

Industrial Gas Project Protocol Scoping Meeting



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Washington, DC
May 19, 2009

What is the Climate Action Reserve?



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- 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 CO₂e registered for years 2000 - 2007





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Today's Agenda

Morning

- Reserve protocol development process
- ODS project typologies

break for lunch

Afternoon

- Nitric acid N₂O project typologies
- Other potential industrial gas project typologies

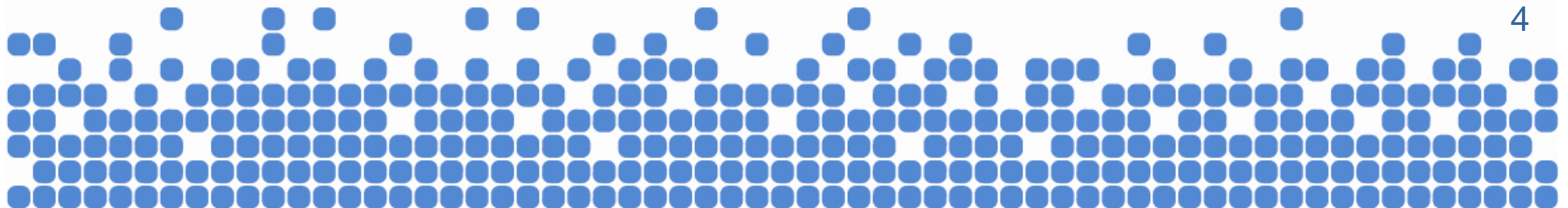




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Scoping Meeting Purpose

- 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



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- 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 N₂O



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| | |
|------------------------------------------|--------------------|
| 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 |

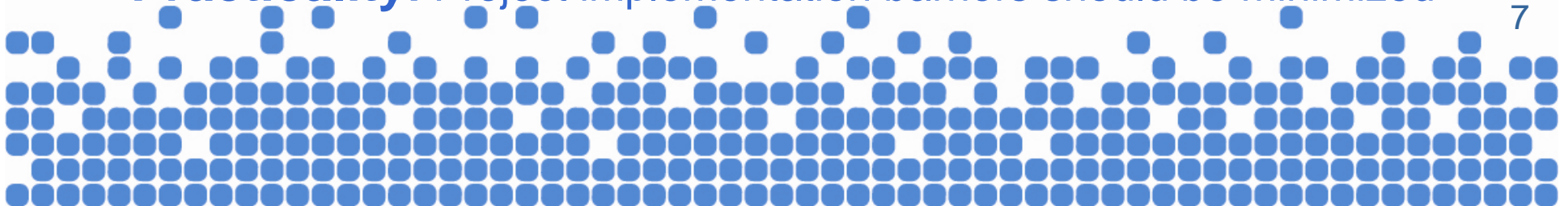




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Principles of Reserve Project Accounting

- **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

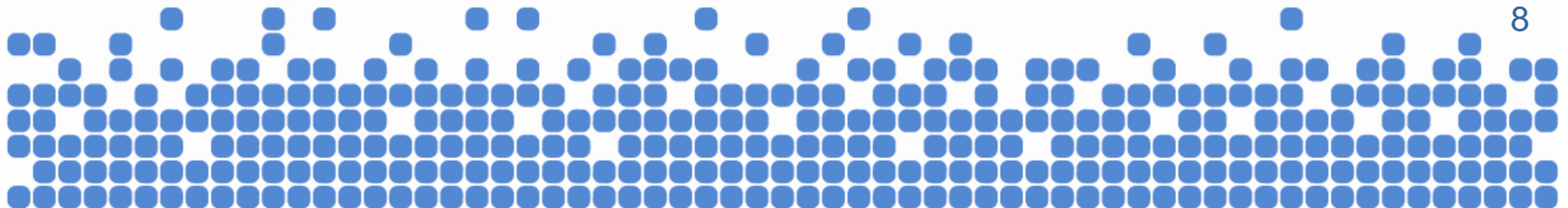


Project Accounting Frameworks



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- 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





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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





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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

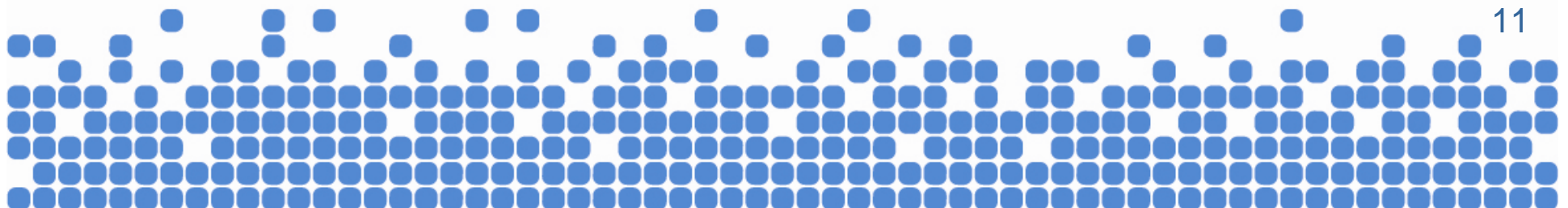


Define GHG Reduction Project



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- 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





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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



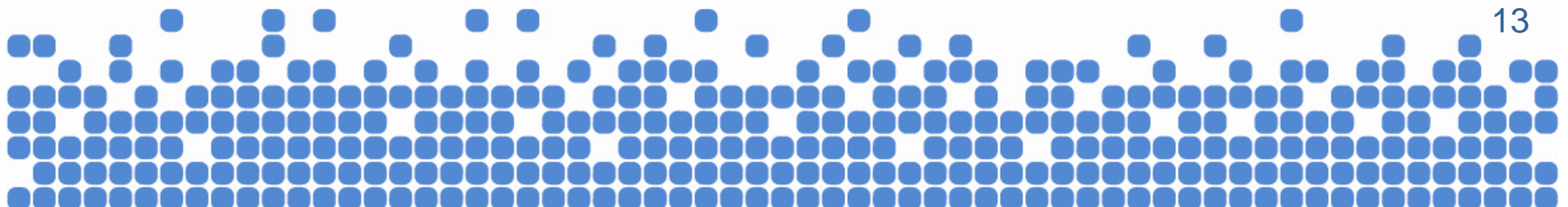


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Define Eligibility (cont.)

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



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- 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

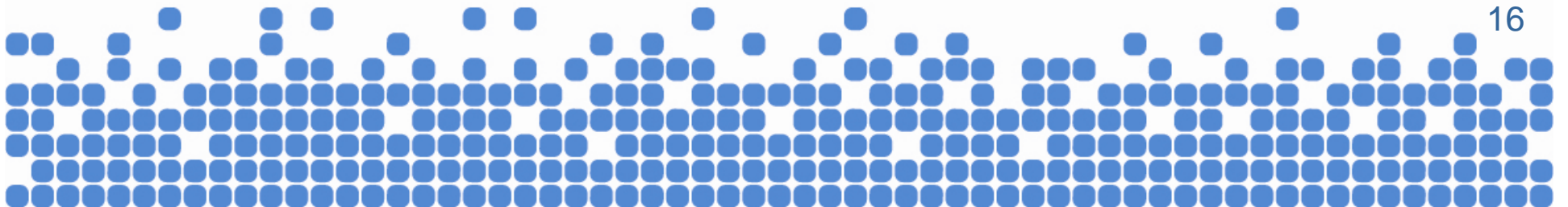




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Verify Project Performance

- 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%)





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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

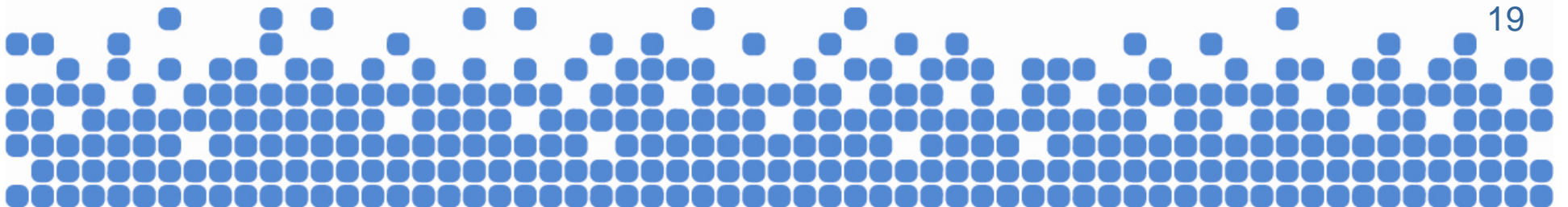


Background – Kyoto Protocol



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- 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)





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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 MMTCO₂e (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 | | |

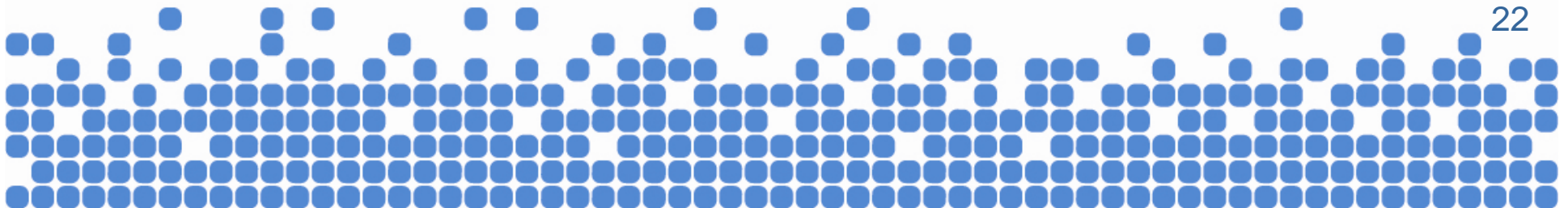




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Project – Refrigerants

- 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

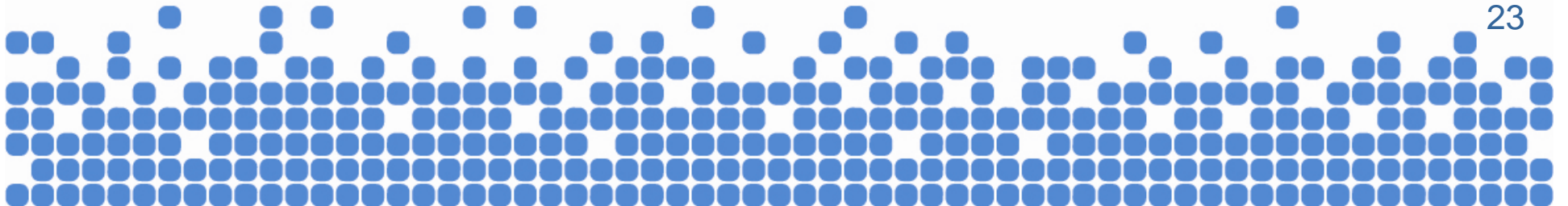




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Project – Fire Suppressants

- 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

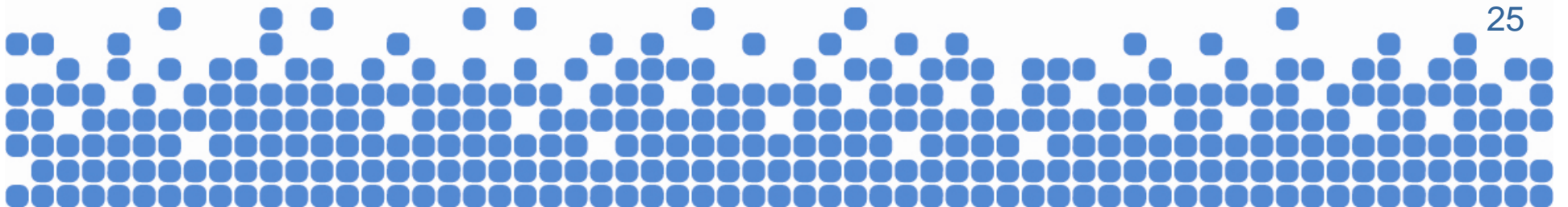
- ODS used as a blowing agent for certain foams:
 - appliance insulation (refrigerators, A/C, etc.)
 - insulation in building materials
- ODS is released during shredding, and in landfill
 - **CFC-11: 4,750 GWP** (appliance insulation)
 - **HCFC-141b: 725 GWP** (building insulation)
- **Assumption:** 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?



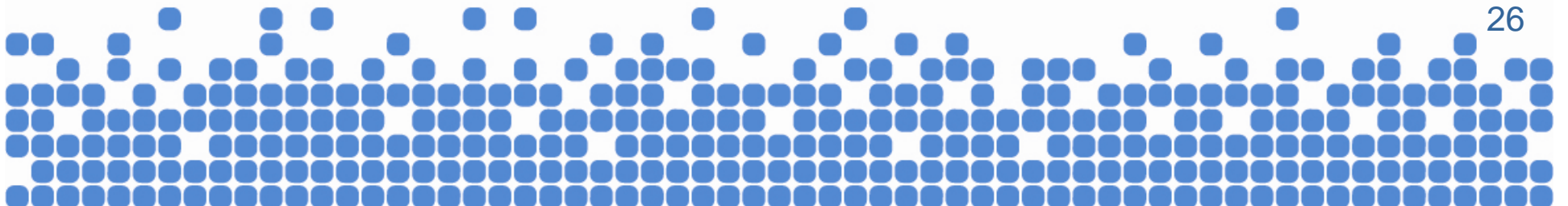
Discussion – Performance Standard



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- 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?

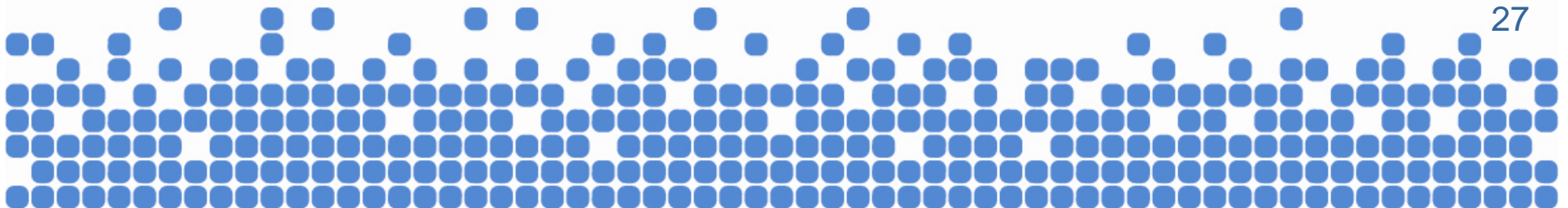




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Discussion – Additionality

- 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?

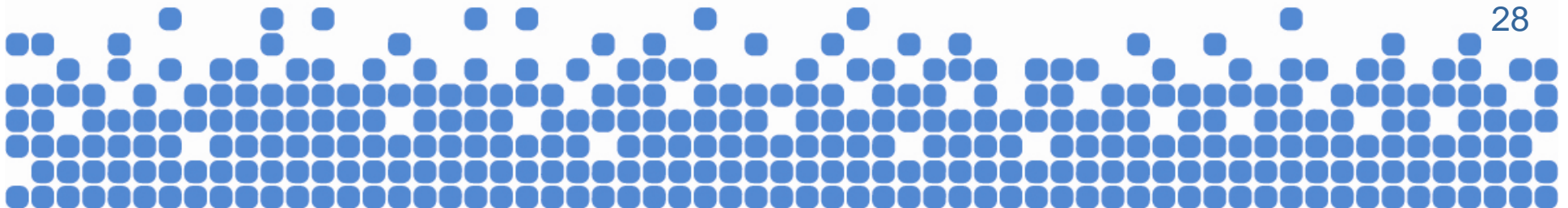




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Discussion – Destruction Facility

- 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?





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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?

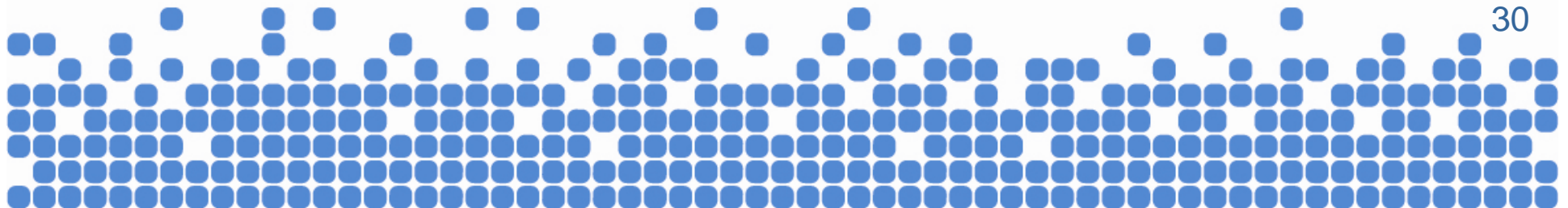




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Discussion – Prioritization

- 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?

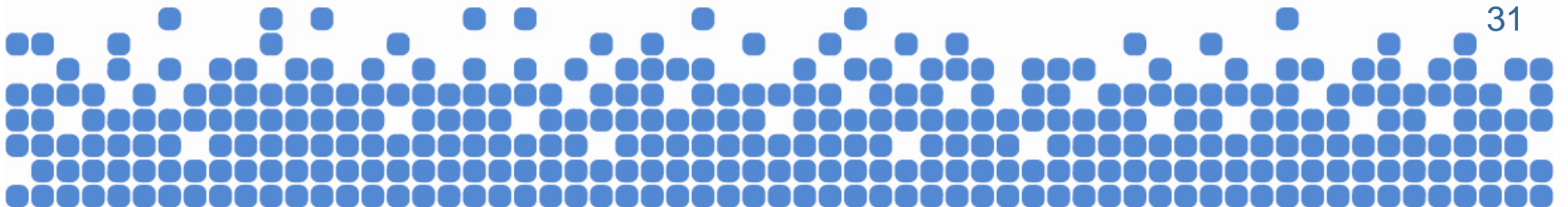




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Issues for Future Discussion

- 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?

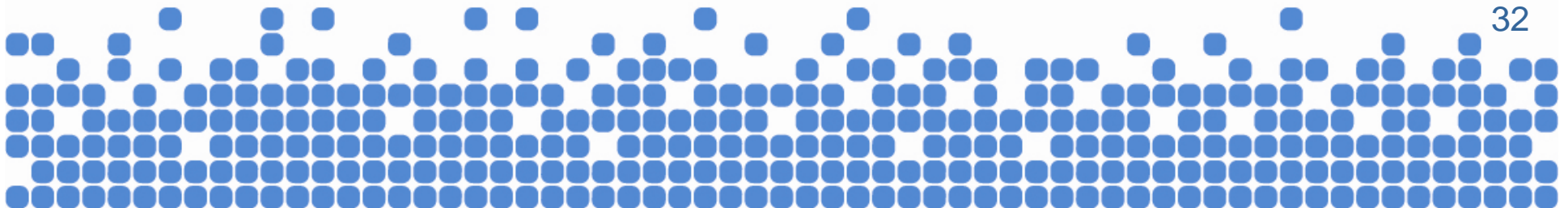




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References

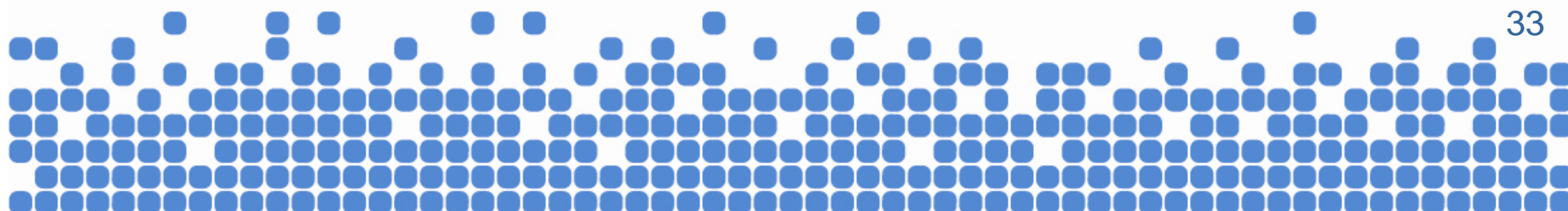
1. EOS Climate, Methodology for Ozone Depleting Substances Destruction Projects (2008)
2. EPA, Destruction of Ozone Depleting Substances, prepared by ICF International (Draft 2008)
3. UNEP/TEAP, Report of the Task Force on HCFC Issues and Emissions Reduction Benefits Arising from Earlier HCFC Phase-Out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





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LUNCH





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N_2O at Nitric Acid Plants





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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 CO₂e in U.S.

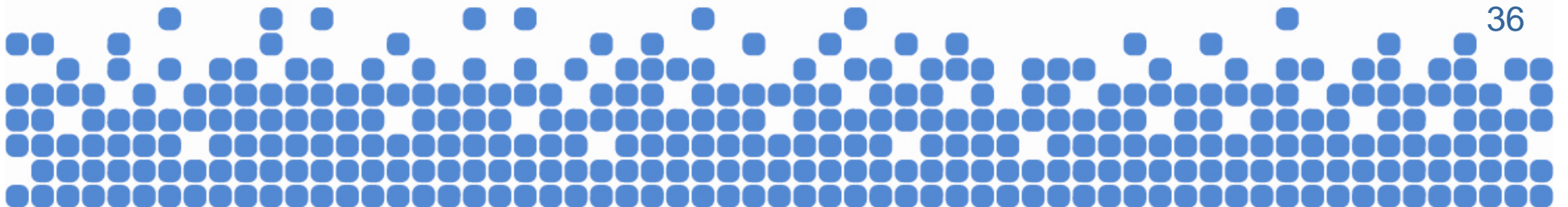




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Background – Process

- 2 step process:
 - Ammonia is first oxidized over a precious metal gauze catalyst to form NO and NO₂
 - Absorption in water creates HNO₃
- Bi-products of these reactions are NO, NO₂, and N₂O
- Pollution control technology targets NO_x





Background – Abatement

- 2 NO_x abatement technologies in the U.S.
 - Non-selective catalytic reduction (NSCR)
 - Catalysts include platinum, rhodium, palladium
 - Controls up to 80% of N₂O in addition to NO_x
 - Installed until late-1970s
 - Requires high temperature and energy inputs
 - Selective catalytic reduction (SCR)
 - Catalysts include petoxide, platinum, iron/chromium oxides
 - Does not control N₂O, only NO_x
 - 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 Caprolactum Production Plants*
 - 15 projects, estimated 7,415,849 tCO₂e/yr*
 - AM 0034: *Catalytic reduction of N_2O inside the ammonia burner of nitric acid plants*
 - 42 projects, estimated 9,942,836 tCO₂e/yr*

*6 projects and 1,049,696 tCO₂e/yr are under *both* AM 0028 and AM 0034



Project – Secondary Abatement (AM 0034)



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- 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)



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- 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

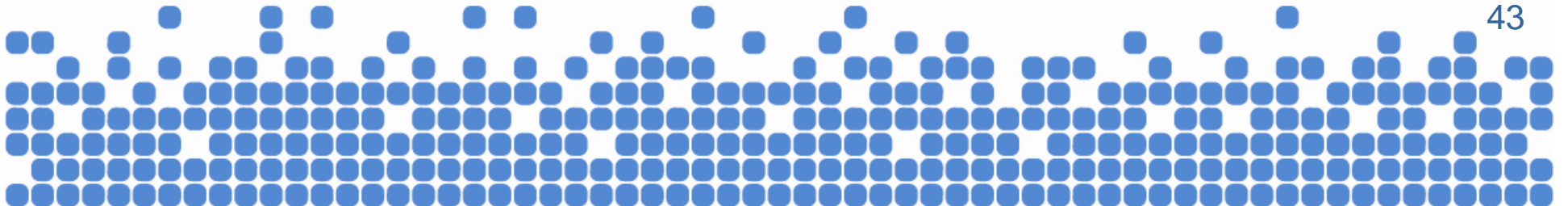
- Should the protocol pursue secondary and/or tertiary abatement?
 - Should both be included in a single protocol?
 - What is the uncertainty associated with emission factors used for secondary treatment?
 - What is the uncertainty associated with CEMS used for tertiary treatment?
 - Are there significant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

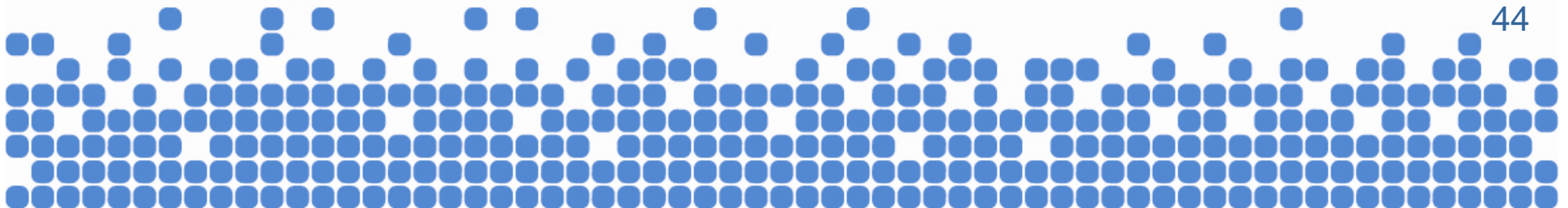




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References

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)





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Potential Project Types for Industrial Gases



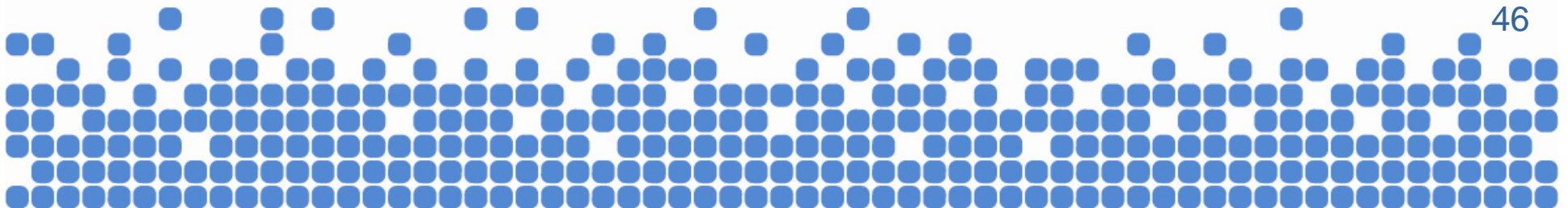


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Purpose

- 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!





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Agenda

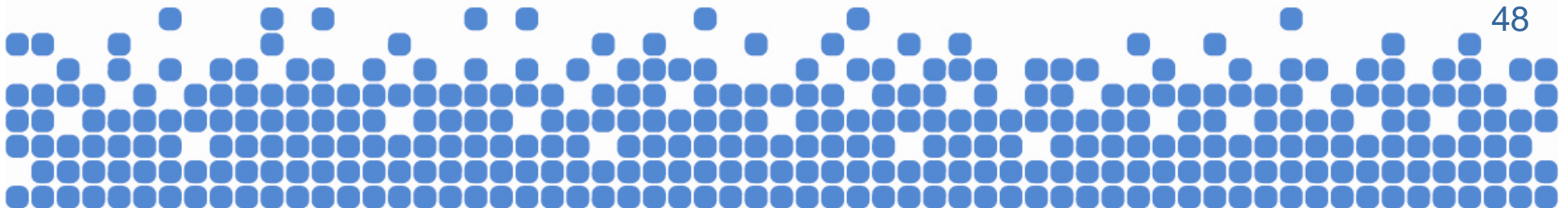
- Evaluating project types for protocol development
- Potential project types
 - HFCs from commercial refrigeration systems
 - HFCs from foam blowing agents
 - SF₆
 - NF₃
 - PFCs
 - Others?
- Discussion





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

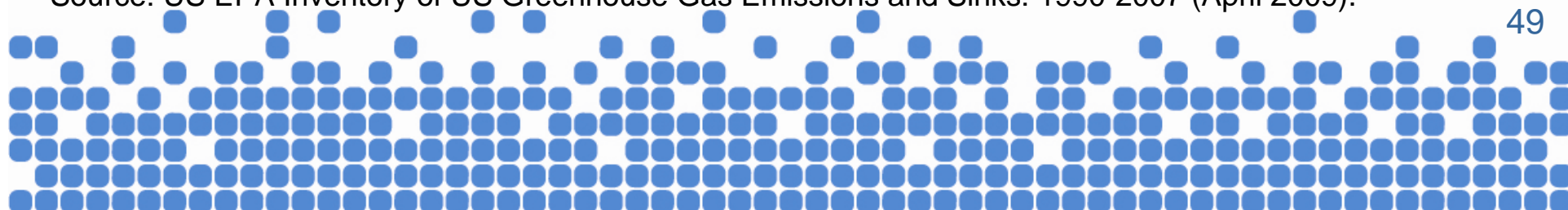
- Use and emissions of HFCs and PFCs significantly increased since 1990; will likely accelerate over next decade

Emissions of HFCs and PFCs from ODS Substitutes by Sector (TgCO₂e)

| 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).





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HFCs - Commercial Refrigeration Systems

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

Issues/Questions

- 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?





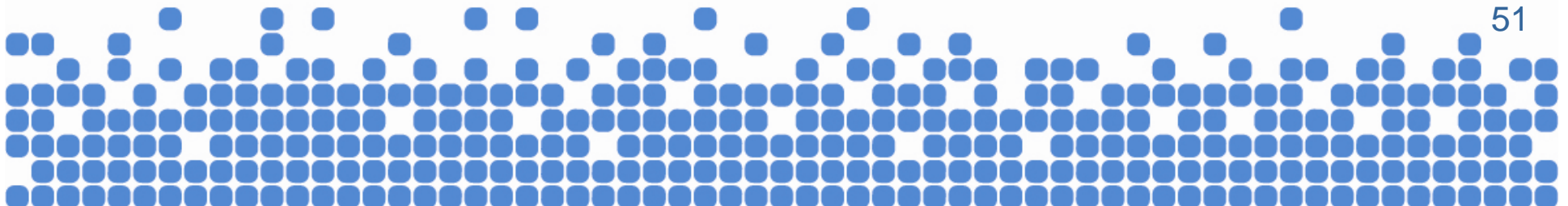
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HFCs - Foam Blowing Agents

- 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?





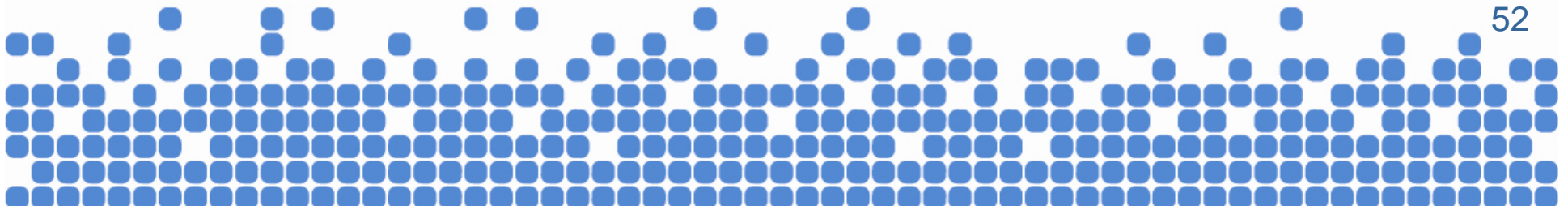
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PFCs

- 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?



SF₆

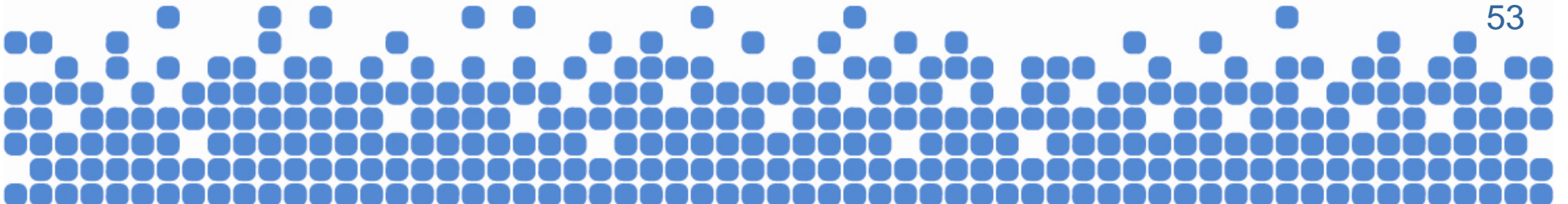


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- Used in electricity generation, magnesium production and semiconductor manufacturing sectors
- Project: SF₆ leak reduction from existing applications OR replacement with alternative gas

Issues/Questions

- Strong voluntary commitments (and measured reductions) with industries already in place
- Pending and future regulation?
- Expense of SF₆ - financial incentive to manage?
- Substitutes available?



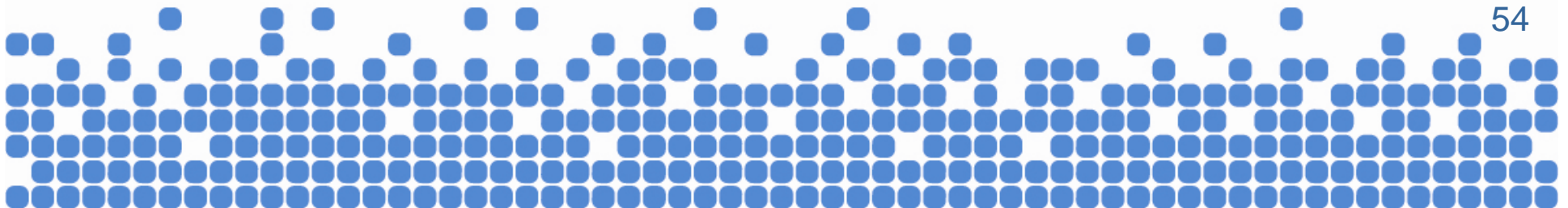


NF₃

- Introduced as a substitute for PFCs; primarily for semiconductor manufacture
- Estimated emissions have ↑ as plasma product sales ↑
- Project: NF₃ leak reduction from existing applications through increased destruction efficiency OR replacement with alternative gas

Issues/Questions

- 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



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Let's hear from you!



Contacts



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