



Verification Report for CAR811 – Rentech Energy Midwest Corporation –
Nitric Acid Plant 1
October 6, 2013 – August 20, 2014 Reporting Period

Prepared for:
Rentech Nitrogen, LLC

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1.0 Introduction

Ruby Canyon Engineering (RCE) was contracted by ClimeCo America Corporation (ClimeCo) to perform the verification of Rentech Nitrogen, LLC's (Rentech) Rentech Energy Midwest Corporation Nitric Acid Plant 1 project (Project) for the reporting period October 6, 2013 through August 20, 2014 to the Climate Action Reserve (Reserve). The Project involves GHG emission reductions from the destruction of nitrous oxide (N₂O) using a tertiary abatement catalyst at a nitric acid plant located in East Dubuque, Illinois.

1.1 Project Background & Site Description

The Project involves the installation of a new catalyst in the tail gas leaving the absorption tower, catalytically decomposing the nitrous oxide (N₂O) that would have otherwise been vented to the atmosphere. The Project is at Nitric Acid Plant 1 at Rentech's facility in East Dubuque, Illinois. Nitric Acid Plant 1 has been in operation since 1978. The facility also includes a plant for ammonia production, a plant for urea production, and a second plant producing nitric acid. Rentech is the project owner and is responsible for ongoing operation and maintenance of the monitoring system and data acquisition and handling system. ClimeCo is the technical consultant to Rentech and is responsible for overall program management, development of monitoring reports, and oversight of the verification process.

This is the verification of the fourth reporting period for the Project. The reporting period includes two full campaigns (Campaign 8 and 9). Campaign 8 began on October 6, 2013 and ended on April 8, 2014 at 2:00PM, and Campaign 9 began on April 8, 2014 at 3:00PM and ended on August 20, 2014.

1.2 Responsible Parties

Project Developer

Rentech Nitrogen, LLC
16675 Highway 20 West
East Dubuque, IL 61025

Technical Consultant

ClimeCo America Corporation
10 North Reading Avenue
Boyertown, PA 19512

1.3 Verification Team

The RCE verification team consisted of the following individuals who were selected based upon verification experience under the Reserve's program and knowledge of U.S. EPA regulations and the nitric acid plant sector.

Lead Verifier: Nina Pinette
Senior Internal Reviewer: Zach Eyler

1.4 Objectives

The goal of the verification activities was to ensure that the claimed GHG emission reductions were complete, consistent, accurate, transparent, and permanent and that the Project was in compliance with the Protocol's project additionality, monitoring, and reporting requirements. Furthermore, the

verification activities ensure that the data provided to RCE is well documented and free of any material errors or omissions.

1.5 Scope

The scope of the verification consisted of the following independent and objective activities:

- Review the reporting period's Project Monitoring Plan,
- Review Project boundaries,
- Review Project eligibility,
- Review Project data acquisition and quality control procedures,
- Review Project's historical emissions to ensure that historical parameter values have not changed from the previous reporting period,
- Review Project's baseline emissions,
- Review the Project's emission reduction calculations,
- Review Project documents and data against the Verification Criteria listed in Table 1,
- Issue requests for additional documentation, clarifications, and corrective actions as necessary, and
- Issue a Verification Report, List of Findings, and Verification Statement to Rentech and the Reserve.

1.6 Verification Criteria

Table 1 - Verification Criteria

Criteria	Details
Standard of Verification	• Nitric Acid Production Project Protocol Version 2.0 (September 28, 2011) (Protocol) • Errata and Clarifications to Nitric Acid Production Protocol Version 2.0 (October 4, 2013) • Verification Program Manual (December 20, 2010) • Program Manual (October 26, 2011)
Verification Process	The Reserve Verification Program Manual and ISO 14064-3 Specification with guidance for the validation and verification of greenhouse gas assertions
Level of Assurance	Reasonable assurance
Materiality	97 percent materiality threshold (<3% error) because total annual ERs are greater than 25,000 tCO ₂ e but less than or equal to 100,000 tCO ₂ e

2.0 Verification Activities Summary

RCE developed a verification plan to be followed throughout the verification. The verification plan consisted of the following activities:

- RCE completed the Project NOVA/COI form to identify any potential conflicts of interest with the Project or Project developer. The NOVA/COI form was submitted to the Reserve's website, and the COI assessment revealed no conflicts of interest and was approved by the Reserve on November 7, 2014.
- RCE held a verification kickoff meeting with ClimeCo and Rentech on November 21, 2014. During the kickoff meeting RCE reviewed the verification objectives and process, the verification schedule, and requested the verification background documents.
- RCE performed a strategic review and risk assessment of the received data and support documents in order to understand the scope and areas of potential risk in the GHG emissions reductions.
- RCE developed a risk-based sampling plan based upon the strategic review and risk assessment. The verification plan and sampling plan were used throughout the verification and were revised as needed based upon additional risk assessments.
- RCE conducted a site visit to the Project on December 3, 2014. During the site visit RCE inspected the continuous emission monitoring system (CEMS) equipment; observed the onsite GHG management systems and data gathering, monitoring and handling practices; and interviewed key personnel.
- RCE conducted a detailed desktop review of submitted material including evidence of regulatory compliance, documentation of ongoing QA/QC procedures, source data, and emission reduction calculations.
- RCE submitted requests for additional documentation, clarifications, and corrective actions to ClimeCo throughout the verification.
- RCE's Senior Internal Reviewer conducted a review of the verification sampling, Verification Report, and Verification Statement.
- RCE issued a final Verification Report, Verification Statement, and List of Findings.
- RCE held an exit meeting with ClimeCo and Rentech on March 19, 2015.

3.0 Verification Findings

3.1 *Assessment of the GHG Reduction Project Operations*

The Project destroys N_2O from a nitric acid plant (NAP) via a tertiary abatement catalyst in the tail gas stream located between the reheater and expander. RCE confirmed that a non-selective catalytic reduction (NSCR) unit was not operating at the plant at any time since December 2, 2007.

Direct measurements of the N_2O concentration in the stack gas and the tail gas are monitored continuously using a CEMS. The data acquisition and handling system (DAHS) along with the PLC and server are used for CEMS data monitoring, recordkeeping and reporting. The system monitors gas flow rate, N_2O concentration, process temperature, pressure, and ammonia-to-air ratio on a continuous basis and records the data every minute, meeting Protocol requirements.

During the verification of the first reporting period, RCE confirmed that the installation and initial certification of the CEMS were completed according to manufacturer's specifications and the requirements of the Protocol. RCE verified the installation of the tertiary abatement catalyst and

campaign dates through review of plant gauze records. RCE determined that the methodology defined in the Monitoring Plan Version 3.1 was adhered to throughout the verification and the parameters monitored are in accordance with Table 6.2 of the Protocol.

3.2 GHG Project Boundary (sources, sinks and/or reservoirs)

According to the Protocol, CO₂, CH₄, and N₂O are included from the Baseline and Project activities for tertiary abatement projects. Since the Project has no ammonia input to the N₂O destruction facility, uses no hydrocarbons as reducing agents or for reheating the tail gas, and has no external energy input to reheat the tail gas, N₂O is the only GHG included from the Baseline and Project activities for this Project.

Table 2 lists the sources of GHG emissions reviewed during the verification of the Project.

Table 2 - Project GHG Sources, Sinks and Reservoirs

Activity	GHG Sources, Sinks & Reservoirs
Baseline	N₂O vented to the atmosphere.
Project	N₂O vented to the atmosphere

3.3 Project Eligibility Criteria

The Protocol specifies four eligibility rules that GHG Project developers must meet in order to register reductions with the Reserve. RCE confirmed that the Project's location and Project start date met Protocol requirements during the first verification cycle. Below is a summary of the Protocol's eligibility rules and the Project's compliance to each requirement.

- Eligibility Rule I: Location**

The Project is located at a nitric acid plant in East Dubuque, Illinois, U.S. The Project therefore meets the location eligibility requirement.

- Eligibility Rule II: Project Start Date**

During the first verification cycle, RCE reviewed evidence showing that plant operations were shut down on June 27-28, 2011 for installation of the catalyst. The Project start date for a tertiary catalyst project is defined as the date on which nitric acid production first commences after installation of the tertiary N₂O abatement technology. The plant was restarted and production of nitric acid commenced on June 29, 2011, which is the Project start date and was the start date of the first reporting period.

- Eligibility Rule III: Additionality**

Legal Requirement Test

Data from the Project's CEMS shows how the Project continues to meet or exceed the legal requirement test because it clearly shows evidence of the installation of a tertiary catalyst (e.g. the N₂O concentration in the tail gas is on average 10 times lower than N₂O concentration before the catalyst). RCE also viewed the catalyst during the site visit. RCE confirmed that there are currently no laws requiring the abatement of N₂O at the plant. In addition, Rentech's Environmental, Health, Safety, Security and QA Manager monitors periodicals, websites, newsletters, and other materials provided by trade associations and legal advocacy groups such as the Chemical Industry Council of Illinois and The Fertilizer Institute. RCE reviewed Rentech's Title V Permit, but the permit does not address N₂O. Rentech's nitric acid plant 1 has not triggered the PSD Tailoring Rule for GHGs. RCE also verified that the project developer accurately completed the Attestation of Voluntary Implementation form and uploaded it to the Reserve website.

Performance Standard Test

RCE verified that the Project satisfies the Performance Standard by installing a new tertiary N₂O abatement catalyst. RCE reviewed plant records indicating the installation of the catalyst on June 27-28, 2011.

- **Eligibility Rule IV: Regulatory Compliance**

The Project was in material compliance with all applicable laws throughout the reporting period. RCE reviewed the ECHO database and any entries associated with the Rentech facility. There was a notice of violation (NOV) issued by the EPA for the nitric acid plant at which the Project is located in October 2009 related to the previous owners of the plant never filing for a PSD permit prior to construction of the plant. However, Rentech entered into a Consent Decree filed February 10, 2012 to resolve the NOV. The Consent Decree does not address N₂O, and RCE determined that the NOV does not affect the regulatory compliance of the Project. RCE also reviewed Semi-Annual Reports submitted to the U.S. EPA as required by the Consent Decree. The facility was also listed as “in violation” during a Title V compliance certification review by the state on June 3, 2014, prior to the reporting period. RCE confirmed that this was an administrative issue. Finally, RCE verified that the Attestation of Regulatory Compliance was correctly completed and uploaded to the Reserve.

3.4 Ownership of GHG reductions

Rentech owns the nitric acid plant and thus owns full right to any emission reductions associated with the plant. ClimeCo serves only as a technical consultant to Rentech. RCE reviewed the “Designation of Authority” in which Rentech designated authority to ClimeCo as the Account Holder Agent on the Reserve website. RCE also verified that the Attestation of Title was correctly completed and uploaded to the Reserve website after the end of the reporting period.

3.5 Assessment of Information System Controls

The majority of the GHG management systems review took place during the site visit through observations of onsite procedures and interviews with Project key personnel. The onsite review included confirming that the Project monitoring was done by direct measurements from a CEMS for both gas flow rates and N₂O concentration. The Project uses a Kurz insertion mass flow meter to measure gas flows in the stack. These flow measurements are used in both baseline and project emission calculations. The Project uses two N₂O analyzers, one upstream of the tertiary abatement system (inlet) and one downstream of the system (outlet). Both are EcoChem infrared gas analyzers. RCE confirmed the locations of the sample probes within the stack through review of plant diagrams.

The Project uses the CEMS DAHS coupled with a programmable logic controller (PLC) that consolidates the data. The data is stored on the server with regular backup as well as a thumb drive in the system.

3.6 CEMS Installation and Certification

The Protocol states that the project developers follow the CEMS installation and certification requirements:

- 40 CFR Part 60, Sec. 60.13
- 40 CFR Part 60, Appendix B, Performance Specification 2
- 40 CFR Part 75, Appendix A, Sec. 6

As is the case with most NAPs located in the U.S., parts of the Rentech CEMS were installed prior to the Project. All CEMS components were installed by the manufacturers of the equipment or electrical

contractors. RCE verified that the Project met all CEMS installation and certification requirements during the first verification cycle.

RCE verified that the following requirements were met for installation and certification of the CEMS:

7-day Calibration Error Test:

RCE reviewed the results of the 7-day calibration error tests performed for the flow meter (7/14/2010 – 7/20/2010), the inlet analyzer (6/22/2011 – 6/28/2011), and the outlet analyzer (7/14/2010 – 7/20/2010). All tests were completed prior to the project start date and the percent calibration errors were within the allowable range.

Linearity Check:

RCE reviewed the results of the linearity checks performed for the inlet analyzer (6/21/2011) and the outlet analyzer (6/20/2011). Both checks took place prior to the project start date and both met the requirement of less than 5.0 percent error.

RATA and bias tests:

RCE reviewed the results of the RATA that was conducted on June 22, 2011 for the flow meter, inlet analyzer, and outlet analyzer. The relative accuracy (RA) for all three was within the allowable range and all three pieces of equipment passed the bias test.

Cycle Time Test:

RCE reviewed the results of the cycle time test on August 16, 2010 which ensures that the monitoring system is capable of completing at least one cycle of sampling, analyzing, and data recording every 15 minutes.

3.7 Ongoing CEMS QA/QC Program

RCE confirmed that the ongoing CEMS QA/QC requirements were met throughout the reporting period.

3.7.1 Daily Requirements

RCE reviewed evidence that the daily calibration error test is performed for both N₂O analyzers. The analyzers perform an automatic daily calibration error test. Rentech reported that the analyzers are very stable and the systems almost never have to recalibrate. RCE viewed the raw data and results of each test. RCE also confirmed that calibration adjustments are performed if necessary, data is validated daily, data is continuously monitored and recorded every minute, and QA checks are performed. There were a few instances during the reporting period for the inlet and the outlet analyzers where the results of the automatic calibration error test indicated “warning” or “out of control”. Each time, the analyzer was automatically recalibrated and another test was performed until the result indicated “cal OK”. Most of the “warning” or “out of control” periods correspond to periods for which the missing data substitution procedure was applied.

3.7.2 Quarterly Requirements

RCE verified that the following quarterly assessments were performed according to Protocol requirements:

Calibration Error Test:

RCE reviewed evidence that the quarterly calibration error test requirement was met for the flow meter. The meter performs an automatic daily calibration error test. Rentech reported that the flow meter is very stable and the system almost never has to recalibrate. RCE viewed the raw data and results of each test. RCE also confirmed that calibration adjustments are performed if necessary, data is validated, data

is continuously monitored and recorded every minute, and QA checks are performed. There were no instances during the reporting period when the flow meter was out of calibration.

Leak Check:

The Protocol states that leak checks are required for differential pressure flow meters only. Because the Project utilizes a thermal mass flow meter, this quarterly assessment is not required.

Flow-to-Load or Heat Rate Evaluations:

The Protocol states that units not producing electrical output or thermal output are exempted from the flow-to-load ratio test requirements. The Project meets this exemption and is therefore not required to perform this quarterly assessment.

Linearity Checks

RCE confirmed that the quarterly linearity checks were performed for both N₂O analyzers. Linearity checks were conducted for all four quarters in which emission reductions were generated during this reporting period, for the fourth quarter of 2013, and for quarters one, two, and three of 2014. The checks for the outlet analyzer were performed on November 20, 2013; March 5, 2014; May 29, 2014; and August 27, 2014, and the checks for the inlet analyzer were performed on November 19, 2013; February 17, 2014; May 22, 2014; and August 26, 2014. RCE verified that the results of all checks met Protocol and Part 75 requirements. The checks for the inlet analyzer were all within the required range (less than 5 percent error) and the checks for the outlet analyzer were all within the required range for high-level gas concentrations and low- and mid-level concentrations for three quarters. For the low-level and mid-level concentrations for the linearity check on November 20, 2013, the errors were greater than 5 percent; however, the range met an alternative criteria defined by Part 75 which also accepts checks if the difference between the average of the monitor response values and the average of the reference values is less than 5 ppm; RCE confirmed that it was for all three checks.

Data Validation

RCE confirmed that the results of all QA/QC checks were within the ranges required by the Protocol and 40 CFR Part 75 Appendix B requirements.

3.7.3 Annual and Semi-Annual Assessments

RCE reviewed the results of the November 8, 2012 RATA conducted by ARI Environmental—a testing body conforming to the requirements of ASTM D7036-04. The results showed the relative accuracy for the inlet and outlet N₂O analyzers and the flow meter to be within the acceptable range and below 7.5 percent, qualifying for the reduced RATA frequency of annually rather than semiannually.

Because of a cancelled RATA in the fourth quarter of 2013 due to an unscheduled facility outage, ARI Environmental conducted the RATA on January 22, 2014. The results showed the relative accuracy for the inlet and outlet N₂O analyzers and the flow meter to be within the acceptable range and below 7.5 percent.

The inlet analyzer and the flow meter failed the bias test during the November 8, 2012 RATA. BAFs were applied to the inlet gas concentrations and the gas flow for the relevant periods during this reporting period as per the requirements of Part 75 Appendix A Section 7.6.5. The BAFs were applied manually in the calculation database. RCE confirmed that all BAFs were applied correctly to the raw data.

Table 3 - Bias Adjustment Factors

Equipment	10/6/13 – 1/22/14*	1/22/14 – 8/20/14*
Inlet Analyzer	1.014	None
Outlet Analyzer	None	None
Flow Meter	1.023	None

*Because the RATA was conducted mid-day on 1/22/14, the BAFs from the 11/8/12 RATA were applied for a partial day on 1/22/14

3.7.4 Missing Data Substitution

Missing data substitution methods were applied for a total of 74 hours for inlet concentration and 20 hours for outlet concentration. There was no missing data substitution for flow. The DAHS automatically calculates the substitute values based on the guidance in the Protocol. ClimeCo manually inserts the substituted values into the raw data. RCE confirmed that these values were appropriately substituted.

3.8 Assessment of GHG Emissions Reductions Calculations

The emission reduction calculations assessment included a review of the historical, baseline, and project assumptions, data inputs, data management, and accuracy of calculations. During the first verification cycle, RCE assessed the information generated from the Historical campaigns. For this reporting period, RCE assessed the data generated from the project campaigns and evaluated the completeness of the data and how it is transferred from Rentech's DAHS to ClimeCo's GHG calculation database.

The Protocol requires a variety of data manipulations to the data as part of the quantification of GHG emission reductions. ClimeCo conducted the data management in a MS Access database file using various queries of the raw data and provided the data to RCE in a MS Excel spreadsheet. RCE reviewed the queries/formulas and data outputs for compliance with the Protocol.

The flow meter and analyzers record at 68°F and 1 atm; RCE confirmed that all data was normalized to 0°C and 101.325 kPa in the calculation database/spreadsheets. ClimeCo also performed unit conversions for some monitoring parameters, and RCE confirmed that the conversions were performed correctly and that the raw data was converted to the units required by the protocol for all parameters.

Historical Campaigns

The project was implemented at an existing NAP. RCE confirmed that five years of historical data were not available; therefore ClimeCo used historical data from the eight previous consecutive campaigns dating from May 20, 2008 to March 20, 2011. The last historical campaign ended immediately prior to the start of the first campaign included in the first reporting period of the Project (accounting for the first 28 days of the reporting period). RCE assessed the raw data and calculations used to determine HNO₃max and the allowable operating conditions (AOCs) for temperature, pressure, and ammonia-to-air ratio. RCE confirmed that all parameters were calculated and measured according to the methods outlined in the Protocol.

- HNO₃max = 204.45 tHNO₃/day
- Oxidation temperature: min. = 843.89°C, max. = 911.11°C
- Oxidation pressure: min. = 6.76 bar, max. = 8.00 bar
- Ammonia-to-Air Ratio: max. = 9.87%

RCE confirmed that values for each historical parameter were used in calculations for both campaigns during this reporting period.

Baseline Emissions

Tertiary abatement projects are required to sample the tail gas prior to entering the tertiary abatement catalyst. The inlet analyzer continuously measures the N₂O concentration in the gas. Since actual average daily operating conditions for pressure, temperature, and ammonia-to-air ratio were outside of the AOCs for periods of time during the reporting period, but less than 50 percent of the time, baseline emissions during these periods were calculated according to the guidance in section 5.2.2 of the Protocol. ClimeCo used the lower of the two options provided for each hour outside of the average daily operating conditions. RCE confirmed that the calculations for percent of time that the plant operated outside of the AOCs were correct and that ClimeCo compared the mean values for oxidation temperature, oxidation pressure, and ammonia-to-air ratio to the AOCs and that they were within the corresponding ranges.

Project Emissions

ClimeCo provided project data for the entire reporting period which included two full campaigns.

RCE verified that the Project campaigns operated inside the established AOCs greater than 50 percent of the campaign, meeting the requirement in the Protocol. RCE also confirmed that the operating conditions during the Project campaigns are representative of AOC by verifying that the mean values for oxidation temperature, oxidation pressure, and ammonia-to-air ratio are within the corresponding ranges defined for the AOC.

RCE confirmed that HNO_{3,RP} was below HNO_{3max,scaled} for both project campaigns. RCE also verified the operating hours for each campaign.

There were no project emissions from ammonia input to operate the tertiary catalyst, from the use of hydrocarbons as a reducing agent, or from hydrocarbons or external energy to reheat tail gas. RCE determined that the emission reduction calculations followed the Protocol and found no material misstatements in the Project GHG reductions calculations and results.

4.0 Verification Results

ClimeCo and Rentech provided sufficient evidence and documentation of their emission reduction estimates, data collection procedures, monitoring, and quality control procedures. The verification process focused on verifying the historical emissions, baseline emissions, and full campaign project emission reductions and the source data used by ClimeCo to quantify the emission reductions in accordance with the Protocol.

During the verification process, RCE made requests for clarifications, corrective actions, and supplemental documentation to complete the verification. The details of RCE's findings are documented in the List of Findings provided to the Reserve and the project developer.

The Project reported emission reductions of 58,955 metric tons of CO₂ equivalents as per the information provided in the calculation summary spreadsheets. During the final review, RCE identified no material misstatements in the data or emission reduction calculations. Table 4 and Table 5 define the emission reductions verified for this reporting period.

5.0 Conclusion

RCE conducted a risk-based analysis of the Rentech Energy Midwest Corporation Nitric Acid Plant 1 Project GHG assertion including a strategic review of the Project data and evidence. Based upon the processes and procedures and the evidence collected, RCE concludes that the Project emission reductions resulting from the destruction of N₂O during the reporting period October 6, 2013 through August 20, 2014 can be considered:

- In conformance with the Reserve's Nitric Acid Production Project Protocol Version 2.0 and ISO 14064-3 standards,
- Without material discrepancy, and
- Verified to a reasonable level of assurance.

The verified emission reductions are listed in Table 4 and Table 5 (note that while RCE confirmed the emission reduction calculations and the total emission reductions to be correct and within the materiality threshold, the values in the table below are summary data only with significant figures rounded for summary purposes in this report):

Table 4 - Emission Reductions Verified for October 6, 2013 – August 20, 2014 by Campaign

Emissions Verified	Baseline Emissions CO₂e (metric tons)	Project Emissions CO₂e (metric tons)	Emission Reductions CO₂e (metric tons)
Campaign 8 11/3/2013 – 4/8/2014	32,116	2,537	29,578
Campaign 9 4/8/14 – 8/20/2014	32,152	2,775	29,377
Total	64,268	5,312	58,955

Table 5 Emission Reductions Verified for October 6, 2013 – August 20, 2014 by Vintage

Emissions Verified	Emission Reductions CO₂e (metric tons)
2013 Emission Reductions	5,511
2014 Emission Reductions	53,444
Total	58,955

Lead Verifier Signature



Nina Pinette

Senior Internal Reviewer Signature



Zach Eyler