Industrial Gas
Project Protocol
Scoping Meeting

CLIMATE
ACTION
RESERVE

Washington, DC
May 19, 2009

What is the Climate Action Reserve?

- Non-profit national GHG offsets registry
  - Develop high-quality projects 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
- Also houses the **California Climate Action Registry**
  - Non-profit GHG inventory registry created by state legislation in 2001
  - Encourage voluntary entity-wide reporting and reductions
  - Over 350 members and 730 million metric tons CO_2e registered for years 2000 - 2007

Today's Agenda

Morning

- Reserve protocol development process
- ODS project typologies

break for lunch

Afternoon

- Nitric acid N_2O project typologies
- Other potential industrial gas project typologies

Scoping Meeting Purpose

CLIMATE ACTION RESERVE

- Engage stakeholders in process
- Help shape direction and scope of protocols
- Gather information and input on key issues
- Assess project types for future development

Protocol Development Process

- Internal protocol scoping
- Form multi-stakeholder workgroup
- Discussion paper and/or draft protocol:
  - Maintain consistency with other high quality emission reduction standards
- Send draft through workgroup process
  - Workgroup provides feedback, consensus is built
  - Can be iterative process
- Draft protocol released for public review
- Public comments incorporated
- Protocol submitted to Reserve board for adoption

Timeline – ODS and/or N_2O

Scoping meeting	May 19, 2009
Drafting of protocol	June - July 2009
Workgroup process	August – Oct. 2009
Public review period and public workshop	Oct. – Dec. 2009
Adoption by Reserve Board	December 2009

Principles of Reserve Project Accounting

- **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 verifiably free of material misstatements
- **Owned unambiguously:** Ownership of GHG reductions must be clear
- **Not harmful:** Negative externalities must be avoided
- **Practicality:** Project implementation barriers should be minimized

Project Accounting Frameworks

- Top-down (standardized) approach
  - Criteria developed by GHG program (Reserve)
  - Applicable to multiple projects within sector
- Bottom-up (project-specific) approach
  - Developed on case-by-case basis by project developer
  - Represent conditions for a single project
  - CDM style approach to project accounting

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

Project Protocol Components

- Define the GHG reduction project
- Define eligibility (incl. “additionality”)
- Establish assessment boundary
- Calculate GHG reductions
  - Baseline emissions
  - Project emissions
- Verify project performance

Define GHG Reduction Project

- GHG project is a specific activity or set of activities intended to:
  - Reduce GHG emissions
  - Increase carbon storage or
  - Enhance GHG removals from atmosphere
- Project definition will delineate what activities are "creditable" under protocol
  - i.e., what baseline and project scenarios are accepted

Define Eligibility

Additionality criteria

- Regulatory test
  - Is it required by law?
- Project start date
  - As early as Jan 1, 2001 for 12 month period after protocol is adopted
  - Only new projects after initial 12 months
- Performance threshold, technology standard and/or other conditions
  - Standard of performance applicable to all industrial gas projects, as defined in the individual protocol

Define Eligibility (cont.)

Other eligibility criteria

- Project location
  - Must be based in the United States
- Regulatory compliance
  - Project activity must comply with all air & water quality regulations

Establish Assessment Boundary

- Delineates the sources and gases required to be assessed to determine net change in emissions from project activity
  - Primary effects
    - For industrial gas, destruction of substance or reduction of fugitive emissions
  - Secondary effects
    - Must be identified and assessed
    - Large, negative secondary effects can render project activity unviable

Calculate GHG Reductions

- Develop standardized measurement and monitoring to:
  - Estimate baseline emissions and
  - Calculate project emissions
- Procedures for collecting necessary data
- Frequency of monitoring
- Standardized calculation methodologies and default emission factors, where necessary

Verify Project Performance

- Reserve requires annual third-party verification by an accredited verification body
- Develop companion verification project protocol to guide verifiers
- Risk assessment and data sampling exercise
  – Site visits and desktop review of data to ensure no material misstatements (+/- 5%)

Ozone Depleting Substances

Background – Montreal Protocol

- Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol):
  - Phased out worldwide production and consumption of most Ozone Depleting Substances (ODS)
- Led to an amendment of the U.S. Clean Air Act (CAA) in 1990
  - Title VI Stratospheric Ozone Protection: authorizes the U.S. Environmental Protection Agency (EPA) to manage the phase out of ODS
  - ODS include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, carbon tetrachloride, methyl chloroform, methyl bromide, and hydrobromofluorocarbons (HBFCs)
  - Some, like HCFCs and methyl bromide are still in the process of being phased out
- Montreal Protocol and Title VI of the CAA do not forbid the **use** of **existing** or **recycled** controlled substances beyond the phase out dates

Background – Kyoto Protocol

- Continued use and disposal of ODS contribute to both ozone depletion and climate change
- Global warming potentials (GWPs) for common ODS range from ~ 1,000 to 10,000
- Because production was already regulated by the Montreal Protocol, ODS were not included in the Kyoto Protocol
  - ODS emission reduction projects are not eligible for offsets under the Clean Development Mechanism (CDM)

Background – Common uses

- CFCs and HCFCs are commonly used in:
  - Refrigeration and air conditioning applications
  - Blowing agents for foam manufacturing
  - Propellants in spray cans

- Halons and carbon tetrachloride are used in fire suppression applications

- Accessible banks in the U.S. are estimated at over 1,400 $MMTCO_2e$ (EPA, 2007)

Organization of Presentation

- Presentation of each class of ODS separately
- Discussion of cross-cutting issues (regulation, ownership, tracking, verification) together at the end

Refrigerants	Foams	Fire Suppressants
•commercial/ industrial	•building/ construction	•stockpiled
•consumer appliances	•consumer appliances	•equipment
•stockpiled		

Project – Refrigerants

- Refrigerants used in commercial and industrial refrigeration and A/C systems, and residential appliances
  - Recovered from industrial equipment when upgrades, decommissioning, or servicing occurs
  - Removed from residential appliances at end-of-life
    - **CFC 11: 4,750**
    - **CFC-12: 10,900 GWP**
    - **HCFC-22: 1,810 GWP**
    - **HCFC-123: 77 GWP**
    - **R-502: 4,700 GWP**
- **Assumption:** eventual fate is 100% fugitive release from leaky equipment (10-90%/year leak rates)
- **Project**: collection and destruction by incineration at a qualifying facility

Project – Fire Suppressants

- Used in fire suppression equipment
  - Released through leaks and discharge of equipment
- Storage tanks, cylinders, etc. being stockpiled for future use
  - Average annual leak rates of 4.5 – 5%, eventually recharges equipment
    - **Halon 1301: 7,140 GWP** (for “flooding” fire suppression)
    - **Halon 1211: 1,890 GWP** (portable fire extinguishers)
    - **Halon 2402: 1,620 GWP**
- **Assumption:** eventual fate is 100% release through use
- **Project**: collection and destruction by incineration at a qualifying facility

Project – Foams

- ODS used as a blowing agent for certain foams:
  - appliance insulation (refrigerators, A/C, etc.)
  - insulation in building materials
- ODS is released during shredding, and in landfill
    - **CFC-11: 4,750 GWP** (appliance insulation)
    - **HCFC-141b: 725 GWP** (building insulation)
- **Assumption**: 50-65% will be released
- **Project**: collection, extraction, and destruction at a qualifying facility

Discussion – Regulatory Status

- What is the regulatory framework for ODS?
  - Refrigerants?
  - Fire suppressants?
  - Foams?

- Certain HCFCs will not be completely phased out of production until 2030 in developed countries and 2040 in developing countries
  - Should there be any provisions for allowing reductions to be claimed for these ODS?

Discussion – Performance Standard

- What are the current incentives and common practice for 1) recycling ODS and 2) destroying ODS?
  - Refrigerants?
  - Fire suppressants?
  - Foams?

- For refrigerants and fire suppressants, replacements must be considered
  - Can the replacements, some with higher GWP, be adequately accounted for?

Discussion – Additionality

- Are imports available either legally *or* illegally?
  - i.e., will destroyed ODS simply be replaced by a new source, with no or diminished net reduction?

- Can chain of custody and origin of ODS be tracked and verified?
  - What might such a data management system look like?
  - What verification challenges will this entail?

Discussion – Destruction Facility

- How many RCRA-approved hazardous waste combustors exist in the U.S.?
  – Are there further requirements of an ODS destruction facility?
- Can adequate chemical analysis of destroyed materials be conducted at destruction facilities?
- Is this information verifiable?

Discussion – Ownership

- Who is the project proponent?
  - Recovery operation, aggregator, or destruction facility?
  - For each, what are the implications for verification?

- What defines a project?
  - An on-going operation or a discrete action?
  - Will one provide greater verification challenges?

Discussion – Prioritization

- The Reserve may not be able to pursue all project types simultaneously
  - Which of the project types on the previous slides should the Reserve prioritize?

Issues for Future Discussion

- Issues to be discussed in stakeholder workgroup process
  - Given that emissions would accrue on a rolling basis, should the Reserve consider forward-crediting?
  - Are assumptions of 100% eventual fugitive emissions valid?

References

1. EOS Climate, Methodology for Ozone Depleting Substances Destruction Projects (2008)
2. EPA, Destruction of Ozone Depleting Substances, prepared by ICF International (Draft 2008)
3. UNEP/TEAP, Report of the Task Force on HCFC Issues and Emissions Reduction Benefits Arising from Earlier HCFC Phase-Out and Other Practice Measures (2007)
4. CCX, CCX Exchange Offsets and Exchange Early Action Credits, Appendix 9.4 (2007)

LUNCH

N_2O at Nitric Acid Plants

Background – Industry

- Nitric acid is a primary input in the production of fertilizer and certain explosives
- Produced in approximately 40 plants in the U.S.
- Estimated 2007 GHG emissions of 21.7 Tg CO_2e in U.S.

Background – Process

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

- Bi-products of these reactions are NO, NO_2, and N_2O

- Pollution control technology targets NO_x

Background – Abatement

- 2 NOx abatement technologies in the U.S.
  - Non-selective catalytic reduction (NSCR)
    - Catalysts include platinum, rhodium, palladium
    - Controls up to 80% of N_2O in addition to NOx
    - Installed until late-1970s
    - Requires high temperature and energy inputs
  - Selective catalytic reduction (SCR)
    - Catalysts include petoxide, platinum, iron/chromium oxides
    - Does not control N_2O, only NOx
    - Lower cost of operation, lower temperature requirements
    - Employed in 80% of U.S. nitric acid plants

Opportunity

- 80% of U.S. nitric acid plants employ SCR, releasing N_2O untreated to the atmosphere
  - Emissions range up to 12 kg N_2O / t HNO_3

- Two proven CDM methodologies exist:
  - AM 0028: *Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactuam Production Plants*
    - 15 projects, estimated 7,415,849 tCO_2e/yr*
  - AM 0034: *Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants*
    - 42 projects, estimated 9,942,836 tCO_2e/yr*

*6 projects and 1,049,696 tCO_2e/yr are under *both* AM 0028 and AM 0034

Project – Secondary Abatement (AM 0034)

- Places a secondary catalyst inside the reactor vessel, beneath primary gauze, and destroys N_2O almost instantaneously

- Advantages:
  - Low capital cost
  - Can be employed at most plants
- Disadvantages
  - Lower destruction efficiencies
  - Monitoring difficulties (must rely on EFs)

Project – Tertiary Abatement (AM 0028)

- Involves treatment of the N_2O in the tailgas, within a separate chamber
  - Can be situated in a number of places, depending on the engineering of the plant

- Advantages:
  - High destruction efficiency
  - Ability to monitor N_2O destruction directly
- Disadvantages:
  - High capital cost, extensive engineering
  - Not suitable for all acid plants
  - Requires high temperatures and fuel inputs (e.g., CH_4)

Discussion – Additionality

- Regulatory
  - What is the status of potential regulation of N_2O at nitric acid plants?
    - How will this effect the availability of projects?
    - What might N_2O regulation look like?
    - Emissions intensity or part of cap?

- Performance Threshold
  - What is the U.S. market penetration of N_2O abatement technology at pre-existing plants?
  - What is common practice for new nitric acid plants?
  - Do current carbon costs justify the necessary investment?
  - Are there sufficient technical/technological resources and expertise to support projects?

Discussion – Definition

- Should the protocol pursue secondary and/or tertiary abatement?
  - Should both be included in a single protocol?
  - What is the uncertainty associated with emission factors used for secondary treatment?
  - What is the uncertainty associated with CEMS used for tertiary treatment?
  - Are there significant data management challenges with either/both?
  - Are there specific verification challenges with either/both?

Discussion – Other Issues

- Ownership of credits?
- Should the protocol allow for projects at NSCR facilities?
  - If NSCR removes 80% of N_2O, is there opportunity?
- Can SCR facilities be retrofitted to NSCR?
  - Could this be a viable project type?
- Are there resources or approaches other than CDM methodologies?

References

1. AM0028: Catalytic N_2O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants
2. AM0034: Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants
3. AM0051: Secondary catalytic N_2O destruction in nitric acid plants
4. EFMA, Production of Nitric Acid (2000)
5. US EPA, US Emissions Inventory 2005 (2005)

Potential Project Types for Industrial Gases

Purpose

- Explore project activities that reduce/avoid release of high GWP gases
- Present what we know and our ideas
- Discuss what you know and your ideas
- Not making decisions today on what protocols to develop, but

  you are the experts and we want your input!

Agenda

- Evaluating project types for protocol development
- Potential project types
  - HFCs from commercial refrigeration systems
  - HFCs from foam blowing agents
  - SF_6
  - NF_3
  - PFCs
  - Others?
- Discussion

Evaluating Project Types

- What is the likelihood that the sector will be part of a GHG cap?
- Are there existing methodologies or protocols that could serve as a starting point?
- What are the potential total GHG reductions from this type of project activity?
- Are there high quality datasets related to the sector?
- Are there positive or negative environmental impacts from this type of project activity?
- Is the project type amenable to standardization?
- Does the project type create direct or indirect emission reductions?

ODS Substitutes

- Use and emissions of HFCs and PFCs significantly increased since 1990; will likely accelerate over next decade

Emissions of HFCs and PFCs from ODS Substitutes by Sector ($TgCO_2e$)

Gas	1995	2000	2007
Refrigeration/AC	19.3	58.6	97.5
Aerosols	8.1	10.1	6.2
Foams	+	+	2.6
Solvents	0.9	2.1	1.3
Fire protection	+	+	0.7

+ Does not exceed 0.5 Mg

Source: US EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007 (April 2009).

HFCs - Commercial Refrigeration Systems

- Commercial refrigeration systems using HFCs
- Project: Reducing HFC leak rates through leak detection management systems OR equipment replacement

<u>Issues/Questions</u>

- Pending and future regulation?
- Potential quantity of projects?
- Data available to set performance standards?

  Equipment replacement:
  - How do you establish baseline?
  - When do you credit reductions?

HFCs - Foam Blowing Agents

- Project: Avoid release of HFCs used as blowing agent during production of rigid polyurethane foam
  - Replace HFCs with low- or no- GWP blowing agents

Issues/Questions

- Potential for regulation?
- Potential size and quantity of projects?
- Major release at end of life, not at manufacturing - when do you credit reduction?
- Length of crediting period
- Other environmental impacts of replacements?

PFCs

- Used in semiconductor manufacturing and created as a byproduct in aluminum production
- Semiconductor project: Management improvements to minimize release of PFCs
- Aluminum project: Process improvements to minimize creation of PFCs

Issues/Questions

- Strong voluntary commitments (and measured reductions) with industries already in place
- Pending and future regulation?
- What are specific opportunities in semiconductor industry?

SF_6

- Used in electricity generation, magnesium production and semiconductor manufacturing sectors
- Project: SF_6 leak reduction from existing applications OR replacement with alternative gas

Issues/Questions

- Strong voluntary commitments (and measured reductions) with industries already in place
- Pending and future regulation?
- Expense of SF_6 - financial incentive to manage?
- Substitutes available?

NF_3

- Introduced as a substitute for PFCs; primarily for semiconductor manufacture
- Estimated emissions have ↑ as plasma product sales ↑
- Project: NF_3 leak reduction from existing applications through increased destruction efficiency OR replacement with alternative gas

<u>Issues/Questions</u>

- Not a Kyoto gas, but high GWP - being grouped into “fluorinated gases”
- Pending and future regulation?
- Very high expected destruction efficiency, but no reporting requirements

Discussion

Let's hear from you!

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