioned an integral part of the certified management system (ISO9000). This procedure covers the aspect of internal audits for activities concerning the CDM activity. The overall management system covers the issue of management review for all activities as required for

Expectations for GHG data management system/controls	Score	Verifiers Comments (including *Forward Action Requests* or *Corrective Action Requests*)
		system certification.
5.3. Internal validation and verification	Full	An ongoing internal audit and management review - in sense of a daily consistency check - take place in a daily morning meeting of all responsibility Process engineer, laboratory staff and AA Plant manager. The immediately identification and solution of problems in a very early stage is guaranteed;
5.4. Data protection measures	Full	Mr Patrick Rossiny, Mr Gilles Brossier and Mr Ki-Hwan Son are the only persons having access to modify the structure of the file system containing raw data and consolidated data. Only after consolidation data is available for further users on different folders. The rights for the file system are protected by IT solutions requiring the correct use of passwords.
5.5. IT systems	Full	The IT system is based on standard multi-user server systems and MS-office solutions. It designed to give exclusively access to file systems for specifically for each user through the system administrator. Production data is processed and maintained by a database system able to allocate rights for writing and reading for each record to each type of user separately. The CDM team only has the right to read data and to export data to excel files.

Table 2: GHG calculation procedures and management control testing

Identification of potential reporting risk	Identification, assessment and testing of management controls	Areas of residual risks
Potential reporting risks based on an assessment of the emission estimation procedures can be expected to occur in the following fields of action: 1. raw data collection 2. calculation methods, Key source data applicable to the project assessed are hereby: • Metering records • Laboratory/analytical data • Accounting records. Appropriate calibration and maintenance of equipment resulting in a high accuracy of data supplied should be in place. It is hereby needed to focus on those risks that impact the accuracy, completeness and consistency of the reported data. Risks are weakness in the GHG calculation systems and may include: ➢ manual transfer of data/manual calculations, ➢ position of metering equipment ➢ unclear origins of data, ➢ accuracy due to technological limitations	Regarding the potential reporting risks identified in the left column the following mitigation measures have been observed during the document review and the on site mission. Calculation methods: The use of excel files is requiring a detailed check of correct transfer of algorithms into this format and a carefully treatment of all "copy and paste" actions to avoid any overwriting of cells. A detailed review of any excel spreadsheet of Rhodia's Workbook ER ONSAN including multiple detailed cross checks had been carried out on-site. Any key parameters had been focused in special awareness. Any automatic raw data entry and a proper use of correct default data form external data sources had been proved. Calibration and Maintenance: Spot checks have been made in order to get proofs for the realization of calibration measures as required. Accuracy: Spot checks have been made in order to find out level of accuracy following the documents ANGERKO Data Accuracy Rationale Rev 02 and ANGEKO Uncertainty Rev 02, both submitted by Rhodia Recherchés et Technologies September 23, 2006. There are no risks	The use of excel tools in the calculation required further assessment.

Identification of potential reporting risk	Identification, assessment and testing of management controls	Areas of residual risks
	of missing information on data accuracy. Internal Quality Checks: Rhodia performs a daily consistency check of raw and lab data which are needed for reporting. Like this a permanent internal quality check is guaranteed.	

Table 3: Detailed audit testing of residual risk areas and random testing

Areas of residual risks	Additional verification testing performed	Conclusions and Areas Requiring Improvement (including *Forward Action Requests* and *Corrective Action Requests*)
The use of excel tools in the calculation requires further assessment.	All excel files used to deliver consolidated figures have been investigated excessively. The ways how new data are transferred to the excel sheet has been discussed in detail. For all relevant data sets spot checks with raw data have been taken and the correct transfer to the excel-files and their appropriate compilation has been checked.	No inconsistencies could be detected for this aspect.

Table 4: Compilation of open issues

Corrective and Forward Action Requests by audit team	Summary of project owner response	Audit team conclusion
Clarification Request No 1: In the monitoring period the N2O unit was shut down on April 28, 2007, because electric power failure (KEPCO). On April 28, 2007 the N2O unit was 47% online.	Regarding to the repeating shut down because of electric failure a failure investigation was conducted by Rhodia system engineers. Outcome of this failure investigation Rhodia was that the inverters had been to sensitive. Like corrective and preventive action after the shut down Rhodia will change the inverter during the next annual shut down period because the present inverts are too sensitive.	The issue is pending and will be resolved as soon as possible during the next annual shut down (probably end of June). There is no impact on the amount of CERs and data quality.
Clarification Request No 2: On April 30, 2007 Rhodia has a temperature sensor failure on reduction chamber of the N2O unit. On April 30, 2007 the N2O unit was 63% online.	Regarding to the temperature failure sensor a failure investigation was conducted by Rhodia system engineers. Like corrective and preventive action Rhodia replaced the sensor TX58044 in the re-oxidation chamber with spare transmitter. The gain setting is changed. Furthermore the transmitter was condensated inside of the signal element. The temperatu-	The issue has been clarified.

Corrective and Forward Action Requests by audit team	Summary of project owner response	Audit team conclusion
	re sensor is changed from S-type to K-type. Additional use the redundancy temperature indicators, - Alarm setting for critical items and PID tuning had been taken place.	
<u>Clarification Request No 3:</u> On May 4, 2007 the N2O unit stopped due to steam leakage thorough the gasket on the inspection hole of the waste heat boiler. On May 3, 2007 the N2O unit was 91% online, on May 4&5, 2007 the N2O unit was 0% online and on May 6, 2007 the N2O unit was 17% online.	Regarding to the shut down because steam leakage thorough the gasket on the inspection hole of the waste heat boiler a failure investigation was conducted by Rhodia system engineers. At the border line from the reduction chamber to the quench chamber some bricks damaged and fall down. As an intermediate corrective action the following was done. 1.) Welding of the hole 2.) Leak check and rebolting 3.) Installation of the air spry nozzle 4.) Permanent record of the casing temperature in the damaged area During the next annual shut down period the bricks will be replaced.	The issue is pending and will be resolved as soon as possible during the next annual shut down (probably end of June). There is no impact on the amount of CERs and on data quality.
<u>Clarification Request No 4:</u> On page 13/30 of the Rhodia Monitoring Report #6 submitted by Rhodia on May 09, 2007 the value of Parameter Ly is published with one digit after the comma. To be consistent with the other Parameter such as ERy, BEy and PEy there should be no	Rhodia agrees and will eliminate the comma in future Monitoring Reports.	The issue has been clarified.

Corrective and Forward Action Requests by audit team	Summary of project owner response	Audit team conclusion
comma and no digit after the decimals.		

Industrie Service

Annex 2: Information Reference List

Reference No.	Document or Type of Information
1	UNFCCC homepage http://www.unfccc.int including the CDM section cdm.unfccc.int
2	Approved baseline and monitoring methodology AM0021
3	Final Project Design Document for CDM project "N2O Emission Reduction in Onsan, Republic of Korea", dated September 1, 2005 as available at cdm.unfccc.int
4	Validation Report No. 2005-0786 Revision No. 02 for CDM project "N2O Emission Reduction in Onsan, Republic of Korea" issued by Det Norske Veritas, dated July 14, 2005 as available at cdm.unfccc.int
5	On-site interviews conducted on May 14, 2007 in Onsan/Korea by auditing team of TÜV SÜD Verification team: Nikolaus Kröger TÜV SÜD, ghg lead auditor, technical expert Stefan Reis TÜV SÜD Korea Ltd., ghg auditor Jung-Ho Yoon TÜV SÜD Korea Ltd., ghg auditor trainee Interviewed persons in Onsan/Korea: Mr Ki-Hwan Son Rhodia Korea – Onsan AA production manager Mr Young-Jae Kim Rhodia Korea – Onsan AA process engineer Mr Chang-Oh Kim Rhodia Korea - Onsan supply chain Interviewed persons in Paris/France: Mr Pascal Siegwart Rhodia Energy SAS, France – CO2 operations director Interviewed persons in Lyon/France: Mr Gilles Brossier Rhodia Recherches et Technologies, France – Project Manager
6	UNFCCC homepage http://www.unfccc.int including the CDM section cdm.unfccc.int
7	Approved baseline and monitoring methodology AM0021
8	Verification Report No. 953337-PV06, Revision 01 N2O Emissions Reduction in Onsan, Republic of Korea", dated April 13, 2007 issued by TÜV SÜD Industrie Service GmbH
9	CDM Monitoring Report #6 of "N2O Emission Reduction in Onsan, Republic of Korea" UNFCCC 0099 covering the period April 01, 2007 to May 06, 2007, submitted May 09, 2007
10	Workbook ER ONSAN rev 6 - Period # 6 rev 1.1.xls (Excel-file), submitted by Rhodia Rhodia Polyamid Co. Ltd. May 09, 2007

Reference No.	Document or Type of Information
11	ANGEKO Monitoring of Emissions Data Accuracy Rationale Revision 02 (Excel-file), submitted by Rhodia Recherchés et Technologie September 21, 2006; Accuracy of the elements and their importance in the process as part of Rhodia quality management procedure
12	ANGEKO Uncertainty Revision 02 (Excel-file), submitted by Rhodia Recherchés et Technologies September 23, 2006; Uncertainty calculation as part of Rhodia quality management procedure
13	Data Handling Protocol RP-Q1-706-30 Revision 05, submitted by Rhodia Rhodia Polyamid Co. Ltd. April 05, 2007 with definitions of data collection procedure, data processing procedure, data archiving procedure and data back-up procedure as part of Rhodia quality management procedure
14	Data Review Protocol RP-Q1-706-31 Revision 01, submitted by Rhodia Polyamid Co. Ltd. June 01, 2006 with definitions of data collection procedure, as part of Rhodia quality management procedure
15	Calibration sheets and related calibration documents as per list in following document pages, submitted by Rhodia Recherchés et Technologie June 21, 2006;
16	Calculation s of Electric Grid Emission factor for Republic of Korea
17	Multiple, interactive generated reports (as required on-line by the audit team) on historic data generated by database software
18	Technical data sheet of digital data collection system DCS
19	Samples of laboratory analyses reports prepared by ANAM and submitted by the operator
20	Technical data sheet of installed N2O meter type Neo Monitors AS, LaserGas II SP Monitor
21	Manual of N2O metering device
22	Linnerud, Kaspersen, Jaeger, Applied Physics B, Laser and Optics, Gas monitoring in the process industry using diode laser spectroscopy, Springer-Verlag 1998
23	Factory acceptance tests of N2O laser diode, serial number 17005
24	Certificate of on-site-installation of N2O laser diode, dated June 22, 2006
25	Certificate of analysis of gas cylinders N2O, NO, NO2 with multiple concentrations by Deokyang Energen Corporation, all dated valid in 2006
26	ANGEKO project sheet, Reference drawings of sample conditioning system for TMS System, submitted by KAS System Co. Ltd. April 20, 2006
27	Flow sheets from process management system of N2O-abatement-plant
28	Protocols of adipic acid production
29	Protocols of nitric acid consumption
30	Protocols of KA-oil level consumption

Reference No.	Document or Type of Information
31	Research of PI system data extraction on DCS for graphic review of reporting period #6 - see: DCS-screen "Kyoto calculation" with parameter reference: 1 Emission/P_ADOH, 2 Emission/AA_ON_LINE, 3 Emission/P_AA_ONLINE, 4 Emission/N2O_ON_LINE, 5 Emission/P_N2O_ON_LINE and 6 Emission/P_ON_LINE as submitted in file ONSAN N2O EMISSION REDUCTION - DATA EXTRACTION PERIOD #6 rev 0.doc
32	Process samples analysis results
33	KA-oil samples analysis results
34	Special Process samples analysis results
35	MGC product sample analysis results
36	Statistics of electric power in Korea by Korea Electric Power Corporation (KEPCO)
37	Complete data records of consolidated emission reduction calculations covering the whole monitoring period
38	1996 Revised IPCC Guidelines
39	IPCC Good Practice Guidance and Uncertainty Management 2000
40	TÜV SÜD audit procedure ONSAN MR#2, submitted by TÜV SÜD Industrie Service GmbH dated November 22, 2006
41	TÜV SÜD Korea Ltd. Audit Protocol No. 74911448 Rev. 0.0 dated May 14, 2007