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# Nitric Acid Production Protocol

# U.S. Module

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Climate Action Reserve  
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## Abbreviations and Acronyms

|      |                                               |
|------|-----------------------------------------------|
| BACT | Best available control technology             |
| CAA  | Clean Air Act                                 |
| EPA  | United States Environmental Protection Agency |
| NSCR | Non-Selective Catalytic Reduction             |
| SIPs | State Implementation Plans                    |

# 1 Introduction

This document supplements the Nitric Acid Production Protocol (Protocol) by specifying requirements applicable to projects located in the United States. Projects in this jurisdiction must comply with both the Protocol and this module to register greenhouse gas (GHG) emission reductions with the Reserve.

Section headings in this document refer to the Protocol.

## 2 The GHG Reduction Project

### 2.1 Background

Nitric acid production is the largest source of industrial emissions in the U.S.,<sup>1</sup> resulting in significant nitrous oxide (N<sub>2</sub>O) emissions.

In response to the federal Clean Air Act (CAA), most NAPs currently operate with some form of NO and NO<sub>2</sub> (i.e., NO<sub>x</sub>) emission control, usually selective catalytic reduction (SCR) technology and less often non-selective catalytic reduction (NSCR) technology. SCR can have a minor impact on N<sub>2</sub>O emissions (+/- < 5%), while NSCR destroys both NO<sub>x</sub> and N<sub>2</sub>O. However, NSCR is generally not preferred in modern plants because of high energy costs and associated high gas temperatures. N<sub>2</sub>O emissions remain unregulated at nitric acid plants in the U.S.

### 2.2 Project Definition

Newly built nitric acid plants (NAPs) are not eligible – only existing, relocated, or upgraded plants are eligible. Furthermore, the Protocol does not apply to projects at:

- NAPs that are restarted any time after December 2, 2007, after being out of operation for a period of 24 months or longer;
- New NAPs constructed after December 2, 2009, with the exception of new NAPs for which a permit application for construction was submitted to the appropriate government authorities prior to December 2, 2009;
- Secondary catalyst projects at existing NAPs where NSCR is currently operating; or
- Secondary catalyst projects at existing NAPs that have used NSCR technology for NO<sub>x</sub> abatement at any point since December 2, 2007.

If a tertiary catalyst project is installed at an existing NAP where NSCR has operated at any point since December 2, 2007, the NSCR must continue to operate during any period of time for which the project will claim CRTs (any N<sub>2</sub>O abatement that occurs as a result of the pre-existing NSCR is not eligible for emission reduction credits).

### 2.3 The Project Developer

The project developer must be the entity with liability for the emissions of the U.S. NAP, i.e., the entity named on the facility's Title V permit, unless the rights to the emission reductions have been transferred to another entity.

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<sup>1</sup> Kanter, David R., Wentz, J., & Davidson, E. (2025). Abating industrial nitrous oxide emissions in the United States: legal, economic and scientific dimensions. *Climate Policy*, 1–12. <https://doi.org/10.1080/14693062.2026.2662997>

## 3 Eligibility Rules

### 3.1 Location

Under this module, projects located at nitric acid plants located in the United States and its territories are eligible to register with the Reserve.

### 3.5 Additionality

#### 3.5.1 The Performance Standard Test

Projects pass the Performance Standard Test by meeting a performance threshold, i.e., a standard of performance applicable to all N<sub>2</sub>O abatement projects, established on an ex-ante basis by the Protocol.

The Performance Standard Test employed by the Protocol (see Section 3.5.1 of the Protocol) is applicable to NAPs in the U.S.<sup>2</sup>

#### 3.5.2 The Legal Requirement Test

Section 3.5.2 of the Protocol establishes the legal requirements test and the minimum threshold for establishing additionality. As of the Effective Date of this module, the Reserve could identify no existing federal, state, or local regulations that obligate NAPs in the U.S. to abate N<sub>2</sub>O emissions.

##### 3.5.2.1 U.S. EPA GHG Permitting Requirements under the Clean Air Act

Starting on January 2, 2011, the United States Environmental Protection Agency (U.S. EPA) had tried to phase in<sup>3</sup> regulation of GHG emissions from major stationary sources under the Clean Air Act (CAA).<sup>4</sup> Under this rule, commonly referred to as the “Tailoring Rule,” all existing stationary sources emitting more than 100,000 tons (approximately 90,719 MT) of CO<sub>2</sub>e emissions per year were required to obtain Title V operating permits for GHG emissions. However, this rule has since been vacated by legal action in *Utility Air Regulatory Group v. EPA*, 134 S. Ct. 2427 (2014) and *Coalition for Responsible Regulation, Inc. v. EPA*, Nos. 09-1322, 10-073, 10-1092 and 10-1167 (D.C. Cir. April 10, 2015). The EPA issued guidance that these permit restrictions should be rescinded and until that time they will not be enforced.

The Tailoring Rule also required Prevention of Significant Deterioration (PSD) permits that address GHG emissions for (1) new source construction with emissions of 100,000 tons CO<sub>2</sub>e per year or more and (2) major facility modifications resulting in GHG emission increases of 75,000 tons (approximately 68,000 MT) of CO<sub>2</sub>e per year or more.<sup>5</sup> If a facility triggered the PSD requirements and an official BACT review resulted in the mandatory installation of a technology that reduces N<sub>2</sub>O emissions, this activity will not be eligible for carbon credits.

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<sup>2</sup> A summary of the performance standard test analysis is provided in Appendix A.

<sup>3</sup> All major sources already subject to PSD and/or Title V under the Clean Air Act for other pollutants will be subject to EPA’s GHG permitting rules starting January 2, 2011. All sources *not* previously subject to the Clean Air Act will come under the GHG permitting rules on July 1, 2011, assuming they trigger the thresholds noted herein.

<sup>4</sup> U.S. EPA published the final rulemaking, “Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule; Final Rule,” in the Federal Register 3 June 2010. The rulemaking is commonly referred to as the “Tailoring Rule,” and amended 40 CFR Parts 51, 52, 70, and 71. <http://www.gpo.gov/fdsys/pkg/FR-2010-06-03/pdf/2010-11974.pdf#page=1>

<sup>5</sup> “PSD and Title V Permitting Guidance for Greenhouse Gases,” available at: <http://www.epa.gov/nsr/ghgdocs/epa-hq-oar-2010-0841-0001.pdf>

Verifiers will need to review Title V and PSD permits to ensure that projects are able to pass the Legal Requirement Test.

## 8 Verification Guidance

In addition to the requirements in Table 8.1 of the Protocol, Tables 8.1 and 8.2 below outline eligibility criteria for nitric acid projects in the United States. This table does not represent all criteria for determining eligibility comprehensively; verification bodies must also refer to Section 3 of the Protocol and Sections 2 and 3 of this module.

**Table 8.1.** Summary of Eligibility Criteria

| Eligibility Rule | Eligibility Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Frequency of Rule Application                                                           |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Exclusions       | <ul style="list-style-type: none"> <li>Nitric acid plants that are restarted any time after December 2, 2007, after being out of operation for a period of 24 months or longer</li> <li>New nitric acid plants constructed after December 2, 2009, with the exception of new nitric acid plants for which a permit application for construction was submitted to the appropriate government authorities prior to December 2, 2009</li> <li>Secondary catalyst projects at existing nitric acid plants where NSCR is currently operating</li> <li>Secondary catalyst projects at existing nitric acid</li> <li>Plants that used NSCR technology at any point since December 2, 2007</li> </ul> | During the first verification of the initial reporting period for each crediting period |

Table 8.2 below provides items that a verification body needs to address while verifying a nitric acid production project in the U.S., in addition to those specified in Section 8.6 of the Protocol.

**Table 8.2.** Eligibility Verification Items

| Protocol Section | Eligibility Qualification Item                                                                                                                                      | Apply Professional Judgment? |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 2.2              | Verify that the plant is not a newly built plant                                                                                                                    | No                           |
| 2.3              | Verify ownership of the reductions by reviewing the Title V permit, contracts (as applicable), and Attestation of Title                                             | No                           |
| 3.1              | Verify that the project only consists of activities at a single nitric acid plant at a nitric acid production facility operating within the U.S. or its territories | No                           |
| 3.4.2            | Confirm that neither the Title V nor PSD permit for the NAP includes language requiring installation of a secondary or tertiary catalyst                            | No                           |

## Appendix A Summary of Performance Standard Development

The following performance standard analysis was conducted for the development of this module for nitric acid production projects.

### A.1 Federal and State Regulations

A comprehensive review of federal regulations and standards that apply to monitoring and controlling air emissions from nitric acid plants was undertaken by the Reserve, including the New Source Performance Standard and New Source Review programs under the Clean Air Act. The review found that while N<sub>2</sub>O emissions from nitric acid production are not regulated – entities responsible for the production of nitric acid are not required to report on or limit N<sub>2</sub>O emissions from their facilities – existing federal air quality regulations do limit NO<sub>x</sub> emissions from nitric acid production, which may require the use of NO<sub>x</sub> emission controls for some facilities.

Under 1998 EPA NO<sub>x</sub> Transport Rule (also known as the EPA NO<sub>x</sub> SIP Call),<sup>39</sup> EPA called for 23 states in Eastern U.S. to revise their State Implementation Plans (SIPs) and NO<sub>x</sub> budget or emission targets for each of these states to achieve ozone attainment. It also set up a NO<sub>x</sub> emissions trading program in which the states could participate. The definition of NO<sub>x</sub> under the NO<sub>x</sub> SIP is “the sum of nitric oxide and nitrogen dioxide in the flue gas or emission point, collectively expressed as nitrogen dioxide.”<sup>7</sup> There is no specific federal mandate to the states to regulate or monitor N<sub>2</sub>O in the revision of their SIPs.

In response to federal and state regulations, most nitric acid production facilities in the United States are operating some form of NO<sub>x</sub> emission controls. As discussed further below, NO<sub>x</sub> emission controls can indirectly impact N<sub>2</sub>O emissions and therefore the extent to which specific technologies are deployed at nitric acid plants was evaluated to identify common practice for NO<sub>x</sub> and incidentally N<sub>2</sub>O emission controls.

Nitric acid plants with a Title V permit or that are subject to NSPS are required to implement certain monitoring requirements in accordance with Title 40 of the Code of Federal Regulations Part 75 on continuous emission monitoring systems. EPA has also issued a Rule for Mandatory Reporting of Greenhouse Gases under which nitric acid plants are required to report annual GHG emissions data starting in 2010. Nitric acid plants are to undergo an annual performance test under normal operating conditions, without N<sub>2</sub>O emissions controls operating, and to use the emissions data to derive a site-specific emission factor. Alternatively, nitric acid plants can use CEMS for N<sub>2</sub>O to measure and report N<sub>2</sub>O emissions. The mandatory reporting rule does not require implementation of actions to reduce N<sub>2</sub>O emissions.

Under the Clean Air Act, the EPA has also been developing the Clean Power Plan, which will set standards for power plants and drive emission reductions at the state level. Though the U.S. Supreme Court stayed implementation of the Clean Power Plan on February 9, 2016, the Reserve does not anticipate the Clean Power Plan requiring any emission reductions or

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<sup>6</sup> See 40 CFR. §51.121 & §51.122 and <http://www.epa.gov/air/urbanair/nox/effrt.html>.

<sup>7</sup> See 40 CFR. §51.9.

installation of emission reduction technology at nitric acid plants, such as those eligible under this protocol.<sup>8</sup>

## A.2 Current Industry Practice for using NO<sub>x</sub> Emission Controls (2012)

The U.S. EPA maintains a facility-level database to support development of the U.S. national greenhouse gas inventory and published a summary of these data in a technical support document (TSD) for the mandatory GHG reporting rule.<sup>9</sup> The EPA database was assembled from permit data and personal communications with nitric acid facility contacts.

Members of the Nitric Acid Production Project Protocol stakeholder workgroup (assembled for the development of the U.S. Nitric Acid Production Protocol) provided additional information to expand the database. For example, Terra Industries provided the Reserve with data on nine process units it owns and operates in the U.S. These data were used to fill some gaps in the EPA database and to describe two additional process units not in the EPA database.

According to the EPA database, there are 45 nitric acid production facilities operating in 25 states with a total of 65 process units (plants). The EPA database and information provided by Terra Industries were used to summarize data on NO<sub>x</sub> emission control technologies currently in use at 34 N<sub>2</sub>O plants in the U.S. In addition, two workgroup members provided summary data based on their knowledge of the industry and confidential industry surveys. Trends from all sources are shown in Table A.1.

All data sources show SCR as the most common NO<sub>x</sub> emission control technology currently in use, with market penetration of at least 75%. However, the EPA database appears to under-represent the number of process units with NSCR currently installed. Therefore, market penetration for NSCR is more difficult to pinpoint. These data suggest NSCR installations range from 6% to 20% (i.e., 4 to 13 process units).

**Table A.3.** Current Industry Practice for Use of NO<sub>x</sub> Emission Control Technologies

|                                                  | EPA Database<br>(N=34)<br>% (n) | Workgroup Report 1<br>(N=40)<br>% (n) | Workgroup Report 2 (N=60)<br>% (n) |
|--------------------------------------------------|---------------------------------|---------------------------------------|------------------------------------|
| SCR                                              | 76.47% (26)                     | 75% (30)                              | 80% (48)                           |
| Extended absorption                              | 11.76% (4)                      | ---                                   | ---                                |
| NSCR                                             | 5.88% (2)                       | 20% (8)                               | 20% (12)                           |
| None                                             | 5.88% (2)                       | 2.5% (1)                              | ---                                |
| Other (peroxide-based NO <sub>x</sub> abatement) | ---                             | 2.5% (1)                              | ---                                |

According to the EPA data, extended absorption is used by less than a quarter of process units. No information on extended absorption was provided by workgroup members, because it is not widely considered by the industry as an emission control technology *per se*, but rather a standard for production efficiency. The EPA data are surprising, given reports that extended

<sup>8</sup> EPA, "Clean Power Plan for Existing Power Plants," <https://www.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants>

<sup>9</sup> [http://epa.gov/climatechange/emissions/downloads/tsd/TSD%20Nitric%20Acid%20\\_EPA%201-22-09.pdf](http://epa.gov/climatechange/emissions/downloads/tsd/TSD%20Nitric%20Acid%20_EPA%201-22-09.pdf)

absorption is a cost-effective means to increase  $\text{HNO}_3$  production and a standard component of facilities. The Reserve suspects that the EPA database underestimates the number of plants operating with extended absorption.

The most commonly used technology for  $\text{NO}_x$  emission control is SCR. NSCR, which also controls  $\text{N}_2\text{O}$ , was more common before the 1970s; however, since then, SCR technology has been widely applied because of its cost effectiveness. While NSCR is less common, it is still used by as many as 20% of existing process units. Therefore,  $\text{N}_2\text{O}$  is being abated currently at as many as 12 process units. As a result, the opportunities to further destroy  $\text{N}_2\text{O}$  from these facilities are limited.

### **A.3 Industry Practice for Using $\text{N}_2\text{O}$ Emission Controls (2012)**

Installation of  $\text{N}_2\text{O}$  emission controls is not standard industry practice anywhere globally and it has only been recently that the technologies were developed (i.e., since the onset of compliance and voluntary GHG markets). At the time of protocol development, CDM methodologies have been approved for both secondary (AM0034) and tertiary abatement (AM0028). At that time, 42 projects using secondary abatement (following AM0034) were being implemented outside of North America with estimated reductions of 9,942,836 tCO<sub>2</sub>e/year. Fifteen tertiary abatement projects were being implemented outside North America using AM0028 with estimated reductions of 7,415,849 tCO<sub>2</sub>e/year. Since 2010, when the Reserve completed development of its Nitric Acid Plant Project Protocol, Version 1.0, the CDM methodologies have undergone a number of revisions. Since May 31, 2013, the CDM methodology which address  $\text{N}_2\text{O}$  abatement from nitric acid production has been ACM0019 (version 2.0), which is the CDM methodology upon which the NAPPP Version 2.1 protocol update is based.

The EPA database does not cover use of dedicated  $\text{N}_2\text{O}$  emission control technologies (NSCR is reported because of its use as a  $\text{NO}_x$  control technology). However, according to the Terra Industries representative and others on the workgroup, there are only two  $\text{N}_2\text{O}$  abatement units operational in the United States. Both are secondary abatement units operated by Terra Industries. They have been installed at two process units in different locations to demonstrate the efficacy of the technology and to demonstrate positive action towards reducing GHG emissions.

### **A.4 Baseline Scenarios for $\text{NO}_x$ Emission Controls and $\text{N}_2\text{O}$ Emissions**

The most plausible baseline scenario for nitric acid plants with regard to  $\text{NO}_x$  emission controls is for the continued use of SCR technology, which has minimal impact on  $\text{N}_2\text{O}$  emissions. This includes at existing, upgraded, relocated, or restarted plants. SCR technology enables compliance with existing  $\text{NO}_x$  regulations, is cost effective compared to other  $\text{NO}_x$  control technologies, and is considered the industry standard. Historically, there was a transition from using the older, now outdated NSCR technology to SCR and there is little chance for reversing that trend under business as usual conditions.

Nitric acid plants currently operating with NSCR are likely to continue using this technology unless they undergo a significant plant upgrade. In cases where NSCR is replaced with SCR, there are implications for  $\text{N}_2\text{O}$  emissions (i.e., a shift from NSCR to SCR would increase  $\text{N}_2\text{O}$  emissions in the baseline scenario). In addition, the opportunity for additional  $\text{N}_2\text{O}$  emissions reductions from plants operating NSCR are relatively small compared to plants operating SCR or no  $\text{NO}_x$  controls.

There are believed to be very few process units operating without some form of NO<sub>x</sub> emission control and in the event that emission controls would need to be added to these process units, it is probable that SCR would be the chosen technology.

## **A.5 Common Practice for Nitric Acid Production Levels**

If a facility produces HNO<sub>3</sub> in excess of what would be produced under business as usual, a case can be made that more N<sub>2</sub>O is generated and controlled by the abatement technology than would otherwise, resulting in emission reductions that should not be considered additional.

Industry representatives on the stakeholder workgroup for this protocol contend that the economics of HNO<sub>3</sub> production make this scenario implausible as production levels are driven entirely by natural gas prices and market demand for raw and upgraded nitric acid products, and the cost to produce HNO<sub>3</sub> exceeds the potential revenue from carbon credits, based on current market conditions. (According to the workgroup, the current cost to produce one metric ton of 100% HNO<sub>3</sub> is approximately \$90, with the corresponding potential to reduce about 2.5 metric tons of CO<sub>2</sub>e.)

## **A.6 2026 Review of the Performance Standard Test**

The Reserve reviewed the Performance Standard Test to determine if there have been changes to common practice in the nitric acid industry in the U.S. As of the Effective Date of this module, it remains valid and continues to apply, as there have been no material changes in available data or in prevailing common practice.

# Acknowledgements

## Expert Consultation

This module was modified from the U.S. Nitric Acid Production Protocol Version 3.0. The list of workgroup members below comprises all individuals and organizations who have assisted in developing and updating various versions of the U.S. Nitric Acid Production Protocol. Not all members were involved in every protocol revision process. For more information, see the Reserve Program Manual.

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