




Verification and certification report form for CDM project activities

(Version 01.0)

Complete this form in accordance with the "Attachment: Instructions for filling out the verification and certification report form for CDM project activities" at the end of this form.

VERIFICATION AND CERTIFICATION REPORT

Title of the project activity	Catalytic N ₂ O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.
Reference number of the project activity	0765
Version number of the verification and certification report	Version 01
Completion date of the verification and certification report	18/12/2015
Monitoring period number and duration of this monitoring period	<ul style="list-style-type: none"> Monitoring period number : 29 (3rd monitoring period in the 2nd crediting period) Duration : 01/01/2015 – 31/08/2015
Version number of monitoring report to which this report applies	Version 2
Crediting period of the project activity corresponding to this monitoring period	From 22/01/2014 to 21/01/2021
Project participant(s)	<ul style="list-style-type: none"> Carbon CDM Korea Ltd. Hu-Chems Fine Chemical Corp. RWE Power AG Carbon Climate Protection GmbH
Host Party	Republic of Korea
Sectoral scope(s), selected methodology(ies), and where applicable, selected standardized baseline(s)	<ul style="list-style-type: none"> Sectoral scope 5 : Chemical industries Selected methodology : ACM0019 (version 02) (N₂O abatement from nitric acid production) No standardized baseline(s) applicable
Estimated GHG emission reductions or net anthropogenic GHG removals for this monitoring period in the registered PDD	<p>Amount estimated in PDD for 2015: 1,243,557 tCO₂e</p> <p>→ Corresponding estimated amount for the duration of the monitoring period (243 days): 827,902 tCO₂e</p>
Certified GHG emission reductions or net anthropogenic GHG removals for this monitoring period	446,055 tCO ₂ e
Name of DOE	Korean Foundation for Quality (KFQ)
Name, position and signature of the approver of the verification and certification report	<p>Soon Hong YEOM</p> <p>Managing Director of Sustainability management institute</p> 

SECTION A. Executive summary

CARBON Climate Protection GmbH has commissioned Korean Foundation for Quality (KFQ) to carry out the verification and certification of emission reductions reported for the “Catalytic N₂O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.” in the Republic of Korea (the project) in the period from 01/01/2015 to 31/08/2015. This report contains the findings from the verification and a certification statement for the certified emission reductions.

Verification objective

Verification is the periodic, thorough and independent assessment and ex post determination by a Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM project activity during a defined monitoring period. Certification is the written assurance by a DOE that, during a specific period in time, a project activity achieved the emission reductions as verified.

The objective of this verification was to verify and certify emission reductions reported for the “Catalytic N₂O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.” for the period from 01/01/2015 to 31/08/2015 in accordance with paragraph 62 of CDM modalities and procedures.

Verification scope

The scope of the verification is to verify that:

- The project activity has been implemented and operated in accordance with the renewed and approved PDD (hereinafter referred to as “the registered PDD”) and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place.
- The monitoring report and other supporting documents provided are complete in accordance with latest applicable version of the completeness checklist for requests for issuance of CERs and verifiable and in accordance with applicable CDM requirements.
- The monitoring plan complies with the monitoring methodology and the actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved methodology including applicable tools and compliance with any guidance provided by the Board regarding deviations from the provisions of a registered plan and/or methodology.
- Data is recorded and stored as per the monitoring methodology ACM0019 (version 02) and the calculation of GHG emission reductions have been assessed to correctly support the emission reductions being claimed.

Furthermore, it was KFQ’s objective to identify any concerns related to the conformity of the actual project activity and its operation with the registered project design document and determine whether any deviation or proposed or actual changes in the implementation or operation of the project activity comply with the requirements of the Project Standard.

The verification shall ensure that reported emission reductions are complete and accurate in order to be certified. The verification is incorporating both quantitative and qualitative information on emission reductions.

Verification process

KFQ has made publicly available the MR received from the project participants. Only verification activities after the publication of the MR on the UNFCCC CDM website have been used as a basis for conclusion of verification.

The verification process includes desk review of the MR published (and any updated versions, if available), emission reduction calculation spreadsheets and other supporting documents and data. Further, onsite assessments and interviews with those involved in project management and operations are conducted. This is followed by preparation of draft verification report summarizing desk review and on-site assessment findings (i.e. CARs, CLs, and FARs). Upon successful closing of the CARs and CLs raised (if any), the final verification report is prepared. The final report then undergoes a technical review and final approval according to KFQ's internal quality assurance procedures.

The data presented in the MR were assessed by review of the detailed project documentation and production records, as well as by interviews with personnel at Hu-Chems, CARBON CDM Korea Ltd. and Carbon Climate Protection GmbH, and observation of collection of measurements, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. This has enabled the verification team to assess the accuracy and completeness of reported monitoring results, as well as to verify the correct application of the approved monitoring methodology. Furthermore, this has enabled the verification team to assess and determine that the implementation and operation of the project activity as well as the steps taken to report emission reductions in compliance with the CDM criteria and relevant guidance provided by the Board.

In addition, all parameters, as required (and as applicable) by the monitoring methodology ACM0019 (version 02) as well as the monitoring plan and the management system were assessed during the site visit.

Description of the project activity

Project Parties	Republic of Korea (Host) Germany Austria
Title of project activity	Catalytic N ₂ O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.
UNFCCC Reference Number	0765
Project Participants	Hu-Chems Fine Chemical Corp. (Korea) CARBON CDM Korea Ltd. (Korea) RWE Power AG (Germany) Carbon Climate Protection GmbH (Austria)
Baseline and monitoring methodology	ACM0019 (Version 02)
Location of the project activity	Address Yeosu, 7-6, Wollae-dong, Jeollanam-do, Republic of Korea GPS Coordinates: Longitude: 127.743198E // Latitude: 34.848686N
Registration Date	22/01/2007
PDD (2 nd crediting period)	Version 4.1 of 14/10/2013 Unless explicitly stated otherwise, any reference to the "PDD" or the "registered PDD" is considered to refer to this version (4.1), as it is the latest version and the only one relevant in this verification period. The same applies for the monitoring plan that is contained in the registered PDD.
Validation (2 nd crediting period)	Validation report of 07/11/2013 by TUEV Nord
Renewal date	05/02/2014
2 nd Crediting Period	22/01/2014 to 21/01/2021
Period verified in this verification	01/01/2015 to 31/08/2015

The project has installed tertiary N₂O reduction technology in the tail gas stream of the three nitric acid production plants of Hu-Chems Fine Chemicals Corp. (hereafter called "Hu-Chems") in Yeosu, Korea. Nitrous oxide, formed as a by-product of the nitric acid production, is removed by three EnviNOx® Systems provided by UHDE GmbH.

In plant II and III each EnviNOx® system comprises one reactor with two catalyst beds. Nitrogen oxides (NO_x) and nitrous oxide (N₂O) are simultaneously catalytically reduced in the first bed by using the reducing agents ammonia and propane, respectively. In the second bed carbon monoxide is oxidised to carbon dioxide. The additional GHG emission from the use of propane is monitored and considered in the calculation of emission reduction. The existing selective catalytic reduction (SCR) reactors are still operating.

In plant IV the system also contains two catalyst beds arranged in series. The first bed reduces N₂O by catalytic decomposition (no use of hydrocarbons) while in the second bed NO_x is reduced with ammonia and some further reduction of N₂O takes place. Other than in plant II and Plant III, the SCR reactor existing prior to project implementation in plant IV has been removed here, as it was described in the registered PDD.

The tail gas from the nitric acid facility is fed into EnviNOx® Systems, and according to the ex-ante emission reductions in the PDD, the nitrous oxide is reduced by approximately 97%.

The tail gas volume flow and the nitrous oxide concentration at the outlet of the EnviNOx® System are monitored and recorded. The propane used in the catalytic reduction is monitored in order to calculate the non-N₂O project emissions of the project activity (whereas propane gas is applied in the EnviNOx® System of Plant II and III but not in plant IV, as it was described in the PDD).

Conclusion

KFQ has performed the verification of the emission reductions reported for the project activity “Catalytic N₂O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.” in the republic of Korea (UNFCCC Registration Ref. No. 0765) for the period from 01/01/2015 to 31/08/2015.

The verification of the emission reductions has assessed all factors and issues that constitute the basis for emission reductions from the project. All relevant records of data from the EnviNOx® System and records from the production logs of the nitric acid production have been examined and verified for the reporting period.

The verification team has during its preparations identified the key reporting risks and used the assessment to determine to which extent the project operator's control systems were adequate for mitigation of these key reporting risks. In addition, other areas that can have an impact on reported emission reductions have also undergone detailed audit testing.

KFQ also confirms that the GHG emission reductions are calculated without material misstatements. Our opinion refers to the project's GHG emissions and resulting GHG emission reductions reported, both determined using the valid and registered project's baseline, its monitoring plan and its associated documents.

The implementation of the project resulted in 446,055 tCO₂e of emission reductions during the period from 01/01/2015 to 31/08/2015 which is within the renewable, second crediting period from 22/01/2014 to 21/01/2021. In our opinion, the GHG emission reductions reported for the project in the MR (Version 2) are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology ACM0019 (version 02) and monitoring plan in the Project Design Document of version 4.1 dated 14/10/2013.

KFQ is able to certify that the emission reductions from the “Catalytic N₂O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.” in Korea during the period from 01/01/2015 to 31/08/2015 amount to 446,055 tCO₂e.

SECTION B. Verification team, technical reviewer and approver**B.1. Verification team member**

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk review	On-site inspection	Interview(s)	Verification findings
1.	Team Leader(*)	IR	JEONG	Yu Shim	KFQ	√	√	√	√
2.	Verifier	IR	CHO	Jin Seok	KFQ	√	√	√	√
3.	Verifier(*)	IR	PARK	Sang Yeon	KFQ	√	-	-	√

(*) means a personnel with technical expertise in technical area 5.2

B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer	IR	YOON	Sung Han	KFQ
2.	Approver	IR	YEOM	Soon Hong	KFQ

Please refer to Appendix 2 below for demonstration of how the team meets the competence required for the verification.

SECTION C. Application of materiality**C.1. Consideration of materiality in planning the verification**

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1	Number of Monitoring parameters	L	Methodology and tool require a rather low number of monitoring parameters	In response of that risk, the KFQ verification team nevertheless included three verifiers in total and two of them on-site in order to cover/ review all monitoring parameters in a complete and detailed manner.
2	Error rate in Monitoring report	L	Expert organization is involved in compilation of MR as well as calculation	In response of that risk, the KFQ verification team focused on systematic consistency and error checks
3	Familiarity with Monitoring system	L	This is 29 th monitoring period (3 rd period of second crediting period). Application of new methodology does not	In response to that risk, the KFQ verification team checked the existence of any and all monitoring instruments as well as their valid calibration,

			<p>impact on the familiarity of monitoring system. Only a few components have been changed for the 2nd crediting period.</p> <p>Expert organization is involved in the periodic inspection of monitoring equipment</p>	<p>independently from the fact that the PPs would already be familiar with the monitoring system. Nevertheless, the relatively new parts of the monitoring system introduced in the 2nd crediting period have been checked especially.</p>
4	QA/QC	M	<p>Stable QA/QC system has been implemented and integrated into existing QMS.</p> <p>However, QA/QC required by EN 14181 is introduced newly.</p>	<p>In response to that risk, the KFQ verification team focused on periodic calibration and QA/QC activities performed as per EN 14181. Additionally, the KFQ verification team also focussed on crosschecking in order to ensure data quality.</p>
5	Data flow	L	<p>Transmitted to the spreadsheet automatically</p>	<p>In response to that risk, the KFQ verification team checked the safeguard measures for raw data and crosschecked raw data with the MS Excel spreadsheets on a random sampling basis, in an extent to ensure the functioning of the transferring system.</p>
6	Recalculation	M	<p>Calculation is performed in excel spreadsheet applying formulae.</p> <p>However, recalculation is done manually.</p>	<p>In response to that risk, the KFQ verification team firstly checked on the existence of omissions of events for recalculations and secondly reviewed all recalculations in detail.</p>

KFQ's verification plan draws on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. KFQ planned the verification by obtaining evidence and other information and explanations that KFQ considers necessary to give reasonable assurance on the reported GHG emission reductions on the basis of risk level identified and materiality concept in accordance with "Guideline of application of materiality in verifications" (ver. 02).

C.2. Consideration of materiality in conducting the verification

One of detected findings do impact the amount of emission reductions, but immaterial. As this finding is considered as a systematic error in regard to the detection process of events, the verification team reviewed the detection process in detail and found needs to review trend curves on the basis of logging data as well as on daily reports. Accordingly, the verification team checked the trend curves on the basis of logging data during specific periods in the monitoring period to reach a reasonable level of assurance that the claimed emission reductions in the MR are free from material error, omission or misstatement.

SECTION D. Means of verification

D.1. Desk review

KFQ's verification is based on the monitoring documentation provided by the PP especially the MR (Version 1 dated 29/10/2015 (published on 02/11/2015) and Version 2 dated 01/12/2015) and the CDM Project spreadsheets. Furthermore, the registered PDD and validation report were reviewed as well as the monitoring plan, previous verification reports, the applied baseline and monitoring methodology and any other information and references relevant to the project activity's emission reductions (e.g. IPCC reports, etc.). A complete list of all documents reviewed is shown in Appendix 3 of this verification report. KFQ's verification process takes into consideration all the CDM Rules and Guidances applicable to the project activity, e.g. Clean Development Mechanism Validation and Verification Standard, Clean Development Mechanism Project Standard, Clean Development Mechanism Project Cycle Procedure, Post Registration Changes and Request for Issuance: Completeness checklist, Post Registration Changes and Request for Issuance: Information and reporting checklist and relevant decisions, clarifications and guidance from the CMP and the CDM EB.

During the desk review, KFQ has applied standard auditing techniques to assess the quality of information provided. The following activities were performed:

- Verify the compliance of the MR with the guidance for completing the monitoring report form;
- Verify the completeness of the data and the information presented;
- Review the monitoring plan and monitoring methodology. Check the compliance of the MR with respect to the monitoring plan and verify that the applied methodology was carried out. Particular attention to coverage of all monitoring parameters, the frequency of measurements, the quality of the metering equipment including calibration requirements and the quality assurance and quality control procedures was paid;
- Review the calculations and assumptions used to obtain GHG data and ER
- Evaluate the data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

D.2. On-site inspection

Detailed verification of all data contained in the MR was performed during the site visit at Hu-Chems Fine Chemicals Corp. on 26/11/2015. During the site visit, the personnel were interviewed or assisted the verification team. During the on-site assessment, KFQ has applied standard auditing techniques to assess the quality of information provided. The following aspects of the CDM project activity have been confirmed:

- The implementation and operation of the CDM project activity;
- The information flow for generating, aggregating, recording, calculation and reporting of the monitoring parameters; and
- The operational and data collection procedures and their implementation in accordance with the monitoring plan.

Further, the following activities were performed:

- A cross-check between information provided in the MR and data from other sources such as plant log books, inventories, purchase records or similar data sources;
- A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD, the monitoring plan and ACM0019 (Version 02);
- A review of calculations and assumptions made in determining the GHG data and emission reductions; and

- An identification that quality control and quality assurance procedures are in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

Duration of on-site inspection: 26/11/2015				
No.	Activity performed on-site	Site location	Date	Team member
1	Confirmation of the correct & complete implementation and operation of the Project Activity and check of all physical features as described in the PDD are in place.	Yeosu	26/11/2015	Yu Shim JEONG Jin Seok CHO
2	Review of the complete data flow from data generation, aggregation, recording, calculation to reporting of the monitoring parameters.	Yeosu	26/11/2015	Yu Shim JEONG Jin Seok CHO
3	Confirmation of the complete & correct implementation of procedures for the operation and data collection.	Yeosu	26/11/2015	Yu Shim JEONG Jin Seok CHO
4	Verification of the information provided in the MR and documentation with other sources.	Yeosu	26/11/2015	Yu Shim JEONG Jin Seok CHO
5	Check of the monitoring equipment against the PDD, the monitoring plan as well as the approved methodology, including check of calibration & maintenance, etc. in relation to that equipment.	Yeosu	26/11/2015	Yu Shim JEONG Jin Seok CHO
6	Identification whether suitable QA/QC procedures are in place in order to prevent errors or to enable the corrections of errors and omissions in the reported parameters.	Yeosu	26/11/2015	Yu Shim JEONG Jin Seok CHO

D.3. Interviews

A list of the persons interviewed during this verification activity is included in Table below.

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1	HAN	DuHee	Hu-Chems Fine Chemicals Corp	26/11/2015	General support	Yu Shim JEONG Jin Seok CHO
2	Baek	Jongmin	Same as above	26/11/2015	General support, maintenance	Yu Shim JEONG Jin Seok CHO
3	LEE	Seunghun	Same as above	26/11/2015	Production, documentation	Yu Shim JEONG Jin Seok CHO
4	KIM	DongHyun	Carbon CDM Korea	26/11/2015	CDM coordination	Yu Shim JEONG Jin Seok CHO
5	Bichler	Sonja	Carbon Climate Protection GmbH	26/11/2015	QA/QC, Calculation, Reporting	Yu Shim JEONG Jin Seok CHO
6	Dunkel-Schwarzenberger	Gerald	Carbon Climate Protection GmbH	26/11/2015	General support	Yu Shim JEONG Jin Seok CHO

D.4. Sampling approach

As per the requirements set out in VVS (Version 9.0), random sampling has been applied, as relevant for the present case in the Project Activity, where no sampling approach was applied by the PP.

Since automatic transferred system to the spreadsheet is in place, crosscheck for data in spreadsheet against raw data were done based on random sampling after confirming safeguard measure for raw data in DCS and server and transferring system. Sampling plan when the verification team planned for verification has been revised as some minor omissions in the detection process of events related to emission reductions were found.

Whereas recalculations for all events, the locations, calibrations of all measurement instruments and intervals (Measuring frequency, Reading frequency and Recording frequency) were assessed.

D.5. Clarification requests, corrective action requests and forward action requests raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form	1	0	0
Compliance of the project implementation with the registered PDD	0	0	0
Post-registration changes	0	0	0
Compliance of the monitoring plan with the monitoring methodology including applicable tool and standardized baseline	0	0	0
Compliance of monitoring activities with the registered monitoring plan	1	0	0
Compliance with the calibration frequency requirements for measuring instruments	0	1	0
Assessment of data and calculation of emission reductions or net removals	0	0	0
Others (please specify)	0	0	0
Total	2	1	0

The objective of this phase of the verification was to resolve any issues which were needed to be clarified prior to KFQ's conclusion that i) the project activity has been implemented and operated in accordance with the registered PDD or any approved revised PDD, ii) the monitoring plan complies with the monitoring methodology and the actual monitoring complies with the monitoring plan including any guidance provided by the Board regarding deviations from the provisions of a registered/revised plan and/or methodology and iii) the data and calculation of GHG emission reductions are correct.

A corrective action request (CAR) is issued, where:

- Non-conformities with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the project participants, or if the evidence provided to prove conformity is insufficient;
- Modifications to the implementation, operation and monitoring of the registered project activity has not been sufficiently documented by the project participants;
- Mistakes have been made in applying assumptions, data or calculations of emission reductions which will impair the estimate of emission reductions;
- Issues identified in a FAR during validation or previous verification(s) to be verified during next verification have not been resolved by the project participants.

A clarification request (CL) shall be raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

A forward action request (FAR) is issued for actions if the monitoring and reporting require attention and/or adjustment for the next monitoring period.

All findings were satisfactorily addressed by the project participant in the MR.

SECTION E. Verification findings

E.1. Compliance of the monitoring report with the monitoring report form

Means of verification	KFQ has checked the MR provided by the PP against the latest MR form in order to determine, whether the MR is in compliance with it.
Findings	It was found that there are no deviations between the MR and the latest monitoring report form. However, it is identified that "Contact information of PPs and responsible person/entities" in Appendix 1 of MR (v1) is not consistent with MoC (Refer to Appendix 4 / Table 2 / CL ID 01). After the PP has submitted new MoC to the UNFCCC and the revised MR (Version 2) to the verification team, it was found that there are no deviations between the contact information in the MR and the new MoC.
Conclusion	The verification team concludes that the MR (Version 2) is in compliance with the latest monitoring report form (Version 5.1) and the instructions therein. And the raised CL (ID 01) has been completely resolved.

E.2. Remaining forward action requests from validation and/or previous verification

There was a forward action request (FAR) raised from the validation for renewal of crediting period and no FAR was raised from previous verification. The FAR was sufficiently addressed by the PPs. Please refer to Appendix 4 of this report for more details with regard to the FAR from validation.

E.3. Compliance of the project implementation with the registered project design document

Means of verification	<p>Physical project implementation During the on-site visit, the KFQ verification team visually inspected the installations of the EnviNOx® systems and all instrumentations necessary for the monitoring of the emission reductions and checked, whether all physical features of the CDM Project activity, including the data collection systems and storage, have been implemented in accordance with the registered PDD (version 4.1 dated 14/10/2013). Also, the KFQ verification team reviewed the documentation in respect of start-up and operation of the EnviNOx® systems, monitoring instrument specifications including containing details such as instrument history and measuring ranges.</p> <p>Project operation The verification team checked the operational records and other relevant information (Appendix 3) and interviewed relevant plant staff on the actual operation of the nitric acid plants and the EnviNOx® systems. Also daily reports, event log files, service reports, maintenance & calibration reports, DeltaV curves and detecting process of events were checked by the KFQ verification team, especially with regard to times with shutdowns and special events, as indicated in the MR.</p> <p>Management system and quality control and quality assurance The operation procedures and QA/QC procedures and respective reports have been reviewed and crosschecked by the KFQ verification team. Furthermore, the latest organizational arrangements were checked by means of interviews with relevant staff from Hu-Chems Fine Chemical Corp. (hereinafter referred to as "Hu-Chems") and Carbon Climate Protection GmbH (hereinafter referred to as "CARBON").</p>
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Findings	<p>Physical project implementation</p> <p>The project covers three nitric acid plants (three EnviNOx® systems, respectively). The EnviNOx® system at Hu-Chems IV was installed in December 2006, at II and III were installed in February and March 2007 respectively. The starting dates of operation of the project activity, with putting all physical features and data collection systems and storage in place, for each of the plants were as follows.</p> <ul style="list-style-type: none"> • Hu-Chems nitric acid plant IV: 09/01/2007 • Hu-Chems nitric acid plant II : 26/03/2007 • Hu-Chems nitric acid plant III: 29/03/2007 <p>The implementation status of the project activity was the same during the monitoring period and found to be in accordance with the relevant documentation.</p> <p>Project operation</p> <p>Specifically in the monitoring period, the nitric acid plants Hu-Chems II and Hu-Chems III and thus also their EnviNOx® Systems were permanently shut down during the monitoring period, due to nitric acid inventory control since December 2012 as reported to the environmental authority. During the monitoring period, in total lasting for 243 days, the nitric acid plant Hu-Chems IV as well as its EnviNOx® system was in normal operation, except during the downtimes as mentioned in the MR. The KFQ verification team can confirm that during these downtimes, no emission reductions were claimed by the PPs.</p> <p>Operation of the monitoring system & data collection system were operational during the monitoring period - the maintenance/ calibration periods of the monitoring instruments performed during the monitoring period and as described in the MR are complete, respective re-calculation of N₂O emissions during times of observations (if applicable) were done correctly & conservatively in the project spreadsheets and in accordance with the registered PDD and the applied methodology.</p> <p>During the site visit it was found through interview with staff and sample review of trend curves for raw data that there are operational events during regular monthly health checks by Emerson (i.e. fluctuation of N₂O concentration), however operation events in January, May and July 2015 are not presented in the MR (Refer to Appendix 4 / Table 3 / CAR ID 01).</p> <p>After the PP has submitted the revised MR (Version 2) with relevant emission reduction spreadsheets, it was found that there are no inconsistencies between the MR and the actual situation anymore.</p> <p>Management system and Quality assurance</p> <p>KFQ found that the project is operated and monitored by Hu-Chems Fine Chemicals Corp. (Hu-Chems), responsibility for checking & reporting of data under the CDM activity has been contracted to CARBON CDM Korea Ltd. and is supervised by CARBON. The procedures & responsibilities are described in the MR and are considered applied in full. There are no deviations between the MR and the actual situation.</p> <p>With respect to quality control and quality assurance, the KFQ verification team found that the EnviNOx system and the monitoring system are designed as an automatic process, so the involvement of the personnel during normal operation is minimised. In case of any deficiency, appropriate procedures are in place. The MR includes a detailed description of the periodical observations of the EnviNOx system and the monitoring instruments, in case of failures responsibilities are defined.</p> <p>It has been found that a service agreement is in place for the analyser system and the DeltaV system between Hu-Chems and Emerson Process Management Korea Ltd. The contract covers regular preventive checks on operational condition of the analyser system (on a monthly basis), "On site" DeltaV system health checks (on a monthly basis), 24 hour emergency service, inspections visits (on a quarterly basis) and respective reporting. Service reports of performed maintenance activities, calibrations and checks and other service reports (where applicable) were made available for verification and were found to be complete & suitable. Data handling solutions involve redundancy check, data manipulation protection, integrity check as well as archiving and were also found to be suitable. Safeguarding procedures in</p>
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	<p>accordance to the monitoring plan have been applied in a conservative way. KFQ found that the quality assurance and quality control procedures in terms of equipment operation, maintenance, calibration as well as data reporting are covered by project operator's management system which is certified to comply with ISO 9001:2009 and ISO 14001:2009, certification has found to be valid during the whole monitoring period. Hu-Chems covers all CDM activities in the internal, external audit and management reviews.</p> <p>It was found that local operators and instrumentation engineers of the system have been trained by the equipment suppliers. The related procedures were kept on site and were easily available.</p>
Conclusion	<p>KFQ confirms that the project has been implemented according to the description in the registered PDD. The raised CAR (ID 01) has been completely resolved.</p> <p>The verification team specifically confirms that</p> <ul style="list-style-type: none"> • All physical features of the proposed CDM project activity including data collection systems and storage are in place and in accordance with the registered PDD; and • All other relevant information provided in the MR is fully in accordance with respective information stated in the registered PDD; and • The information on project operation, the management system and quality assurance are complete, correct and in accordance with the registered PDD and; • The management system and quality assurance and related procedures have implemented as described in the MR and in accordance with the registered PDD.

E.4. Post-registration changes

E.4.1. Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline

There were no temporary deviations applied to this monitoring period.

In monitoring period 27 (22/01/2014 – 11/06/2014) a temporary deviation applied. Any reasons for that have been remedied by technical works during the NA plant shutdown on 12/06/2014. Since then, the project fully complies with the registered monitoring plan and applied methodology.

E.4.2. Corrections

There were no post registration changes identified by verification team during this verification.

E.4.3. Changes to the start date of the crediting period

There were no post registration changes identified by verification team during this verification.

E.4.4. Inclusion of a monitoring plan to a registered project activity

There were no post registration changes identified by verification team during this verification.

E.4.5. Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline

There were no post registration changes identified by verification team during this verification.

E.4.6. Changes to the project design of a registered project activity

There were no post registration changes identified by verification team during this verification.

E.4.7. Types of changes specific to afforestation and reforestation project activities

Not applicable

E.5. Compliance of monitoring plan with the monitoring methodology including applicable tool and standardized baseline

Means of verification	The KFQ verification team reviewed the monitoring plan contained in the registered PDD against the approved methodology, ACM0019 (Version 02) and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 2) which is applied by the project activity.
Findings	The KFQ verification team found that there are no incompliances between the applicable monitoring plan, the applied methodology ACM0019 (Version 02) and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 2). Furthermore it was found that there are no standardized baselines applied in the project activity.
Conclusion	KFQ confirms that the monitoring plan is in accordance with the approved methodology, ACM0019 (Version 02) and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 2) applied by the project activity (no standardized baselines are used in the project activity).

E.6. Compliance of monitoring activities with the registered monitoring plan

General statement on data and parameters

Means of verification	The means of verification in relation to the different parts (Information flow and data collection system, monitoring parameters and Social Fund) are stated in detail in the section & tables further below.
Findings	The findings in relation to the different parts (Information flow and data collection system, monitoring parameters and Social Fund) are stated in detail in the section & tables further below.
Conclusion	<p>KFQ confirms that the monitoring is complete and has been carried out in accordance with the monitoring plan and any monitoring activities comply with it. The monitoring plan has been properly implemented and is followed by the PPs.</p> <p>KFQ confirms that all parameters stated in the monitoring plan have been monitored and updated as applicable, including project emission parameters, baseline emission parameters (leakage is not applicable) and management and operational system: the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan.</p> <p>KFQ confirms that the equipment used for monitoring is controlled and calibrated in accordance with the monitoring plan, the applied methodology as well as methodological tools and the relevant guidance provided by the CDM Executive Board. Details on calibration are given in section E.7 below.</p> <p>KFQ confirms that monitoring results are consistently recorded as per the approved frequency.</p> <p>KFQ confirms that QA/QC procedures have been applied in accordance with the monitoring plan.</p> <p>KFQ confirms that the MR lists each parameter required by the monitoring plan and the information flow (i.e. from data generation, aggregation, recording, calculation and reporting) for these parameters is provided in the MR (The information flow for</p>

each parameter is further verified in the following sections).
KFAQ confirms that the monitoring methodologies and sustaining records are sufficient to enable verification of emission reductions.

E.6.1. Data and parameters fixed ex ante or at renewal of crediting period

Means of verification	Data and parameters fixed ex-ante as listed in the MR have been crosschecked & reviewed – as applicable – against the monitoring plan in the registered PDD as well as against the applied methodology (ACM0019 – Version 02) and other relevant CDM related documentation.																																		
Findings	<p><i>Data & Parameters fixed ex-ante and COMMONLY relevant for all three plants:</i></p> <table border="1"> <thead> <tr> <th>Data/parameter (unit)</th><th>Source of data</th><th>Value(s) applied</th><th>KFAQ Findings</th></tr> </thead> <tbody> <tr> <td>EF_{new,y} Baseline N₂O emission factor for nitric acid production in year y (2015) (related to 100 per cent pure acid) (kg N₂O/t HNO₃)</td><td>PDD/ACM0019 (Version 02)</td><td>3.40</td><td>Crosscheck of the value with the registered PDD & Monitoring plan and the applied methodology showed compliance of parameter.</td></tr> <tr> <td>GWP_{N2O} Global warming potential of N₂O (t CO₂e/t N₂O)</td><td>Relevant decision by the CMP & according to the registered PDD / ACM0019 (Version 02)</td><td>298</td><td>Value is correctly applied & justified and has been determined in accordance with the provisions of the CDM project standard, the PDD and ACM0019 (Version 02).</td></tr> </tbody> </table> <p>Due to the permanent shutdown of plants Hu-Chems II and Hu-Chems III during the verification period, findings & assessments in relation data and parameters that are exclusively relevant to one of these two plants are not listed here. This enhances the readability and clearness of the whole report and has no negative or non-conservative effect, since no emission reductions were claimed by the PP during this monitoring period out of these two plants at all.</p> <p><i>Data & Parameters fixed ex-ante and ONLY relevant for plant Hu-Chems IV:</i></p> <table border="1"> <thead> <tr> <th>Data/parameter (unit)</th><th>Source of data</th><th>Value(s) applied</th><th>KFAQ Findings</th></tr> </thead> <tbody> <tr> <td>Operating pressure IV Operating pressure of ammonia burner of Hu-Chems IV (kPa)</td><td>PDD</td><td>335</td><td>Crosscheck of the value with PDD & monitoring plan showed compliance of parameter</td></tr> <tr> <td>EF_{historical,IV} Historical baseline emission factor of the nitric acid plant of Hu-Chems IV (kg N₂O/t HNO₃)</td><td>PDD</td><td>5.70</td><td>Crosscheck of the value with the PDD & monitoring plan showed compliance of parameter</td></tr> <tr> <td>EF_{default,IV} Default emission factor according to the operating procedure of the ammonia burner in year y (2015) (related to 100 percent pure acid) of Hu-Chems IV (kg N₂O/t HNO₃)</td><td>PDD/ACM0019 (Version 02)</td><td>8.00</td><td>Crosscheck of the value with the PDD & monitoring plan showed compliance of parameter</td></tr> <tr> <td>P_{product, max,IV} Design capacity of nitric acid production during the first crediting period of Hu-Chems IV (tHNO₃)</td><td>PDD</td><td>467,200 (311,040 for this monitoring period)</td><td>Crosscheck of the value with the PDD & monitoring plan showed compliance of parameter</td></tr> </tbody> </table>			Data/parameter (unit)	Source of data	Value(s) applied	KFAQ Findings	EF _{new,y} Baseline N ₂ O emission factor for nitric acid production in year y (2015) (related to 100 per cent pure acid) (kg N ₂ O/t HNO ₃)	PDD/ACM0019 (Version 02)	3.40	Crosscheck of the value with the registered PDD & Monitoring plan and the applied methodology showed compliance of parameter.	GWP _{N2O} Global warming potential of N ₂ O (t CO ₂ e/t N ₂ O)	Relevant decision by the CMP & according to the registered PDD / ACM0019 (Version 02)	298	Value is correctly applied & justified and has been determined in accordance with the provisions of the CDM project standard, the PDD and ACM0019 (Version 02).	Data/parameter (unit)	Source of data	Value(s) applied	KFAQ Findings	Operating pressure IV Operating pressure of ammonia burner of Hu-Chems IV (kPa)	PDD	335	Crosscheck of the value with PDD & monitoring plan showed compliance of parameter	EF _{historical,IV} Historical baseline emission factor of the nitric acid plant of Hu-Chems IV (kg N ₂ O/t HNO ₃)	PDD	5.70	Crosscheck of the value with the PDD & monitoring plan showed compliance of parameter	EF _{default,IV} Default emission factor according to the operating procedure of the ammonia burner in year y (2015) (related to 100 percent pure acid) of Hu-Chems IV (kg N ₂ O/t HNO ₃)	PDD/ACM0019 (Version 02)	8.00	Crosscheck of the value with the PDD & monitoring plan showed compliance of parameter	P _{product, max,IV} Design capacity of nitric acid production during the first crediting period of Hu-Chems IV (tHNO ₃)	PDD	467,200 (311,040 for this monitoring period)	Crosscheck of the value with the PDD & monitoring plan showed compliance of parameter
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	<p>However, it was found that the value of $P_{\text{product,max,IV}}$ for the monitoring period was not indicated. Only the value of $P_{\text{product,max,IV}}$ determined on yearly basis is presented in the MR. Which was also found in the $P_{\text{product,max,II}}$ and $P_{\text{product,max,III}}$ (Refer to Appendix 4 / Table 2 / CL ID 02).</p> <p>After the PP has submitted the revised MR (Version 2), it was found that the value for year and the monitoring period are correctly presented.</p> <p><i>Parameters from the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 02.0.0)” COMMONLY relevant for all three plants:</i></p>			
	Data/parameter (unit, description)	Source of data	Value(s) applied	Assessment
	R_u Universal ideal gases constant (Pa.m ³ /kmol.K)	PDD/ Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0)	8,314	Crosscheck of the value with the PDD and the applied methodological tool showed compliance of parameter.
	MM_i Molecular mass of greenhouse gas i (kg/kmol)	PDD /Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0)	44.02	Crosscheck of the value with the PDD and the applied methodological tool showed compliance of parameter.
	P_n Total pressure at normal conditions (Pa)	PDD/ Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0)	101,325	Crosscheck of the value with the PDD and the applied methodological tool showed compliance of parameter.
	T_n Temperature at normal conditions (K)	PDD/ Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0)	273.15	Crosscheck of the value with the PDD and the applied methodological tool showed compliance of parameter.
Conclusion	<p>KFQ confirms that all data and parameters fixed ex ante or at the renewal of the crediting period, such as emission factors, etc. are explicitly mentioned in the MR and have been correctly and consistently applied. And the raised CL (ID 02) has been completely resolved.</p> <p>All values are in compliance with relevant documentation such as the PDD & monitoring plan as well as the applied methodology, applied tools and other CDM related documentation, where applicable.</p>			

E.6.2. Data and parameters monitored

Information flow & data collection system

Means of verification	<p>The KFQ verification team assessed the information flow and data collection system and by means of physical inspection of all major components of the information flow & data collection system as well as related documentation. Interviews with relevant staff were held in order to experience the system in action. Furthermore, the verification of the information flow (where applicable) for all monitoring parameters was successfully done by means of following documents and cross checks:</p> <p><i>Data generation and aggregation:</i></p> <ul style="list-style-type: none"> • Calibration records and certificates • Monthly Health Check reports • Quarterly Inspection Check Reports • General Maintenance service reports • Plausibility of tail gas flow volume flows with ex-ante values in the PDD • Monthly Emerson Service Reports, confirming the functionality of the data transmission system for all instruments • Certificate of analysis of the standard test gas for analyser calibration • Intervals (measuring frequency, reading frequency and recording frequency) of instruments for each instrument are also verified through display panel on-site and DCS generated <p><i>Aggregation to recording:</i></p> <ul style="list-style-type: none"> • Monthly Emerson Service Reports, confirming the functionality of the data storage system for all instruments • Data cross check between values from analysers/transmitters and values in control room & • Data cross check between DeltaV Trend curves (directly generated from raw data) and DeltaV Reports <p><i>Calculation and reporting:</i></p> <ul style="list-style-type: none"> • Crosscheck of implemented calculations in Excel sheets against the PDD formulae • Data cross check between DeltaV Report, production reports, and Excel Sheets
Findings	<p>As stated in the MR and verified by the KFQ verification team, common data flow systems are used in the project activity for the following parameters:</p> <ul style="list-style-type: none"> • Nitric acid produced ($P_{\text{production},y}$) • Operating parameters of the nitric acid plants (NH_3 flow to AOR for determining h_y) • Volumetric flow of the gaseous stream ($V_{t,db}$) • Volumetric fraction of N_2O in the gaseous stream ($v_{i,t,db}$) • Quantity of hydrocarbon ($\text{FC}_{i,j,y}$): for plants Hu-Chems II and III only and not considered in this verification period, as plants Hu-Chems II and III were in permanent shutdown. No emission reductions were claimed out of these two plants. <p>KFQ also verified that the instrument transmitters continuously provide an analogue signal to I/O cards and the signals are collected by a DCS Processor (DeltaV, respectively). Thus collected and processed data, i.e. calculation, raw data, calculated values, are stored in the server continuously and available in the network system as digital values. DCS System (DeltaV, respectively) also generates aggregated daily reports based on the raw data stored at the delegated server. Data are digitally transferred to the Excel sheets, where calculations of emission reductions are performed.</p> <p>It was found by the KFQ verification team, that the information flow & data collection system are fully functional and were so during the whole verification period covered under this verification. Respective documents and results were made available to KFQ for verification.</p>

Conclusion	The KFQ verification team confirms that the information flow & data collection system meets the requirements of the registered PDD and its monitoring plan as per the applied and approved methodology, ACM0019 (Version 02) as well as the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0) and the "Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion" (Version 02). Intervals (measuring frequency, reading frequency and recording frequency) are applied in accordance with the applied methodology, the above mentioned tools and the monitoring plan.
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Due to the permanent shutdown of plants Hu-Chems II and Hu-Chems III during the verification period, findings & assessments in relation data and parameters that are exclusively relevant to one of these two plants are not listed here. This enhances the readability and clearness of the whole report and has no negative or non-conservative effect, since no emission reductions were claimed by the PP during this monitoring period out of these two plants at all.

The table out of the CDM-VCR-FORM has been used for the assessment, following rows as needed have been added: Data/Parameter, Unit, Description, Source of data used, Value(s)

Plant specific parameters: Hu-Chems IV

Data/Parameter	P_{production,y,IV}
Data Unit	tHNO ₃
Description	Nitric acid produced in year y of Hu-Chems IV
Source of data used	Production reports
Value(s)	280,149
Means of verification	<p>The KFQ verification team checked, whether the monitoring activities in relation to this parameter comply with the monitoring plan by physically inspecting the applied measuring device & related equipment for generation, aggregation, recording and reporting. The verification team checked the DCS daily reports and compared the values reported in the excel spreadsheets. All results have been verified against the requirements out of the monitoring plan and the applied methodology.</p> <p>Furthermore, procedures and records on calibration, maintenance and QA/QC activities have been reviewed, discussed in interviews and checked against the requirements out of the monitoring plan and the applied methodology.</p>
Findings	<p>Locations of instruments have been verified by physical inspection and are in accordance with the description in the MR. All specifications in relation of this parameter are fulfilled and suitable instruments and ranges are used. Monitoring results are fully available at the required intervals for the whole monitoring period.</p> <p>The nitric acid flow and density are measured with a mass flow meter, temperature with a temperature measurement and concentration is automatically determined based on measured parameters. Values are sent to the DCS (control room), and the nitric acid production (as 100% HNO₃) is calculated based on mass flow and HNO₃ concentration. Final production values are exported in production reports through the DeltaV System. Data from the DeltaV daily reports are digitally transferred to spreadsheets where emission reduction calculations are performed. There were no errors found in the digital transfer of data from the DeltaV daily reports to the spreadsheets.</p> <p>The calibration and maintenance routines for the parameter are the responsibility of Hu-Chems. The QA/QC and related procedures are covered by the ISO 9001 / ISO 14001 Quality Management Procedures of the nitric acid plant and considered appropriate by the verification team. Valid calibration certificates covering the whole monitoring period are available for the used equipment. It was found that the calibrations were carried out for a measuring range comparable with the actual measuring range and that the calibrations confirmed proper functioning of the monitoring equipment.</p>

Conclusion	<p>KFQ confirms that the monitoring of this parameter has been carried out in accordance with the monitoring plan and any monitoring activities comply with it.</p> <p>KFQ confirms that monitoring results of this parameter are consistently recorded as per the approved frequency.</p> <p>KFQ confirms that the equipment used for monitoring of this parameter is calibrated in accordance with the monitoring plan, the applied methodology as well as methodological tools and the relevant guidance provided by the CDM Executive Board. Details on calibration are given in section E.7 below.</p> <p>KFQ confirms that QA/QC procedures are suitable and have been applied in accordance with the monitoring plan.</p>
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Data/Parameter	$h_{y,IV}$
Data Unit	h
Description	Number of hours of operation in year y of Hu-Chems IV
Source of data used	Measuring device
Value(s)	5,773
Means of verification	<p>As per the PDD, the flow of NH_3 to the ammonia oxidation reactor indicates the operational status. In case, the volume flow of NH_3 to the ammonia oxidation reactor lies above the threshold of 500 Nm^3/h during an hour, the reactor is considered in normal operation. KFQ has checked, whether this has been correctly determined in the MS Excel sheets based on measured data, in accordance with the PDD and the respective monitoring plan.</p> <p>The KFQ verification team also checked, whether the monitoring activities in relation to the volume flow to the AOR comply with the monitoring plan by physically inspecting the applied measuring device & related equipment for generation, aggregation, recording and reporting. The verification team checked the DCS daily reports and compared the values reported in the excel spreadsheets. All results have been verified against the requirements out of the monitoring plan and the applied methodology.</p> <p>Furthermore, procedures and records on calibration, maintenance and QA/QC activities have been reviewed, discussed in interviews and checked against the requirements out of the monitoring plan and the applied methodology.</p>
Findings	<p>Location of instrument, coriolis flowmeter, for measuring the NH_3 flow to the AOR has been verified by physical inspection and is in accordance with the description in the MR. All specifications in relation of this parameter are fulfilled and suitable instrument and range are used. Monitoring results are fully available at the required intervals for the whole monitoring period.</p> <p>The instrument continuously provides an analogue signal to an I/O card. Data are made available in the network system as digital values and are stored by a server. DCS System generates aggregated daily reports based on stored raw data. Data from daily reports are digitally transferred to spreadsheets, where emission reduction calculations are performed. There were no errors in the digital transfer of data from the DCS daily reports to the spreadsheets.</p> <p>It was found that the determination of the parameter based on measured values (i.e. whether NH_3 flow is > 500 Nm^3/h) has been implemented correctly in the spreadsheets and is traceable and transparent. Values over the monitoring period are correct.</p>
Conclusion	<p>KFQ confirms that the monitoring of this parameter has been carried out in accordance with the monitoring plan and any related monitoring activities comply with it.</p> <p>KFQ confirms as well that</p> <ul style="list-style-type: none"> • The monitoring of the volume flow to the AOR has been carried out in accordance with the monitoring plan and any monitoring activities comply with it; and • The monitoring results of the volume flow to the AOR are consistently recorded as per the approved frequency; and • KFQ confirms that the equipment used for monitoring of this parameter is

	<p>calibrated in accordance with the monitoring plan, the applied methodology as well as methodological tools and the relevant guidance provided by the CDM Executive Board. Details on calibration are given in section E.7 below; and</p> <ul style="list-style-type: none"> The QA/QC procedures are suitable and have been applied in accordance with the monitoring plan.
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Data/Parameter	$h_{r,y,IV}$
Data Unit	h
Description	For tertiary N ₂ O abatement, Number of hours (<i>h</i>) in year <i>y</i> where the abatement system is by-passed, underperforming or failed of Hu-Chems IV
Source of data used	Measuring device
Value(s)	1
Means of verification	<p>As per the applied methodology and the PDD, this parameter is determined based on measured data, applying following formula</p> $F_{N_2O, tail\ gas, h, IV} > EF_{existing, y, IV} \times P_{NA, h, IV}$ <p>KFQ has thus checked, whether the parameter has been correctly determined in the MS Excel sheets based on the measured data, in accordance with the PDD and the respective monitoring plan as well as the applied methodology.</p>
Findings	<p>It was found that the determination of this parameter based on measured values has been correctly implemented in the excel spreadsheets and been done without errors. Values over the monitoring period are correct.</p> <p>The measured parameters based on which the determination of this parameter is done and that have been mentioned formula above, are verified in other tables of this section.</p>
Conclusion	KFQ confirms that the monitoring (determination based on measured parameters) of this parameter has been carried out in accordance with the monitoring plan and any related monitoring activities comply with it.

Data/Parameter	$V_{t,db,IV}$
Data Unit	m ³ dry gas/h
Description	Volumetric flow of the gaseous stream in time interval <i>t</i> on a dry basis of Hu-Chems IV
Source of data used	Measuring device
Value(s)	159,688 (average value over the monitoring period)
Means of verification	<p>The KFQ verification team checked, whether the monitoring activities in relation to this parameter comply with the monitoring plan by physically inspecting the applied measuring device & related equipment for generation, aggregation, recording and reporting. Furthermore, the KFQ verification team performed data checks between trend curves (generated from raw data) and DCS daily reports. Furthermore, the verification team checked the DCS daily reports and the values reported in the excel spreadsheets. All results have been verified against the requirements out of the monitoring plan, the applied methodology and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0).</p> <p>Furthermore, procedures and records on calibration, maintenance as well as QA/QC and EN 14181 related activities have been reviewed, discussed in interviews and checked against the requirements out of the monitoring plan and the applied methodology.</p>
Findings	<p>Location of instrument has been verified by physical inspection and is in accordance with the description in the MR. All specifications in relation of this parameter are fulfilled and suitable instrument and range are used. Monitoring results are fully available at the required intervals for the whole monitoring period.</p> <p>The instrument continuously provides an analogue signal to an I/O card. Data are made available in the network system as digital values and are stored by a server. DCS System generates aggregated daily reports based on stored raw data. Data from daily reports are digitally transferred to spreadsheets, where emission reduction calculations are performed. There were no errors in the digital transfer of</p>

	<p>data from the DCS daily reports to the spreadsheets.</p> <p>It was found, that as described in the monitoring plan, that this parameter is automatically expressed at normal conditions and thus, clearly according to the applied methodology, actual conditions ($P_{t,IV}$ and $T_{t,IV}$) are not necessary to be monitored.</p> <p>The calibration and maintenance routines for the parameter are the responsibility of Hu-Chems. The QA/QC and related procedures are covered by the ISO 9001 / ISO 14001 Quality Management Procedures of the nitric acid plant. In addition, QA is covered by EN 14181, especially QAL 2 reference measurements (calibration). Valid calibration covering the whole monitoring period is available for the used equipment. The correction factor out of the calibration curve determined during the QAL 2 reference measurement (calibration) has been correctly applied on an hourly basis in the emission reduction spreadsheet. It was found that the calibrations were carried out for a measuring range comparable with the actual measuring range and that the calibrations confirmed proper functioning of the monitoring equipment.</p>
Conclusion	<p>KFQ confirms that the monitoring of this parameter has been carried out in accordance with the monitoring plan and any monitoring activities comply with it. KFQ confirms that monitoring results of this parameter are consistently recorded as per the approved frequency.</p> <p>KFQ confirms that the equipment used for monitoring of this parameter is calibrated in accordance with the monitoring plan, the applied methodology as well as methodological tools and the relevant guidance provided by the CDM Executive Board. Details on calibration are given in section E.7 below.</p> <p>KFQ confirms that QA/QC procedures are suitable and have been applied in accordance with the monitoring plan and the applied methodology.</p>

Data/Parameter	$V_{i,t,db,IV}$
Data Unit	$m^3 \text{ gas } i / m^3 \text{ dry gas } \rightarrow (m^3 \text{ N}_2\text{O} / m^3 \text{ dry gas})$
Description	Volumetric fraction of greenhouse gas i in a time interval t on a dry basis of plant Hu-Chems IV
Source of data used	Measuring device Non-dispersive infrared (NDIR) photography analyser
Value(s)	$5.58 \cdot 10^{-5}$ (average value over the monitoring period)
Means of verification	<p>The KFQ verification team checked, whether the monitoring activities in relation to this parameter comply with the monitoring plan by physically inspecting the applied measuring device & related equipment for generation, aggregation, recording and reporting. Furthermore, the KFQ verification team performed data checks between trend curves (generated from raw data) and DCS daily reports. Furthermore, the verification team checked the DCS daily reports, QAL2 & 3 results and the values reported in the excel spreadsheets. All results have been verified against the requirements out of the monitoring plan and the applied methodology.</p> <p>Furthermore, procedures and records on calibration, maintenance and QA/QC activities have been reviewed, discussed in interviews and checked against the requirements out of the monitoring plan and the applied methodology</p>
Findings	<p>Location of instrument has been verified by physical inspection and is in accordance with the description in the MR. All specifications in relation of this parameter are fulfilled and suitable instrument and range are used. Monitoring results are fully available at the required intervals for the whole monitoring period.</p> <p>The instrument continuously provides an analogue signal to an I/O card. Data are made available in the network system as digital values and are stored by a server. The N_2O concentration is measured in ppmv and automatically converted to '$m^3 \text{ N}_2\text{O} / m^3 \text{ dry gas}$' according to the applied methodology and tool. It was found, that at described in the monitoring plan, that this parameter is automatically expressed at normal conditions and thus, clearly according to the applied methodology, actual conditions ($P_{t,IV}$ and $T_{t,IV}$) are not necessary to be monitored.</p> <p>As stated in section E.3 above, it was found through interview with staff and sample review of trend curves for raw data that there are operational events during regular</p>

	<p>monthly health checks by Emerson (i.e. fluctuation of N₂O concentration), however operation events in January, May and July 2015 are not presented in the MR (Refer to Appendix 4 / Table 3 / CAR ID 01).</p> <p>After the PP has submitted the revised MR (Version 2) with relevant emission reduction spreadsheets, it was found that there are no inconsistencies between the MR and the actual situation anymore.</p> <p>The calibration and maintenance routines for the parameter are the responsibility of Hu-Chems. The QA/QC and related procedures are covered by the ISO 9001 / ISO 14001 Quality Management Procedures of the nitric acid plant. In addition, QA is covered by EN 14181, especially QAL 2 reference measurements (calibration). Valid calibration covering the whole monitoring period is available for the used equipment. The correction factor out of the calibration curve determined during the QAL 2 reference measurement (calibration) as well as results from QAL 3 (if applicable) has been correctly applied on an hourly basis in the emission reduction spreadsheet. In this monitoring period, no correction to the raw data was done as all data in zero/span test were in permissible range as showed in the SHEWHART control charts of QAL 3 which were conducted as per EN 14181.</p> <p>It was found that the calibrations were carried out for a measuring range comparable with the actual measuring range and that the calibrations confirmed proper functioning of the monitoring equipment.</p>
Conclusion	<p>KFQ confirms that the monitoring of this parameter has been carried out in accordance with the monitoring plan and any monitoring activities comply with it.</p> <p>KFQ confirms that monitoring results of this parameter are consistently recorded as per the approved frequency.</p> <p>KFQ confirms that the equipment used for monitoring of this parameter is calibrated in accordance with the monitoring plan, the applied methodology as well as methodological tools and the relevant guidance provided by the CDM Executive Board. Details on calibration are given in section E.7 below.</p> <p>KFQ confirms that QA/QC procedures are suitable and have been applied in accordance with the monitoring plan and the applied methodology.</p> <p>The raised CAR (ID 01) has been also completely resolved.</p>

Data/Parameter	C_{H2O,t.db,n,IV}
Data Unit	mg H ₂ O/m ³ dry gas
Description	Moisture content of the gaseous stream at normal conditions, in time interval t of Hu-Chems IV
Source of data used	Measurements according to the USEPA CF42 method 4-Gravimetric determination of water content (Measurement report)
Value(s)	Below 4.0*10 ³ (equivalent to 0.004 kg H ₂ O/m ³ dry gas)
Means of verification	The KFQ verification team checked, whether the monitoring activities in relation to this parameter comply with the monitoring plan by document review of QAL 2 report issued by the qualified, external entity AIRTEC.
Findings	<p>It was found that, in line with the monitoring plan, the measurements campaigns of moisture content were conducted when the first calibration (QAL 2) of the flow meter for the gaseous stream was done during 24/09/2014. The repeated measurements were conducted in accordance with USEPA CF42 method 4.</p> <p>It was found that, according to the report, the moisture content of the gaseous stream is below 0.004 kg H₂O/m³ dry gas and thus significantly below the maximum threshold value of 0.05 kg H₂O/m³ dry gas. Therefore, as stated by the PPs in the MR and according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0), the gaseous stream is to be considered dry.</p>
Conclusion	<p>KFQ confirms that the monitoring of this parameter has been carried out in accordance with the monitoring plan and any monitoring activities comply with it.</p> <p>KFQ confirms that monitoring results of this parameter are consistently recorded as per the approved frequency.</p> <p>KFQ confirms that QA/QC procedures are suitable and have been applied in accordance with the monitoring plan & relevant tool by the performing institute (AIRTEC).</p>

All the other parameters (including their IDs, details available in the respective tables of the MR) are not applicable and not included here in this VR.

Social Fund

Means of verification	The KFQ verification team reviewed the protocol from the social fund committee as well as a balance sheet and transaction records for the contribution of the CDM Project Activity to the social fund for all years between 2007 and 2014.
Findings	The KFQ verification team found that the figures stated in the MR with regard to the contributions of the CDM project activity to the social fund were in line with the actual situation. The information for 2015 will be aggregated in the end of this year and thus reported in the 30 th period consistent with PP's accounting year.
Conclusion	KFQ confirms that the PPs have effectively invested a share of the income from the sale of CERs in the Social Fund to support local projects in the area of the project activity (Yeosu) and that the amounts are correctly stated in the MR.

E.6.3. Implementation of sampling plan

Means of verification	N/A
Findings	N/A
Conclusion	N/A

E.7. Compliance with the calibration frequency requirements for measuring instruments

General statement

Means of verification	The means of verification in relation to the specific instruments are stated in detail in the tables further below.
Findings	The findings in relation to the specific instruments are stated in detail in the tables further below.
Conclusion	KFQ confirms that the calibration of the measuring equipment has been conducted as per the applied methodology and the monitoring plan. KFQ confirms, that there has not been any calibration delay for any instrument affecting the verification period and thus, there is no error to be applied on any monitored parameters.

Due to the permanent shutdown of plants Hu-Chems II and Hu-Chems III during the verification period, findings & assessments in relation data and parameters that are exclusively relevant to one of these two plants are not listed here. This enhances the readability and clearness of the whole report and has no negative or non-conservative effect, since no emission reductions were claimed by the PPs during this monitoring period out of these two plants at all.

The table of the CDM-VCR-FORM has been used for the assessment, following rows as needed have been added: Data/Parameter, Data Unit, Description, TAG / Serial Number, Type, Accuracy level, Calibration entity, Calibration frequency, Previous calibration (when applicable), Latest calibration, Applied period of max. permissible error (when applicable). Some parameters involve several instruments, table rows have been added as needed accordingly.

Data/Parameter	P_{production,y,IV}
Data Unit	tHNO ₃
Description	Nitric acid produced in year y of Hu-Chems IV
TAG Number / Serial Number	TAG Number: 324-FT-4-609 / Serial number: 14326811
Type	Coriolis Flowmeter
Accuracy level	± 0.35%
Calibration entity	FM Tech (as per KOLAS)

Calibration frequency	60 months
Previous calibration (if applicable)	N/A (latest calibration is valid for whole monitoring period)
Latest calibration	27/05/2014 (Validity: 26/05/2019)
The applied period of max. permissible error (when applicable)	N/A (no calibration delay)
Means of verification	The KFQ verification team has visually checked the physical existence of the instrument. The KFQ verification team has checked the calibration records & instrument history against the calibration requirements as per the applied methodology and the monitoring plan as well as instrument specifications including manufacturer recommended frequencies.
Findings	It was found that the instrument, as stated in the MR, physically exists and could be identified by the TAG Number and the serial number. It was found that the instrument has been calibrated regularly and as per the defined requirements. No delay of calibration has been observed. It was found, that the instrument had a valid calibration covering the whole verification period and was working within the specified error ranges as per available, suitable certificates.
Conclusion	KFQ confirms that the calibration has been conducted as per the calibration frequency requirements and that the equipment used for monitoring is controlled and calibrated in accordance with the monitoring plan and the applied methodology.
TAG Number / Serial Number	TAG Number: 324-TT-4-237 / Serial number: 966595
Type	Temperature Transmitter
Accuracy level	± 0.15% of span
Calibration entity	EMERSON
Calibration frequency	48 months
Previous calibration	N/A (latest calibration is valid for whole monitoring period)
Latest calibration	02/06/2014 (Validity: 01/06/2018)
The applied period of max. permissible error (when applicable)	N/A (no calibration delay)
Means of verification	The KFQ verification team has visually checked the physical existence of the instrument. The KFQ verification team has checked the calibration records & instrument history against the calibration requirements as per the applied methodology and the monitoring plan as well as instrument specifications including manufacturer recommended frequencies.
Findings	It was found that the instrument, as stated in the MR, physically exists and could be identified by the TAG Number and the serial number. It was found that the instrument has been calibrated regularly and as per the defined requirements. No delay of calibration has been observed. It was found, that the instrument had a valid calibration covering the whole verification period and was working within the specified error ranges as per available, suitable certificates.
Conclusion	KFQ confirms that the calibration has been conducted as per the calibration frequency requirements and that the equipment used for monitoring is controlled and calibrated in accordance with the monitoring plan and the applied methodology.

Data/Parameter	$h_{y,IV}$
Data Unit	h (determined based on ammonia flow Nm ³ /h)
Description	Number of hours of operation in year y of Hu-Chems IV
TAG Number / Serial Number	TAG Number: 324-FT-4-5020 / Serial number: 14137655
Type	Coriolis Flowmeter
Accuracy level	± 0.35%
Calibration entity	FM Tech (as per KOLAS)
Calibration frequency	60 months
Previous calibration (if applicable)	N/A (latest calibration is valid for whole monitoring period)

Latest calibration	27/05/2014 (Validity: 26/05/2019)
The applied period of max. permissible error (when applicable)	N/A (no calibration delay)
Means of verification	The KFQ verification team has visually checked the physical existence of the instrument. The KFQ verification team has checked the calibration records & instrument history against the calibration requirements as per the applied methodology and the monitoring plan as well as instrument specifications including manufacturer recommended frequencies.
Findings	It was found that the instrument, as stated in the MR, physically exists and could be identified by the TAG Number and the serial number. It was found that the instrument has been calibrated regularly and as per the defined requirements. No delay of calibration has been observed. It was found, that the instrument had a valid calibration covering the whole verification period and was working within the specified error ranges as per available, suitable certificates.
Conclusion	KFQ confirms that the calibration has been conducted as per the calibration frequency requirements and that the equipment used for monitoring is controlled and calibrated in accordance with the monitoring plan and the applied methodology.

Data/Parameter	$V_{t,db,IV}$
Data Unit	m ³ dry gas/h
Description	Volumetric flow of the gaseous stream in time interval t on a dry basis of Hu-Chems IV
TAG Number / Serial Number	TAG Number: 324-FT-4-522 / Serial number: 1240834
Type	Annubar
Accuracy level	± 2% of span
Calibration entity	AIRTEC
Calibration frequency	(EN 14181/QAL 2) 36 months
Previous calibration (if applicable)	N/A (latest calibration is valid for whole monitoring period)
Latest calibration	23/09/2014 to 25/09/2014 (validity: 24/09/2017)
The applied period of max. permissible error (when applicable)	N/A (no calibration delay)
Means of verification	The KFQ verification team has visually checked the physical existence of the instrument. The KFQ verification team has checked the calibration records & instrument history against the calibration requirements as per the applied methodology and the monitoring plan as well as instrument specifications including EN 14181 required frequencies.
Findings	<p>It was found that the instrument, as stated in the MR, physically exists and could be identified by the TAG Number and the serial number. It was found that the instrument has been calibrated regularly and as per the defined requirements. It was found, that the instrument had a valid calibration covering the whole verification period and was working within the specified error ranges as per available, suitable certificates.</p> <p>In accordance with EN14181, QAL 2 reference measurement as per required standards was performed by the qualified entity AIRTEC during 23/09/2014 to 25/09/2014, which is the initial measurement after successfully setting up the instrument, i.e. this initial QAL 2 measurement was performed during the monitoring period. It was found that the technical features of the instrument in terms of the CDM Project / Monitoring were exactly the same since the start of the monitoring period, based on physical inspection and installation & operation records. This, and the fact, that the QAL 2 calibration factors (the calibration curve) was clearly & traceably applied to the monitored values in the MS Excel sheets for all values of the whole monitoring period enables KFQ to confirm that the measurement done in September 2014 & applied for the whole monitoring period is representative for the whole monitoring period due to the same characteristics and reliability of the instrument used at all times. Valid QAL 1</p>

	certification was found to be in place and available.
Conclusion	KFQ confirms that the calibration has been conducted as per the calibration frequency requirements and that the equipment used for monitoring is controlled and calibrated in accordance with the monitoring plan, the applied methodology.

Data/Parameter	$V_{i,t,db,IV}$
Data Unit	m ³ gas i/m ³ dry gas
Description	Volumetric fraction of greenhouse gas i in a time interval t on a dry basis of plant Hu-Chems IV
TAG Number / Serial Number	TAG Number: 324-AT-4-0107 / Serial number: 990861497818
Type	NDIR Analyser
Accuracy level	± 1% (zero/span)
Calibration entity	AIRTEC
Calibration frequency	(EN 14181/QAL 2) 36 months
Previous calibration (if applicable)	N/A (latest calibration is valid for whole monitoring period)
Latest calibration	23/09/2014 to 25/09/2014 (validity: 24/09/2017)
The applied period of max. permissible error (when applicable)	N/A (no calibration delay)
Means of verification	The KFQ verification team has visually checked the physical existence of the instrument. The KFQ verification team has checked the calibration records & instrument history against the calibration requirements as per the applied methodology and the monitoring plan as well as instrument specifications including EN 14181 required frequencies.
Findings	<p>It was found that the instrument, as stated in the MR, physically exists and could be identified by the TAG Number and the serial number. It was found that the instrument has been calibrated regularly and as per the defined requirements. It was found, that the instrument had a valid calibration covering the whole verification period and was working within the specified error ranges as per available, suitable certificates.</p> <p>In accordance with EN14181, QAL 2 reference measurement as per required standards was performed by the qualified entity AIRTEC during 23/09/2014 to 25/09/2014, which is the initial measurement after successfully setting up the instrument, i.e. this initial QAL 2 measurement was performed during the monitoring period. It was found that the technical features of the instrument in terms of the CDM Project / Monitoring were exactly the same since the start of the monitoring period, based on physical inspection and installation & operation records. This, and the fact, that the QAL 2 calibration factors (the calibration curve) was clearly & traceably applied to the monitored values in the MS Excel sheets for all values of the whole monitoring period enables KFQ to confirm that the measurement done in September 2014 & applied for the whole monitoring period is representative for the whole monitoring period due to the same characteristics and reliability of the instrument used at all times. Valid QAL 1 certification was found to be in place and available.</p> <p>Furthermore, the analyser is self-calibrated (zero, span) using a set of certified calibration gases in accordance with EN 14181. Independently from EN 14181, as an additional measure, latest test for performance of zero/span test by Korean Testing Laboratory was done on 25/03/2014.</p> <p>The calibration gases applied were marked to be stable in the verifying period and cover the range of measurement. Detailed supplier certificates including information on concentration, accuracy and stability are available.</p> <p>Control check for zero/span test result was conducted as shown in SHEWHART CONTROL CHART – #4 Nitric Acid Plant.</p>
Conclusion	KFQ confirms that the calibration has been conducted as per the calibration frequency requirements and that the equipment used for monitoring is controlled

	and calibrated in accordance with the monitoring plan, the applied methodology.
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E.8. Assessment of data and calculation of emission reductions or net removals

E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means of verification	<p>KFQ has reviewed all data, parameters and calculations with respect to calculation of the baseline GHG emissions and checked them against the requirements out of the applied methodology (ACM0019 – Version 02) as well as the PDD (Version 4.1 dated on 14/10/2013), as well as relevant tools applied.</p> <p>KFQ has also assessed the completeness, quality and appropriateness of the data, parameters and calculations.</p> <p>Furthermore, KFQ has assessed, whether any assumptions, emission factors, default values, GWPs or other reference values – as applicable – used by the PPs have been justified and correctly applied, in line with the requirements.</p> <p>KFQ has further crosschecked – as applicable - any information with other sources available, such as but not limited to production log sheets, meters available in the operators control room or on-site, etc.</p>
Findings	<p>The baseline GHG emissions have been found to be 475,778 tCO₂e for the verification period. The figure is based exclusively on the operation of the EnviNOx® system in plant Hu-Chems IV, since it has been found based on evidence that plants Hu-Chems II and Hu-Chems III were permanently shut-down during the monitoring period and no emission reductions were claimed for these two plants during the verification period by the PPs.</p> <p>It was found that a complete set of data covering the monitoring period has been provided by the PPs. Activity levels and non-activity parameters have been monitored in accordance with the monitoring plan, as applicable.</p> <p>The calculation was found to be correct as well as carried out in accordance with the formulae and methods described in the monitoring methodology ACM0019 (version 02) and the registered PDD (Version 4.1 dated 14/10/2013).</p> <p>It was found that all emission factors, GWPs and default values and reference values, as applicable, have been correctly justified, are explicitly mentioned in the MR and have been correctly applied. It was found that no assumptions are used that have any relevant influence on reported emission reductions.</p> <p>It was found that all parameters are automatically collected by the DeltaV DCS provided by Emerson. It was found that there is no uncertainty related to manual transfer of data used in the calculation of emission reduction since the monitored parameters are automatically collected by the DeltaV DCS. All actions performed at the computer station are logged and the log file is available for KFQ. There were no errors in the digital transfer of data from DeltaV DCS files to the excel spreadsheets for the calculation of emissions reductions.</p> <p>It was found that the spreadsheets, including corresponding re-calculations of data during events as described in the MR, were made available completely by the PP and that all formulae have been correctly implemented and are accessible and traceable. Any recalculations are in line with the procedure in the registered PDD and have been checked and found to be correct and conservative. Safeguarding procedures in accordance to the monitoring plan have been applied in a conservative way. Rounding of digits, where applicable, has been applied both correctly and conservatively.</p> <p>All necessary documentation is collected, referenced and aggregated and is easily accessible in spreadsheets and daily reports in electronic format. Measurements are performed by calibrated equipment, and key data could be cross-checked via other sources (if applicable), such as raw data generated in the DCS, production log sheets and meters available in the operators control room or on-site. Further details on cross-checks for each parameter and the information flow are given in sections E.6.2 above.</p> <p>A detailed assessment of all relevant parameters for the verification period is given in E.6.1 and E.6.2 above.</p>
Conclusion	<p>KFQ confirms that all required data for calculation of the baseline GHG emissions were available for the whole verification period and no data were missing due to any</p>

	<p>non-monitoring of activity levels or non-activity parameters.</p> <p>KFQ confirms that suitable cross-checking of data was possible and has been performed as described.</p> <p>KFQ confirms that the PPs have followed appropriate methods and formulae for calculating baseline GHG emissions have been followed.</p> <p>KFQ confirms that any emission factors, GWPs and default values and reference values – as applicable – that were applied in the calculation have been justified and correctly applied. No assumptions were used.</p> <p>KFQ confirms that the calculation of the baseline GHG emissions for the covered monitoring period is fully complete and based on suitable and verifiable evidence.</p>
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E.8.2. Calculation of project GHG emissions or actual net GHG removals by sinks

Means of verification	<p>KFQ has reviewed all data, parameters and calculations with respect to calculation of the project GHG emissions and checked them against the requirements out of the applied methodology (ACM0019 – Version 02) and the PDD (Version 4.1 dated 14/10/2013), as well as relevant tools applied.</p> <p>KFQ has also assessed the completeness, quality and appropriateness of the data, parameters and calculations.</p> <p>Furthermore, KFQ has assessed, whether any assumptions, emission factors, default values, GWPs or other reference values – as applicable – used by the PPs have been justified and correctly applied, in line with the requirements.</p> <p>KFQ has further crosschecked – as applicable – any information with other sources available, such as but not limited to production log sheets, meters available in the operators control room or on-site, etc.</p>
Findings	<p>The project GHG emissions have been found to be 29,723 tCO₂e for the verification period. The figure is based exclusively on the operation of the EnviNOx® system in plant Hu-Chems IV, since it has been found based on evidence that plants Hu-Chems II and Hu-Chems III were permanently shut-down during the monitoring period and no emission reductions were claimed for these two plants during the verification period by the PPs.</p> <p>It was found that a complete set of data covering the monitoring period has been provided by the PPs. Activity levels and non-activity parameters have been monitored in accordance with the monitoring plan, as applicable.</p> <p>The calculation was found to be correct as well as carried out in accordance with the formulae and methods described in the monitoring methodology, ACM0019 (Version 02) and the PDD (Version 4.1 dated 14/10/2013), as well as relevant tools applied.</p> <p>It was found that all emission factors, GWPs and default values and reference values, as applicable, have been correctly justified, are explicitly mentioned in the MR and have been correctly applied. It was found that no assumptions are used that have any relevant influence on reported emission reductions.</p> <p>It was found that all parameters are automatically collected by the DeltaV DCS provided by Emerson. It was found that there is no uncertainty related to manual transfer of data used in the calculation of emission reduction since the monitored parameters are automatically collected by the DeltaV DCS. All actions performed at the computer station are logged and the log file is available for KFQ. There were no errors in the digital transfer of data from DeltaV DCS files to the excel spreadsheets for the calculation of emissions reductions.</p> <p>It was found that the spreadsheets, including corresponding re-calculations of data during events as described in the MR, were made available completely by the PP and that all formulae have been correctly implemented and are accessible and traceable. Any recalculations are in line with the procedure in the registered PDD and have been checked and found to be correct and conservative. Safeguarding procedures in accordance to the monitoring plan have been applied in a conservative way. Rounding of digits, where applicable, has been applied both correctly and conservatively.</p> <p>All necessary documentation is collected, referenced and aggregated and is easily accessible in spreadsheets and daily reports in electronic format. Measurements are performed by calibrated equipment, and key data could be cross-checked via other sources (if applicable), such as raw data generated in the DCS, production log sheets and meters available in the operators control room or on-site. Further details on cross-checks for each parameter and the information flow are given in sections</p>

	<p>E.6.2 above.</p> <p>A detailed assessment of all relevant parameters for the verification period is given in E.6.1 and E.6.2 above.</p>
Conclusion	<p>KFQ confirms that all required data for calculation of the project GHG emissions were available for the whole verification period and no data were missing due to any non-monitoring of activity levels or non-activity parameters.</p> <p>KFQ confirms that suitable cross-checking of data was possible and has been performed as described.</p> <p>KFQ confirms that the PPs have followed appropriate methods and formulae for calculating project GHG emissions have been followed.</p> <p>KFQ confirms that any emission factors, GWPs and default values and reference values – as applicable – that were applied in the calculation have been justified and correctly applied. No assumptions were used.</p> <p>KFQ confirms that the calculation of the project GHG emissions for the covered monitoring period is fully complete and based on suitable and verifiable evidence.</p>

E.8.3. Calculation of leakage GHG emissions

Means of verification	KFQ has checked, whether leakage emissions (if any) were determined by the PPs in accordance with the applied methodology and the PDD.
Findings	KFQ has found that the approach applied by the PPs that leakage emissions need not to be considered (i.e. being considered zero, consequently) is in accordance to the applied methodology ACM0019 (Version 2).
Conclusion	KFQ confirms that the PPs approach with regard to leakage GHG emissions is correct and that no leakage GHG emissions need to be considered in the project activity based on the applied methodology.

E.8.4. Summary of calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

Means of verification	<p>KFQ has reviewed all data, parameters and calculations with respect to calculation of the GHG emission reductions and checked them against the requirements out of the applied methodology (ACM0019 – Version 02) and the PDD (Version 4.1 dated 14/10/2013), as well as relevant tools applied.</p> <p>KFQ has also assessed the completeness, quality and appropriateness of the data, parameters and calculations.</p> <p>Furthermore, KFQ has assessed, whether any assumptions, emission factors, default values, GWPs or other reference values – as applicable – used by the PPs have been justified and correctly applied, in line with the requirements.</p> <p>KFQ has further crosschecked – as applicable - any information with other sources available, such as but not limited to production log sheets, meters available in the operators control room or on-site, etc.</p> <p>Means of verification in respect of baseline GHG emissions, project GHG emissions and leakage GHG emissions that form the basis for calculation of the GHG emission reductions, are stated in detail in sections E.8.1., E.8.2. and E.8.3. above.</p>
Findings	<p>The GHG emission reductions have been found to be 446,055 tCO₂e for the verification period. The figure is based exclusively on the operation of the EnviNOx® system in plant Hu-Chems IV, since it has been found based on evidence that plants Hu-Chems II and Hu-Chems III were permanently shut-down during the monitoring period and no emission reductions were claimed for these two plants during the verification period by the PPs. It was found that the first day on which CERs are being claimed in this verification period has been correctly specified by the PPs, being 01/01/2015.</p> <p>It was found that a complete set of data covering the monitoring period has been provided by the PPs. Activity levels and non-activity parameters have been monitored in accordance with the monitoring plan, as applicable.</p> <p>The calculation was found to be correct as well as carried out in accordance with the formulae and methods described in the monitoring methodology ACM0019 (version 02) and the PDD (Version 4.1 dated 14/10/2013), as well as relevant tools applied.</p>

	<p>It was found that all emission factors, GWPs and default values and reference values, as applicable, have been correctly justified, are explicitly mentioned in the MR and have been correctly applied. It was found that no assumptions are used that have any relevant influence on reported emission reductions.</p> <p>It was found that all parameters are automatically collected by the DeltaV DCS provided by Emerson. It was found that there is no uncertainty related to manual transfer of data used in the calculation of emission reduction since the monitored parameters are automatically collected by the DeltaV DCS. All actions performed at the computer station are logged and the log file is available for KFQ. There were no errors in the digital transfer of data from DeltaV DCS files to the excel spreadsheets for the calculation of emissions reductions.</p> <p>It was found that the spreadsheets, including corresponding re-calculations of data during events as described in the MR, were made available completely by the PP and that all formulae have been correctly implemented and are accessible and traceable. Any recalculations are in line with the procedure in the registered PDD and have been checked and found to be correct and conservative. Safeguarding procedures in accordance to the monitoring plan have been applied in a conservative way. Rounding of digits, where applicable, has been applied both correctly and conservatively.</p> <p>All necessary documentation is collected, referenced and aggregated and is easily accessible in spreadsheets and daily reports in electronic format. Measurements are performed by calibrated equipment, and key data could be cross-checked via other sources (if applicable), such as raw data generated in the DCS, production log sheets and meters available in the operators control room or on-site. Further details on cross-checks for each parameter and the information flow are given in sections E.6.2 above.</p> <p>A detailed assessment of all relevant parameters for the verification period is given in E.6.1 and E.6.2 above. Findings in respect of baseline GHG emissions, project GHG emissions and leakage GHG emissions, that form the basis for calculation of the GHG emission reductions, are stated in detail in sections E.8.1., E.8.2. and E.8.3. above.</p>
Conclusion	<p>KFQ confirms that all required data for the calculation of GHG emission reductions were available for the whole verification period and no data were missing due to any non-monitoring of activity levels or non-activity parameters.</p> <p>KFQ confirms that suitable cross-checking of data was possible and has been performed as described.</p> <p>KFQ confirms that the PPs have followed appropriate methods and formulae for calculating GHG emission reductions have been followed.</p> <p>KFQ confirms that any emission factors, GWPs and default values and reference values – as applicable – that were applied in the calculation have been justified and correctly applied. No assumptions were used.</p> <p>KFQ confirms that the calculation of the GHG emissions for the covered monitoring period is fully complete and based on suitable and verifiable evidence.</p> <p>KFQ confirms that the first day in which CERs are being claimed in the verification period is 01/01/2015, i.e. later than 31/12/2012. No pro-rata approach is applicable.</p> <p>KFQ finally confirms that the amount of emission reductions claimed by the PPs for the verification period from 01/01/2015 to 31/08/2015, amounting to 446,055 tCO₂e, is correctly determined and calculated.</p>

E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Means of verification	KFQ compared the ex-ante estimation of emission reductions in the registered PDD with the emission reductions reported by the PPs in the MR.
Findings	<p>KFQ found that the annual emission reductions for 2015 (from 01/01/2015 to 31/08/2015) in the PDD were estimated as 1,243,557 tCO₂e which corresponds to 827,902 tCO₂e during the 243 days of the monitoring period (value rounded down). The emission reductions reported by the PPs during the same period were 446,055 tCO₂e and is thus lower than the value estimated in the PDD.</p> <p>Since the plants Hu-Chems II and Hu-Chems III were shut-down during the whole</p>

	<p>verification period, the only plant where emission reductions were claimed by the PPs was plant Hu-Chems IV. For that, the ex-ante estimation in the PDD was 673,174 tCO₂e which corresponds to 448,168 tCO₂e during the 243 days of the verification period. The emission reductions reported by the PPs during the same period for the plant were 446,055 tCO₂e and is thus lower than the value estimated in the PDD.</p> <p>It was found that the PPs have correctly described the situation in the MR as well.</p>
Conclusion	<p>KFQ confirms that the overall emission reductions of the project activity were clearly below the ex-ante estimation in the PDD, whereas also the specific emission reductions in the nitric acid plant Hu-Chems IV were lower than estimated in the PDD for that plant.</p> <p>KFQ confirms that no increase in the in the actual GHG emissions reductions were observed during the verification period.</p> <p>KFQ confirms that the emission reductions claimed by the PPs are reasonable.</p>

E.8.6. Remarks on difference from estimated value in registered PDD

Means of verification	As per the specific instructions of the CDM-VCR-FORM, in this section it is to be explained how the cause of any increase in the actual GHG emission reductions in this monitoring period were assessed in accordance with the applicable verification requirements in the VVS. As there is no actual increase of actual GHG emission reductions (refer to E.8.5), the section is therefore not applicable in this verification period.
Findings	N/A
Conclusion	N/A

E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Means of verification	The GHG emission reductions reported in the MR are 446,055 tCO ₂ e. As described in detail in <i>Section E</i> of this report, all relevant aspects of the project activity have been assessed in order to determine, whether the claimed emission reductions by the PPs are correctly determined, reasonable and fairly stated and based on verifiable evidence and in accordance with the applied methodology and the registered PDD as well as applicable tools.
Findings	It was found that the project activity is implemented and operated according to the registered PDD and the monitoring of any and all data and parameters as well as calculation of baseline GHG emissions, project GHG emissions and GHG emission reductions is complete conducted in accordance with the registered PDD, the applied methodology.
Conclusion	KFQ arrived at the conclusion that the GHG emission reductions reported in the MR and claimed by the PPs are correctly determined with 446,055 tCO ₂ e for the covered verification period between 01/01/2015 to 31/08/2015. This implies, that 100% of the reported GHG emission reduction in this verification period has been achieved in a period after the end of 31/12/2012, i.e. the first commitment period is untouched by this verification period.

SECTION F. Internal quality control

According to KFQ's Procedure for deciding whether to proceed request for issuance, the final verification report and verification findings underwent a technical review before being submitted to the PPs for requesting issuance CERs. The technical review was performed by technical review team composed of a person qualified for this project activity in accordance with KFQ's qualification scheme for CDM project validation and verification.

SECTION G. Verification opinion

Through the verification of the MR of the CDM project activity: “Catalytic N₂O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.” in accordance with VVS (version 9.0), KFQ could confirm that:

- The project activity has been implemented and operated as per the registered PDD (Version 4.1, dated 14/10/2013),
- The installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately,
- The monitoring plan is as per the applied methodology,
- The monitoring plan in MR is as per the monitoring plan in the registered PDD,
- The monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan, and approved methodology including applicable tool(s) and generated GHG emission reductions data,
- The GHG emission reductions in the MR (v2) are calculated without material misstatements.

KFQ’s verification opinion refers to the project’s GHG emissions and resulting GHG emission 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 followings:

Title of project activity	Catalytic N ₂ O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.
UNFCCC Reference Number	0765
Date of registration	22/01/2007
Renewal date	05/02/2014
PDD (2 nd crediting period)	14/10/2013 (Version 4.1)
Methodology applied	ACM0019 (Version 02)
Final version of MR	2 (dated 01/12/2015)
Crediting period	22/01/2014 to 21/01/2021
Monitoring period	01/01/2015 to 31/08/2015
Total GHG emission Reductions Verified	Baseline emissions: 475,778 tonnes CO _{2e} Project emissions: 29,723 tonnes CO _{2e} Leakage: 0 tonnes CO _{2e} Emission reductions: 446,055 tonnes CO _{2e}

It is the opinion of KFQ that the amount of GHG emission reductions achieved by the project activity during this monitoring period is correct and that complies with all applicable CDM requirements.

SECTION H. Certification statement

Korean Foundation for Quality has performed the periodic verification of the emission reductions that have been reported for the CDM project activity: “Catalytic N₂O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp.” (UNFCCC Registration Ref. No. 0765) for the period 01/01/2015 to 31/08/2015.

The PPs are responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the project.

It is KFQ's responsibility to express an independent verification statement on the reported GHG emission reductions from the project.

KFQ conducted the verification on the basis of the monitoring methodology ACM0019 (version 02), the registered PDD of 14/10/2013 (version 4.1), the validation report (dated 07/11/2013) and the MR (version 2) dated 01/12/2015. The verification included i) checking whether the provisions of the monitoring methodology and the monitoring plan were consistently and appropriately applied and ii) the collection of evidence supporting the reported data.

KFQ's verification approach draws on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. KFQ planned and performed the verification by obtaining evidence and other information and explanations that KFQ considers necessary to give reasonable assurance on the reported GHG emission reductions.

In our opinion the GHG emissions reductions of the "Catalytic N₂O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp." (UNFCCC Registration Ref. No. 0765) for the period from 01/01/2015 to 31/08/2015 are fairly stated in the MR (v2).

The data generation, aggregation, recording, calculation and reporting of GHG emission reductions were conducted correctly on the basis of the approved baseline and monitoring methodology ACM0019 (version 02) and the monitoring plan containing in the registered PDD.

Hence, KFQ is able to certify that the emission reductions from the "Catalytic N₂O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp." during the period from 01/01/2015 to 31/08/2015 are 446,055 tCO₂e.

Signed on behalf of the Korean Foundation for Quality

Signature : 

Name : Soon Hong YEOM, Managing Director

Date : 18 December 2015

Appendix 1. Abbreviations

Abbreviations	Full texts
AOR	Ammonia oxidation reactor
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CL	Clarification Request
CMP	COP/MOP Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO ₂	Carbon dioxide
CO _{2e}	Carbon dioxide equivalent
DCS	Distributed Control System
DOE	Designated Operational Entity
FAR	Forward Action Request
GC	Gas chromatography
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
KFQ	Korean Foundation for Quality
KTL	Korean Testing Laboratory
MoC	Modalities of Communication
MP	Monitoring Plan
MR	Monitoring Report
NA	Nitric Acid
N ₂ O	Nitrous oxide
PDD	Project Design Document
PP	Project participant
PS	Clean Development Mechanism Project Standard
QMS	Quality Management System
SCR	Selective catalytic reduction
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Clean Development Mechanism Validation and Verification Standard

Appendix 2. Competence of team members and technical reviewers



CERTIFICATE OF COMPETENCE

Name: Yu Shim JEONG

Qualification:

	Validation	Verification
-Lead auditor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-Auditor	<input type="checkbox"/>	<input type="checkbox"/>
-Technical Expert	<input type="checkbox"/>	<input type="checkbox"/>
-Local Expert	<input type="checkbox"/>	<input type="checkbox"/>

Scopes of Expertise:

Technical Area (TA)

- 1.2 Renewables
- 5.1 Chemical Industry
- 5.2 Caprolactam, nitric acid, adipic acid

She is approved as the qualification above according to the KFQ's procedure of Qualifying and Maintaining of Auditor on 03 March 2015

Sustainability Management Institute
Sang Yeon PARK



CERTIFICATE OF COMPETENCE

Name: Jin Seok CHO

Qualification:

	Validation	Verification
-Lead auditor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-Auditor	<input type="checkbox"/>	<input type="checkbox"/>
-Technical Expert	<input type="checkbox"/>	<input type="checkbox"/>
-Local Expert	<input type="checkbox"/>	<input type="checkbox"/>

Scopes of Expertise:

Technical Area (TA)

- 1.2 Renewables
- 13.1 Solid waste and wastewater
- 13.2 Manure

He is approved as the qualification above according to the KFQ's procedure of Qualifying and Maintaining of Auditor on 03 March 2015

Sustainability Management Institute
Sang Yeon PARK



CERTIFICATE OF COMPETENCE

Name: Sang Yeon PARK

Qualification:

	Validation	Verification
-Lead auditor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-Auditor	<input type="checkbox"/>	<input type="checkbox"/>
-Technical Expert	<input type="checkbox"/>	<input type="checkbox"/>
-Local Expert	<input type="checkbox"/>	<input type="checkbox"/>

Scopes of Expertise:

Technical Area (TA)

- 1.2 Renewables
- 3.1 Energy demand
- 5.2 Caprolactam, nitric and adipic acid
- 13.1 Solid waste and wastewater

She is approved as the qualification above according to the KFQ's procedure of Qualifying and Maintaining of Auditor on 03 March 2015

Sustainability Management Institute
Yu Shim JEONG



CERTIFICATE OF COMPETENCE

Name: Sung Han YOON

Qualification:

	Validation	Verification
-Lead auditor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
-Auditor	<input type="checkbox"/>	<input type="checkbox"/>
-Technical Expert	<input type="checkbox"/>	<input type="checkbox"/>
-Local Expert	<input type="checkbox"/>	<input type="checkbox"/>

Scopes of Expertise:

Technical Area (TA)

- 1.1 Thermal energy generation
- 1.2 Renewables
- 5.1 Chemical Industry
- 5.2 Caprolactam, nitric and adipic acid
- 11.1 Emissions of fluorinated gases
- 13.1 Solid waste and wastewater
- 13.2 Manure

He is approved as the qualification above according to the KFQ's procedure of Qualifying and Maintaining of Auditor on 03 March 2015.

Sustainability Management Institute
Sang Yeon PARK

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1	Project participants	Monitoring report: <ul style="list-style-type: none"> Version 1: HUC-0765_MP#29_MR_v1_CLEAN Version 2: HUC-0765_MP#29_MR_v2_CLEAN 	From 29/10/2015 From 01/12/2015	Project participants
2	Project participants	CDM Project MS Excel Spreadsheet : Version 1: <ul style="list-style-type: none"> HUC-0765_II_MP29_UNFCCC_CONFIDENTIAL HUC-0765_III_MP29_UNFCCC_CONFIDENTIAL HUC-0765_IV_MP29_UNFCCC_CONFIDENTIAL HUC-0765_OVERALL_MP29_UNFCCC_CONFIDENTIAL Version 2: <ul style="list-style-type: none"> HUC-0765_IV_MP29_UNFCCC_CONFIDENTIAL HUC-0765_OVERALL_MP29_UNFCCC_CONFIDENTIAL 	All from 29/10/2015 All from 01/12/2015	Project participants
3	Project participants	Shewhart control charts / QAL 3 records	From 01/01/2015 to 31/08/2015	Project participants
4	Project participants	Summary on Shut-downs & Special observations of the monitoring system	From 01/01/2015 to 31/08/2015	Project participants
5	Delta V / DCS System	Daily monitoring reports (PDF files, CSV files), Data trend curves	From 01/01/2015 to 31/08/2015	Project participants
6	Delta V / DCS System	Daily event log files (TXT files)	From 01/01/2015 to 31/08/2015	Project participants
7	Project participants	CDM Project Design Document (Version 4.1) for the "Catalytic N2O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp." (Renewal of the crediting period)	14/10/2013 Published under: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1163081212.47/view?cp=2	Others
8	TUV NORD	Validation Report for the "Catalytic N2O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp." project. Report No. 800420315-13/095 (Renewal of the crediting period)	07/11/2013 Published under: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1163081212.47/view?cp=2	Others
9	KFQ	Verification/Certification Report for the "Catalytic N2O destruction project in the tail gas of three Nitric Acid Plants at Hu-Chems Fine Chemical Corp." for the monitoring period from 12/06/2014 to 31/12/2014 (Version 01.1)	From 30/08/2015 Published under: https://cdm.unfccc.int/Projects/DB/TUEV-SUED1163081212.47/CP/FAZXN6VQ7XXO5PF73E0MV6184C5JF7/iProcess/KFQ1429151112.8/view	Others
10	TMS (Tele Measuring System) connected to environmental authority	Shutdown notifications for nitric acid plants Hu-Chems II & Hu-Chems III	From December 2012	Project participants
11	Hu-Chems & UHDE GmbH	Nitric acid plant Hu-Chems IV operation manual (Capacity)	From 21/03/2014	Project participants
12	Project	Equipment list and specifications for all monitoring	All from	Project

	participants	equipment and analysers: <ul style="list-style-type: none"> Plant Hu-Chems II Plant Hu-Chems III Plant Hu-Chems IV 	01/01/2015 to 31/08/2015	participants
13	Emerson Process Management	Instruction Manual – NGA 2000 for MLT Analyser (8 th Edition)	From August 2004	Project participants
14	UHDE GmbH TUEV Nord	Performance Guarantee Test Run (PGTR) protocols <ul style="list-style-type: none"> Plant Hu-Chems II Plant Hu-Chems III Plant Hu-Chems IV TUEV Nord PGTR Certificates <ul style="list-style-type: none"> Plant Hu-Chems II Plant Hu-Chems III Plant Hu-Chems IV 	From 02/04/2007 From 04/04/2007 From 16/01/2007 From 09/04/2007 From 09/04/2007 From 20/01/2007	Project participants
15	Project participants	Calibration gas (test gas) exchange History including all exchanges in the monitoring period.	From 12/09/2014 to 19/08/2015	Project participants
16	KRISS ¹ Hu-Chems KRISS Hu-Chems KRISS Hu-Chems AIRGAS EPMK ²	Calibration gas records (all for plant Hu-Chems IV) First gas used in period: <ul style="list-style-type: none"> KRISS / D014966 / 1% Stability / Expiration on 04/03/2015 Hu-Chems / Installation report / Installation on 12/09/2014 Second gas used in period: <ul style="list-style-type: none"> KRISS / D068074 / 1% Stability / Expiration on 06/07/2015 Hu-Chems / Installation report / Installation on 09/01/2015 Third gas used in period: <ul style="list-style-type: none"> KRISS / D233627 / 1% Stability / Expiration on 03/11/2015 Hu-Chems / Installation report / Installation on 05/05/2015 Fourth gas used in period: <ul style="list-style-type: none"> AIRGAS / CC458864 / 1% Stability / Expiration on 03/06/2017 EPMK / Installation report / Installation on 19/08/2015 	From 11/09/2014 From 12/09/2014 From 07/01/2015 From 09/01/2015 From 04/05/2015 From 05/05/2015 From 28/05/2015 From 20/08/2015	Project participants
17	EPMK & Hu-Chems	Service Support Agreements: Delta-V system for EnviNOx® Hu-Chems as well as for Analyser systems for EnviNOx Hu-Chems between Hu-Chems Fine Chemical Corp. and Emerson Process Management Korea Ltd.	From 02/04/2013	Project participants
18	EPMK	Annual extended general maintenance service report for analyser and sampling system of all three nitric acid plant N2O analysers, performed in August 2014	From 29/08/2014	Project participants
19	EPMK	Regular service reports: <ul style="list-style-type: none"> Monthly Health Check report January 2015 Monthly Health Check report February 2015 Monthly Health Check report March 2015 Monthly Health Check report April 2015 Monthly Health Check report May 2015 Monthly Health Check report June 2015 	From 20/01/2015 From 17/02/2015 From 18/03/2015 From 21/04/2015 From 20/05/2015 From 23/06/2015	Project participants

¹ KRISS refers to Korean Research Institute of Standards and Science and is used as such reference in the whole Appendix 3.

² EPMK refers to Emerson Process Management Korea Ltd. and is used as such reference in the whole Appendix 3.

		<ul style="list-style-type: none"> Monthly Health Check report July 2015 Monthly Health Check report August 2015 Service report_Range Switching April 2015 Service report_Analyser power supply fault July 2015 	From 17/07/2015 From 20/08/2015 From 03/04/2015 From 01/07/2015	
20	EPMK	Instrumentation general maintenance reports <ul style="list-style-type: none"> Plant Hu-Chems II Plant Hu-Chems III Plant Hu-Chems IV 	From 14/05/2013 From 15/05/2013 From 02/06/2014	Project participants
21	Hu-Chems	CDM Analyser cabinet check lists (Shift) & key list CDM Check sheets of EnviNOx system (daily)	From 01/01/2015 to 31/08/2015	Project participants
22	Hu-Chems	List of spare parts of monitoring system including provisions for re-purchasing.	From 31/08/2015	Project participants
23	TÜV Rheinland Energie und Umwelt GmbH TÜV Rheinland Energie und Umwelt GmbH Hu-Chems FM Tech Emerson Process Management EPMK EPMK EPMK EPMK	Instrument records & certificates (Hu-Chems Plant II) <ul style="list-style-type: none"> N2O Outlet Analyser (322-AT-2-0127) – QAL1 Certification Statement (performed on 05/03/2013, valid until 04/03/2018) Tail gas flow meter (322-FT-2-522) – QAL1 Certification Statement (performed on 05/03/2013, valid until 04/03/2018) Tail gas flow meter (322-FT-2-522) – Hu-Chems Installation report (performed on 12/06/2014) Propane flow meter (322-FT-2-5121) – Korean Laboratory Accreditation Scheme (KOLAS) Calibration Certificate (performed on 02/06/2011, valid until 01/06/2016) Nitric acid production flow meter (322-FT-2-512) – Emerson Factory Calibration Certificate (performed on 09/11/2012, valid until 08/11/2017) Nitric acid temperature converter (322-TI-2-127) – EPMK Calibration Certificate (performed on 14/05/2013, valid until 13/05/2017) AOR Ammonia flow differential pressure transmitter (322-FT-2-503) – EPMK Calibration Certificate (performed on 14/05/2013, valid until 13/05/2017) AOR Ammonia flow pressure transmitter (322-PT-2-303) – EPMK Calibration Certificate (performed on 14/05/2013, valid until 13/05/2017) AOR Ammonia flow temperature transmitter (322-TT-2-103) – EPMK Calibration Certificate (performed on 14/05/2013, valid until 13/05/2017) 	From 22/03/2013 From 22/03/2013 From 12/06/2014 From 03/06/2011 From 09/11/2012 From 14/05/2013 From 14/05/2013 From 14/05/2013 From 14/05/2013	Project participants
24	TÜV Rheinland Energie und Umwelt GmbH TÜV Rheinland Energie und Umwelt GmbH Hu-Chems	Instrument records & certificates (Hu-Chems Plant III) <ul style="list-style-type: none"> N2O Outlet Analyser (323-AT-3-0127) – QAL1 Certification Statement (performed on 05/03/2013, valid until 04/03/2018) Tail gas flow meter (323-FT-3-522) - QAL1 Certification Statement (performed on 05/03/2013, valid until 04/03/2018) Tail gas flow meter (323-FT-3-522) – Hu-Chems Installation report (performed on 12/06/2014) 	From 22/03/2013 From 22/03/2013 From 12/06/2014	Project participants

	FM Tech	<ul style="list-style-type: none"> Propane flow meter (323-FT-3-5121) – Korean Laboratory Accreditation Scheme (KOLAS) Calibration Certificate (performed on 02/06/2011, valid until 01/06/2016) 	From 03/06/2011	
	Emerson Process Management	<ul style="list-style-type: none"> Nitric acid production flow meter (323-FT-3-512) – Emerson Factory Calibration Certificate (performed on 20/11/2012, valid until 19/11/2017) 	From 20/11/2012	
	EMPK	<ul style="list-style-type: none"> Nitric acid temperature converter (323-TI-3-127) – EMPK Calibration Certificate (performed on 15/05/2013, valid until 14/05/2017) 	From 15/05/2013	
	EPMK	<ul style="list-style-type: none"> AOR Ammonia flow differential pressure transmitter (323-FT-3-503) – EMPK Calibration Certificate (performed on 15/05/2013, valid until 14/05/2017) 	From 15/05/2013	
	EPMK	<ul style="list-style-type: none"> AOR Ammonia flow pressure transmitter (323-PT-3-303) – EMPK Calibration Certificate (performed on 15/05/2013, valid until 14/05/2017) 	From 15/05/2013	
	EPMK	<ul style="list-style-type: none"> AOR Ammonia flow temperature transmitter (323-TT-3-103) – EMPK Calibration Certificate (performed on 15/05/2013, valid until 14/05/2017) 	From 15/05/2013	
25	TÜV Rheinland Energie und Umwelt GmbH	<p>Instrument records & certificates (Hu-Chems Plant IV)</p> <ul style="list-style-type: none"> N2O Outlet Analyser (324-AT-4-0107) – QAL1 Certification Statement (performed on 05/03/2013, valid until 04/03/2018) 	From 22/03/2013	Project participants
	AIRTEC	<ul style="list-style-type: none"> N2O Outlet Analyser (324-AT-4-0107) – AIRTEC QAL2 Test Certification (performed on 23 to 25/09/2014, valid until 24/09/2017) 	From 16/03/2015	
	TÜV Rheinland Energie und Umwelt GmbH	<ul style="list-style-type: none"> Tail gas flow meter (324-FT-4-522) – QAL1 Certification Statement (performed on 05/03/2013, valid until 04/03/2018) 	From 22/03/2013	
	Hu-Chems	<ul style="list-style-type: none"> Tail gas flow meter (324-FT-4-522) – Hu-Chems Installation report (performed on 12/06/2014) 	From 12/06/2014	
	AIRTEC	<ul style="list-style-type: none"> Tail gas flow meter (324-FT-4-522) – AIRTEC QAL2 Test Certification (performed on 23 to 25/09/2014, valid until 24/09/2017) 	From 16/03/2015	
	FM Tech	<ul style="list-style-type: none"> Nitric acid production flow meter (324-FT-4-609) – Korean Laboratory Accreditation Scheme (KOLAS) Calibration Certificate (performed on 27/05/2014, valid until 26/05/2019) 	From 27/05/2014	
	EPMK	<ul style="list-style-type: none"> Nitric acid temperature transmitter (324-TT-4-237) – EMPK Calibration Certificate (performed on 02/06/2014, valid until 01/06/2018) 	From 02/06/2014	
	FM Tech	<ul style="list-style-type: none"> AOR Ammonia flow meter (324-FT-4-5020) – Korean Laboratory Accreditation Scheme (KOLAS) Calibration Certificate (performed on 27/05/2014, valid until 26/05/2019) 	From 27/05/2014	
26	KTL ⁴	<p>KTL Certificates & Protocols of the historically performed N₂O analyser certifications:</p> <ul style="list-style-type: none"> July 2008 May 2010 March 2012 March 2014 	<p>From 31/07/2008</p> <p>From 04/06/2010</p> <p>From 06/04/2012</p> <p>From 25/03/2014</p>	Project participants
27	AIRTEC	AIRTEC QAL2 Test Certification Report (performed on	From 16/03/2015	Project

⁴ KTL refers to Korean Testing Laboratory and is referred to as such in the whole Appendix 3.

CDM-VCR-FORM

		25/09/2014), including moisture content measurement records & report		participants
28	European Committee for Standardization (CEN)	EN 14181:2014 – Stationary source emissions – Quality assurance of automated measuring systems	From November 2014	Others
29	Hu-Chems	Quality Management System (QMS) Documents <ul style="list-style-type: none"> • CDM Operation Management Procedure (HFC-I-EP0448, Rev. 5) • CDM Procedures for environment operation management (HFC-I-EP0446, Rev. 4) • CDM Social Fund Commitment (HCSI-448, Rev. 2) 	From 12/06/2014 From 12/06/2014 From 12/03/2012	Project participants
30	Hu-Chems & ShinHan Bank	Balance sheets and transaction evidence for CDM contribution to Social Fund for all years from 2007 – 2014	From 31/12/2014	Project participants
31	Hu-Chems	Hu-Chems Training records until August 2015 & Training documents	Status from August 2015	Project participants
32	Hu-Chems	Report on environmental regulations (N ₂ O and NO _x): <ul style="list-style-type: none"> • From January 2015 • From February 2015 • From March 2015 • From April 2015 • From May 2015 • From June 2015 • From July 2015 • From August 2015 	From 31/01/2015 From 28/02/2015 From 31/03/2015 From 30/04/2015 From 31/05/2015 From 30/06/2015 From 31/07/2015 From 31/08/2015	Project participants
33	Korean Foundation for Quality	ISO 9001:2009 Certificate, valid until 31/08/2017 ISO 14001:2009 Certificate, valid until 31/08/2017	From 01/09/2014 From 01/09/2014	Project participants
34	Hu-Chems	Internal audit records 2014 Internal audit records 2013 External audit records 2014 External audit records 2013 Management review records 2014 Management review records 2013	From 18/06/2014 From 16/07/2013 From 14/08/2014 From 06/08/2013 From 30/12/2014 From 23/12/2013	Project participants
35	Ministry of Environment	Clean Air Conservation Act of the Republic of Korea	From 21/07/2015 Published under: http://www.law.go.kr/%EB%B2%95%EB%A0%B9/%EB%8C%80%EA%B8%B0%ED%99%98%EA%B2%BD%EB%B3%B4%EC%A0%84%EB%B2%95	Others
36	Ministry of Environment	Framework Act on Low Carbon, Green Growth	From 31/10/2013 Published under: http://www.law.go.kr/lsInfoP.do?lsiSeq=142380#0000	Others
37	Ministry of Knowledge, Economy	Letter, confirming that Hu-Chems plants do not have an obligation from the relevant environmental regulations (Energy & GHG Target Scheme)	From 21/10/2011	Project participants
38	CDM Executive Board	Methodology and Tools <ul style="list-style-type: none"> • Methodology ACM0019 “N₂O abatement from nitric acid production” (Version 02) 	From 31/05/2013 Published under: http://cdm.unfccc.int/methodologies/DB/MNMFNF10VUEOJACEIRX3E	Others

		<ul style="list-style-type: none"> • Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 2.0.0) • Tool to calculate project or leakage CO₂ emission from fossil fuel combustion (version 02) <p>Standards, Procedures & Checklists</p> <ul style="list-style-type: none"> • Standard – CDM Validation and Verification Standard (Version 09.0) • Standard – CDM Project Standard (Version 09.0) • Standard – Sampling and surveys for CDM project activities and programme of activities (Version 05) • Procedure – Clean Development Mechanism Project Cycle Procedure, version 09.0. • Guideline – Application of materiality in verifications (Version 02.0) • Checklist – Request for issuance and post registration changes: Completeness Checklist (Version 03.0) • Checklist – Request for issuance and post registration changes: Information and Reporting Checklist (Version 02.0) • Form - Monitoring report form (Version 05.1) • Form - Verification and certification report form for CDM project activities (Version 01.0) 	<p><i>HYC9QXGDC</i> From 03/06/2011</p> <p>From 02/08/2008</p> <p>From 20/02/2015</p> <p>From 20/02/2015 From 16/10/2015</p> <p>From 20/02/2015</p> <p>From 20/02/2015</p> <p>From 09/07/2015</p> <p>From 27/03/2015</p> <p>From 04/05/2015 From 23/03/2015 All published under: http://cdm.unfccc.int/Reference/index.html</p>	
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Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. Remaining FAR from validation and/or previous verification

FAR ID	01	Section no.	E.2	Date: 27/11/2015
Description of FAR				
During verification of MPs in CP 2 the implementation of the Korean ETS and its consequences for the plant shall be observed and considered to avoid double counting of emission reductions.				
Project participant response				Date: 01/12/2015
Korea government has started Korean ETS since 01/01/2015 as per the Act on the Allocation and Trading of Greenhouse-gas Emission Permits (13/03/2013). According to the Act, Hu-Chems Fine Chemical Corp. is designated as allocation entity, and there was a notification received from the Ministry of Environment that CDM projects are exempted from allocation. Thus, Hu-Chems nitric acid plants #2 ~ #4 have no obligation to reduce its N ₂ O emissions and there is no double counting of emission reductions due to Korean ETS.				
Documentation provided by project participant				
<ul style="list-style-type: none"> Act on the Allocation and Trading of Greenhouse-gas Emission Permits (13/03/2013) Notification on emissions allocation to Hu-Chems Fine Chemical Corp. by the ministry of environment (01/12/2014) 				
DOE assessment				Date: 03/12/2015
The verification team have checked Korean ETS has started since 01/01/2015 as per the Act on the Allocation and Trading of Greenhouse-gas Emission Permits (13/03/2013). It was verified that CDM projects are exempted from allocation in Korean ETS through the notification on emissions allocation to Hu-Chems Fine Chemical Corp. by the Ministry of Environment. Thus, it is concluded that Hu-Chems nitric acid plants #2 ~ #4 have no obligation to reduce its N ₂ O emissions, and there is no double counting of emission reductions for Hu-Chems nitric acid plants #2 ~ #4 due to Korean ETS.				

Table 2. CL from this verification

CL ID	01	Section no.	E.1	Date: 27/11/2015
Description of CL				
It is identified that "Contact information of project participants and responsible person/ entities" in Appendix 1 of MR (v1) is not consistent with MoC.				
Project participant response				Date: 01/12/2015
At the time of verification meeting, the MoC were about to be changed and submitted to the UNFCCC for approval and publication. Hence, the "Contact information of project participants and responsible person/ entities" in Appendix 1 of MR (v2) will then be consistent with the new MoC.				
Documentation provided by project participant				
MR(v2)				
DOE assessment				Date: 13/12/2015
The verification team confirms that the contact information in Appendix 1 of MR (v2) and the new MoC valid as of 11/12/2015 on UNFCCC website are consistent.				

CL ID	02	Section no.	E.6	Date: 27/11/2015
Description of CL				
It is not indicated that the value of $P_{\text{product,max,IV}}$ for the monitoring period. Only the value of $P_{\text{product,max,IV}}$ determined in yearly basis is presented in the MR. Which was also found in the $P_{\text{product,max,II}}$ and $P_{\text{product,max,III}}$.				
Project participant response				Date: 01/12/2015
The parameter tables of $P_{\text{product,max}}$ were corrected and show now the annual amount and the amount for the monitoring period.				
Documentation provided by project participant				
MR(v2)				
DOE assessment				Date: 03/12/2015

The verification team confirms that the value of $P_{\text{product,max,IV}}$ for year and monitoring period are correctly presented in the MR (v2).

Table 3. CAR from this verification

CAR ID	01	Section no.	E.3, E.6	Date: 27/11/2015
Description of CAR				
It was found through interview with staff and sample review of trend curves for raw data that there are operational events during regular monthly health checks by Emerson (i.e. fluctuation of N ₂ O concentration), however operation events in January, May and July 2015 are not presented in the MR.				
Project participant response				Date: 01/12/2015
The raw data of the whole monitoring was reviewed again with special focus on checking already considered operational events and possibly detecting further operational events. After this thorough check some additional events were detected (e.g. EMERSON site visits). Therefore relevant sections of the MR (v2) and the ER calculation sheet were adapted and corrected accordingly.				
Documentation provided by project participant				
<ul style="list-style-type: none"> MR (v2) ER spreadsheets (v2): <ul style="list-style-type: none"> HUC_IV_MP29_UNFCCC_CONFIDENTIAL HUC_OVERALL_MP29_UNFCCC_CONFIDENTIAL 				
DOE assessment				Date: 03/12/2015
<p>It was confirmed by the verification team.</p> <p>The verification team reviewed the additional events and recalculation for each event. Furthermore sample review of trend curves for other periods selected randomly were conducted and concluded the events are identified completely and recalculation for all events identified are correct.</p>				