Overview of the Climate Action Reserve

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CLIMATE ACTION RESERVE

Workshop on Nitric Acid Production Projects
Houston, TX
September 21, 2010

Background on the Climate Action Reserve

- Chartered by state legislation in 2001
  - Mission is to encourage early voluntary actions to reduce emissions and to have such emissions reductions recognized
    - Initially focused on emission reporting and reductions by member organizations
    - Now on emission reduction projects generating offsets
- Balances business, government, and environmental interests

Board of Directors

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- California EPA
- Duke University
- Environmental Defense Foundation
- Goldman Sachs
- Metropolitan Water District
- National Institute of Ecology of Mexico
- Natural Resources Defense Council
- New Resource Bank
- NRG Energy
- Pacific Gas & Electric
- Shell Oil Company
- Sierra Club

Objectives of the Reserve

- Encourage actions to reduce greenhouse gas emissions
- Show that carbon offsets can be a useful tool in addressing climate change
- Model an offset program that has environmental integrity but is not burdensome to use
- Create value for the North American carbon market
  - For project developers: High value projects
  - For buyers: Confidence in offsets they are buying
- Provide technical resources on offset standards and policy

What We Do

1. Develop High Quality Standards
   - Convene stakeholders and lead development of standardized protocols for carbon offset projects

2. Manage Independent Third Party Verification
   - Training and oversight of independent verification bodies

3. Operate a Transparent Registry System
   - Maintain registry of approved projects
   - Issue and track serialized credits generated by projects

What makes the Reserve different?

Recognition

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Recognized and Supported by:

- California Air Resources Board
- State of Pennsylvania
- Voluntary Carbon Standard (VCS)
- Leading environmental organizations:
  - Environment America
  - Natural Resources Defense Council (NRDC)
  - Environmental Defense Fund
  - Union of Concerned Scientists
  - Sierra Club
  - Wilderness Society

What makes the Reserve different?

Transparency

- Unparalleled transparency makes the Reserve unique
- Public reports include:
  - All protocols and associated documents
  - List of all account-holders
  - List of all projects and all project documents
  - List of all issued CRTs for every project
  - All retired CRTs

What makes the Reserve different?

Performance Standard

- Why a performance standard is different
  - The hard work is upfront
  - Assess industry practice as a whole, rather than individual project activities
- Less subjective determination to qualify
- More certainty in amount of credits
- Lower risk for developers and investors
- Faster project processing

What makes the Reserve different?

Scalability

- In 12 months, we have increased from 40 to 350 projects with just three additional staff.
  - We still process submitted documents in two weeks
  - Performance standard: Once the standards are in place, not much staff time to review a project
  - Verification: 15 verification bodies and more going through ANSI program
  - Software: Very robust system, operated by APX
- We can continue to expand to meet compliance market needs

What makes the Reserve different?

Separation of Roles

- Reserve does not fund or develop projects
- Does not take ownership of offsets
- Is not an exchange
- Is a 501(c)3 not-for-profit organization
- Independent third-party verification
  - Consistent with international standards
  - Accreditation done by ANSI
  - Assiduous oversight of verifiers

What makes the Reserve different?

Connecting Markets

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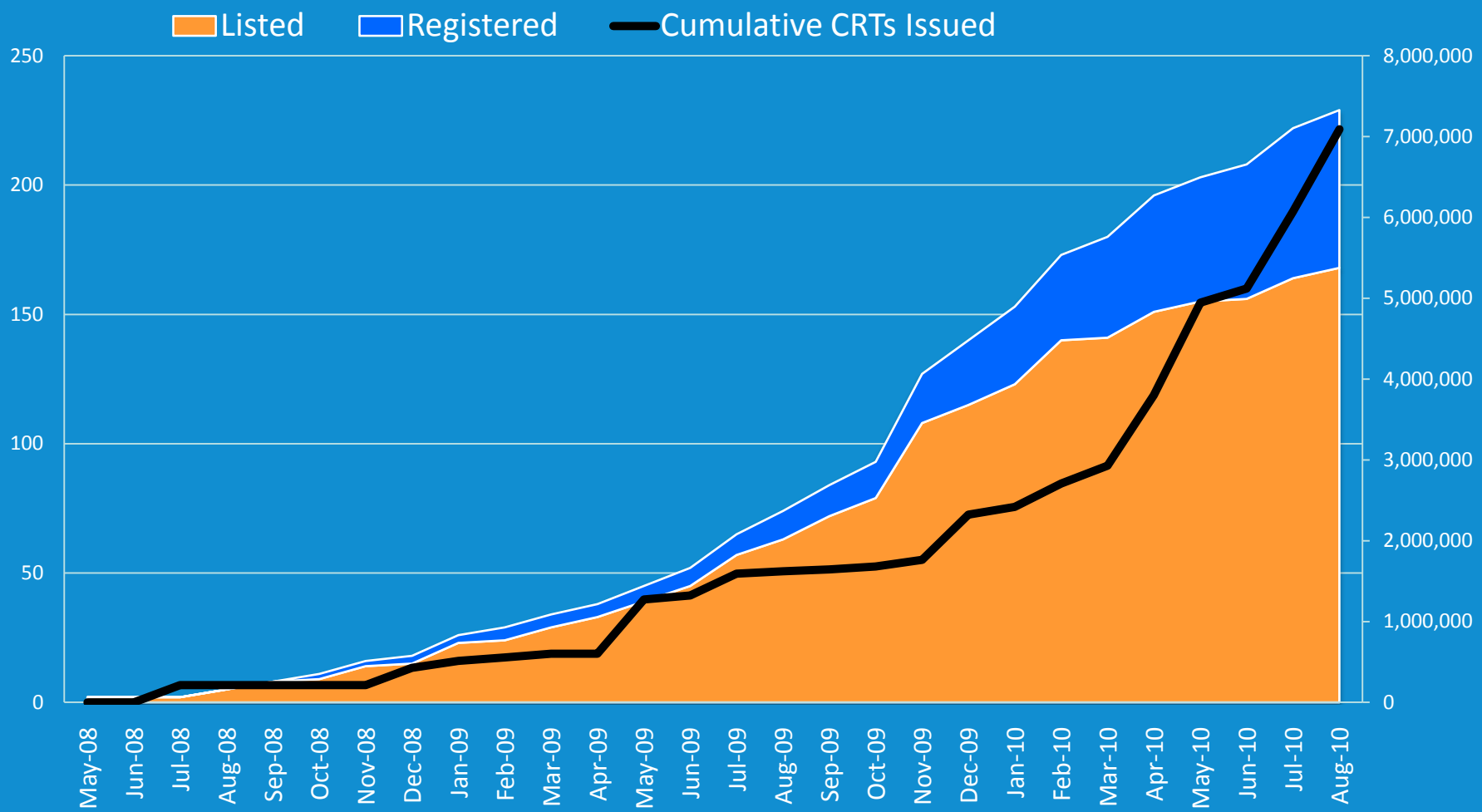
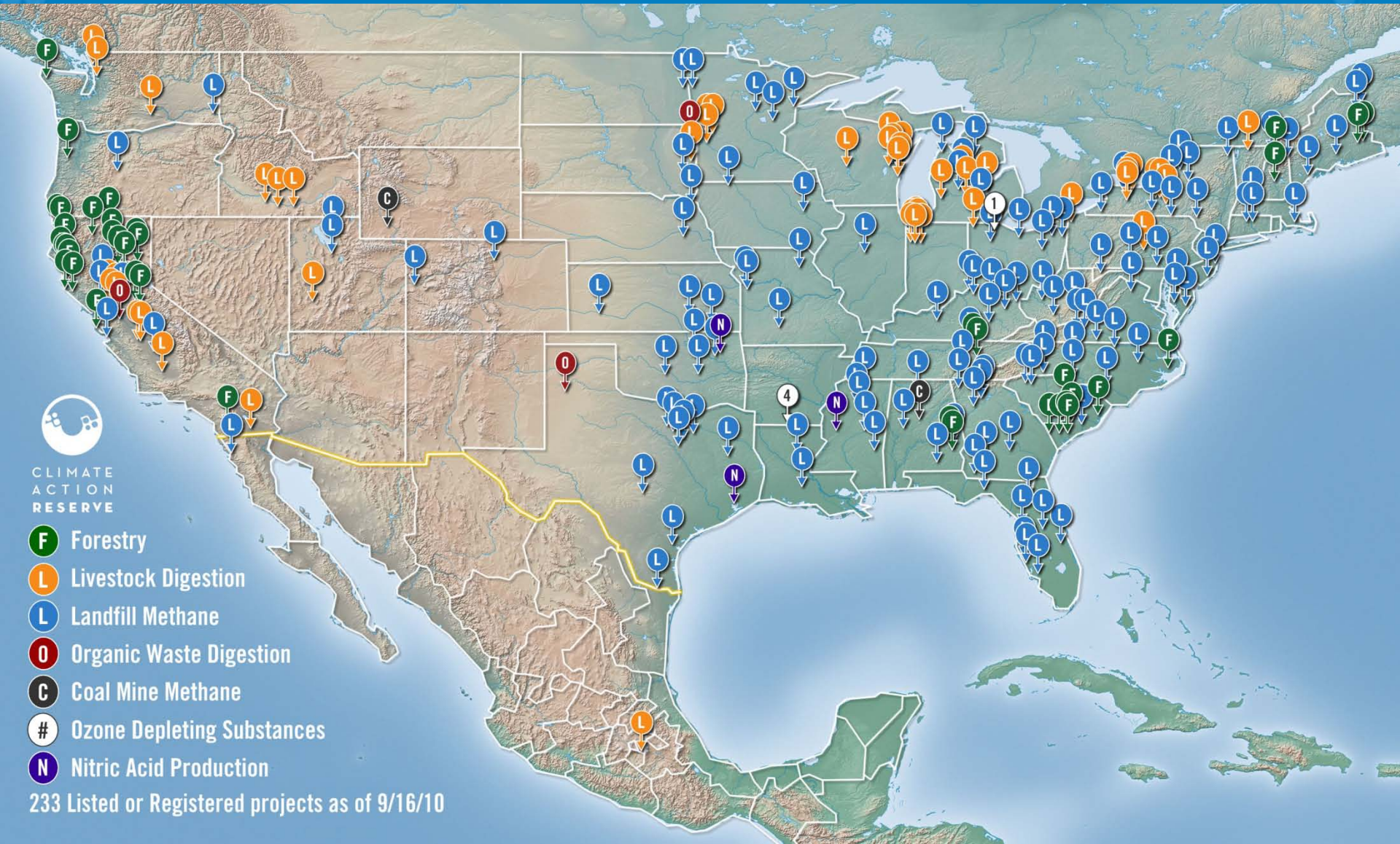
- CRTs are used in voluntary market today
- Many buyers expect that projects will be usable for compliance in California, Western Climate Initiative or in a national system
  - Regulators have yet to make decisions
  - The Reserve "is considered the premier pre-compliance offset standard." (*State of the Voluntary Carbon Markets 2009)*
- Provides project developers with multiple options for selling their projects

Offset projects in the Reserve



It’s not just California



Reserve stats

Launch date	**May 2008**
CRTs registered	**7.25 million**
Account holders	**345**
Projects submitted	**365**
Exchanges	**CRT futures are traded on:** • **Chicago Climate Futures Exchange (CCFE)** • **Green Exchange**
Recent prices	**$2-7 per CRT**

Our Protocols

- Developed with broad public input
- Goal is to create a uniform standard that is widely recognized and builds on best practice
  - We incorporate the best elements of other protocols
  - We do not adopt protocols from other programs (i.e. CDM, Gold Standard, VCS, etc.)
- Designed as step-by-step instructions on project development

The Big 5 Tests

- REAL
  - It can be accurately measured.
- ADDITIONAL
  - Occurs outside of any regulatory requirement
    - Including outside capped sector
  - Would not have occurred but for the incentive provided by a GHG market.
- VERIFIABLE
  - It can be independently verified.
- ENFORCEABLE
  - Its ownership is undisputed.
- PERMANENT

Protocol Development Process

1. Literature review
2. Scoping/kick-off meeting
3. Multi-stakeholder workgroup formation
4. Draft protocol to workgroup
5. Revised draft released for public comment
6. Public workshop
7. Adoption by Reserve board in public session
    - It is unique for a non-profit Board to meet in public

Existing Protocols

- Forestry
  - Improved forest management
  - Avoided conversion
  - Reforestation
- Urban forestry
- Landfill gas capture (US & Mexico)
- Livestock methane capture (US & Mexico)
- Organic waste digestion
- Coal mine methane
- Nitric Acid Production
- Ozone Depleting Substances (US & Article 5 sources)
- Organic Waste Composting

Protocols Under Consideration

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Agriculture and Biological Sequestration

- Soil Conservation
- Nutrient Management
- Rice Cultivation
- Tidal Wetlands Restoration
- Biochar

Industrial Processes

- Boiler Efficiency
- Natural Gas T&D Systems

Transportation

- Truck Stop Electrification

International Expansion

- Mexican Forestry *
- Canadian Protocols

**** In-progress***

Renewable Energy and Energy Efficiency Protocols

- No renewable energy protocol is planned
  - You may be able to generate RECs through other programs from methane destruction projects if you are generating electricity
- No electrical energy efficiency/green building protocols are planned
  - This is only for electricity. We are planning a natural gas efficiency protocol
- Why? Electricity is certain to be a capped sector under any GHG regulation

Steps to Register a Project

1. Open an account on the Reserve
2. Submit project for listing
   - Project submittal form and documents
3. Conduct project activities
4. Select verifier
   - Verifier submits conflict of interest form
5. Submit project documents, verification report and verification opinion
6. Project registered and CRTs issued

The Reserve process

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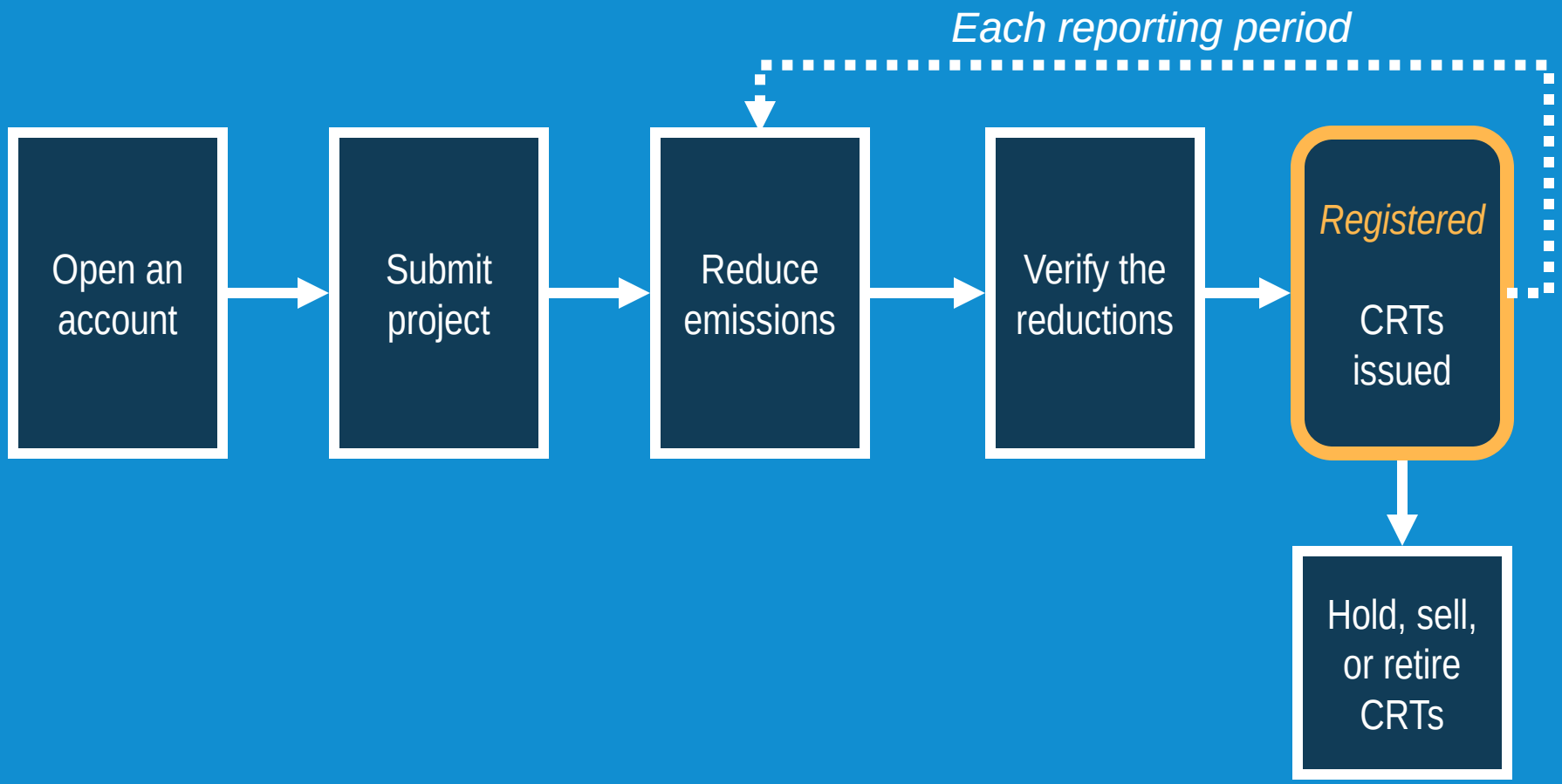

Verification

- Verification bodies (VBs) must get accredited to ISO standards by American National Standards Institute (ANSI)
- Lead Verifiers must take protocol-specific and general Reserve training
- Developer hires accredited and trained VB
  - VB makes determination as to the accuracy of reported CRTs
  - Project documents, verification report and verification opinion submitted to the Reserve
- VB submits NOVA/COI form and receives approval from Reserve to proceed

Transferring Credits

- Developer contracts to sell CRTs to a buyer
  - Financial transaction is outside of the system
  - Buyer must have an account on the system
- Developer instructs the system to transfer the CRTs into the buyer's account
- Buyer can hold them, retire them or transfer them
- Financial transaction can be done through:
  - Broker
  - Exchange: CCFE or Green Exchange
  - Directly
  - Public auction

Fee Structure

- Account Maintenance: $500/year
- Project Listing: $500/project
- CRT Issuance: $0.20/tonne
- CRT Transfer: $0.03/tonne
- Retirement: Free

Website Demo

www.climateactionreserve.org

Contact Information

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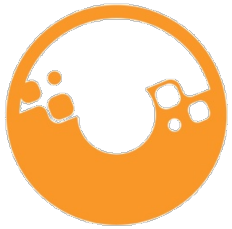
Nitric Acid Production Project Protocol v1.0

Max DuBuisson

Business Development Manager



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Workshop on Nitric Acid Projects

Houston, TX

September 21, 2010

Agenda

- Introduction to the Nitric Acid Production Project Protocol
  - Background
  - Project definitions
  - Eligibility rules
  - Calculations
  - Monitoring and reporting requirements
  - Verification guidance
  - Errata & clarifications
- Q&A

What are these projects?

- Activities that reduce nitrous oxide (N_2O) emissions from nitric acid plants (NAPs) at nitric acid production facilities in the U.S.
- Why?
  - N_2O is a potent greenhouse gas
  - Global warming potential of 310 tCO_2e

Protocol Development Goals

- Develop a standardized approach for quantifying, monitoring and verifying GHG reductions from N_2O emissions abatement projects at NAPs in the U.S.
- Improve upon existing CDM methodologies
  - AM 0028: *Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants (tertiary)*
  - AM 0034: *Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants (secondary)*
- Ensure accuracy and practicality of projects

Protocol Differences from CDM Methodologies

- A more flexible, yet still conservative, baseline approach for secondary projects that allows for shorter sampling timeframes
- A modified safeguard against overproduction of nitric acid based on plant- specific historical production levels rather than nameplate capacity
- Removal of a difficult to verify CDM restriction that limits changes in primary catalyst composition
- Removal of requirement for secondary projects to use a moving average for the calculation of project emissions.
  - The Reserve has taken a more direct approach by requiring consistent operating conditions throughout the baseline sampling and project crediting period.

Protocol Development Process

- Internal protocol scoping - April 2009
- Stakeholder scoping meeting in DC on May 19, 2009
- Form multi-stakeholder workgroup
- Legal requirements and performance standard research
- Send draft through workgroup process
  - Workgroup provides technical expertise and practitioner experience
  - Periodic meetings and individual consultation when needed
- Draft protocol released for 30-day public review Oct 2009
- Public comments incorporated
- Protocol adopted by Reserve Board on Dec 2, 2009
- Errata and clarifications issued August 19, 2010 (updates are marked on the slides with a red asterisk *)

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

Background – Nitric Acid Production Process

- 2 step process:
  - Ammonia is first oxidized over a precious metal gauze catalyst to form NO and NO_2
  - Absorption in water creates nitric acid (HNO_3)

- Bi-products of these reactions are
  - NO and NO_2 (or collectively, NO_x)
  - N_2O

- In the U.S., current pollution control technology targets NO_x only.

Background – NO_x Abatement

- **Non-selective catalytic reduction** (NSCR)
  - Installed until late-1970s
  - Controls NO_x and controls N_2O up to ~80%
  - Requires high temperature and energy inputs
  - Some U.S. nitric acid plants still using NSCR to control NO_x

- **Selective catalytic reduction** (SCR)
  - Employed in most U.S. nitric acid plants today
  - Controls only NOx, does not control N_2O
  - Lower cost of operation, lower temperature requirements

Background – Potential N_2O Abatement Measures

Measure	Point of Application
Primary abatement	Prevents N_2O formation in the ammonia burner by modification of (i.e. optimizing) the ammonia oxidation process and/or primary catalysts.
Secondary abatement	Removes N_2O from the gases between the ammonia oxidation reactor (AOR) and the absorption tower. Usually this will mean intervening at the highest temperature, immediately downstream of the primary catalyst and catalytically reducing the N_2O once it has been formed in the AOR.
Tertiary abatement	Treats the tail-gas leaving the absorption tower to destroy N_2O. N_2O abatement can be placed upstream or downstream of the tail-gas expansion turbine. These abatement measures may include catalytic decomposition or NSCR.

Project Definition

- Installation any of the following N_2O abatement technology at a single Nitric Acid Plant (NAP)
- Two Eligible Project Types:
  - "Secondary" Abatement

    Installation of secondary catalyst inside or directly below reactor
  - "Tertiary" abatement

    Installation of tertiary catalyst or a NSCR unit in tail gas

Project Definition

- **Eligible NAPs**
  - Existing, relocated and upgraded NAPs
- **Non- Eligible NAPs**
  - NAPs that have been idle for more than 24 months at any time since December 2, 2007
  - NAPs constructed after December 2, 2009 (unless permitted before December 2, 2009)
  - NAPs using NSCR for NO_x abatement now or at anytime since December 2007

Project Eligibility Rules

1. Location	U.S. and its territories
2. Project Start Date	- Not earlier than December 2, 2007 - 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
5. Crediting Period	10 years, renewable one time

Performance Standard

- Technology-specific threshold
- Installation of any of the following technologies for N_2O abatement goes beyond common practice:
  - Secondary catalyst
  - Tertiary catalyst
  - NSCR (at eligible NAPs only)
- Performance Standard Test is applied once at the beginning of each crediting period

Legal Requirement Test

- Regulatory analysis identified no existing laws or regulations obligate N_2O abatement at NAPs
  - EPA mandatory reporting rule does not legally require N_2O abatement.
  - Under CAA, NOx abatement is required but there is no prescription of technology to achieve performance standards
    - SCR is common practice
    - NSCR (which also abates N_2O) is NOT common practice
- Project developers are required to submit signed Regulatory Compliance Attestation and Voluntary Implementation 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

Roadmap of Project Process

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- Determine Historical maximum HNO_3 Production; Permitted Operating Conditions; Campaign Length Cap
- Establish CEMS for N_2O emissions monitoring
- Develop Monitoring Plan
- Run baseline N_2O sampling (secondary projects only)

Before Project Starts

- Install N_2O Abatement Unit

Project Starts

- Monitor required variables (see Table 6.1 and 6.2)
- Ensure staying within permitted range for operating conditions
- Calculate baseline and project emission factors and emission reductions

Each Reporting Period

- Verification

After each Reporting Period

GHG Assessment Boundary: Secondary Catalyst Projects

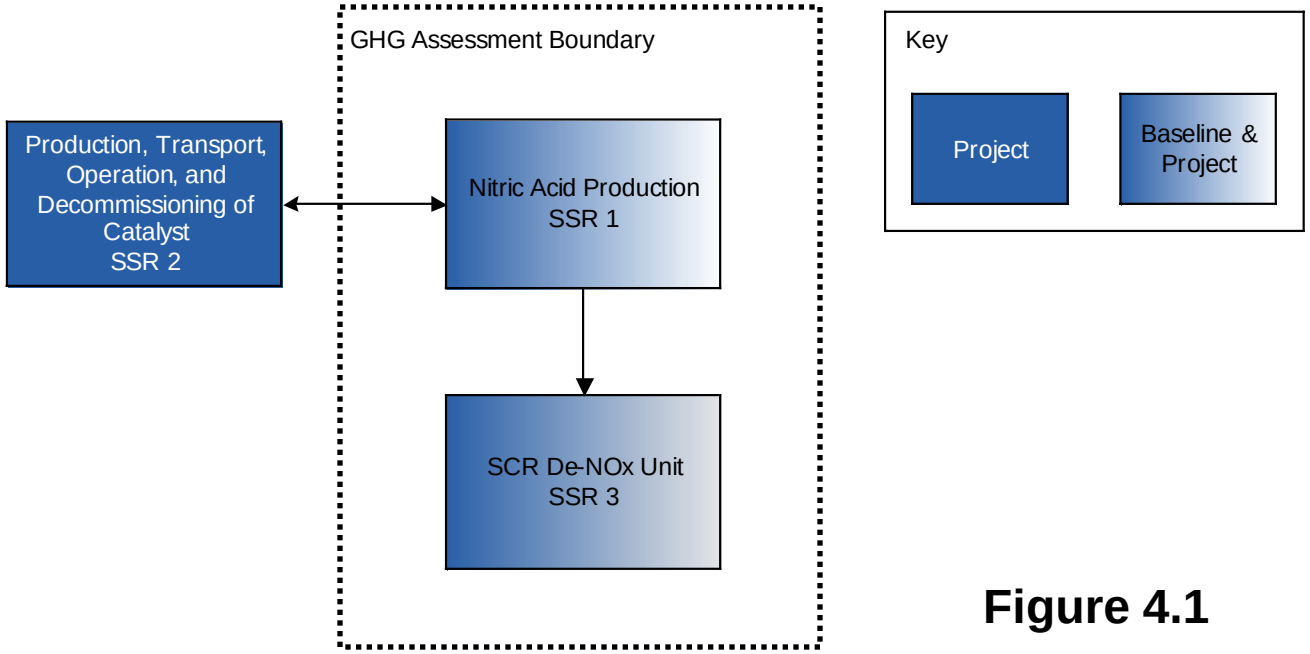

Figure 4.1

GHG Assessment Boundary: Tertiary Catalyst Projects

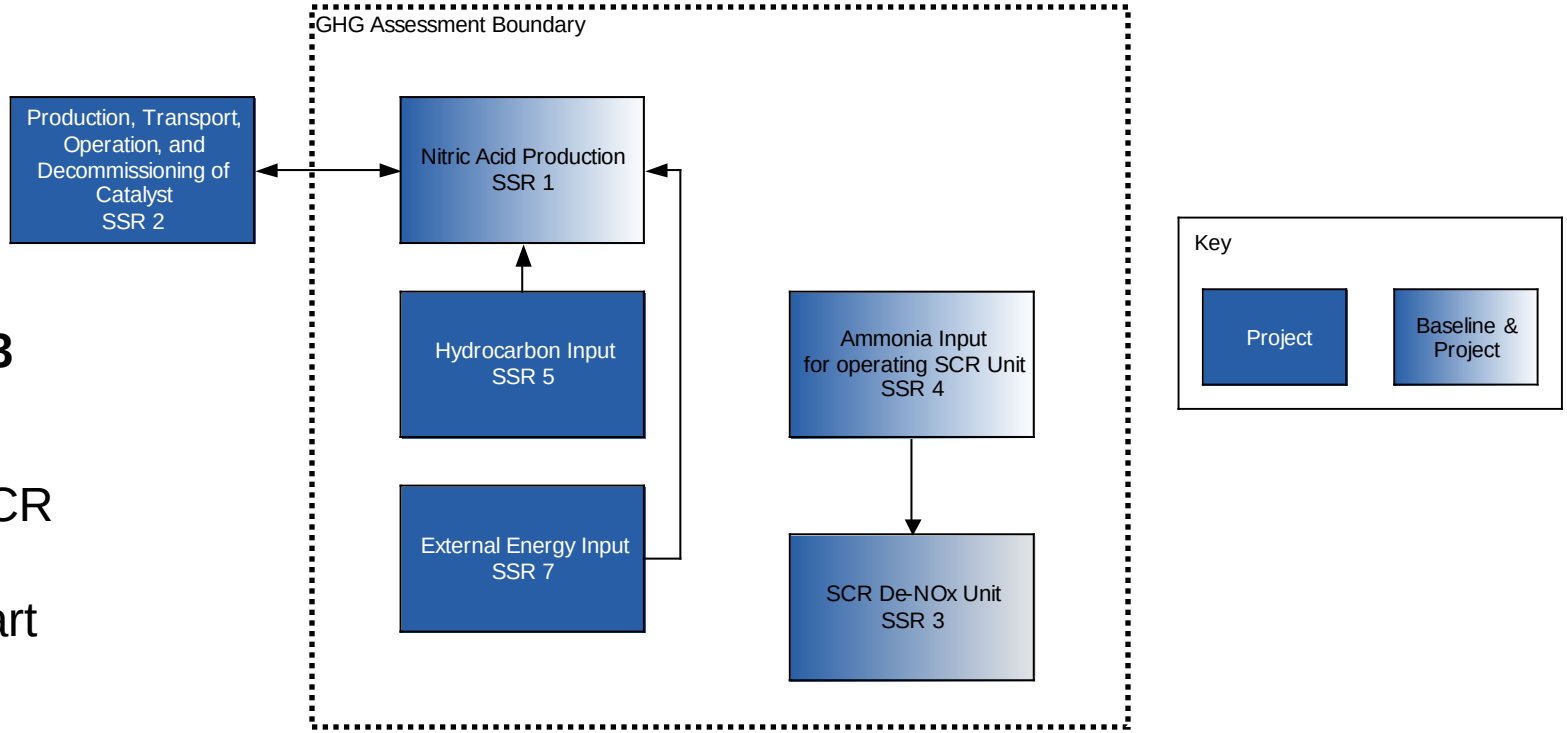

Figure 4.3

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

GHG Assessment Boundary: Tertiary Catalyst Projects

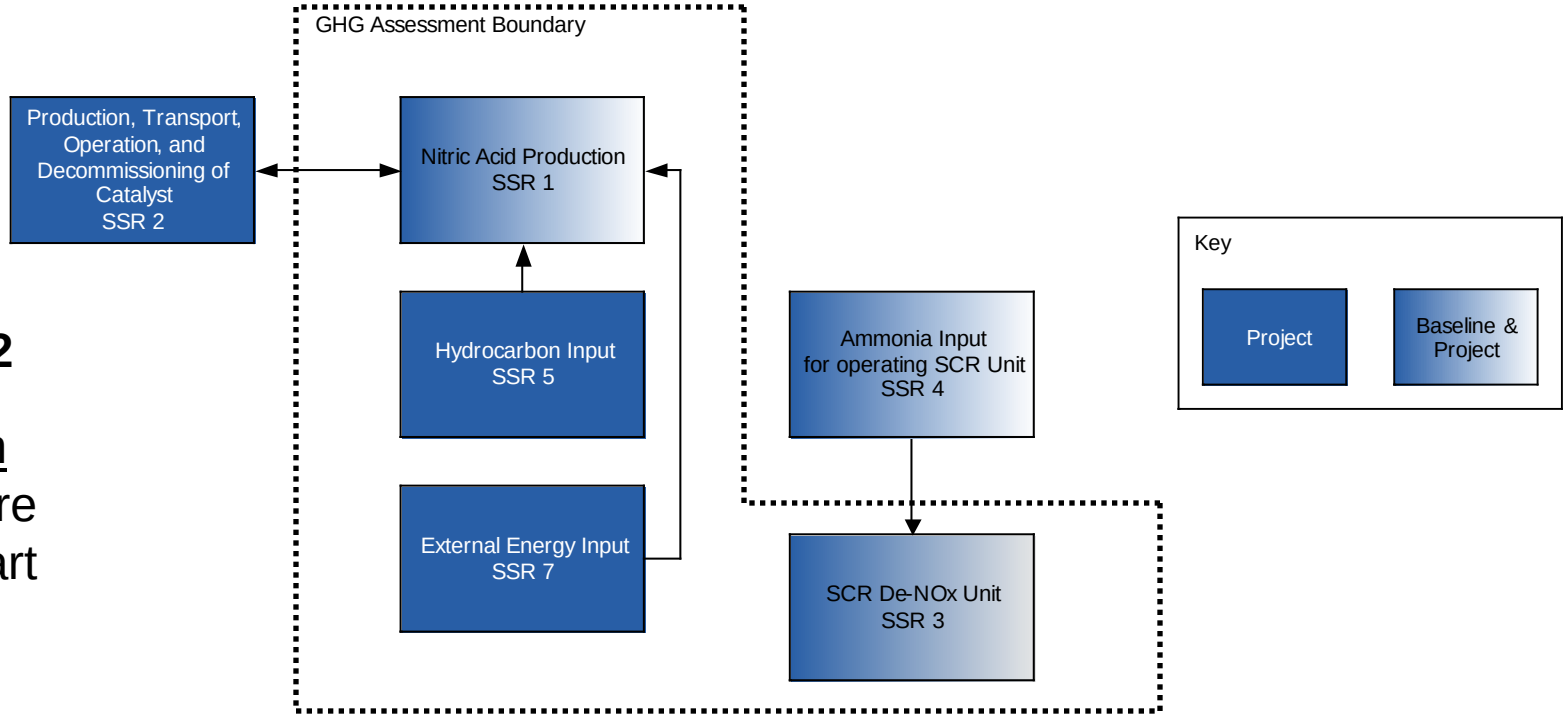

Figure 4.2

NAPs <u>with</u> SCR before project start

Historical HNO_3 Production

- **Purpose:** to provide assurance that HNO_3 production levels are consistent with business as usual
  - HNO_{3MAX} is used to limit the emission reductions that can be claimed
- Based on the maximum annual average production of HNO_3 for 5 years
- If 5 years of data are not available HNO_{3Max} may be based on:
  - Five or more campaigns prior to project start
  - Or, nameplate capacity (as specified in the operating manuals and permits)
- Upgraded NAPs** base historical production on historical data from before the upgrade

** upgraded within 24 months before the project starts or anytime during the project crediting period.

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 in a single campaign
- Times nitric acid production ($HNO3_{ER}$), which is based on the lower of:
  - Historical maximum annual average $HNO_{3MAXscaled}$ *
  - Actual HNO_3 produced during a campaign
- Calculated at end of each campaign after project is initiated

Secondary Catalyst Projects: Baseline Sampling + Calculating Baseline Emission Factor

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

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

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

(See Equation 5.2 and 5.3)

Secondary Projects: 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

Permitted Operating Conditions (POC) Secondary abatement projects

- **Purpose**: to ensure project operating conditions are representative of typical conditions and, for secondary projects, that baseline sampling conditions are comparable to project conditions
  - Permitted range established for oxidation temperature and pressure
  - Permitted maximum established for ammonia to air ratio
  - NAPs must operate within POC ranges and below POC max during baseline and project sampling
  - If not, N_2O data may be eliminated or sampling could be considered invalid and baseline must be repeated

POC

- 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)
- Upgraded or relocated NAPs base POCs on historical data from after the upgrade/relocation

Tertiary Catalyst Projects: Emission Reductions

$$ER = BE - PE$$

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

Tertiary Catalyst Projects: Baseline Emissions + Sampling

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

- Equation 5.7
- Based on N_2O from nitric acid production (i.e. 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

Tertiary Catalyst Projects: 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

Tertiary Projects: Historical HNO_3 Production Limit

$$BE = \left[\left(\sum_{i}^{n} F_i \times CI_{N_2O,i} \times M_i \right) \times GWP_{N_2O} \right] \times HNO_{3MAX} / HNO_{3RP}$$

- If HNO_3 produced during the reporting period (HNO_{3RP}) exceeds the maximum annual average ($HNO_{3MAXscaled}$), then the above equation must be used
- Maximum annual 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): Tertiary abatement projects

- 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

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 * (changes introduced to remove redundancy in this section)
- Collect data for all parameters found in Table 6.1 and Table 6.2

CEMS Requirements

Accuracy testing and audit (RATA)	EPA test method 320 or ASTM D6348-03 for FTIR spectroscopy
Calibration procedures	Performance Specification 2, 40 CFR Part 60 Appendix B and 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

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
- Allows for “joint project verification” - single verification body to verify multiple projects at a single facility
- Verification at a minimum annually; reporting period can be NO longer than 12 months (except for the first). Sub-annual reporting and verification is allowed.

Verifying Management Systems

- In addition to data management systems verification (CEMS)…verifiers want to see that the party(s) responsible for managing and reporting project activities are qualified:
  - Appropriate training was provided to personnel assigned to greenhouse gas reporting duties
  - Contractors are qualified for managing and reporting greenhouse gas emissions if relied upon by the project developer
  - Internal oversight to assure the quality of the contractor's work.
  - Service providers are qualified for installing, calibrating, and certifying CEMs monitoring systems
  - Internal oversight to assure the quality of the CEMs operations

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 Compliance Attestation+
- Signed Voluntary Implementation Attestation+

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

\+ Submitted for each reporting period

Questions

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