



Validation report form for post-registration changes for CDM project activities
(Version 01.0)

Complete this form in accordance with the "Attachment: Instructions for filling out the validation report form for post-registration changes for CDM project activities" at the end of this form.

VALIDATION REPORT ON POST-REGISTRATION CHANGES (PRCs)

Title and reference number of the project activity	Catalytic N ₂ O Abatement Project in the Tail Gas of the Nitric Acid Plant of the Hanwha Corporation (HWC) in Ulsan, Republic of Korea (Ref. No.: 0922)
Process track	<input checked="" type="checkbox"/> Prior approval <input type="checkbox"/> Issuance <input type="checkbox"/> Renewal of crediting period
Version number of the validation report on PRCs	Version 01
Completion date of the validation report on PRCs	06/07/2016
Type(s) of PRCs	<input type="checkbox"/> Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline <input checked="" type="checkbox"/> Corrections <input type="checkbox"/> Changes to the start date of the crediting period <input type="checkbox"/> Inclusion of a monitoring plan to a registered project activity <input checked="" type="checkbox"/> Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline <input checked="" type="checkbox"/> Changes to the project design of a registered project activity <input type="checkbox"/> Types of changes specific to afforestation and reforestation project activities
Version number of PDD to which this report applies	Version 13
Project participant(s)	Hanwha Corporation (HWC)
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 02.0 • No standardized baseline(s) applicable

Name of DOE	Korean Foundation for Quality (KFQ)
Name, position and signature of the approver of the validation report on PRCs	Soon Hong YEOM  Managing Director of Sustainability management institute

SECTION A. Executive summary

Korean Foundation for Quality (KFQ) is performing periodic verification of the CDM project “Catalytic N₂O Abatement Project in the Tail Gas of the Nitric Acid Plant of the Hanwha Corporation (HWC) in Ulsan, Republic of Korea”, UNFCCC Registration Ref. No. 0922 for the 1st monitoring period 27/06/2014 ~ 26/06/2015 of 2nd crediting period.

The validation for the post registration change has been conducted in the course of the verification for the monitoring period from 27/06/2014 ~ 26/06/2015 of the project activity and the post registration changes for the project activity requires the prior approval by the Board as per CDM project standard (version 09)

Validation scope

This validation is an independent and objective review of the post registration changes in registered PDD. The scope of the validation of post registration changes is to determine whether the proposed or actual changes to the project design of the registered CDM project activity and the suggested post registration changes comply with the relevant requirements in the Project standard.

The information presented in the revised PDD provided by the PP was assessed by review of the detailed project documentation especially regarding to reason for change to project design of registered project activity and permanent changes from registered monitoring plan as well as by interviews with personnel at Hanwha Corporation. This has enabled the validation team to assess and determine that the post-registration change is in compliance with CDM Project standard and relevant guidance provided by the Board.

Validation process

The validation process includes desk review of the revised PDD (and the registered PDD) and other supporting documents and data. Further, onsite inspection and interviews with those involved in project management and operations are conducted. This is followed by preparation of draft validation report for the post registration changes summarizing desk review and on-site inspection findings (i.e. CARs, CLs, and FARs). Upon successful closing of the CARs and CLs raised (if any), the final validation report is prepared. The final report then undergoes a technical review and final approval according to KFQ's internal quality assurance procedures.

General description of the project activity and summary of post-registration change

Title of project activity	Catalytic N ₂ O Abatement Project in the Tail Gas of the Nitric Acid Plant of the Hanwha Corporation (HWC) in Ulsan, Republic of Korea	
UNFCCC Reference Number	0922	
Project Participants	Hanwha Corporation (HWC)	
Baseline and monitoring methodology	ACM0019 (version 02.0)	
Location of the project activity	Address	753-22 On-san eup, Ul-ju gun, Ulsan city
	GPS Coordinates	Longitude : 129.3392106°E Latitude : 35.4139980°N
Registration Date	03/05/2007	
Registered PDD	Version 08 of 17/11/2006	
1 st crediting period	27/06/2007~ 26/06/2014 (Renewable, 7 years)	
Renewal PDD	Version 12 of 06/05/2014	

Renewal Date	06/08/2014
2 nd Crediting period	27/06/2014 ~ 26/06/2021
1 st monitoring period among the 2 nd crediting period	27/06/2014 ~ 26/06/2015 (Monitoring period under verification)

The project has installed tertiary N₂O reduction technology in the tail gas stream of the nitric acid production plant of Hanwha Corporation (hereafter called "HWC) in Ulsan, Republic of Korea. Nitrous oxide (N₂O), formed as a by-product of the nitric acid (HNO₃) production facility, is removed by DeN₂O unit called Tertiary Catalyst System.

Throughout the 1st crediting period from 27/06/2007~ 26/06/2014, the CDM project activity had been implemented as well as operated according to the registered PDD (v.8) and the approved CDM methodology, AM0028 v3. A Request for Renewal of crediting period with a new PDD under the methodology ACM0019 v2 was submitted by the Project participant (PP) and the 2nd crediting period was renewed on 06/08/2014. Thus, the project activity for the 2nd crediting period started on 27/06/2014.

In the meantime, PP has requested this post-registration change for the project activity and the changes are as follows:

Firstly, the information on 'the measurement method and procedure' of ' $V_{i,t,db}$ ' in the monitoring plan is not appropriate and thus, PP requests to correct the information in the revised PDD(v.13). This was assessed in D.3 of this report.

Also, In the process of the maintenance during the overhaul period, PP has conducted overall works for the efficiency improvement of the process in the plant. Thus, PP had decided to replace the DeN₂O unit resulting from the removal efficiency improvement. With this, the location for DeN₂O unit is switched in the hottest position in the tail gas steam and the applied catalyst was changed.

The validation team checked that this change does not impact the production design capacity of the registered project and do not adversely impact the application of the methodology, additionality and the scale of the project activity throughout site inspection and the relevant documents.

Nonetheless, it leads to change of the registered monitoring plan.

- According to switching location of DeN₂O unit, the LNG (which is fossil fuel) consuming equipment for maintaining optimal temperature of DeN₂O units will be removed in this project and the existing parameters related with the project emission by fossil fuel does not need to be monitored. Thus, these parameters are deleted in the monitoring plan of the revised PDD.

And lastly, the source of data for three existing parameters are changed and new flowmeter with QAL1 is installed for complying with EN14181 in accordance with approved methodology

Above permanent changes of monitoring plan and change of project design were assessed in D.6 and D.7 of this report and these requires prior approval by the Board as per the CDM Project standard (ver.09).

Conclusion

As a result of our assessment, KFQ confirms that the post-registration change comply with the relevant requirements related to the 'Permanent changes to the registered monitoring plan' and 'Changes to the project design of a registered project activity' in CDM Project standard.

Hence, KFQ recommends approving the post-registration changes as described in 'revised PDD' document provided by the PP of project activity "Catalytic N₂O Abatement Project in the Tail Gas of the Nitric Acid Plant of the Hanwha Corporation (HWC) in Ulsan, Republic of Korea".

SECTION B. Validation team, technical reviewer and approver**B.1. Validation 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)	Validation findings
1.	Team Leader	IR	PARK	Sang Yeon	KFQ	√	√	√	√
2.	Validator	IR	CHO	Jin Seok	KFQ	√	√	√	√

B.2. Technical reviewer and approver of the validation report on PRCs

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 demonstrate of how the team meets the competence required for the validation.

SECTION C. Means of validation**C.1. Desk review**

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The revised PDD was submitted by the PP and it was reviewed as initial step of the validation process as for the post registration changes. Also, over the whole validation period, validation team reviewed the previous verification reports, the applied baseline and monitoring methodology and any other information and references relevant to the post registration change. A complete list of all documents reviewed is shown in Appendix 3 of this validation report. KFQ's validation process takes into consideration all the CDM Rules and Guidance applicable to the Project Cycle Procedure, Post Registration Changes and Request for issuance.

C.2. On-site inspection

Detailed validation of all post registration change related information contained in the revised PDD was performed during the site visit at Hanwha Corporation on 07/10/2015. During the site visit, the personnel were interviewed. The following aspects of the CDM project activity have been confirmed:

- Current status of CDM project activity in place, location, planned schedule of the change
- A cross-check between information provided in the revised PDD and information from other sources
- A check on whether the changes are included in para.284, 289 and Appendix 1 of project standard
- A check on whether the change impact the additionality, scale of the project activity, applicability of approved methodology and level of accuracy of the monitoring

Duration of on-site inspection: 08/07/2015				
No.	Activity performed on-site	Site location	Date	Team member
1.	Current status of CDM project activity in place, location, planned schedule of the changes	Onsan plant	07/10/2015	Sang Yeon PARK Jin Seok CHO
2	Project design changes according to the physical change of DeN ₂ O unit	Onsan plant	07/10/2015	Sang Yeon PARK Jin Seok CHO
3	Changes to the registered monitoring plan and applied methodology	Onsan plant	07/10/2015	Sang Yeon PARK Jin Seok CHO
4	Additionality and Scale of the project activity, application of the approved methodology and level of accuracy of the monitoring	Onsan plant	07/10/2015	Sang Yeon PARK Jin Seok CHO

C.3. Interviews

A list of the persons interviewed during this validation activity is included in the table below.

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Woo	BomJe	Hanwha Corporation	07/10/2015	General support	Sang Yeon PARK Jin Seok CHO
2	LEE	MinHo	Hanwha Corporation	07/10/2015	Facilities, instruments and analysis, QA/QC calculation	Sang Yeon PARK Jin Seok CHO
3	PARK	SangHyuk	Eco Network Co., Ltd	07/10/2015	CDM coordination	Sang Yeon PARK Jin Seok CHO
4	MOON	SeonYoung				
5	KIM	YeahWon				

C.4. Clarification requests, corrective action requests and forward action requests raised

Areas of validation findings	No. of CL	No. of CAR	No. of FAR
Compliance with PDD form	0	0	0
Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline	-	-	-
Corrections	0	0	0
Changes to the start date of the crediting period	-	-	-
Inclusion of a monitoring plan to a registered project activity	-	-	-
Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline	0	0	0
Changes to the project design of a registered project activity	0	0	0
Types of changes specific to afforestation and reforestation project activities	-	-	-
Others (please specify)	-	-	-
Total	0	0	0

SECTION D. Validation findings**D.1. Compliance with PDD form**

Means of validation	KFQ has checked the PDD provided by the PP against the latest PDD form in order to determine, whether the PDD form is in compliance with it.
Findings	The PP submitted the revised PDD both track-change and clean versions with the valid version of the latest PDD form for CDM project activities (v.07.0) and the instructions therein for filling out the PDD form. The PP used the later version of the PDD form for the revised PDD(v.13) than the version of the PDD form of the registered PDD(v.8).
Conclusion	KFQ confirms that the revised PDD(v.13) is in compliance with the latest PDD form(v.07.0) and the instruction therein. Also, KFQ confirms that the information transferred to the later version of the PDD form is materially the same as that in the registered PDD.

D.2. Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline

Means of validation	N/A
Findings	N/A
Conclusion	N/A

D.3. Corrections

For monitoring the fraction of N₂O from tail gas emission, the parameter 'V_{i,t,db}' is monitored. According to 'the measurement method and procedure' of 'V_{i,t,db}' in the monitoring plan, it is monitored by NDIR and its information is indicated.

Since the installation of the DeN₂O unit for the project activity, NDIR has not been changed and successfully monitoring the parameter, 'V_{i,t,db}' for the project. Nevertheless, the validation team found that the information on 'the measurement method and procedure' of 'V_{i,t,db}' in the monitoring plan is not appropriate and thus, it is adjusted in the revised PDD(v.13).

Means of validation	Reviewed the registered documents (registered PDD, monitoring reports(1 st ~10 th) and renewed PDD) during the project period and NDIR supplier's specification. Also, check QAL2 and AST report.		
Findings	Since the project was registered, NDIR at the DeN ₂ O unit has not been changed. However, PP checked that the information of the NDIR in the monitoring plan between the 1 st registered PDD and the renewed PDD(v.12) is not same as below.		
	Type of documents	Parameter	Accuracy level
	Registered PDD (1 st crediting period)	CO _{N2O} i	4% (Estimated total uncertainty)
	Renewed PDD (2 nd crediting period)	V _{i,t,db}	0.02% of Full scale by supplier's specification
	The accuracy class, 0.02% of full scale is for linearity in the supplier's specification and thus, it's not appropriate in the context of accuracy for the data from NDIR. For the N ₂ O measurement by NDIR, the periodic zero/span check shall be performed and its accuracy level is referred on calibrating the instrument of NDIR. Thus, the accuracy level on zero/span calibration is more appropriate for the item of 'measurement method and procedure' of 'V _{i,t,db} '. Accordingly, PP corrected the accuracy level of NDIR as 1% (zero/span) in supplier's specification in order to show the accuracy level in appropriate manner.		
Conclusion	KFQ confirms that this correction does not impact the level of accuracy of NDIR and well reflect the actual condition.		

D.4. Changes to the start date of the crediting period

Means of validation	N/A
Findings	N/A
Conclusion	N/A

D.5. Inclusion of a monitoring plan to a registered project activity

Means of validation	N/A
Findings	N/A
Conclusion	N/A

D.6. Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline**Change #1. Deletion of parameters as per the fossil fuels used for operation of a DeN₂O unit****The reason for permanent change**

Throughout the 1st crediting period, the CDM project activity had been implemented as well as operated according to the registered PDD(v.8). Although the CDM project implemented on the 1st crediting period had been successfully completed, the PP has been acknowledged that the removal efficiency of DeN₂O unit has been reduced. The below is a result from the verified data during the 1st crediting period.

	No.	Monitored/verified period	Removal efficiency	Remark
1 st crediting period	1	27/06/2007~31/12/2007	91.98%	CER issued
	2	01/01/2008~31/12/2008	90.18%	CER issued
	3	01/01/2009~31/12/2009	85.43%	CER issued
	4	01/01/2010~31/12/2010	87.89%	CER issued
	5	01/01/2011~31/12/2011	90.67%	CER issued
	6	01/01/2012~30/06/2012	88.49%	CER issued
	7	01/07/2012~30/09/2012	87.42%	CER issued
	8	01/10/2012~31/12/2012	86.62%	CER issued
	9	01/01/2013~26/06/2014	86.45%	CER issued
2 nd crediting period	10	27/06/2014~26/06/2015	82.32%	Under verification

At the time of CDM registration, the technical supplier of DeN₂O unit had ensured the removal efficiency of more than 90%. In the early stage of DeN₂O unit's operation, it was shown about 90% removal efficiency. However, the removal efficiency has tends to be decreased since 2012 as shown above table. Thus, the PP was planning to conduct efficiency improvement of DeN₂O units.

In the tertiary abatement system, N₂O is removed by catalytic reduction with ammonia. With Selective Catalytic Reduction (SCR), ammonia is injected into the flue gas and reacts catalytically with NO_x to produce molecular nitrogen and water vapour. Under the project scenario, N₂O is removed from the tail gas downstream of the absorption tower by catalytic destruction and the optimum position for a tertiary N₂O destruction facility is at the hottest position in the tail gas stream. Thus, the location for DeN₂O unit is switched in the hottest position in the tail gas steam and the applied catalyst was changed. By this change, the LNG (which is fossil fuel) consuming equipment for maintaining optimal temperature of DeN₂O units will be removed in this project. Consequently, the existing parameters related with the project emission by fossil fuel do not need to be monitored.

The detailed assessment regarding the change to the project design is described in D.7 of this report and the validation team confirmed that the reason for the change is reliable through our assessment and investigation.

Assessment on the permanent change

The monitoring plan in the revised PDD was assessed and confirmed it is clearly deleted three parameters below related with the fossil fuel used for maintaining optimal temperature of DeN₂O unit and complying with the applied methodology, ACM0019 v2 to the project activity.

- $FC_{i,j,y}$ (Quantity of natural gas combusted in the tertiary N₂O abatement facility)
- $W_{C,j,y}$ (Weighted average mass fraction of carbon in natural gas)
- $\rho_{i,y}$ (Weighted average density of natural gas)

Change #2. Change of 'source of data' in the parameters**The reason for permanent change**

In the course of implementation of monitoring plan since starting of 2nd crediting period, it was needed to indicate clearly the source of data for three parameters below.

- $P_{production,y}$ (Nitric acid produced in year y)
- h_y (Number of hours of operation in year y)
- $h_{r,y}$ (Number of hours of operation in year y where: For tertiary N₂O abatement. The abatement system is by-passed, underperforming or failed)

According to the registered PDD (v.12), the data from the 'ERP (Enterprise Resource Planning)' is adopted for these three parameters as a source data. Under the verification, it was raised that the HNO₃ production on the ERP report does not reflect the actual amount of HNO₃ production due to adjustment done in the report for the internal purpose of sales and stock control. Thus, PP used the data from the magnetic flow meter as a data source of HNO₃ production and the verification team could confirm that it is more accurate. Also, for producing the Nitric acid, the ammonia oxidation reactor (AOR) shall be operated in the plant. Thus, the source of data for checking the operation hour of the plant is more reasonable to apply the operating hour of AOR.

Through our assessment and investigation, the validation team confirmed that the reason for the change is reliable.

Assessment on the permanent change

The detailed assessment of proposed alternative monitoring is as follows:

Data/Parameter	$P_{production,y}$
Description	Nitric acid produced in year y
Means of validation	Review on the data from ERP report and measured HNO ₃ production
Findings	<p>Comparing monthly data sheet (measuring from the magnetic flow meter) with ERP report, the amount of HNO₃ produced in monthly data sheet is different with that of the data of ERP report.</p> <p>It was found that the HNO₃ production on the ERP report does not reflect the actual amount of HNO₃ production due to adjustment done in the report for the internal purpose of sales and stock control.</p> <p>Thus, the PP changes the data source of $P_{production,y}$ to the magnetic flow meter instead of ERP.</p> <p>The verification team could confirm that it is more accurate and the emission reduction will not be overestimated as a result of this change.</p>
Conclusion	KFQ confirms that this change in the monitoring plan does not lead to a reduction in the accuracy of the calculation of emission reductions and is compliance with the applied methodology, ACM0019 v2 and relevant requirements of the Project Standard (v.09.0).

Data/Parameter	h_y
Description	Number of hours of operation in year y

Means of validation	The validation team reviewed the changes to the monitoring plan described in the revised PDD are in compliance with the applied methodology (ACM0019 v.2) and the changes complies with the requirements in Project standard(v.09.0).
Findings	Measurements by the ammonia oxidation reactor will be chosen in order to determine whether or not the nitric acid plant is in operation. The flow of NH ₃ to the ammonia oxidation reactor indicates the operational status. Thus, the emission reduction will not be overestimated as a result of this change. Furthermore, this change does not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan.
Conclusion	KFQ confirms that this change in the monitoring plan is completely complied with the requirements of para.284-287 in the Project Standard (v.09.0).

Data/Parameter	$h_{r,y}$
Description	Number of hours of operation in year y where: For tertiary N ₂ O abatement. The abatement system is by-passed, underperforming or failed
Means of validation	The validation team reviewed the changes to the monitoring plan described in the revised PDD are in compliance with the applied methodology (ACM0019 v.2) and the changes complies with the requirements in Project standards(v.09.0).
Findings	Measurements by the ammonia oxidation reactor will be chosen in order to determine whether or not the nitric acid plant is in operation. The flow of NH ₃ to the ammonia oxidation reactor indicates the operational status. Thus, the emission reduction will not be overestimated as a result of this change. Furthermore, this change does not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan.
Conclusion	KFQ confirms that this change in the monitoring plan is completely complied with the requirements of para.284-287 in the Project Standard (v.09.0).

Change #3. Installation of new flow meter with QAL1 to the provision of EN14181

The reason for permanent change

In 2nd crediting period, the Automated Monitoring System (AMS) on N₂O emission from tail gas has been monitored with already installed equipment used during the 1st crediting period without any technical modification or change.

According to the AM0028 applied in the 1st crediting period, EN 14181 could be used as optional and the basis for selecting and operating the monitoring system. Thus PP had been practically implemented QAL2 and AST for the flowmeter according to EN 14181. As the suitability test of QAL1 was not available for the flowmeter during the 1st crediting period, its suitability was ensured in accordance with the industrial standard.

At the timing of renewal of this CDM project activity, the applied methodology for the 2nd crediting period has been changed as ACM0019 v2 which requires that the AMS is to be installed and maintained based on the EN 14181 under the ACM0019.

Consequently, the PP had decided to install new flowmeter with QAL1 to the provision of EN14181 according to the applied methodology ACM0019 (v.2).

Assessment on the permanent change

The specification and QAL 1 of the new flowmeter was checked and its information is clearly indicated in the monitoring plan of the parameter of ' $V_{t,db}$ (Volumetric flow of the gaseous stream in time interval t on a dry basis)'.

D.7. Changes to the project design of a registered project activity**The description of the changes to the project design**

The revised PDD (v.13) includes the information regarding the change of location for DeN₂O unit in the Section A.3 and Section B.3. The detail on the change is as follows:

Throughout the 1st crediting period, the CDM project activity had been implemented as well as operated according to the registered PDD (v.8). As mentioned above Change #1 of section D.6 in this report, the PP has been acknowledged that the removal efficiency of DeN₂O unit has continuously been reduced and thus, PP is planning to conduct efficiency improvement of DeN₂O units. With this, the DeN₂O unit including the catalyst will be changed. Consequently, the location for DeN₂O unit is switched in the hottest position in the tail gas steam and LNG (which is fossil fuel) consuming equipment for maintaining optimal temperature of DeN₂O units will be removed

The detailed facts regarding the change are assessed as below and the KFQ validation team checked whether this explanation for the reason for change is reliable through interview with the PP and review of relevant documents.

Assessment on the changes to the project design**i. Assessment on the time and reason the changes occurred**

During the overhaul period, PP has conducted overall works for the efficiency improvement of the process in the plant. In this course, it was also reviewed the removal efficiency of DeN₂O unit decided to proceed a revamping project for the efficiency improvement of the DeN₂O unit on June of 2014 together with process improvement in the plant. Accordingly, HWC started to request of proposal regarding the revamping project of HWC and discussed with various technical suppliers in earnest since March of 2015.

In addition to that, HWC had considered whether this revamping project is appropriate for the CDM project and thus the Clarification to the UNFCCC MP regarding the application of existing methodology was requested on 17/07/2015. And HWC has received the reply on acceptance of same methodology from the UNFCCC MP on 07/07/2015 (Reference). Also, on 28/05/2015, the engineering contract for the revamping project was made and the catalyst supplier was determined as ECOPRO on 04/09/2015.

Through the document review of the internal feasibility report, contract and technical specification of catalyst & reactor, process flow diagram and interview with the PP as well as on-site inspection, it is confirmed that the efficiency improvement of DeN₂O unit could not be considered at the time of the CDM registration and this kind of change to the project design for efficiency improvement could be occurred after the operation of DeN₂O unit (27/06/2007) and registration date (on 09/12/2010).

ii. Assessment on how the changes would impact on the overall operation/ability of the project activity to deliver emission reduction as stated in the PDD

The validation team could check that the baseline emission in the registered PDD is based on 90% removal efficiency of DeN₂O unit and thus, this efficiency improvement of DeN₂O is for reaching the 90% removal efficiency as described in D.6 of this report. And thus, the validation team confirms that it does not impact the baseline emission of the project.

In an aspect of project emission, the fossil fuels used for the operation of N₂O abatement as project emission are not required and hence emissions from this source are considered to be zero. Therefore, entire PE_y will be reduced compared to existing PDD.

Assessment on the impact of the change to the project design**i. Assessment on the impact of Additionality of the registered CDM project activity**

Law and/or regulations, which would mandate the complete or partial destruction of N₂O from nitric acid plant, did not exist in the host country. No economic benefit related to the abatement of N₂O emissions from the nitric acid plant could be generated based on any

regulations. Hence, in accordance with the applied methodology, the proposed CDM project was considered additional.

According to the registered PDD and its validation report, KFQ have checked that the project does not require assessing the additionality in accordance with the methodology. Nevertheless, we checked that additional cost for change of catalyst and installation of DeN₂O unit were required and the project has no financial benefit except CER revenue. Thus, the validation team confirms that the change has no impact on the additionality of the project activity.

ii. Assessment on the impact of the changes on scale of the project activity

The production design capacity of the project activity is 107,100ton/yr in the registered PDD and it does not change. Thus, the validation team confirms that the change has no impact on the scale of the project activity.

iii. Assessment on the impact of applicability and application of approved baseline methodology and later valid version of the applied methodology

The project has applied the approved baseline methodology of ACM0019 (v.2), which is 'N₂O abatement from nitric acid production'. The change of the project activity does not lead to change the applied methodology and does not impact the applicability of the methodology, ACM0019 (v.2). Thus, the validation team confirms that the change has no impact of applicability and application of the applied baseline methodology and it does not need to change as the later valid version of the methodology.

iv. Assessment on the impact of the change on the compliance of the monitoring plan with the applied monitoring methodology

The project-applied the approved monitoring methodology of ACM0019 (v.2), which is 'N₂O abatement from nitric acid production'. The change of the project activity leads to result in changing the monitoring plan.

Three parameters for fossil fuel used are needed to delete in the registered PDD. The details are explained in D.6 of this report. Although the change has impact on the monitoring plan in the registered monitoring plan, the validation team could confirm that no impact on the compliance of revised monitoring plan with the applied monitoring methodology.

v. Assessment on the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan

The revision of monitoring caused by this change to the project design is for deletion of three parameters related with use of fossil fuel as stated above. Thus, the validation team confirms that the change does not impact the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan,

KFQ confirms that the change to the project design resulting from the efficiency improvement in the plant is complied with the requirements of para.288-289 and 292 in the Project Standard (v.09.0).

The detailed assessment on the proposed change is as following:

Means of validation	The validation team reviewed the changes to the project design of a registered CDM project activity are in compliance with the applied methodology (ACM0019, v.2) and the changes complies with the requirements in Project standards(v.09.0).
Findings	<p>KFQ has checked the relevant evidences as for the efficiency improvement and the planning on the switching the location of DeN₂O unit and change of catalyst was checked at on-site inspection.</p> <p>The relevant documents such as a feasibility study, proposal and internal review documents regarding the revamping project of DeN₂O unit had been reviewed by the verification team and KFQ has checked that all documents are reliable.</p> <p>In addition to that, this change dose not adversely affects the additionality, scale of project and applicability of applied methodology. Also, this change does not impact</p>

	the level of accuracy and it is complied with the applied monitoring methodology.
Conclusion	KFQ confirms that the change to the project design is complied with the requirements of para.288-289 and 292 in the Project Standard (v.09.0).

D.8. Types of changes specific to afforestation and reforestation project activities

Means of validation	N/A
Findings	N/A
Conclusion	N/A

SECTION E. Internal quality control

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According to KFQ's Procedure for deciding whether to proceed with a request for post-registration changes, the validation opinion were underwent a technical review before being submitted a request for post-registration change. The technical review was performed by technical review team composed of a person qualified in accordance with KFQ's qualification scheme for CDM project validation and verification.

SECTION F. Validation opinion

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Korean Foundation for Quality (KFQ) has performed a validation of the post-registration change of CDM project Ref. No. 0922: Catalytic N₂O Abatement Project in the Tail Gas of the Nitric Acid Plant of the Hanwha Corporation (HWC) in Ulsan, Republic of Korea. The validation was performed on the basis of UNFCCC criteria for the CDM and host country criteria, as well as criteria given to provide for the consistent project operation, monitoring and reporting.

The validation is based on the information made available to us and the engagement conditions. The review of the revised PDD(v.13), relevant supporting documents and the subsequent follow-up interviews has conducted with sufficient evidences to determine the fulfilment of all stated criteria. In our opinion, post-registration changes of the project activity meet all relevant UNFCCC requirements for the CDM.

Furthermore, we confirm that the revised PDD ensures that;

- (a) The level of accuracy and completeness in the monitoring and verification process is not reduced as a result of the revision.
- (b) It is in accordance with the approved monitoring methodology applicable to the project activity.

Also, we confirm that the proposed changes of project activity do not impact;

- (a) The additionality of the project activity
- (b) The scale of CDM project activity
- (c) The applicability and application of approved baseline methodology under which the project activity has been registered
- (d) The compliance of the monitoring plan with the applied monitoring methodology
- (e) The level of accuracy of the monitoring contained in the registered monitoring plan

The verification team confirms that the revised PDD submitted in the new format (version 07.0) has been verified and other description except the changes dealt in this report is materially the same as the information in the registered PDD.

Therefore, KFQ requests the approval of post-registration changes of the project activity as justified above.

Signed on behalf of the Korean Foundation for Quality

Signature : 

Name : Soon Hong YEOM, Managing Director

Date : 06/07/2016

Appendix 1. Abbreviations

Abbreviations	Full texts
AM	Approved Methodology
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
DOE	Designated Operational Entity
FAR	Forward Action Request
EB	Executive Board
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
KFQ	Korean Foundation for Quality
MoV	Means of verification
MP	Monitoring Plan
MR	Monitoring Report
PDD	Project Design Document
PP	Project participant
PS	Clean Development Mechanism Project Standard
PV	Photovoltaic
QMS	Quality Management System
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: 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

A handwritten signature in black ink, appearing to be 'Yu Shim JEONG'.



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

A handwritten signature in black ink, appearing to be 'S. Y. Park'.



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 3 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 : • MR10_2CP_ver2.0	Ver. 2 (02/05/2016)	Project participant
2	Project participants	Calculation spreadsheet of emission reductions • Hanwha_CERs_DATA_Sheet_v.2.	Ver. 2 (02/05/2016)	Project participants
3	Project participants	CDM Project Design Document : 'Catalytic N2O Abatement project in the tail gas of the nitric acid plant of the HWC in Ulsan (Ref. No.:0922) version 12 (06/05/2014) Revised PDD (v.13)	http://cdm.unfccc.int/Projects/DB/TUEV-SUED1170949600.29/view v.13 (24/06/2016)	Others
4	TÜV SÜD Industrie Service GmbH	CDM Validation Report: Catalytic N2O Abatement project in the tail gas of the nitric acid plant of the HWC in Ulsan (Ref. No.:0922). (08/02/2007)	http://cdm.unfccc.int/Projects/DB/TUEV-SUED1170949600.29/view?cp=1	Others
5	DNV	CDM Validation Opinion (Renewal): 'Catalytic N2O Abatement project in the tail gas of the nitric acid plant of the HWC in Ulsan (Ref. No.:0922) Report No. 2014-9033 (12/02/2014)	http://cdm.unfccc.int/Projects/DB/TUEV-SUED1341912725.05/view	Others
6	KFQ	CDM Verification Report Catalytic N2O Abatement project in the tail gas of the nitric acid plant of the HWC in Ulsan-9 th monitoring, Report No. 2015-01 (04/02/2015)	http://cdm.unfccc.int/Projects/DB/TUEV-SUED1170949600.29/view?cp=1	other
7	Hanwha Corporation	CDM Monitoring Manual of HWC	July 2014	Project participant
8	Hanwha Corporation	Daily operation report (excel files, pdf files) - ABB logging file - DCS Event log files ERP report Summary shutdowns & observations	27/06/2014~27/06/2015	Project participants
9	Hanwha Corporation	Summary documents regarding the N2O gas emission reduction efficiency	29/02/2016	Project participants
10	FMTech	Flow meter of HNO3 production - Calibration result on flow meter (FT-512)	16/06/2014	Project participants
11	Durag	Flow meter of - Specification of flow meter (FT-562)	-	Project participants
12	Ministry of Environment	Clean Air Conservation Act of the Republic of Korea	2013~2015 (20/01/2015, latest)	Others
13	CDM Executive Board	Clean Development Mechanism Validation and Verification Standard, version 09.0. Clean Development Mechanism Project Standard, version 09.0. Clean Development Mechanism Project Cycle Procedure, version 09.0. ACM0019 (ver. 1) "N ₂ O abatement from nitric acid production" Tool to determine the mass flow of a greenhouse gas in a gaseous stream, version 2.0.0	20/02/2015 20/02/2015 20/02/2015 03/06/2011 03/06/2011	Others

		Standard for application of the global warming potentials to clean development mechanism project activities and programme of activities for the second commitment period of the Kyoto Protocol, version 01.0	13/09/2012	
		Guideline on the application of materiality in verifications , version 02.0	20/02/2015	
		Standard: Sampling and surveys for CDM project activities and programme of activities, version 05.0	16/10/2015	

Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. CL from this validation

CL ID	xx	Section no.	Date: DD/MM/YYYY
Description of CL			
N/A			
Project participant response			Date: DD/MM/YYYY
N/A			
Documentation provided by project participant			
N/A			
DOE assessment			Date: DD/MM/YYYY
N/A			

Table 2. CAR from this validation

CAR ID	xx	Section no.	Date: DD/MM/YYYY
Description of CAR			
N/A			
Project participant response			Date: DD/MM/YYYY
N/A			
Documentation provided by project participant			
N/A			
DOE assessment			Date: DD/MM/YYYY
N/A			

Table 3. FAR from this validation

FAR ID	xx	Section no.	Date: DD/MM/YYYY
Description of FAR			
N/A			
Project participant response			Date: DD/MM/YYYY
N/A			
Documentation provided by project participant			
N/A			
DOE assessment			Date: DD/MM/YYYY
N/A			

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01.0	23 March 2015	Initial publication.
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