# Industrial Gas Project Protocol Scoping Meeting



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<sub>2</sub>e registered for years 2000 - 2007



# Today's Agenda



#### **Morning**

- Reserve protocol development process
- ODS project typologies

break for lunch

#### <u>Afternoon</u>

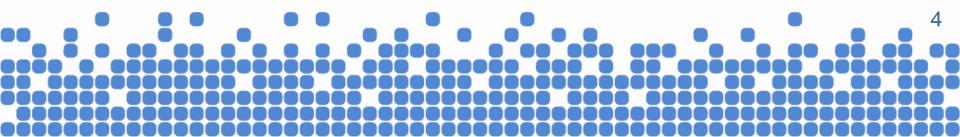
- Nitric acid N<sub>2</sub>O project typologies
- Other potential industrial gas project typologies

3

# Scoping Meeting Purpose



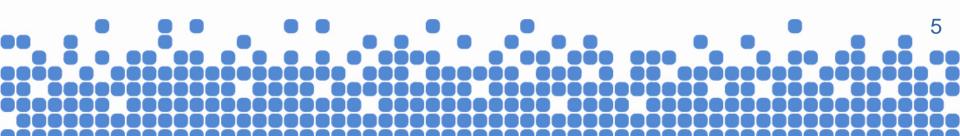
- Engage stakeholders in process
- Help shape direction and scope of protocols
- Gather information and input on key issues
- Assess project types for future development



### 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<sub>2</sub>O



Scoping meeting

May 19, 2009

**Drafting of protocol** 

June - July 2009

Workgroup process

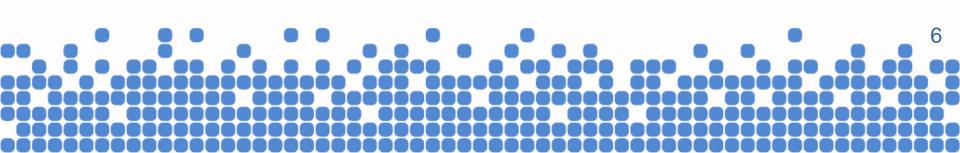
August – Oct. 2009

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



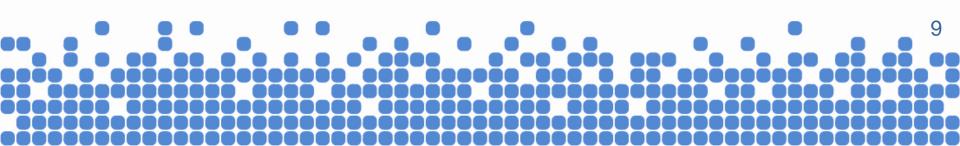
# The Standardized Approach



#### 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

12

# 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



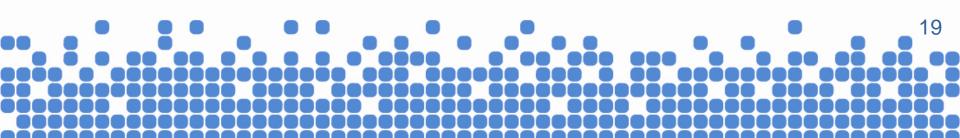
- Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol):
  - Phased out worldwide production and consumption of most Ozone Depleting Substances (ODS)
- Led to an amendment of the U.S. Clean Air Act (CAA) in 1990
  - Title VI Stratospheric Ozone Protection: authorizes the U.S. 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<sub>2</sub>e (EPA, 2007)

20

# 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	<ul><li>building/ construction</li></ul>	•stockpiled
•consumer appliances	<ul><li>consumer appliances</li></ul>	•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

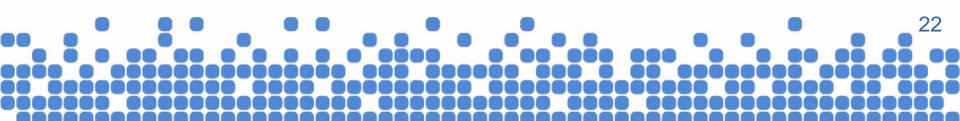
CFC-12: 10,900 GWP

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



### Key Questions: Additionality



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



# Key Questions: Secondary Effects ("Leakage")



- Will destroyed ODS simply be replaced by a new source, with no or diminished net reduction?
  - Are imports available either legally or illegally?
  - Can we allow reductions to be claimed for ODSs that have not yet been phased out?
- For refrigerants and fire suppressants, replacements must be considered
  - Can replacements, some with higher GWP, be adequately accounted for?



# Key Questions: Monitoring & Verification



- 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?
- Can adequate chemical analysis of destroyed materials be conducted at destruction facilities?
- Is this information verifiable?







- How many RCRA-approved hazardous waste combustors exist in the U.S.?
  - What are the requirements for an ODS destruction facility?
  - How might transportation emissions be affected?

28

# Key Questions: 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 either one provide greater verification challenges?



### Other Questions: Baselines



• Are assumptions of 100% eventual fugitive emissions valid?

• Given that emissions would accrue on a rolling basis, should the Reserve consider forwardcrediting?



#### Prioritization



- The Reserve may not be able to pursue all project types simultaneously
  - Which of the project types should the Reserve prioritize?
    - Refrigeration equipment
    - Foams
    - Fire suppressants

#### References



- EOS Climate, Methodology for Ozone Depleting Substances Destruction Projects (2008)
- 2. EPA, Destruction of Ozone Depleting Substances, prepared by ICF International (Draft 2008)
- 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**

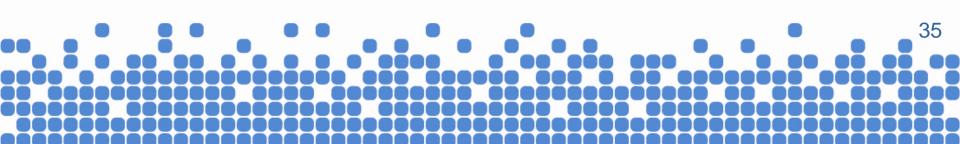
# Industrial Gas Project Protocol Scoping Meeting



Washington, DC May 19, 2009



#### N<sub>2</sub>O 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<sub>2</sub>e in U.S.

36

# Background - Process



- 2 step process:
  - Ammonia is first oxidized over a precious metal gauze catalyst to form NO and NO<sub>2</sub>
  - Absorption in water creates HNO<sub>3</sub>
- Bi-products of these reactions are NO, NO<sub>2</sub>, and N<sub>2</sub>O
- Pollution control technology targets NO<sub>x</sub>

37

## 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<sub>2</sub>O 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<sub>2</sub>O, 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<sub>2</sub>O untreated to the atmosphere
  - Emissions range up to 12 kg N<sub>2</sub>O / t HNO<sub>3</sub>
- Two proven CDM methodologies exist:
  - AM 0028: Catalytic N<sub>2</sub>O destruction in the tail gas of Nitric Acid or Caprolactuam Production Plants
    - 15 projects, estimated 7,415,849 tCO<sub>2</sub>e/yr\*
  - AM 0034: Catalytic reduction of N<sub>2</sub>O inside the ammonia burner of nitric acid plants
    - 42 projects, estimated 9,942,836 tCO<sub>2</sub>e/yr\*

\*6 projects and 1,049,696 tCO<sub>2</sub>e/yr are under both AM 0028 and AM 0034

36

# Project – Secondary Abatement (AM 0034)



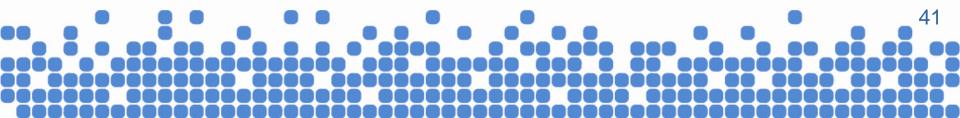
- Places a secondary catalyst inside the reactor, beneath primary gauze, and destroys N<sub>2</sub>O almost instantaneously
- Advantages:
  - Low capital cost
  - Can be employed at most plants
- Disadvantages
  - Lower destruction efficiencies
  - Monitoring difficulties (must rely on EFs)



# Project – Tertiary Abatement (AM 0028)



- Involves treatment of the N<sub>2</sub>O 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<sub>2</sub>O destruction directly
- Disadvantages:
  - High capital cost, extensive engineering
  - Not suitable for all acid plants
  - Requires high temperatures and fuel inputs (e.g., CH<sub>4</sub>)



# Discussion – Additionality



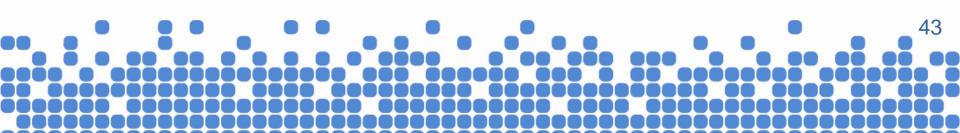
- Regulatory
  - What is the status of potential regulation of N<sub>2</sub>O at nitric acid plants?
    - How will this effect the availability of projects?
    - What might N<sub>2</sub>O regulation look like?
    - Emissions intensity or part of cap?
- Performance Threshold
  - What is the U.S. market penetration of N<sub>2</sub>O 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<sub>2</sub>O, 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<sub>2</sub>O destruction in the tail gas of Nitric Acid or Caprolactam Production Plants
- 2. AM0034: Catalytic reduction of N<sub>2</sub>O inside the ammonia burner of nitric acid plants
- 3. AM0051: Secondary catalytic N<sub>2</sub>O 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

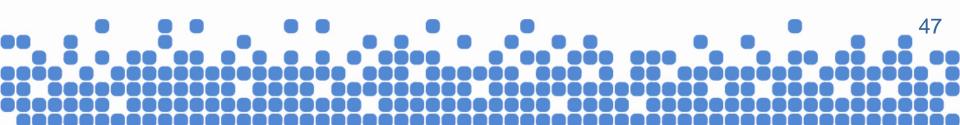


## Purpose



- 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<sub>2</sub>e)

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

- 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?

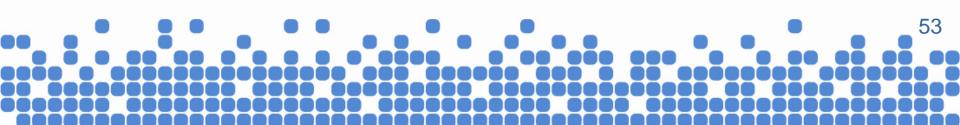


### **PFCs**



- 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

- 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<sub>6</sub> leak reduction from existing applications OR replacement with alternative gas

- Strong voluntary commitments (and measured reductions) with industries already in place
- Pending and future regulation?
- Expense of SF<sub>6</sub> financial incentive to manage?
- Substitutes available?

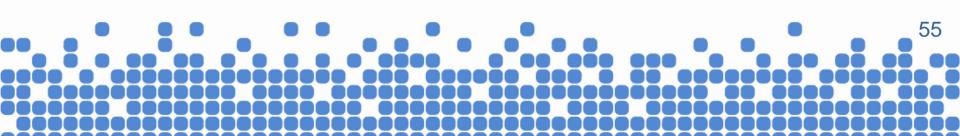


# $NF_3$



- Introduced as a substitute for PFCs; primarily for semiconductor manufacture
- Estimated emissions have ↑ as plasma product sales ↑
- Project: NF<sub>3</sub> leak reduction from existing applications through increased destruction efficiency OR replacement with alternative gas

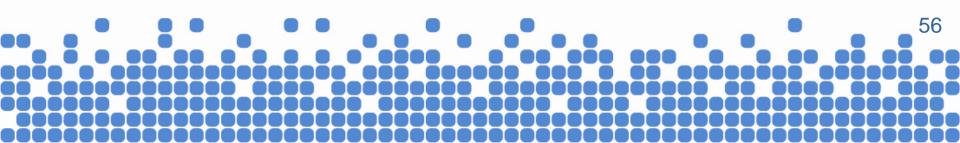
- Not a Kyoto gas, but high GWP being grouped into "fluorinated gases"
- Pending and future regulation?
- Very high expected destruction efficiency, but no reporting requirements



## Discussion



Let's hear from you!



### **Contacts**



Rachel Tornek
Senior Policy Manager
213-891-6930
rachel@climateactionreserve.org

Tim Kidman
Policy Associate
213-542-0282
tim@climateactionreserve.org

Derik Broekhoff
Vice President, Policy
213-542-0299
derik@climateactionreserve.org