# Nitric Acid Production Project Protocol Public Workshop

CLIMATE ACTION RESERVE

November 3, 2009
Call-in number: 773-945-1010
Access code: 277-511-609

# Agenda

- Climate Action Reserve background
- Protocol development process
- Introduction to the Nitric Acid Production Project Protocol
  - Project definitions
  - Eligibility rules
    - Development of performance standard
  - GHG assessment boundary
  - Calculations
  - Monitoring and reporting requirements
  - Verification guidance
- Next steps
- Q&A

# What is the Climate Action Reserve?

- Non-profit GHG offsets registry
- Develop high-quality project standards and register/track offset credits in public online system
- Ensure environmental integrity and quality of offset credits
- Intended to be the premier place to register carbon offset projects for North America
- Reserve stats:
  - 144 account holders
  - 109 projects total with 75 projects listed
  - 15 projects registered with 1.65 million CRTs issued
  - Projects in 35 states

# Protocol Development Goals

- Develop a standardized approach for quantifying, monitoring and verifying GHG reductions from nitrous oxide ($N_2O$) emissions abatement projects at nitric acid plants in the U.S.
- Maintain consistency with or improve upon existing methodologies
- Ensure accuracy and practicality of projects

# Principles of Reserve Project Accounting

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- **Real:** Reductions have actually occurred, and are quantified using complete, accurate, transparent, and conservative methodologies
- **Additional:** Reductions result from activities that would not happen in the absence of a GHG market
- **Permanent:** Reductions verified ex-post, risk of reversals mitigated
- **Verified:** Emission reports must be free of material misstatements, confirmed by an accredited verification body
- **Owned unambiguously:** Ownership of GHG reductions must be clear
- **Not harmful:** Negative externalities must be avoided
- **Practicality:** Project implementation barriers should be minimized

# The Standardized Approach

Benefits to a top-down approach:

- Low up-front costs to project developers
- Efficient review and approval of projects
- Transparency and consistency
- Same approach applies across projects
- Prescriptive guidance to eliminate judgment calls

*But*...high initial resource investment to program

# Protocol Development Process

- Internal protocol scoping
- Form multi-stakeholder workgroup
- Legal requirements and performance standard  research
- Draft protocol
- Send draft through workgroup process
  - Workgroup provides technical expertise and practitioner experience
  - Period meetings and individual consultation when needed
- Draft protocol released for public review
- Public comments incorporated
- Protocol submitted to Reserve board for adoption

# Protocol Timeline

| | |
|---|---|
| *Public Scoping Meeting* | *May 19* |
| *Workgroup Meeting 1* | *August 5* |
| *Draft protocol to workgroup* | *September 3* |
| *Workgroup Meeting 2* | *September 10* |
| *Workgroup Meeting 3* | *October 15* |
| Public comment period | October 14 - November 10 |
| Public workshop | October 23 |
| Protocol adoption by Reserve Board | December 2 |

# Workgroup

| | |
|---|---|
| Kevin Townsend | Blue Source, LLC |
| Lei Guo | California Air Resources Board |
| William Flederbach | ClimeCo America Corporation |
| Trine Kopperud | DNV |
| William Herz | The Fertilizer Institute |
| Marten von Velsen-Zerweck | N. Serve Environmental Services |
| David Hind | Orica Canada Inc /ANNA |
| Jim Schellhorn | Terra Industries Inc. |
| Mausami Desai | U.S. Environmental Protection Agency |
| Nathan Frank | U.S. Environmental Protection Agency |

# Project Protocol Components

| | |
|---|---|
| Define the GHG reduction project | Section 2 |
| Determine eligibility | Section 3 |
| Establish the GHG assessment boundary | Section 4 |
| Calculate GHG reductions<br>– Baseline emissions<br>– Project emissions | Section 5 |
| Monitoring requirements | Section 6 |
| Reporting requirements | Section 7 |
| Verification guidance | Section 8 |

# Project Definition– Eligible Projects

- At existing, relocated and upgraded NAPs
  - includes “restarted NAPs”, idle for less than 24 months
- At NAPs that used NSCR before December 2007

- **Non- Eligible NAPs:**
  - At NAPs that have been idle for more than 24 months
  - At NAPs constructed after the effective date of the protocol
  - At NAPs using NSCR now or anytime since December 2007

# Project Definition– Eligible Projects

- Possible refinements to eligibility criteria:
  - Getter gauze requirement
  - Clarification on when a NAP is considered new versus existing (i.e., when does “construction” begin)
  - Considering allowing NAPs with NSCR to implement tertiary projects
    - Otherwise, some GHG reduction potential could be missed
    - Provided the existing methodology can be easily adapted

# Project Definition– $N_2O$ abatement technologies

- Secondary abatement project
  - Installment of a dedicated catalyst inside or immediately below the ammonia oxidation reactor
- Tertiary abatement project
  - Installment of a dedicated catalyst in the tail gas leaving the absorption tower
  - Installment of a NSCR unit to destroy $N_2O$ along with $NO_x$

# Project Definition (cont.)

- Each NAP can have only one project or one type of abatement technology
- A nitric acid facility that has multiple NAPs may have multiple projects
- What happens when a project switches technologies?
  - Original technology is decommissioned
  - GHG reductions are based on new technology only
  - Project is revised, but not restarted (project continues under same crediting period)

# Eligibility Rules

| | |
|---|---|
| **1. Location** | **U.S. and its territories** |
| **2. Project Start Date** | **- Not earlier than December 2, 2007**<br>**- Within 6 months prior to project submission** |
| | **Projects that started between Dec. 2007 and Dec. 2009 must be listed by December 2010** |
| **3. Additionality** | **Exceed legal requirement** |
| | **Meet performance standard** |
| **4. Regulatory Compliance** | **Compliance with all applicable laws** |

# Project Crediting Period

- Crediting period is 10 years
- Maximum of two crediting periods per project
- Crediting period will end if $N_2O$ abatement is legally required or $N_2O$ emissions from NAPs are capped

# Legal Requirement Test

- Regulatory analysis identified no existing laws or regulations that obligate $N_2O$ abatement at NAPs
- Project developers required to submit signed Regulatory Attestation for each verification
- Emission reductions can be reported up until date $N_2O$ is legally required to be abated or $N_2O$ from NAPs is capped

# Performance Standard Research

- $NO_x$ controls are required in some circumstances and the technology chosen for $NO_x$ abatement could impact $N_2O$
- Common practice for $NO_x$ and $N_2O$ emission controls
  - Two NAPs in the U.S. have $N_2O$ abatement technology
  - Most NAPs have $NO_x$ controls:
    - SCR: most common (75-80%)
    - NSCR: least common (5-20%)
  - NSCR also destroys $N_2O$
  - SCR may have a slight impact +/- on $N_2O$

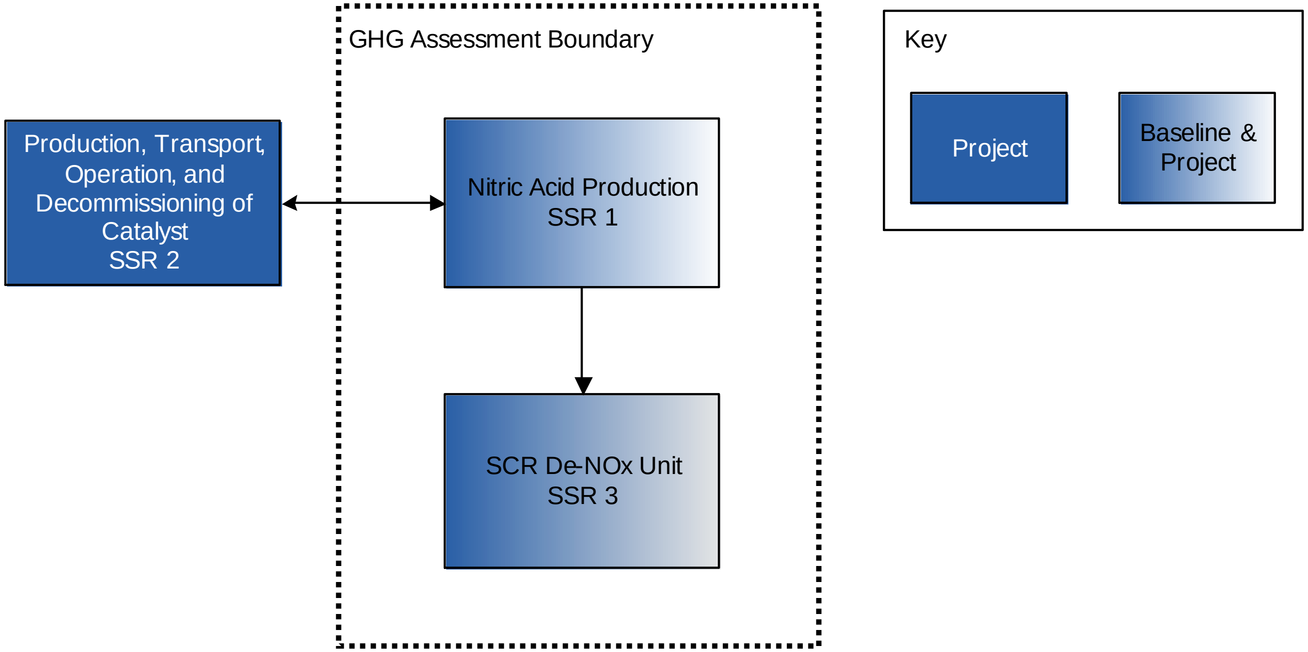
# Performance Standard Research

- Analysis of baseline scenarios for emission controls
  - Most likely baseline scenario is for NAPs to continue using existing $NO_x$ control, which is SCR in most cases
  - Switching from NSCR to SCR for $NO_x$ abatement would increase baseline $N_2O$ emissions (but scenario is unlikely)
  - Installing NSCR is not likely at NAPs where no $NO_x$ controls are in place under business usual
  - GHG market is the only incentive to install secondary or tertiary catalysts
  - Cost of $HNO_3$ production is greater than potential revenue for GHG reductions based on current market conditions

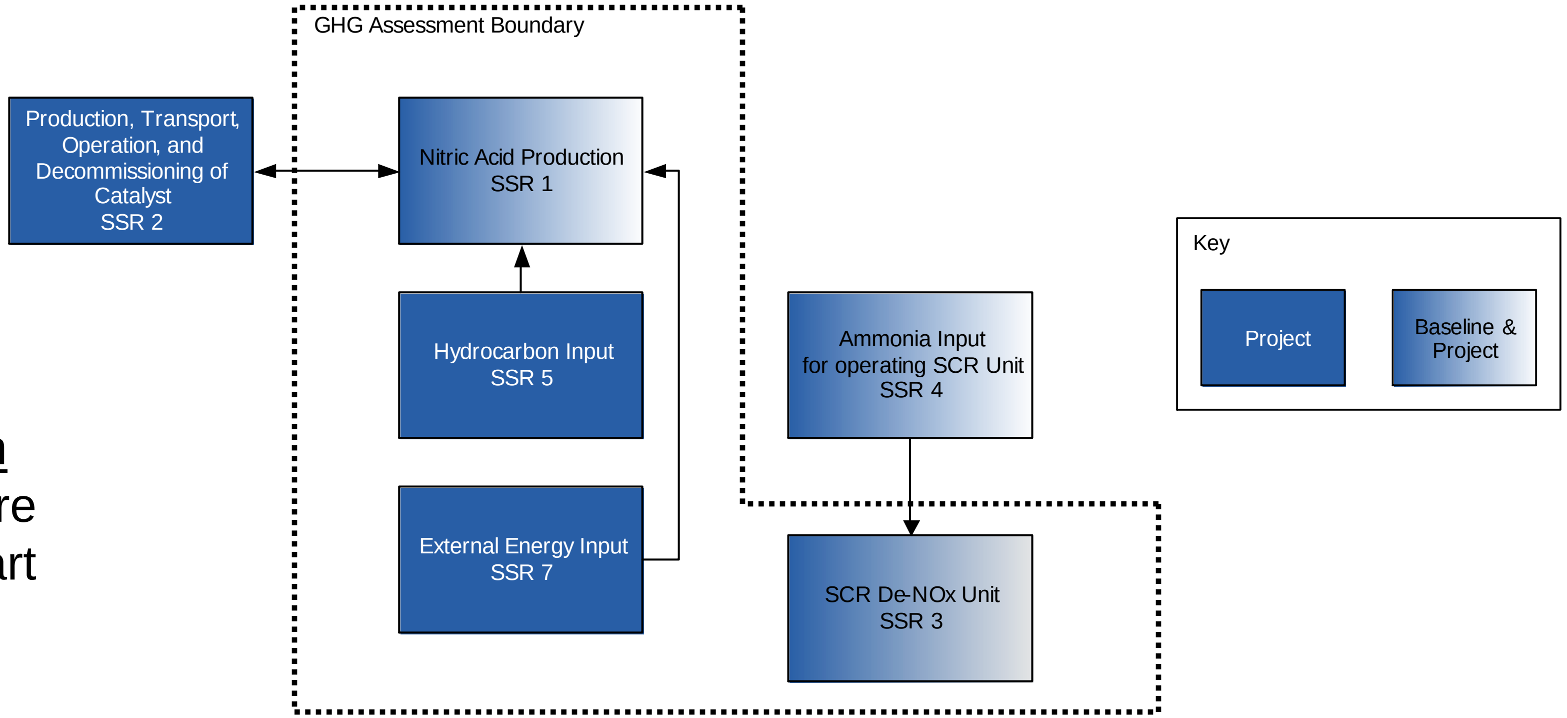
# Performance Standard

- Technology-specific threshold
- Installation of one of the following $N_2O$ abatement technologies:
  - Secondary catalyst
  - Tertiary catalyst
  - NSCR
- None of these are common practice in the U.S.
  - NSCR has a history of use, but is not the current norm

# GHG Assessment Boundary: Secondary Catalyst Projects



# GHG Assessment Boundary: Tertiary Catalyst Projects




NAPs with SCR before project start

# GHG Assessment Boundary: Tertiary Catalyst Projects

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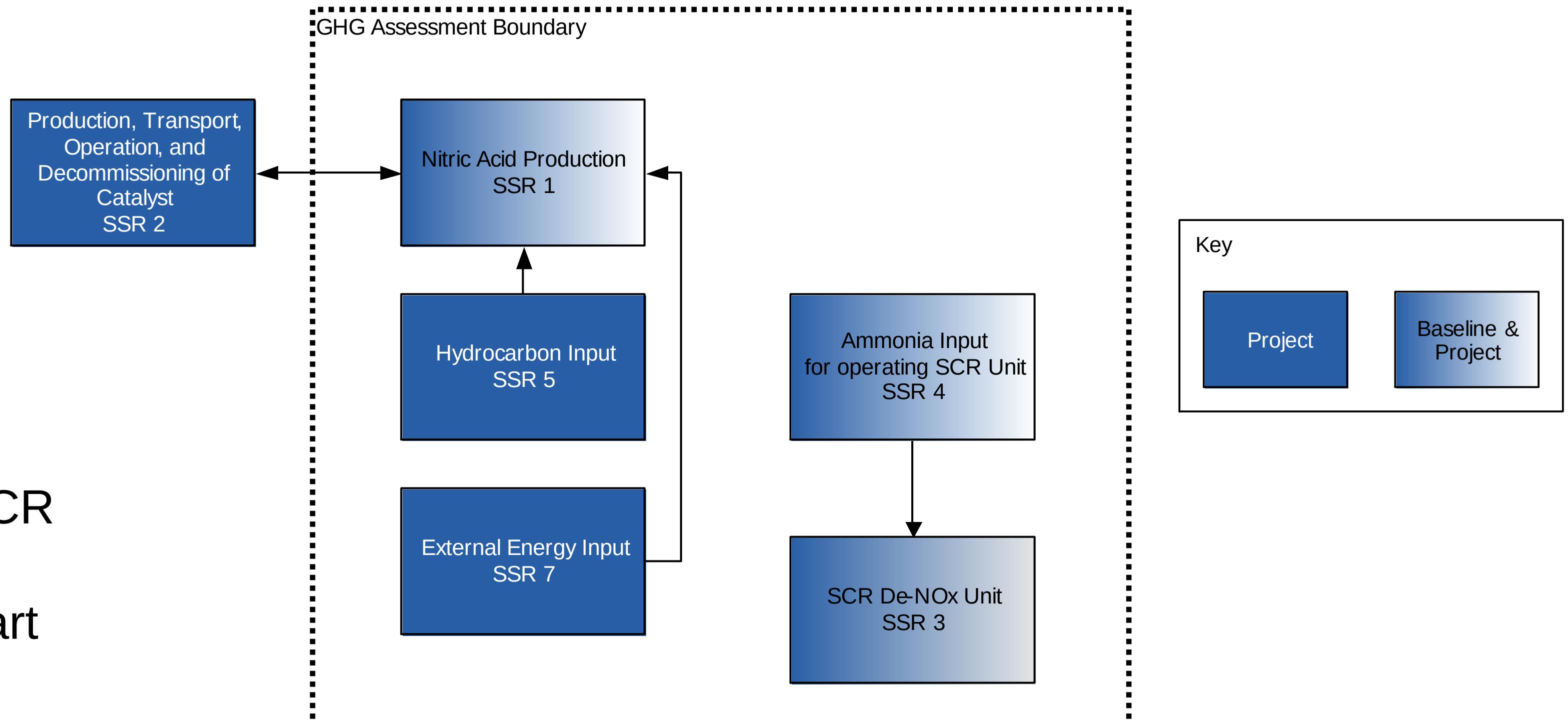


NAPs
<u>without</u> SCR
before
project start

# Emission Reductions: Secondary Catalyst Projects

$$ER = (EF_{BL} - EF_{P}) \times HNO3_{ER} \times GWP_{N2O}$$

- Equation 5.1
- Difference in baseline and project emission factor (EF)
- EF is metric tons $N_2O$ per metric ton $HNO_3$ produced
- Times nitric acid production ($HNO3_{ER}$), which is either:
  - Historical average total output of 100% conc. $HNO_3$ per campaign
  - Or, $HNO_3$ produced during the project campaign
- Calculated at end of each project campaign, in $CO_2e$

# Historical $HNO_3$ Production

- Purpose: to provide assurance that $HNO_3$ production levels are consistent with business as usual
- Based on average of 5 campaigns of data
- For NAPs upgraded within 24 months before the project starts or anytime during the project, historical production is based on data from before the upgrade
- For all other NAPs, based on data used to determine POC
- To improve how well the data represent historical conditions, the Reserve is considering either:
  - (1) extending the time period used to define the average, e.g., to 5 years or
  - (2) basing historical production on the maximum instead of the average

# Baseline Emission Factor ($EF_{BL}$)

- Equations 5.2 and 5.3

$$EF_{BL} = BE_{BC} \div HNO3_{BC}$$

$$BE_{BC} = VSG_{BC} \times NCSG_{BC} \times OH_{BC} \times 10^{-9}$$

  - Continuously measure gas flow ($VSG_{BC}$) and $N_2O$ ($NCSG_{BC}$) in the stack
  - Baseline sampling period ($OH_{BC}$): at minimum, sampling occurs the first 10 weeks of a campaign and before installing the secondary catalyst
  - To account for distortions before and after downtime or malfunctions, data outside of 95% confidence interval are eliminated before calculating $BE_{BC}$

# Permitted Operating Conditions (POC)

- Purpose: to ensure $N_2O$ emissions during baseline sampling are representative of typical conditions and comparable to those during the project
- Permitted ranges of the following must be determined:
  - Oxidation temperature and pressure in ammonia oxidation reactor
  - Ammonia gas flow rates and ammonia to air ratio input to ammonia oxidation reactor
    - Note: considering removing ammonia gas flow rates as permitted variable
- Determined by:
  - Historical data on operations from the previous 5 campaigns
  - Operating manuals and ammonia oxidation catalyst specifications
  - Or, combination of above
  - Ranges constrained by eliminating extremes (upper and lower 2.5 percentiles are dropped)
  - Determined from data post-upgrade or -relocation, if applicable

# Permitted Operating Conditions (POC)

- If the NAP operates outside of POC at anytime during baseline sampling, data for that time period are eliminated
- If the NAP operates outside of POC for more than 50% of the duration of the baseline sampling period, the data are invalid and baseline must be repeated
- Statistical evaluation required to determine if  baseline operating conditions are significantly different than POC.
  - If so, then the data are invalid and baseline must be repeated

# Campaign Length Cap ($CL_{cap}$)

- Purpose: to ensure baseline emission factor represents typical operations, the baseline sampling period must not exceed average historical campaign length
  - $N_2O$ emissions tend to increase over time during a campaign
  - Longer than typical campaigns can overestimate baseline emissions
- Determined by:
  - For all NAPs (including upgrades) $CL_{cap}$ is average historical $HNO_3$ production during the time period used to establish POC
- Application:
  - If $HNO_3$ production during baseline sampling exceeds $CL_{cap}$, then values measured beyond $CL_{cap}$ are eliminated

# Project Emission Factor ($EF_P$)

- Measured for duration of each campaign following the start of the project
- Same as baseline approach (see Equations 5.4 and 5.5)
  - Continuously measure the stack gas volume flow and $N_2O$ concentration and use data to calculate $N_2O$ emissions
  - Divide total $N_2O$ emissions by $HNO_3$ produced during the project campaign
  - Values outside the 95% confidence interval around the mean are excluded
  - If NAP operates outside POC for more than 50% of the time, data are invalid
  - Operations may not be significantly different statistically than POC

# Emission Reductions: Tertiary Catalyst Projects

$$ER = BE - PE$$

- Equation 5.6
- Emission reductions are the difference between baseline and project emissions
- Calculated at end of each reporting period during the project crediting period

# Baseline Emissions

$$BE = \left( \sum_{i}^{n} F_i \times CI_{N_2O,i} \times M_i \right) \times GWP_{N_2O}$$

- Equation 5.7
- Source: $N_2O$ from nitric acid production ($N_2O$ in the tail gas before tertiary abatement unit)
- Continuously measure:
  - $N_2O$ concentration ($CI_{N2O,i}$) at the inlet
  - Gas flow rate at a location near the tertiary abatement unit ($F_i$)
- Calculate $N_2O$ for each interval i (M is length of the interval)
- Summarize over the reporting period (n) and convert to $tCO_2e$

# Baseline Emissions

$$BE = \left[ \left( \sum_{i}^{n} F_i \times CI_{N_2O,i} \times M_i \right) \times GWP_{N_2O} \right] \times {HNO3_{AVG}} / {HNO3_{RP}}$$

- If $HNO_3$ produced during the reporting period ($HNO3_{RP}$) exceeds the historical average ($HNO3_{AVG}$), then the above equation must be used
- Historical average determined the same way as in secondary catalyst projects, but scaled from a per campaign basis to the reporting period length

# Permitted Operating Conditions (POC)

- Determined in the same way as secondary catalyst projects
- If pressure and temperature are outside POC ranges at anytime during interval i, baseline emissions during that interval are the lowest of:
  - $N_2O$ emissions measured during that interval
  - $N_2O$ emissions calculated using the IPCC default emission factor of 4.5 $kgN_2O/tHNO_3$ and $HNO_3$ production during the interval
- If daily ammonia flow rate exceeds upper limit of POC, then baseline emissions are based on the IPCC default factor for that day
- If NAP operates outside POC for > 50% of the time, data are invalid
- Operations may not be significantly different statistically than POC

# Project Emissions

$$PE = PE_{N_2O} + PE_{NH} + PE_{HC} + PE_{EE}$$

- Equation 5.8
- Sources:
  - $N_2O$ at outlet to tertiary abatement unit
  - GHG from external energy used to heat tail gas
  - GHG from hydrocarbons (reducing agent or reheat tail gas)
  - GHG from ammonia production

# Project Emissions: $N_2O$

$$PE_{N_2O} = \left( \sum_{i}^{n} F_i \times CO_{N_2O,i} \times M_i \right) \times GWP_{N_2O}$$

**OR**

$$PE_{N_2O} = \left[ \left( \sum_{i}^{n} F_i \times CO_{N_2O,i} \times M_i \right) \times GWP_{N_2O} \right] \times {HNO3_{AVG}} / {HNO3_{RP}}$$

- Equation 5.9
- Same as Eq. 5.7 (Baseline $N_2O$ emissions), except:
  - concentration is measured at the outlet

# Project Emissions: Other Sources

- Amount of additional ammonia input times an ammonia production GHG emission factor (Equation 5.10)
- Amount of hydrocarbon used and amount converted to $CO_2$ and not converted, i.e., remaining as $CH_4$ (Equations 5.11, 5.12, and 5.13)
- External energy use based on net change in steam import, tail gas utilization, and tail gas heating (Equations 5.14, 5.15, and 5.16)

# Monitoring Requirements

- Develop a Monitoring Plan for verification
  - Procedures that will be followed to meet protocol requirements (e.g. Legal Requirement Test)
  - Frequency of data collection
  - Record-keeping plan
  - Meter calibration
  - QA/ QC
- Installation and certification of CEMS prior to project start date
- Follow Code of Federal Regulations Title 40, Parts 60 and 75 and specified appendices for CEMS

# Monitoring Parameters

- Collect data for all parameters found in Table 6.1 and Table 6.2
- Volume flow rate of the stack gas and/or tail gas
  - measured continuously
  - recorded every 1 minute
- $N_2O$ concentration in the stack gas and/or tail gas
  - measured continuously
  - recorded every 1 minute
- Temperature and pressure of inlet flow and ammonia-to-air ratio
  - measured continuously
  - recorded every hour
- Nitric acid produced
  - measured and recorded daily
- Additional energy/ammonia input for tertiary catalyst projects

# CEMS Requirements

| | |
|---|---|
| Accuracy testing and audit (RATA) | EPA test method 320 or<br>ASTM D6348-03 for FTIR spectroscopy |
| Calibration procedures | Performance Specification 2, 40 CFR Part 60 Appendix B and<br>40 CFR Part 75 Appendix A |
| Frequency of testing | 40 CFR Part 75 Appendix B |
| QA/ QC requirements and data management | 40 CFR Part 75 Appendix B |
| Missing data substitution | §75.33 of 40 CFR Part 75 |

# Project Documentation

Required project documentation (will be made publicly available on Reserve website) includes:

- Completed Project Submittal form
- Project diagram*: diagram of the NAP, showing where the project is located within the NAP
- Signed Attestation of Title
- Verification Report+
- Verification Opinion+
- Signed Regulatory Attestation+

* Must be updated if a NAP upgrades or if there is a change in project activities

\+ Submitted for each reporting period

# Reporting and Record Keeping

- Reporting period cannot exceed 12 months
  - except for the first verification
- Reporting can be based on production campaigns (not exceeding 12 months)
- Reporting periods are contiguous for the crediting period
- Detailed record keeping requirements in Section 7.3
  - Independent verification and historical documentation
  - Records to be kept by project developer for 10 years after info is generated or 7 years after the last verification
  - Information will not be publicly available

# Verification Guidance

- Three resources containing verification guidance:
  - NAP project-specific guidance in Section 8
  - General verification guidance in Verification Program Manual
  - Program Manual
- ISO- accredited verification bodies must be trained by the Reserve for this project type (dates TBA)
- Allows for “joint project verification” - single verification body to very multiple projects at a single nitric acid production facility
  - Verifier may submit one NOVA/COI form, conduct one site visit, and prepare one verification report per facility

# Verification Activities

- Verify project eligibility criteria
- Identify emission sources, sinks and reservoirs
- Review application of the protocol methodology and management systems used to gather data
- Verify emission reductions estimates
  - Determine whether material misstatements occurred
- Table 8.2: Summary of items to be verified and where professional judgment is applied

# Next Steps

- Submit written comments via Reserve webpage
  - Deadline is **5 PM PST on November 10, 2009**
  - Comments will be made public

- Summary of comments with responses and final protocol will be posted on Reserve webpage week of November 30

- Will be presented to Reserve Board on December 2, 2009
  - Opportunity for public comment in person or via conference call

# Contacts

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