Validation report form for post-registration changes for CDM project activities

(Version 02.0)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title and UNFCCC reference number of the project activity	Catalytic abatement of N2O in Nitric Acid Plant of Shiraz Petrochemical Company (UNPA reference number: 8249)
Process track	☒ Prior approval ☐ Issuance ☐ Renewal of crediting period
Version number of the validation report on PRCs	03~~2~~
Completion date of the validation report on PRCs	~~25~~19/0~~5~~6/2019
Type(s) of PRCs	☐ Temporary deviations from the registered monitoring plan, applied methodologies or applied standardized baselines ☐ Corrections ☐ Changes to the start date of the crediting period ☐ Inclusion of a monitoring plan ☐ Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools ☒ Changes to the project design ☐ Changes specific to afforestation and reforestation project activities
Version number of PDD to which this report applies	Version 10, Dated 22/05/2019
Project participants	Shiraz Petrochemical Company Mehr Renewable Energies Company Climate Protection Finance AG
Host Party	Iran
Applied methodologies and standardized baselines	AM0028 / version 05.1.0 "Catalytic N2O destruction in the tail gas of nitric acid or caprolactam production plants"
Mandatory sectoral scopes linked to the applied methodology	Sectoral Scope (5): Chemical industries
Conditional sectoral scopes linked to the applied methodologies	NA
Name and UNFCCC reference number of the DOE	Carbon Check (India) Private Ltd. (E-0052)
Name, position and signature of the approver of the validation report on PRCs	Amit Anand, CEO

	

SECTION A. Executive summary

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Purpose, general description and location of the project activity:

The Project Participant, Climate Protection Finance AG, has commissioned the DOE, Carbon Check (India) Private Ltd. (CCIPL) to perform an independent validation of the post registration changes of the CDM Project Activity "Catalytic abatement of N2O in Nitric Acid Plant of Shiraz Petrochemical Company" in Islamic Republic of Iran (hereafter referred to as "Project Activity").

The objective of the project activity is to reduce the emission of Nitrous Oxide (N_2O), which is a greenhouse gas, from tail gas of Nitric Acid production process in the Nitric Acid Plant of Shiraz Petrochemical Company (SPC) by installing a catalytic N_2O abatement system. N_2O is an undesired by-product of ammonia oxidation reaction (to produce nitric acid). The project activity includes installation of a DeN_2O-$DeNO_X$ unit at the tail gas of nitric acid plant, which is decomposing N_2O and NO_X by chemical reaction over a catalytic bed to N_2 and O_2. This abatement unit utilizes a catalytic bed to decompose N_2O to its elements N_2 and O_2, thereby reducing GHG emissions. The plant utilizes Natural Gas as fuel for heating the tail gas and some ammonia to decompose NO_x emissions, which results in some project emissions. In the baseline scenario Nitrous Oxide (an undesired by product) of ammonia oxidation reaction (to produce nitric acid) and was released to atmosphere in absence of any regulation to restrict N_2O emissions in Iran.

PP proposes the following four project design changes:

- The value of the ex-ante fixed parameter "Historical operating temperature range of the ammonia oxidation reactor" ($T_{g,hist}$), was stated as 840^0 C – 860^0 C in the registered PDD. PP proposes to change this value to 810^0 C – 885^0 C.

- As per the registered PDD, for the ex-ante estimation of emission reductions, "N_2O concentration at the inlet of the N_2O destruction facility" ($CI_{N2O,i}$) was assumed as 1,120 ppmv and "N_2O concentration at destruction facility outlet" ($CO_{N2O,i}$) as 120 ppmv (i.e. 90% efficiency). Based on the actual monitored value, PP proposes to change the value of inlet concentration of N_2O to 2,014.7 ppmv for the ex-ante estimation of emission reductions and outlet concentration as 201.47 ppmv (90% efficiency).

- Change in the AOR catalyst from "woven" to "knitted" type with its composition remaining same (90% Pt and 10% Rh)

- Change in the GWP values for N_2O and CH_4 in line with EB 69, Annex 3

Scope of validation:

This validation is an independent and objective review of the post registration changes in the registered PDD /B04/. The scope of the validation of post registration changes is to determine whether there are proposed or actual changes to the project design of the registered CDM project activity. CCIPL also determined whether the description in the revised PDD /1/ submitted by project participants, which describe the nature and extent of the actual changes, accurately reflects the implementation, operation and monitoring of the modified project activity.

The validation of post registration changes in the revised PDD /1/ were based on the following:

(i) Approved methodology AM0028 (version 05.1) /B02/
(ii) Revised PDD (in track change and clean mode) /1/
(iii) CDM VVS for Project Activities (version 02.0) /B01-1/
(iv) CDM PS for Project Activities (version 02.0) and /B01-2/
(v) CDM PCP for Project Activities (version 02.0) /B01-3/
(vi) Relevant decisions, guidance and clarifications of the CMP and CDM EB

Validation process:

The validation process for post registration changes includes the following steps:

(a) Contract with project participants and appointment of validation team and technical review team
(b) Desk review of the revised PDD by validation team and planning of onsite visit
(c) On site visit and follow up interviews by the validation team
(d) Reporting and closure of findings (CARs/CLs/FARs) and preparation of validation report
(e) Independent technical review of the validation report
(f) Issuance of final validation report to the contracted PP and submission to UNFCCC for approval of post registration changes as appropriate.

The description in the revised PDD (version 10; dated 22/05/2019) /1/ meets all relevant UNFCCC requirements for the CDM PDD and correctly applies the selected baseline and monitoring methodology /B02/.

The version of the template for PDD was the latest version. CCIPL confirms that the revised PDD as provided by the PP complies with the instructions for completion of the PDD. Furthermore, CCIPL through review of revised PDD /1/ confirms that the information included in the new form is materially the same as the information in the registered PDD.

The Validation team confirms the contractual relationship signed on 12/02/2019 in between the DOE, Carbon Check (India) Private Ltd., and the PP, Climate Protection Finance AG. The team assigned to the validation meets the CCIPL's internal procedures including the UNFCCC requirements for the team composition and competence. The validation team has conducted a thorough contract review as per UNFCCC and Carbon Check's procedures and requirements.

The report is based on the assessment of the revised PDD undertaken through application of standard auditing techniques including but not limited to document reviews and stakeholder interviews, review of the applicable/applied methodology and its underlying formulae and calculations.

This report contains the findings and resolutions from the validation and a validation opinion on the proposed post-registration changes thus confirming the revised project design as document is sound and reasonable and meets the stated requirements and identified criteria.

The validation confirms that the implementation of the post registration changes is in line with the applied methodology and all other applicable tools and guidance.

This report is the combined assessment opinion for all the changes that are proposed in the PDD and request is submitted for prior approval by CDM EB.

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SECTION B. Validation team, technical reviewer and approver

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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/document review	On-site inspection	Interviews	Validation findings
1.	Team Leader/	IR	Agarwalla	Sanjay Kumar	CCIPL	X	X	X	X

	Technical Expert								
2.	Local Expert	IR	Mehrani	Neda	CCIPL		X	X	

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	Singh	Vikash Kumar	CCIPL
2.	Technical expert to Technical Reviewer	IR	Nesari	R V	CCIPL
3.	Approver	IR	Anand	Amit	CCIPL

SECTION C. Means of validation

C.1. Desk/document review

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List of all documents reviewed or referenced during the validation is provided in Appendix-3 below.

C.2. On-site inspection

Duration of on-site inspection: 06/01/2019 to 07/01/2019				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**
1.	An assessment of the implementation and operation of the registered project activity as per the registered PDD	SPC plant, Shiraz, Iran	06/01/2019 to 07/01/2019	Sanjay Kumar Agarwalla, Neda Mehrani
2.	A review of information flows for generating, aggregating and reporting the monitoring parameters	SPC plant, Shiraz, Iran	06/01/2019 to 07/01/2019	Sanjay Kumar Agarwalla, Neda Mehrani
3.	Interviews with relevant personnel to determine whether the operational and data collection procedures are implemented in accordance with the monitoring plan in the PDD	SPC plant, Shiraz, Iran	06/01/2019 to 07/01/2019	Sanjay Kumar Agarwalla, Neda Mehrani
4.	A cross check between information provided in the monitoring report and data from other sources such as plant logbooks, inventories, purchase records or similar data sources	SPC plant, Shiraz, Iran	06/01/2019 to 07/01/2019	Sanjay Kumar Agarwalla, Neda Mehrani
5.	A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD and the selected methodology and corresponding tool(s), where applicable	SPC plant, Shiraz, Iran	06/01/2019 to 07/01/2019	Sanjay Kumar Agarwalla, Neda Mehrani
6.	A review of calculations and assumptions made in determining the GHG data and emission reductions	SPC plant, Shiraz, Iran	06/01/2019 to 07/01/2019	Sanjay Kumar Agarwalla, Neda Mehrani
7.	An identification of quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters	SPC plant, Shiraz, Iran	06/01/2019 to 07/01/2019	Sanjay Kumar Agarwalla, Neda Mehrani

C.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Ahadi	Mohammad Sadegh	Mehr Renewable	06/01/2019 to	Project implementation and operation	Sanjay Kumar Agarwalla,

			Energy	07/01/2019	management, monitoring procedure, data and information flow, QA/QC Procedures CER calculation and completeness of monitoring report	Neda Mehrani
2.	Bazdar	Elahe	Mehr Renewable Energy	06/01/2019 to 07/01/2019	CER calculation and completeness of monitoring report	Sanjay Kumar Agarwalla, Neda Mehrani
3.	Madadi	Mohammad	SPC	06/01/2019 to 07/01/2019	Project implementation and operation, monitoring procedure, data and information flow, QA/QC Procedures	Sanjay Kumar Agarwalla, Neda Mehrani
4.	Babak	Dehghanpur		06/01/2019 to 07/01/2019	Project implementation and operation, monitoring procedure, data and information flow, QA/QC Procedures	Sanjay Kumar Agarwalla, Neda Mehrani
5.	Faramarzi	Zarir	SPC	06/01/2019 to 07/01/2019	Plant operation and maintenance	Sanjay Kumar Agarwalla, Neda Mehrani
6.	Golab Fetoosh	Mohammad Hadi	SPC	06/01/2019 to 07/01/2019	Operation and Maintenance of monitoring instrument including calibration	Sanjay Kumar Agarwalla, Neda Mehrani
7.	Karami	Abdolmarim	SPC	06/01/2019 to 07/01/2019	Operation and Maintenance of monitoring instrument including calibration	Sanjay Kumar Agarwalla, Neda Mehrani
8.	Ghanbari	Darab	SPC	06/01/2019 to 07/01/2019	Plant operation and maintenance	Sanjay Kumar Agarwalla, Neda Mehrani
9.	Sherafati	Keivan	SPC	06/01/2019 to 07/01/2019	Plant operation and maintenance	Sanjay Kumar Agarwalla, Neda Mehrani
10.	Parisai	Mohammad Sadegh	SPC	06/01/2019 to 07/01/2019	Plant operation and maintenance	Sanjay Kumar Agarwalla, Neda Mehrani
11.	Talebshokr	Farzad	SPC	06/01/2019 to 07/01/2019	Shift operator and log recording	Sanjay Kumar Agarwalla, Neda Mehrani

C.4. Sampling approach

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Not applicable.

C.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

Areas of validation findings	No. of CL	No. of CAR	No. of FAR
Compliance with PDD form	-	04	-
Temporary deviations from the registered monitoring plan, applied methodologies or applied standardized baselines	-	-	-
Corrections	-	-	-
Changes to the start date of the crediting period	-	-	-
Inclusion of a monitoring plan	-	-	-
Permanent changes to the registered monitoring plan, or	-	-	-

permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools			
Changes to the project design	04	-	-
Changes specific to afforestation and reforestation project activities	-	-	-
Others (please specify) – Clarification requests from UNFCCC	02	-	-
Total	06	04	0

SECTION D. Validation findings

D.1. Compliance with PDD form

Means of validation	Document Review, Interview
Findings	CAR 01, CAR 02, CAR 03 and CAR 04 were raised and successfully resolved. Please refer Appendix 4 for further details.
Conclusion	The revised PDD /1/ has been completed using the latest available template of CDM-PDD-FORM /B03-2/ and has been submitted in both track change and clean versions. Both the registered /B04/ and revised PDD /1/ were reviewed for the consistency of the information and it is confirmed that the information transferred from the previous template to the new template is materially the same as in the registered PDD /B04/ except the changes due to the proposed PRC. This confirms to the requirements of §278 and 279 of the VVS for project activities (version 02.0) /B01-1/. Furthermore, in accordance with §280 (a) of VVS for project activities (version 02.0) /B01-1/, the validation team confirms that: (i) The revised PDD /1/ is compliant with the valid version of the CDM-PDD-Form /B03-2/ and instructions therein; and (ii) The information transferred to the revised PDD /1/ is materially the same as that provided in the registered PDD /B04/.

D.2. Temporary deviations from the registered monitoring plan, applied methodologies or applied standardized baselines

Means of validation	Not applicable
Findings	Not applicable
Conclusion	Not applicable

D.3. Corrections

Means of validation	Not applicable
Findings	Not applicable
Conclusion	Not applicable

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

Means of validation	Not applicable
Findings	Not applicable
Conclusion	Not applicable

D.5. Inclusion of a monitoring plan

Means of validation	Not applicable
Findings	Not applicable
Conclusion	Not applicable

D.6. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

Means of validation	Not applicable
Findings	Not applicable
Conclusion	Not applicable

D.7. Changes to the project design

Means of validation	The changes in the project design have been validated by document review, on-site inspection visit, review of registered and revised PDD.
Findings	CL 01, CL 02, CL 03, CL 04 and CL 05 were raised and successfully resolved. Please refer Appendix 4 for further details.
Conclusion	The current project design involves changes compared to the project design in the registered project activity. The following project design changes are being proposed: **1) The value of the ex-ante fixed parameter "Historical operating temperature range of the ammonia oxidation reactor" ($T_{g,hist}$), was stated as 840^0 C – 860^0 C in the registered PDD. PP proposes to change this value to 810^0 C – 885^0 C.** Assessment by the validation team: In the registered PDD, the validated historical AOR temperature (for the period 21/03/2010 to 20/03/2011) was 840 – 860^{0}C /B04/ /6/. Further, the PP has provided the AOR temperature records for the period 21/03/2010 to 20/11/2016 (i.e. for the pre DCS period) which shows the range from 840 – 862^{0}C /2/, which is almost in the same range as in the registered PDD for the ex-ante fixed parameter "$T_{g,hist}$" which was based on the historical temperature readings from the plant for the period 21/03/2010 to 20/03/2011. However, PP has provided the data for the post DCS installation /3/, which was verified during the on-site visit by reviewing the plant records, showing the AOR temperature range from 862-874 ^{0}C for the period 20/01/2017 to 22/09/2018 /7/. It is observed that there is an average increase of about 1.7% in the AOR temperature post installation of DCS, although the operating conditions remains same. As clarified by the PP, the DCS records are deemed to be accurate and with the possibility of the pre DCS records having some error. It is correct that in the registered PDD, the ex-ante fixed parameter 'historical operating temperature range of the ammonia oxidation reactor, "$T_{g,his}$" was based on historical data. But as clarified by PP, post installation of the DCS, it is observed that the historical temperature recorded pre DCS was not correct. The validation team is able to confirm this based on the fact that there is no change in the operating conditions of the plant pre DCS and post DCS installation (AOR pressure, Nitric Acid production, Ammonia consumption). Accordingly possibility of change in the operating temperature is ruled out and concluded that the historical temperature presented in the registered PDD was not correct. **Now as the historical temperature presented was not correct (i.e. were erroneous), the validation team considers it as good as not available**. **Hence in absence of the available historical temperature, PP has opted for option (b) on page 24 of the applied methodology, AM0028, v5.1** (operating manual also available at the time of registration of the project and since the installation of the nitric plant at SPC in 1986) which is correct and realistic and hence deemed acceptable. In light of the above, PP has proposed PRC in the approach of determining the ex-ante fixed parameter "Historical operating temperature range of the ammonia oxidation reactor ($T_{g,hist}$)". As per the applied methodology: "*in order to determine the permitted range of the operating temperature and pressure in the ammonia oxidation reactor, the project applicant has the obligation to determine the operating temperature and pressure range by:* *(a) Firstly, data on historical temperature and pressure ranges; or, if no data on historical temperatures and pressures are available; then* *(b) Secondly, by range of temperature and pressure stipulated in the operating manual for the existing equipment; or, if no operating manual is available or the*

operating manual gives insufficient information; then
(c) Thirdly, by literature reference (e.g. from Ullmanns Encyclopedia of Industrial Chemistry, Fifth, completely revised edition, Volume A 17, VCH, 1991, P. 298, Table 3. or other standard reference work or literature source)"

In the registered PDD, PP had opted for the option (a). But as assessed above, the historical temperature of the AOR are proved to be erroneous, PP has opted for option (b) (from operating manual available since the installation of the nitric acid plant at SPC in 1986).

In the revised PDD, PP has proposed this ex-ante parameter ($T_{g,hist}$) value based on option (b) of the methodology AM0028, version 05.1 which says "*Secondly, by range of temperature and pressure stipulated in the operating manual for the existing equipment*". Accordingly, PP has proposed the parameter value based on the prescribed operating AOR temperature range by the technology supplier /4/ and further adopted by the PP in its log sheets as 810 – 885^{0}C /5/ which is deemed acceptable to the validation team. Based on sectoral expertise of the validation team, it can be confirmed that the stated temperature range in the registered PDD (840 – 860^{0}C) does not seem to be correct and realistic and the opted temperature range through this PRC (810 – 885^{0}C) is more realistic and deemed acceptable.

As per paragraph 309 (b) of the VVS for project activities, version 02.0 /B01-1/, the following are confirmed:

- *When the changes occurred*: The design change was noted by the PP when the DCS monitoring system was installed.

- *Reasons for these changes taking place*: As stated above, PP could note this change once the DCS monitoring system was installed

- *Whether the changes would have been known prior to the registration of the CDM project activity*: PP had not known this change prior to the registration of the CDM project activity

- *How the changes would impact on the overall operation/ability of the CDM project activity to deliver emission reductions*: With the stated project design change (correct application of the ex-ante historical temperature range of AOR), the emission reductions will be correctly calculated as per the applied methodology

- *Whether the revised estimation of emission reductions due to the change takes into account the applicable limits in accordance with the "CDM project standard for project activities*": There is no revision in estimation of emission reductions due to the stated project design change. Furthermore, the project activity is a large scale project and there is no limit on emission reductions as per the CDM project standard for project activities.

The validation team deemed this project design change for the fixed ex-ante parameter acceptable.

2) As per the registered PDD, for the ex-ante estimation of emission reductions, "N_2O concentration at the inlet of the N_2O destruction facility" ($Cl_{N2O,i}$) was assumed as 1,120 ppmv and "N_2O concentration at destruction facility outlet" ($CO_{N2O,i}$) as 120 ppmv (i.e. 90% efficiency). Based on the actual monitored value, PP proposes to change the value of inlet concentration of N_2O to 2,014.7 ppmv for the ex-ante estimation of emission reductions and outlet concentration as 201.47 ppmv (90% efficiency).

Assessment by the validation team:

In the registered PDD, for the ex-ante estimation of emission reductions, PP had

used the IPCC 2006 default value for N_2O concentration as 1,120 ppmv in the tail gas (inlet to the DeN_2O-$DeNO_x$ unit). This value was used in absence of any actual monitored data available at the time of PDD registration. However, post installation of the DeN_2O-$DeNO_x$ unit and monitoring of N_2O concentration in the tail gas, it is observed that its average value is 2,014.7 ppmv for the period 20/01/2017 to 22/09/2018 /7/. The monitored value was verified during the on-site visit document review by the validation team. Hence PP has proposed a PRC in this respect for values of inlet and outlet concentration of the N_2O in the DeN_2O-$DeNO_X$ unit as 2,014.7 ppmv and 201.47 ppmv (assuming 90% destruction of N_2O) respectively for the ex-ante estimation of emission reductions. It is noted that in the registered PDD, page 9, also it was stated "*It is notable that the estimates of GHG emission reductions are made for reference purpose only and actual emission reductions will be based on monitored data and may differ from this estimate*". Hence the validation team deemed this change, based on the actual monitored data, to be more realistic and hence acceptable. The validation team has reviewed the revised emission reduction calculation /12/ and deemed the revision as acceptable which is based on actual monitored value. Due to this proposed PRC and also adoption of updated values of GWP for second commitment period, the annual average ex-ante emission reductions have increased from 418,730 to 731,361 tCO_2e.

As per paragraph 309 (b) of the VVS for project activities, version 02.0 /B01-1/, the following are confirmed:

- *When the changes occurred*: The design change was noted by the PP when the DCS monitoring system was installed once the CDM project (DeN_2O-$DeNO_x$ system) was commissioned and N_2O concentration data in the tail gas was available.

- *Reasons for these changes taking place*: As stated above, PP could note this change once the DCS monitoring system was installed

- *Whether the changes would have been known prior to the registration of the CDM project activity*: PP had not known this change prior to the registration of the CDM project activity as there was no monitoring system at site for N_2O concentration in the tail gas.

- *How the changes would impact on the overall operation/ability of the CDM project activity to deliver emission reductions*: With the stated project design change (application of more realistic value of N_2O concentration in the tail gas for the purpose of ex-ante estimation of emission reductions), the ex-ante ERs in the PDD will be more realistic

- *Whether the revised estimation of emission reductions due to the change takes into account the applicable limits in accordance with the "CDM project standard for project activities*": The project activity is a large scale project and there is no limit on emission reductions as per the CDM project standard for project activities.

The validation team deemed this project design change acceptable.

3) Change in the AOR catalyst from "woven" to "knitted" type with its composition remaining same (90% Pt and 10% Rh)

During the on-site visit interviews and document review /9/ it was confirmed that the composition of the catalyst being used in the AOR is 90% Pt and 10% Rh which is same as stated in the registered PDD /B04/. But it was noted that as per the recommendation of the catalyst supplier /9/, the catalyst type had been changed from "woven" to "knitted" in April 2018 /10/. The validation team based on its sectoral expertise confirms that this change in type of catalyst (without altering the composition of the catalyst, i.e. 90% Pt and 10% Rh), does not have any

	negative impact on the plant operation and rather may lead to better efficiency of HNO_3 production, i.e. decrease the N_2O concentration in the tail gas. Hence this is deemed acceptable to the validation team. Further it was noted that in the registered PDD, section B.6.2 in the table for the parameter "$G_{com,hist}$", PP had stated the catalyst composition as 90% Pt and 10% Pd and this typographical error has been corrected to 90% Pt and 10% Rh which is consistent with other sections of the PDD and also the evidence from the technology supplier. The validation team deemed the above change catalyst type from woven to knitted acceptable. As per paragraph 309 (b) of the VVS for project activities, version 02.0 /B01-1/, the following are confirmed: - *When the changes occurred*: The design change was done in April 2018. - *Reasons for these changes taking place*: As stated above, the change in catalyst type (without altering in the composition) was done on the recommendation of the catalyst supplier for better efficiency of the nitric acid plant. - *Whether the changes would have been known prior to the registration of the CDM project activity*: PP had not known this change prior to the registration of the CDM project activity. - *How the changes would impact on the overall operation/ability of the CDM project activity to deliver emission reductions*: With the stated change in catalyst type, nitric acid production efficiency is expected to increase and thereby decreasing the concentration of N2O in the tail gas and thus emission reductions are expected to decrease. - *Whether the revised estimation of emission reductions due to the change takes into account the applicable limits in accordance with the "CDM project standard for project activities*": The project activity is a large scale project and there is no limit on emission reductions as per the CDM project standard for project activities. The validation team deemed this project design change acceptable. **4) Change in the GWP values for N2O and CH4 as per EB 69, Annex 3:** PP has updated the GWP values in line with EB 69, Annex 3 as the crediting period for the project activity falls in second commitment period. This is deemed acceptable to the validation team. Accordingly PP has submitted revised emission reduction calculation sheet which is found to be appropriate. Based on on-site visit inspection and document review, the verification team confirms that the above project design changes do not have any adversely impact on the compliance of the additionality, monitoring plan, the level of accuracy of the monitoring activity, the applied monitoring methodology including applicable tool(s) thereby complying paragraphs 303 and 309 of CDM VVS for project activities, version 02.0 /B01-1/. Further in line with paragraph 303 of CDM VVS for project activities, version 02.0, the validation team has assessed the effect of the project design changes as below: a) Additionality of the registered CDM project activity: As per section B.5 of the registered PDD, "*Because the installation of a DeN2O unit (Tertiary measure) needs considerable investment, and has no economical/financial benefit except benefits related to CDM, Simple cost analysis (option I) is applied*". The above stated PRCs do not have any impact on project capital cost, operation cost and other terms which adversely affected

project additionality.

Thus the verification team confirms that the project design changes do not adversely affects the additionality of the project activity and the project activity still remains additional.

b) Scale of the registered CDM project activity:

The project is a large scale project activity and the project design changes do not adversely affect the scale of the project activity,

c) Applicability and application of the applied methodology under which the CDM project activity has been registered;

The applicability conditions of the applied methodology AM0028, version 05.1.0 are demonstrated as below:

Applicability Criteria	**Justification / Assessment**
The applicability is limited to the existing production capacity measured in tonnes of nitric acid or caprolactam, where the commercial production had began no later than 31 December 2005. The definition of "existing" production capacity is applied for the process with the existing ammonia oxidization reactor where N_2O is generated and not for the process with new ammonia oxidizer. Existing production "capacity" is defined as the designed capacity, measured in tonnes of nitric acid or caprolactam per year;	SPC has only one nitric acid plant commissioned in 1986 with the capacity of 600t/d (x 330 d/yr = 198,000ton/yr) and this capacity has not been changed since then. Thus this condition is satisfied.
Existing caprolactam plants are limited to those employing the Raschig process not using any external sources of nitrogen compounds other than feed ammonia, or those employing the HPO® process that may use nitric acid as an external nitrogen source for caprolactam production in addition to feed ammonia;	This condition is not applicable to the project because it is a nitric acid production plant.
The project activity will not result in shut down of an existing N_2O destruction or abatement facility at the nitric acid or caprolactam production plant;	SPC has no N_2O destruction or abatement facility currently. This criterion is still applicable.
The project activity shall not affect the nitric acid or caprolactam production level;	The applied technology targets the tail gas, therefore has no influence on the nitric acid production. In case of market demand for nitric acid or ammonium nitride, SPC may increase the production, however the reason in not due to this project. This criterion is still applicable.
The project activity will not cause an increase in NO_X emissions;	Even though there is no adverse effect of the applied DeN_2O technology on NOX emission of the plant, the unit works as $DeNO_X$ as

		well, thus NO_X emissions will distinctively decreased. Nevertheless SPC currently and without any $DeNO_X$ unit, is in compliance with the NO_X regulation in Iran. This criterion is still applicable.
	In case a $DeNO_X$ unit is already installed prior to the start of the project activity, the installed De-NO_X is a Selective Catalytic Reduction (SCR) De-NO_X unit;	Until now, no any $DeNO_X$ unit has been installed in nitric acid plant of SPC. This criterion is still applicable.
	The N_2O concentration in the flow at the inlet and the outlet of the catalytic N_2O destruction facility is measurable. Furthermore, for a caprolactam plant using the HPO® process, the N_2O concentration in the gas flow between the ammonia oxidation reactor and the absorption column is also measurable, and the N_2O in the product flow from the absorption column to the HPO® process area is quantifiable.	The project activity will be equipped to the real time measurement systems at the upstream and downstream of the DeN_2O unit. Thus the N_2O concentration in the flow at the inlet and outlet of the system will be measured. The project activity is not aimed at the caprolactam production plant. This criterion is still applicable.

Hence it is confirmed that the project design changes (do not adversely affect the methodology and the applicable tools applicability criteria.

d) The compliance of the monitoring plan with the applied monitoring methodology:

The verification team confirms that due to the project design change, there is no change in the monitoring plan of the registered PDD and the monitoring methodology.

The verification team further confirms that due to the stated project design changes, there will not be any adverse impact on the project boundary and any associated leakages; the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan and thus complying paragraph 309 of VVS for project activities, version 02.0 /B01-1/.

The verification team confirms that the proposed project design changes comply with the requirements of the Project Standard for project activities, version 02.0 /B01-2/ thereby complying paragraph 308 of VVS for project activities, version 2.0 /B01-1/.

D.8. Changes specific to afforestation and reforestation project activities

Means of validation	Document Review, Interview
Findings	NA
Conclusion	NA

SECTION E. Internal quality control

>>

The final validation report passed a technical review before being submitted to the UNFCCC Executive Board. A technical reviewer qualified in accordance with the CCIPL's qualification scheme for CDM validation and verification performed the technical review.

SECTION F. Validation opinion

>>

Carbon Check (India) Private Ltd. (CCIPL) has performed the validation of the post-registration changes for the registered CDM Project Activity “Catalytic abatement of N2O in Nitric Acid Plant of Shiraz Petrochemical Company” having UNFCCC reference number 8249. During the validation of the post-registration changes to the project activity, project design changes have been identified. The post registration changes (PRC) to registered project activity has been validated in line with the requirements of CDM PCP for project activities (version 02.0) /B01-3/, CDM PS for project activities (version 02.0) /B01-2/ and CDM VVS for project activities (version 02.0) /B01-1/. In line with §308 of CDM VVS for project activities (version 02.0), CCIPL confirms that the post registration changes information in the revised PDD (version 10, Dated 22/05/2019) /1/ reflects post-registration changes related to the registered PDD /B04/.

The validation was performed on the basis of rules and requirements defined by UNFCCC for the CDM project activities. The review of the revised PDD /1/, supporting documentation and subsequent follow-up actions (including interviews), have provided CCIPL with sufficient evidence to determine the fulfilment of stated criteria.

The description in the revised PDD /1/ meets all relevant UNFCCC requirements for the CDM and correctly applies the selected baseline and monitoring methodology.

This report is the assessment opinion for the changes that are proposed in the revised PDD /1/ and request is submitted for acceptance of the Board as a part of prior approval request.

Appendix 1. Abbreviations

Abbreviations	Full texts
CAR	Corrective Action Request
CCIPL	Carbon Check (India) Private Ltd.
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CL	Clarification Request
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DR	Document review
DOE	Designated Operational Entity
EB	CDM Executive Board
EF	Emission Factor
EI	External individual
FAR	Forward Action Request
FVR	Final verification Report
GHG	Greenhouse gas(es)
I	Interview
IPCC	Intergovernmental Panel on Climate Change
IR	Internal resource
MRE	Mehr Renewable Energies
PDD	Project Design Document
PP	Project Participant
OSV	On Site Visit
QC/QA	Quality control/Quality assurance
RMP	Revised Monitoring Plan
SPC	Shiraz Petrochemical Company
TA	Technical Area
TR	Technical Review
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard

Appendix 2. Competence of team members and technical reviewers

Carbon Check (India) Private Ltd.

Sanjay Agarwalla

has been qualified as per CCIPL's internal qualification procedures, in accordance with requirements of Accreditation Standard (version 06.0):

For following functions:

Validator	☒	Team Leader	☒	Technical reviewer	☒
Verifier	☒	Technical Expert	☒	Local Expert[1]	☒

In the following Technical Areas:

TA 1.1	☒	TA 3.1	☒	TA 5.2	☒	TA 9.2	☒	TA 13.2	☐
TA 1.2	☒	TA 4.1	☒	TA 8.1	☐	TA 10.1	☐	TA 14.1	☐
TA 2.1	☒	TA 5.1	☒	TA 9.1	☒	TA 13.1	☒		

Mr. Vikash Kumar Singh
Compliance Officer

Mr. Amit Anand
CEO

Date of Approval
24/12/2018

Valid Till
23/12/2019

Revision History of the Document

26/12/2014	Initial Adoption
24/12/2015	Annual Revision
20/01/2016	Interim Revision for office address change
23/12/2016	Annual Revision
24/12/2017	Annual Revision
24/12/2018	Annual Revision

[1] India

CARBON CHECK (INDIA) PRIVATE LIMITED
Registered in India: U74930DL2012PTC232495
Regd. Off: 2071/38, 2nd Floor, Naiwala, Karol Bagh, New Delhi - 110005
Corporate off: G 49 & 50, 3rd Floor, Sector – 3, NOIDA (Uttar Pradesh) – 201301
Tel: +91 120 4373114| URL: www.carboncheck.co.in
e-mail: info@carboncheck.co.in

Carbon Check (India) Private Ltd.

Ramchandra Nesari

has been qualified as per CCIPL's internal qualification procedures, in accordance with requirements of Accreditation Standard (version 06.0):

For following functions:

Validator	☐	Team Leader	☐	Technical reviewer	☐
Verifier	☐	Technical Expert	☒	Local Assessor[1]	☒

In the following Technical Areas:

TA 1.1	☒	TA 3.1	☒	TA 5.2	☒	TA 9.2	☒	TA 13.2	☐
TA 1.2	☒	TA 4.1	☒	TA 8.1	☐	TA 10.1	☒	TA 14.1	☐
TA 2.1	☐	TA 5.1	☒	TA 9.1	☒	TA 13.1	☒		

Mr. Vikash Kumar Singh
Compliance Officer

Mr. Amit Anand
CEO

Date of Approval
24/12/2018

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e-mail: info@carboncheck.co.in

Carbon Check (India) Private Ltd.

Vikash Kumar Singh

has been qualified as per CCIPL's internal qualification procedures, in accordance with requirements of Accreditation Standard (version 07.0):

For following functions:

Validator	☒	**Team Leader**	☒	**Technical reviewer**	☒
Verifier	☒	**Technical Expert**	☒	**Local Expert[1]**	☒

In the following Technical Areas:

TA 1.1	☒	**TA 3.1**	☒	**TA 5.2**	☐	**TA 9.2**	☐	**TA 13.2**	☒
TA 1.2	☒	**TA 4.1**	☒	**TA 8.1**	☐	**TA 10.1**	☐	**TA 14.1**	☐
TA 2.1	☐	**TA 5.1**	☐	**TA 9.1**	☐	**TA 13.1**	☒		

Mr. Amit Anand
CEO

Date of Approval
24/12/2018

Valid Till
23/12/2019

Revision History of the Document	
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23/12/2016	Annual Revision
24/12/2017	Annual Revision
24/12/2018	Annual Revision

[1] India, South Africa

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Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1	MRE	1. Revised PDD (in track change and clean mode) 2. Revised PDD (in track change and clean mode) – against UNFCCC comments	Version 09, dated 07/03/2019 Version 10, dated 22/05/2019	PP
2	SPC	Evidence No.1_Daily Data-AOR Tem., Pres., Ammonia Flow and Acid_2010-2018	-	PP
3	SPC	Evidence No. 2_SPC DCS Installation NOM	-	PP
4	Heurtey Industries	Evidence No. 3_AOR Temperature Range by Manufacture_3100-NN-03 SH 3	-	PP
5	SPC	Evidence No. 4_SPC ISO document, Form No. QF-NIA-001.6, log-sheet for daily operating data recording (810-885^0 C)	-	PP
6	SPC	Evidence No. 5_Daily AOR T&P_ PDD Data_21.03.2010-20.03.2011	-	PP
7	SPC	Evidence No. 6_Daily AOR_Monitored Data_20.01.2017-22.09.2018	-	
8	SPC	Evidence No. 7_Daily CDM Plant Logsheet_21.03.2017-22.09.2018	-	PP
9	Hindustan Platinum Private Limited	Evidence No. 8_AOR Catalyst_Knitted Specification_by supplier	-	PP
10	SPC	Evidence No. 9_SPC NA R&M Report_Knitted Catalyst Replaced_28.04.2018	-	PP
11	SPC	Evidence No. 10_Daily Normalized Data-AOR Catalyst replacement Impact_20.01.2017-22.09.2018	-	PP
12	MRE	1. Revised Emission reduction calculation spread sheet 2. Revised Emission reduction calculation spread sheet (against UNFCCC comments)	Dated 07/03/2019 Dated 22/05/2019	PP
13	SPC	Evidence No.11_SPC Monitoring Report_ER Calculation Sheet-Ver.02_05032019	-	PP
14	SPC	Evidence No.12_QAL1_1403N-MTR-Flowmeter and Analyzer	-	PP
15	SPC	Evidence No.	-	PP

		13_QAL2_EZN2O-2017-09-0004-QAL2 AMS program SPC_final		
16	SPC	Evidence No.14_QAL3_and other Calibration Certificates	-	PP
B01	UNFCCC	1. Validation and Verification Standard for project activities, version 02.0 2. Project Standard for project activities, version 02.0 3. Project Cycle Procedure for project activities, version 02.0	http://cdm.unfccc.int/	Others
B02	UNFCCC	Applied baseline and monitoring methodology, AM0028 / version 05.1.0 "Catalytic N2O destruction in the tail gas of nitric acid or caprolactam production plants"	http://cdm.unfccc.int/	Others
B03	UNFCCC	1. CDM PRCV FORM and Instructions for filling out the PRC Validation form, version 02.0 2. CDM PDD FORM and Instruction for filling the form, version 10.1	http://cdm.unfccc.int/	Others
B04	UNFCCC	Registered PDD (version 08 dated 16/09/2012) and corresponding validation reports.	http://cdm.unfccc.int/	Others
B05	Web sites	Websites: 1. http://cdm.unfccc.int/	-	Others

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

Table 1. CLs from this validation

CL ID	01	**Section no.**	D.7	**Date:** 03/03/2019
Description of CL				
In the registered PDD, the value for the ex-ante parameter "Historical operating temperature range of the ammonia oxidation reactor" ($T_{g,hist}$) was taken as 840 – 860^{0}C. This value was based on the historical plant date from 21 Mar 2010 −20 Mar 2011. In the proposed PRC, this value is being changed. PP needs to justify the reason for this change and also clarify how does this meets the requirements of the applied methodology, AM0028, version 05.1.0 along with proper evidence.				
PP's response				**Date:** 14/03/2019
In parallel to De-N_2O plant installation, the DCS system also installed in SPC Nitric Acid plant (20 December 2016- See evidence No.2), which records accurate data and removed human error in data recording. The overview of temperature trend after installing DCS system shows an increase of 1.7% in average temperature in comparison to historical data before installing DCS, although all operating conditions reaming as same. (See evidence No. 1, sheet before DCS). It is observed that before installing DCS system, The quantile of the sample distribution (2.5%-97.5%) for temperature time series data was in range of 840-862 ^{0}C for the period of 21/03/2010-20/11/2016 (See evidence No. 1) . While it raised to range of 862-874 ^{0}C[1] after installing DCS system. On the other hand, in plant operation manual, which provided by technology supplier, the normal operating temperature for AOR reactor is 880 ^{0}C (See evidence No. 3). Hence project participants have the opinion that the AOR temperature was having an error about 1.7% in comparison to pre-DCS period, giving lower readings. Therefore project participants is proposing a Post Registration Changes (PRC) in the ex-ante value of historical AOR temperature by selecting second option i.e. technical data, which provided by the methodology AM0028, version 05.1.0. According to Nitric Acid Operation Manual, it is recommended that the plant operates between 750-910 ^{0}C (See evidence No. 3), while the plant owner (SPC), sets the normal permitted operation range of temperature between 810-885 ^{0}C (See evidence No. 4) for AOR reactor, for saving the catalyst lifetime. Therefore, project participants based on technical data, request to change the ex-ante value of permitted operating temperature range from 840-860 ^{0}C to 810-885 ^{0}C.				
Documentation provided by CME				
Evidence No.1_Daily Data-AOR Tem.,Pres., Ammonia Flow and Acid_2010-2018. Evidence No. 2_SPC DCS Installation NOM Evidence No. 3_AOR Temperature Range by Manufacture_3100-NN-03 SH 3 Evidence No. 4_SPC ISO document, Form No. QF-NIA-001.6, log-sheet for daily operating data recording Evidence No. 5_Daily AOR T&P_ PDD Data_21.03.2010-20.03.2011 Evidence No. 6_Daily AOR_Monitored Data_20.01.2017-22.09.2018 Evidence No. 7_Daily CDM Plant Logsheet_21.03.2017-22.09.2018				
DOE assessment				**Date:** 30/03/2019
In the registered PDD, the validated historical AOR temperature (for the period 21/03/2010 to 20/03/2011) was 840 – 860^{0}C. PP has provided the AOR temperature records for the period 21/03/2010 to 20/11/2016 (i.e. for the pre DCS period) which shows the range from 840 – 862^{0}C, which is almost in the same range as in the registered PDD. However, PP has provided the data for the post DCS installation, which was verified during the on-site visit by reviewing the plant records, showing the AOR temperature range from 862-874 ^{0}C for the period 20/01/2017 to 22/09/2018. It is observed that there is an average increase of about 1.7% in the AOR temperature post installation of DCS, although the operating conditions remaining same. As clarified by the PP, the DCS records are deemed to be accurate and with the possibility of the pre DCS records having some error. In light of the above, PP has proposed PRC in the approach of determining the ex-ante fixed parameter "Historical operating temperature range of the ammonia oxidation reactor ($T_{g,hist}$)". In the revised PDD, PP has proposed this ex-ante parameter ($T_{g,hist}$) value based on option (b) of the methodology AM0028, version 05.1 which says "*Secondly, by range of temperature and pressure stipulated in the operating manual for the existing equipment*". Accordingly PP has proposed the parameter value based on the prescribed operating AOR temperature range by the technology supplier and further adopted by the PP in its log sheets as 810 – 885^{0}C which is deemed acceptable to the				

[1] Reference: Daily AOR_Monitored Data_20.01.2017-22.09.2018

validation team. Hence the CL is closed.

CL ID	02	Section no.	D.7	Date: 03/03/2019
Description of CL				
The arithmetic difference of baseline emissions and projects emissions does not provide the emission reductions as stated in the PDD.				
PP's response				**Date:** 14/03/2019
It has been corrected in ex-ante emission reduction sheet and also relevant part of PDD. For Conservative approaches, the baseline emission has been round-down, while project emission has been rounded-up.				
Documentation provided by CME				
Ex-ante Emission Reduction spreadsheet and revised PDD.				
DOE assessment				**Date:** 30/03/2019
PP has provided revised ER spread sheet with correct ER values. CL is closed.				

CL ID	03	Section no.	D.7	Date: 03/03/2019
Description of CL				
PP has proposed a change in value of the monitoring parameter "N2O concentration at the inlet of the N2O destruction facility" ($CI_{N2O,i}$) and "N2O concentration at destruction facility outlet" ($CO_{N2O,i}$) used for ex-ante estimation of emission reductions. PP is requested to provide justification for this change along with proper evidence.				
PP's response				**Date:** 14/03/2019
In SPC Nitric Acid Plant, before implementation of De-N_2O plant, there was not any N_2O concentration measurement instrument and also measured data on N2O concentration in tail gas, So the project participants, for ex-ante emission reduction estimation, have been used IPCC 2006 Default Value for determining N_2O Concentration (emission factor of 7 kg N_2O/ ton of Nitric Acid, which is equal to 1,120 ppm N_2O). After installing N_2O measurement instruments, the measured N_2O concentration in tail gas shows higher value in comparison to IPCC default value. So for reducing the inconsistency between actual and ex-ante emission reduction, the project participants decided to revised default N_2O emission factor for ex-ante emission reduction and use actual data instead of default IPCC value. Therefore, we used the average daily measured N_2O concentration in monitoring period (20/01/2017-22/09/2018) for ex-ante emission reduction calculation. The result shows that for this period the average of daily average N_2O concentration in tail gas of AOR is 2,014.7 ppm (Please see the daily AOR monitored data in evidence No. 6). So the default IPCC N_2O concentration in PDD for ex-ante emission reduction calculation (1.120 ppm), has been replaced by measured value. The average measured value for N_2O concentration (2014.7 ppm~14 Kg N_2O/ ton Nitric Acid) is rationale, because the report on survey of CDM and JI N_2O projects which published by Öko-Institut e.V., shows that the N_2O emission factor for registered CDM project until 2012 is between 3.5-37 Kg N_2O/ton Acid, which SPC value is in range. (Reference: "*Options for continuing GHG abatement from CDM and JI industrial gas projects*", Öko-Institut e.V. Institute for Applied Ecology, May 2014 https://www.oeko.de/oekodoc/2030/2014-614-en.pdf Please See page 14, Table 2.)				
Documentation provided by CME				
Evidence No. 6_ Daily AOR_Monitored Data_20.01.2017-22.09.2018 cell no. J612), and Öko-Institut e.V report on "*Options for continuing GHG abatement from CDM and JI industrial gas projects", which is available at* https://www.oeko.de/oekodoc/2030/2014-614-en.pdf				
DOE assessment				**Date:** 30/03/2019
In the registered PDD, for the ex-ante estimation of emission reductions, PP had used the IPCC 2006 default value for N_2O concentration as 1,120 ppmv in the tail gas (inlet to the DeN2O-DeNOx unit). This value was used in absence of any actual monitored data available at the time of PDD registration. However, post installation of the DeN2O-DeNOx unit and monitoring of N_2O concentration in the tail gas, it is observed that its average value is 2,014.7 ppmv for the period 20/01/2017 to 22/09/2018. The monitored value was verified during the on-site visit document review by the validation team. Hence PP has proposed a PRC in this respect for values of inlet and outlet concentration of the N_2O in the DeN_2O-DeNO_X unit as 2,014.7 ppmv and 201.47 ppmv (assuming 90% destruction of N_2O) respectively for the ex-ante estimation of emission reductions. The validation team has reviewed the revised emission reduction calculation and deemed the revision as acceptable which is based on actual monitored value. Due to this proposed PRC, the annual average ex-ante emission reductions have increased from 418,730 to 761,263 tCO_2e. The CL is closed.				

CL ID	04	Section no.	D.7	Date: 03/03/2019

Description of CL

During the on-site visit it was confirmed that the catalyst composition for the AOR unit is Pt 90%, Rh 10% which is same as stated in the registered PDD. But in the PDD the type of this catalyst is stated as "woven" whereas it has been changed to "knitted" after the registration of the PDD. Clarification is requested on this change.

PP's response **Date:** 14/03/2019

The plant operator for improvement the Ammonia conversion efficiency and reducing catalyst loss, changed the type of catalyst from Woven to Knitted type with same composition (90% Pt., 10 Rh., 0% Pd.), based on catalyst supplier recommendation (Please see evidence from catalyst supplier-Evidence No.8).

The new type of Gauze has been installed on 28/04/2018, 15th months after starting data monitoring in the CDM plant. The overview of operation parameters in the plant reveals that the changes in Gauze type, not only have any negative impact in plant operation, but also reduced the N_2O concentration in AOR tail gas. (See evidence No.10: Daily normalized data).

Also based on AM0028 version 05.1.0, section "*Procedures used to determine the permitted operating conditions of the nitric acid or caprolactam production plant in order to avoid .overestimation of emission reductions*", The plant operator is allowed "*to use compositions of ammonia oxidation catalysts that are common practice in the region or have been used in the nitric acid or caprolactam production plant during the last three years without limitation of N2O baseline emissions*", while the changes in plant catalyst is not catalyst composition changes and catalyst is same as registered PDD. So it does not have any impact on methodology application or additionality of the project.

Documentation provided by CME

Evidence No. 8_AOR Catalyst_Knitted Specification_by supplier
Evidence No. 9_SPC NA R&M Report_Knitted Catalyst Replaced_28.04.2018
Evidence No. 10_Daily Normalized Data-AOR Catalyst replacement Impact_20.01.2017-22.09.2018

DOE assessment **Date:** 30/03/2019

During the on-site visit interviews it was confirmed that the composition of the catalyst being used in the AOR is 90% Pt and 10% Rh which is same as stated in the registered PDD. But it was noted that as per the recommendation of the catalyst supplier, the catalyst type had been changed from "woven" to "knitted" in April 2018. The validation team based on its sectoral expertise confirms that this change in type of catalyst (without altering the composition of the catalyst, i.e. 90% Pt and 10% Rh), does not have any negative impact on the plant operation and rather may lead to better efficiency of HNO3 production, i.e. decrease the N2O concentration in the tail gas. Hence this is deemed acceptable to the validation team. Further it was noted that in the registered PDD, section B.6.2 in the table for the parameter "$G_{com,hist}$", PP had stated the catalyst composition as 90% Pt and 10% Pd and this typographical error has been corrected to 90% Pt and 10% Rh which is consistent with other sections of the PDD and also the evidence from the technology supplier. The CL is closed.

CL ID	05	Section no.	UNFCCC clarification request	Date: 13/05/2019

Description of CL

1. Changing the ex-ante fixed parameter 'historical operating temperature range of the ammonia oxidation reactor, T g, hist' – as per registered PDD it was fixed as 840-860^{o}C; now is proposed to be changed and fixed as 810-885^{o}C.

(a)As per AM0028 v5.1. page 24, paragraph 3 (a) '…if not data on historical temperatures and pressure are available', then operating manual data could be applicable (item b). The DOE/PP are requested to clarify how the proposed change to option (b) is in line with the methodology considering that historical operating conditions were available (operating data from March 2010-March 2011, as per registered PDD page 30) at the time of registration. In doing so, please refer to AM0028 v5.1, page 24.

Furthermore, T g, hist is an ex-ante parameter fixed at the time of registration and is not expected to change post registration of the PA using data available after registration.

(b) The DOE is requested to further substantiate how it concluded that the historical temperature of the AOR are proved to be erroneous, referred to page 8 of PRCV-FORM, considering that the PA is installed in a nitric acid plant that operates since 1963.

2. Changing the values of parameters, N2O concentration at inlet and outlet of the N2O destruction facility; CIN2O,i and CON2O,i. As per registered PDD CIN2O,i and CON2O,i are 1,120 and 120 ppmv respectively. Now it is proposed to be changed to 2,014.7 and 201.47 ppmv respectively.

The PP/DOE should present the actual value of the concentration for CON2O,i considering that this is a

monitored parameter as per the monitoring plan as per AM0028 v5.1, page 34.
The PP/DOE are requested to further explain how exactly the DCS device is consistent to the requirements of AM0028 v5.1, pages 13 and 16, footnotes 4 and 5 which provides details to measure the concentrations of CON2O,i and CIN2O,i respectively.
In doing so, please provide the details of the conversion from ppmv to tN2O/m3 in the spreadsheet calculations; 'ER' sheet baseline and project emission calculations (rows D3-D7) shall be explained and elaborated in a traceable manner.

3. The DOE/PP are requested to update Global Warming Potential (GWP) values for CH4 and N2O as per the Standard for the 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 (EB 69, Annex 3) and Decision 4, CMP7. This considering that the starting date of the crediting period is 01 October 2014, which is after 1 January 2013.

PP's response | **Date:** 22/05/2019

1. (a) Although historical data from March 2010-March 2011 as per page 30 of registered PDD was available, but recent collected information for AOR operating condition shows that the historical data is incorrect as explained below. . Now as the "historical operating temperature range" is an ex-ante fixed parameter, and the available historical data are proven to be incorrect, therefore we could not replaced it by post-registration AOR operating temperature range values to correct it. So we go to methodology guidance and used the item (b) of methodology i.e. technical data from operation manual of the plant which was available before and at the time of registration (see evidence 3 & 4 AOR temperature range by plant operation manual), for determining the "historical operating temperature range of the ammonia oxidation reactor, T g, hist".

   Yes, it is an ex-ante parameter and fixed at the time of registration, but we did not change it by using plant operation data which available after registration. The historical data was incorrect and we replaced it through the methodology guidance with plant operation manual value which available since date of plant installation.

(b): PPs proved that the historical temperature to be erroneous, because of following reasons:
In plant operation manual which provided by technology supplier, the Normal Operating Temperature was 880 ^{0}C(Evidence 3), while based on recorded operation data before installing DCS, the average operating temperature is about 854 ^{0}C. It has a difference of about 26 ^{0}C from normal operation temperature. Therefore, if we assume that this value is correct and correctly recorded, the operating temperature is far from 880 ^{0}C, and it means that the plant has been operating in non-optimal condition for a long time (March 2010-January 2017), while all operating parameters did not substantial changes before and after installing DCS system (Table 1, below).

Table (1): Average value of operation parameters for Nitric Acid Plant before and after installing DCS system

Nitric Acid operation condition comparison with Licenser recommendation

Parameters	Unit	Plant before installing DCS		Plant During Monitoring Period and after installing DCS		Licenser and operation manual	Remark
		Lower limit	Upper Limit	Lower limit	Upper Limit		
AOR temperature	C	840	862	862	874	880 (810-885)	The AOR normal operation temperature is 880C
AOR pressure (Average)	Bar-Absolute	5.6		5.6		5.4	
Nitric Acid Production (Average)	ton/day (100%)	595		617		420-660 (70-110%)	The plant design capacity is 600 ton per day Acid (100% wt.).

Production Capacity over design capacity	%	99	103	100	
Ammonia Consumption (Average)	ton/hr	7.2	7.2	7.1	
References :		Plant Data, See evidence 3. Sheet Daily T,P before DCS	Plant Data, See evidence 3. Sheet Daily T,P after DCS	Operation Manual and Licenser data, See evidence 3. Sheet NA Plant by Licenser	
Conclusion 3: Comparison of Nitric Acid Plant operation condition before and after DCS system installation shows that all operation parameters not substantial changes except for AOR temperature. The reason for changes in AOR temperature is that before installing DCS system, it has been recorded by operators visually; while after installing DCS system, it is recorded digitally; therefore human error in data recording has been removed. The Ammonia Oxidization is exothermic reaction and therefore AOR temperature is dependent on volume of NH3 consumption, which is same before and after installing DCS system.					

- The plant operation conditions like the Nitric Acid production rate, Volume of Ammonia Consumption , AOR pressure and etc., did not substantial change before and after installing DCS system (see evidence No. 1 and table 1) , while the AOR operating temperature range changed form 840-860 ^{0}C for the period before DCS to 862-874 ^{0}C for the period after DCS. Also it is to be noted that the AOR temperature is dependent on volume of Ammonia consumption, which is same as before and after DCS system installation.

So PPs conclude that the plant for a long-term (7 years) could not operate in **non-optimal condition**, while all operating parameters except for temperature are in normal condition. Also Ammonia consumption which is the main item for temperature balance in AOR, is constant at 7.2 Kg/hr for the period before and after DCS system installation, Therefore PPs conclude that the recorded temperature before DCS was incorrect.

2. The above value for N2O concentration in inlet and outlet of N2O destruction facility is just for ex-ante calculation of emission reduction. PP will present the actual value for N2O concentration in inlet and outlet of N2O destruction facility based on monitoring plan for every 2 hours in monitoring report. Now all actual measured concentration of N2O in inlet and outlet of destruction facility with 2 hours interval are available (See evidence 11, Sheet monitoring Period 2_ER Cal. Columns F and Z for CO N2O,I and CI N2O,I, respectively). The data directly adopted from plant recorded data.

   The DCS system is just for data logging, recording and archive in electronic basis, while for meeting the requirement of AM0028 v5.1, pages 13 and 16, footnotes 4 and 5, for FTE, FTi, CIN2O,i and CON2O,I the relevant instrument have been installed and passed the Quality Assurance Levels (QAL) 1, 2 and 3 test based on procedures of EN14181 and “Good monitoring practice and performance characteristics”, which indicated in page 42 of AM0028 V5.01. Also for quality assurance test report, please see the evidences 12, 13 and 14 (QAL1, QAL2 and QAL3 test report). All the parameters are measured in normalized conditions at the same basis.

   The ER spreadsheet is same as the ER sheet which approved by DOE during validation and registration. The Emission reduction calculation in ER sheet has been revised and explained very detail (please see the revised ER sheet). In ER sheet for elaborating in a traceable manner, the calculation has separated into 3 steps.
   Also the clarification and explanation for converting ppm N2O to ton N2O/Nm3 which has been revised in ER sheet, is explained as below:
   Concentration N2O in ppm: X
   Concentration in tN2O/Nm3=X * 10-6 * 44/22.4 / 1000 (tN2O/Nm3)

3. The GWP for N2O and CH4 revised based on EB-69 Annex 3 and Decision 4 of CMP7. We revised the GWP of N2O and CH4 to 298 and 25, respectively and accordingly the Ex-ante emission reduction in ER sheet and PDD has been revised. (Please see Revised ER sheet and PDD).

Documentation provided by CME

- Evidence No.1_Daily Data-AOR Tem., Pres., Ammonia Flow and Acid_2010-2018
- Evidence No. 3_AOR Temperature Range by Manufacture_3100-NN-03 SH 3
- Evidence No. 4_SPC ISO document, Form No. QF-NIA-001.6, log-sheet for daily operating data recording (810-885 ^{0} C)
- Evidence No.11_SPC Monitoring Report_ER Calculation Sheet-Ver.02_05032019
- Evidence No.12_QAL1_1403N-MTR-Flowmeter and Analyzer
- Evidence No. 13_QAL2_EZN2O-2017-09-0004-QAL2 AMS program SPC_final
- Evidence No.14_QAL3_and other Calibration Certificates
- Revised Emission reduction calculation spread sheet (against UNFCCC comments with updated GWP values)

DOE assessment	**Date:** 25/05/2019

1. It is correct that in the registered PDD, the ex-ante fixed parameter 'historical operating temperature range of the ammonia oxidation reactor, T g, hist' was based on historical data. But as clarified by PP, post installation of the DCS, it is observed that the historical temperature recorded pre DCS was not correct. The validation team is able to confirm this based on the fact that there is no change in the operating conditions of the plant pre DCS and post DCS installation (AOR pressure, Nitric Acid production, Ammonia consumption). Accordingly possibility of change in the operating temperature is ruled out and concluded that the historical temperature presented in the registered PDD was not correct. Now as the historical temperature presented was not correct, the validation team considers it as good as not available. Hence in absence of the available historical temperature, PP has opted for option (b) on page 24 of the applied methodology, AM0028, v5.1 (operating manual also available at the time of registration of the project) which is correct and realistic and hence deemed acceptable.

2. In the PRC submission, PP has presented the actual monitored data for $CI_{N2O,i}$ and CO_{N2Oi} which is deemed more realistic.

   It is confirmed that all the monitoring devices are consistent to the requirements of AM0028 v5.1, footnotes 4 and 5, to measure the concentrations of $CO_{N2O,i}$ and $CI_{N2O,I}$, and flow rates F_{TI} and F_{TE} as they are based on procedures of EN14181. Also all the parameters are measured under normalised conditions and at the same basis.

   In the revised ER spread sheet submitted by PP, details of the conversion from ppmv to tN2O/m3 has been explained and elaborated in a traceable manner which is confirmed as correct.

3. In the revised PDD and ER spread sheet, PP has adopted GWP values for N2O and CH4 in line with EB 69, Annex 3 which is deemed acceptable.

The CL is closed.

CL ID	06	**Section no.**	UNFCCC Clarification request	**Date:** 07/06/2019

Description of CL

Issue: Related to changing ex-ante parameter

Changing the ex-ante fixed parameter 'historical operating temperature range of the ammonia oxidation reactor, T g, hist' – as per registered PDD it was fixed as 840-860 ^{0}C; now is proposed to be changed and fixed as 810-885 ^{0}C.

Based on the clarification provided on the above issue, it is observed that:

- The DCS device was installed at the end of 2016;
- Data for the ex-ante T g, hist parameter is proposed to be based on readings from 20/01/2017 to 22/09/2018;
- Three monitoring reports covering periods: MP1 - 01 October 20014 to 20 March 2017 (with zero CERs); MP2 – 21 March 2017 to 22 September 2017 (with 456,285 CERs); and MP3: 23 September 2017 to 22 September 2018 (with 836,817 CERs) are published.

The DOE/PP are requested to further clarify how:

a) The new source of data for T g, hist parameter is applicable to the first, second and third monitoring periods which is based on readings from 20/01/2017 to 22/09/2018.
b) The new historical data is applicable under Option b: using operating manual of equipment- of AM0028

v5 (page 24), which is based on readings from 20/01/2017 to 22/09/2018 and not provided by technology supplier and plant operation manual.
c) Proposed change to option (b) is in line with the methodology considering that historical operating conditions were available (operating data from March 2010-March 2011, as per registered PDD page 30) at the time of registration.

PP's response | **Date:** 19/06/2019

Response against UNFCCC's observations:

- Yes, the DCS system has been installed in SPC Nitric Acid Plant in parallel to installing N2O abatement system on 23/11/2016.

- No, the ex-ante T g, hist parameter is proposed to be replaced by AOR operation temperature range provided by the technology supplier in plant operation manual and has been available before and at the time of PDD preparation. The SPC nitric acid plant is in operation since 1986 and the plant operation manual from the technology supplier is available since then.
  The temperature reading from 20/10/2017-22/09/2018 is provided to show that the ex-ante T g, hist parameter which has been used in PDD was incorrect, and then we conclude that the ex-ante T g, hist which used in PDD was wrong, therefore instead of option (a) of methodology, we go to option (b), i.e. technical information which provided by technology supplier.

Response against clarifications:

a) No, the new source of data for Tg, hist parameter, is based on plant operation manual provided by the technology provider and not based on the reading from the monitored values from January 2017 to September 2018 as explained above (Evidence No.4_SPC ISO document, Form No. QF-NIA-001.6-8, log-sheet for daily operating data recording). The value for Tg, hist parameter (proposed changed value of the fixed ex-ante parameter, Tg,hist), based on operation manual is 810-885 ^{0}C, so this value will be applicable not only for first, second and third monitoring period, but also for the whole crediting period.
   The readings of temperature value (daily-Tg,d) from 20/01/2017 to 22/09/2018 are used as actual operating temperature of the AOR unit for comparison with "permitted range" of operating temperatures (Tg, hist), for estimating baseline emission in monitoring period and does not use as an ex-ante T g, hist parameter.

b) After careful analysis of the UNFCCC comments we have come to the conclusion that the reviewer may have had the impression that the additional data provided in our PRC are to replace the ex-ante fixed historical data (T g,hist.). This is not the case. The new 2017-2018 data (after installation of the DCS) are only to prove that historical data were not reliable. That is the reason why PRC is requesting the use of Item (b) of methodology for this ex-ante parameter: the data provided in the official operating manual of the installed equipment, instead of the earlier data that were taken on site.

   As explained in section (a), the new historical data is applicable under Option (b) of methodology, using operating manual of equipment of AM0028 v5 (page 24), is not based on reading of information from 20/01/2017 to 22/09/2018 by DCS. It is sourced from operation manual of plant provided by the technology supplier (Evidence No. 3_AOR Temperature Range by Manufacture_3100-NN-03 SH 3 & Evidence No.4_SPC ISO document, Form No. QF-NIA-001.6-8, log-sheet for daily operating data recording).

c) As we explained in PRC submission and also previous response to the UNFCCC clarification request (CL 05 above) part (a), although historical data from March 2010-March 2011 as per page 30 of registered PDD was available, but recent reading temperature from DCS (20/03/2017-22/09/2018) for AOR temperature shows that the historical data is incorrect. We know that the "*historical operating temperature $T_{g, hist}$*" is an ex-ante fixed parameter, and the available historical data are proven to be incorrect. So we go to methodology guidance and used the item (b) of methodology i.e. technical data from operation manual of the plant which was available before and at the time of registration for determining the "*historical operating temperature range of the ammonia oxidation reactor, $T_{g, hist}$*".

Documentation provided by PP

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DOE assessment | **Date:** 19/06/2019

As clarified by the PP above, the validation team confirms that the DCS was installed in the nitric actid plant of SPC in Nov 2016. Furthermore it is being confirmed that the ex-ante parameter Tg,hist is not

being proposed based on the readings from 20/01/2017 to 22/09/2018 as observe by UNFCCC. Rather it is being proposed based on the plant operation manual from the technology supplier available to the PP since the installation of the nitric acid plant at SPC in 1986.

a) As explained by the PP, it is being confirmed that the new source of data (which is based on the plant operation manual and not on readings from 20/01/2017 to 22/09/2018) is not just applicable to the first, second and third MPs but for the whole crediting period.

b) As explained above the new source of data is from the plant operating manual provided by the technology supplier and not on readings from 20/01/2017 to 22/09/2018.

c) As confirmed in section D.7 of this report above, in the registered PDD, the validated historical AOR temperature (for the period 21/03/2010 to 20/03/2011) was 840 – 860^{0}C /B04/ /6/. Further, the PP has provided the AOR temperature records for the period 21/03/2010 to 20/11/2016 (i.e. for the pre DCS period) which shows the range from 840 – 862^{0}C /2/, which is almost in the same range as in the registered PDD for the ex-ante fixed parameter "$T_{g,hist}$" which was based on the historical temperature readings from the plant for the period 21/03/2010 to 20/03/2011. However, PP has provided the data for the post DCS installation /3/, which was verified during the on-site visit by reviewing the plant records, showing the AOR temperature range from 862-874 ^{0}C for the period 20/01/2017 to 22/09/2018 /7/. It is observed that there is an average increase of about 1.7% in the AOR temperature post installation of DCS, although the operating conditions remains same. As clarified by the PP, the DCS records are deemed to be accurate and with the possibility of the pre DCS records having some error. It is correct that in the registered PDD, the ex-ante fixed parameter 'historical operating temperature range of the ammonia oxidation reactor, "$T_{g, his}$" was based on historical data. But as clarified by PP, post installation of the DCS, it is observed that the historical temperature recorded pre DCS was not correct. The validation team is able to confirm this based on the fact that there is no change in the operating conditions of the plant pre DCS and post DCS installation (AOR pressure, Nitric Acid production, Ammonia consumption). Accordingly possibility of change in the operating temperature is ruled out and concluded that the historical temperature presented in the registered PDD was not correct. **Now as the historical temperature presented was not correct (i.e. were erroneous), the validation team considers it as good as not available**. **Hence in absence of the available historical temperature, PP has opted for option (b) on page 24 of the applied methodology, AM0028, v5.1** (operating manual also available at the time of registration of the project and since the installation of the nitric plant at SPC in 1986) which is correct and realistic and hence deemed acceptable. In light of the above, PP has proposed PRC in the approach of determining the ex-ante fixed parameter "Historical operating temperature range of the ammonia oxidation reactor ($T_{g,hist}$)".

Table 2. CARs from this validation

CAR ID	01	**Section no.**	D.1	**Date:** 03/03/2019
Description of CAR				
PP needs to ensure that all the changes with respect to the registered PDD are reflected in track change mode in the revised PDD.				
PP's response				**Date:** 14/03/2019
We insert all changes with respect to registered PDD in track change mode. Please see the pages 1, 7, 8 30, 32 and other pages in revised PDD.				
Documentation provided by CME				
Revised PDD				
DOE assessment				**Date:** 30/03/2019
PP has submitted revised PDD in track changes with respect to the registered PDD. The CAR is closed.				

CAR ID	02	**Section no.**	D.1	**Date:** 03/03/2019
Description of CAR				
Section A.6 of the revised PDD has not been filled as per the PDD completing guidelines.				
PP's				**Date:** 14/03/2019
The section A.6 has revised according to PDD completing guidelines. Please see section A.6, page 8 of revised PDD.				

Documentation provided by CME	
Section A.6, Page 8 of revised PDD.	
DOE assessment	**Date:** 30/03/2019
PP has submitted revised PDD with correction in section A.6. The CAR is closed.	

CAR ID	03	**Section no.**	D.1	**Date:** 03/03/2019
Description of CAR				
PP needs to ensure that the information transferred to the later valid version of the form is materially the same as that in the registered PDD (e.g. the content of section B.7.2 of the older PDD has not been covered in the revised PDD, etc.). Please refer paragraph 279 of CDM VVS for project activities, version 02.				
PP's				**Date:** 14/03/2019
The section B.7.2 of registered PDD has been inserted in section B.7.3 of revised PDD. Please See section B.7.3, page 46 of revised PDD.				
Documentation provided by CME				
Section B.7.3, Page 46 of revised PDD.				
DOE assessment				**Date:** 30/03/2019
It is confirmed that the information transferred to the revised PDD submitted for PRC is materially the same as in the registered PDD. The CAR is closed.				

CAR ID	04	**Section no.**	D.1	**Date:** 03/03/2019
Description of CAR				
PP needs to clearly specify the category in which each of the proposed post registration changes fall (please refer section 8.2 of the CDM PS for project activities, version 02). Also referring the paragraph 242 of the CDM PS, for project design change, PP shall report in the revised PDD the impacts of the proposed or actual changes to the registered CDM project activity on the following: (a) The applicability and application of the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents with which the project activity has been registered; (b) The compliance of the monitoring plan with the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents; (c) The level of accuracy and completeness in the monitoring of the project activity compared with the requirements contained in the registered monitoring plan; (d) The additionality of the project activity; (e) The scale of the project activity.				
PP's				**Date:** 14/03/2019
The type and reason for changes and also the PRC falls in which category are describe in Appendix 7 of revised PDD.				
Documentation provided by CME				
Appendix 7, Page 61 of revised PDD.				
DOE assessment				**Date:** 30/03/2019
In the revised PDD, PP has stated the category of the proposed changes as per CDM PS for project activities, version 02. Also the impacts of the proposed changes have been clarified in the PDD. The CAR is closed.				

Table 3. FARs from this validation

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

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Document information

Version	*Date*	*Description*
02.0	31 October 2017	Revision to align with the requirements in the “CDM validation and verification standard for project activities” (version 01.0).
01.0	23 March 2015	Initial publication.

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