RNG Interconnect Guideline for New York

A Process for "Getting to Yes"

Presented by Dan Dessanti/Bob Wilson

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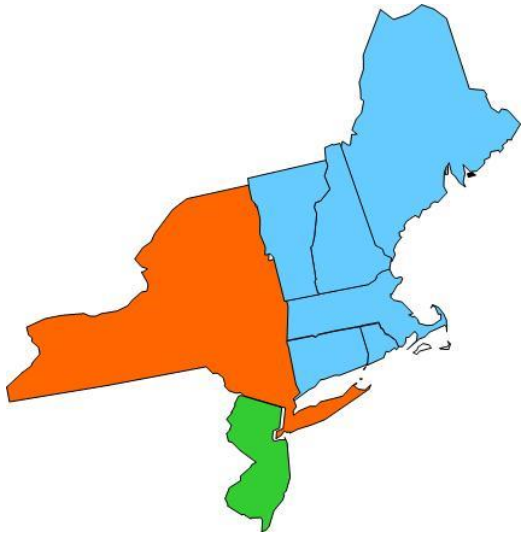
About NGA

- Non-profit trade association
- Local gas utilities (LDCs) serving New England, New York, New Jersey and Pennsylvania
- Several interstate pipeline companies
- LNG importers and LNG trucking companies
- Over 380 “associate member” companies, from industry suppliers and contractors to electric grid operators
- www.northeastgas.org



NGA Function Areas

Education & Training

RD&D

Advocacy

RNG Guide Sponsors and Participants

- Sponsors
  - Central Hudson
  - Con Edison
  - National Fuel
  - National Grid
  - NYSEG/RGE
  - Orange and Rockland
- Project Manager
  - NGA
- Consultant
  - GTI

Can We *Reasonably & Rationally* Meet The Challenges of The Second "Great Conversion"

A purge burner igniting manufactured gas being replaced in a main by natural gas during the 'great conversion' in 1952

- **Supply Mix Is Changing……..**
- **Renewable Gas is a *reality and an important part of the nations supply future***
- **Clean-up Technology has evolved**

Guideline Development Process

- Kickoff Discussion – 09/29/2016
- Interim Report Review – NYS Utilities 11/29/2016
- Draft Guide Review – NYS Utilities 04/10/2017
- Final Guide Review & Revision– 09/22/2017
- Discussion with NYSDPS, NYSERDA – 01/24/ 2018
- Peer Review with RNC & ABC – 06/2018 –6/2019
- Final Document – September 16, 2019

Policy Collides with Science .....

- RNG is already accepted and used in New York and in the US.
- For example, introduction of RNG directly into a gas distribution system has been successfully practiced for over 30 years from the Staten Island, NY landfill 4-7 MMSCF/Day recovered and processed followed by direct injection into the local distribution system.
- Project developers are in discussion with gas distributors throughout NE and the northeast but the processes, requirements, and agreements are not uniform, resulting in commercial and technical uncertainty for both parties.
- A consistent approach will bring certainty for all parties involved in negotiations with regard to safety, reliability, continuity, and interchangeability.

What, Why How Approach

- What are LDC concerns ?
- Why are LDC's concerned ?
- How can we address these concerns ?

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The What ?

- HHV/SG
- Total Inerts
- Moisture
- Oxygen
- Sulfur Compounds / Total Sulfur
- Trace Constituents
- Supply Reliability

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The Why ?

- HHV/SG – Interchangeability, Therm Billing
- Total Inerts – Interchangeability, Integrity
- Moisture – System Integrity
- Oxygen – System Integrity, Interchangeability
- Sulfur Compounds – System Integrity, Safety
- Trace Constituents – End Use, Safety
- Supply Reliability – gas system supply balancing

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Constituents of Concern Summary

- Potential COCs that may be found in raw gas from specific feedstocks for RNG production – focus analysis on reasonable COC's

Parameter	Landfill	Agricultural and Clean Organics	WWTP	Source / Facility Separated Organics	Gasifier Syngas
Water Content	■	■	■	■	■
Sulfur, including Hydrogen Sulfide	■	■	■	■	■
Hydrogen	■	■	■	■	■
Carbon dioxide	■	■	■	■	■
Nitrogen	■	■	■	■	■
Oxygen	■	■	■	■	■
Ammonia	■	■	■	■	■
Biologicals	■	■	■	■	
Mercury	■		■		■
Volatile metals	■				■
Siloxanes	■		■	■	
Volatile Organic Compounds	■		■		■
Semi-volatile Organic Compounds	■				■
Halocarbons	■		■		■
Aldehydes and Ketones	■				■
Polychlorinated biphenyls (PCBs)(1)					
Pesticides (1)					

(1) Unless reasonably suspected

Observed Range Found in Upgraded RNG from Landfills/Dairy Farms/ WWTPs

Parameter	AGA 4A Reported Range	Range Found in Upgraded Landfill-Derived RNG	Range Found in Upgraded Dairy-Derived RNG	Range Found in Upgraded WWTP-Derived RNG	Range Found in Natural Gas Samples
Total Sulfur gr. per 100 SCF	max 0.5 to 20	BDL (0.003) to 0.32	BDL (0.003) to 0.31	BDL (0.003) to 0.01	BDL (0.003) to 1.1
Hydrogen Sulfide gr per 100	maxi 0.25 to 1	BDL (0.003) to 0.03	BDL (0.003	BDL (0.003) to 0.01	BDL (0.003) to 0.36
Hydrogen (vol%)	max. 0.04 to 0.1	BDL (0.1) to 1.0	BDL (0.1)	BDL (0.1)	BDL (0.1) to 0.3
Carbon dioxide (vol%)	maximum 1 to 3	BDL (0.03) to 2.2	0.06 to 0.95	0.49 to 0.66	BDL (0.03) to 2.6
Nitrogen (vol%)	maximum 1 to 4	0.5 to 9.5	0.20 to 7.81	BDL (0.03)	BDL (0.03) to 12.7
Oxygen (vol%)	max. 0.001 to 1 ; most 0.1-0.2	BDL (0.03) to 1.3	BDL (0.03) to 1.99	BDL (0.03 vol%)	BDL (0.03) to 1.2 vol%
Diluents + Inerts (vol%)	max 3 to 6	0.6 to 10.0	0.37 to 10.65	0.49 to 0.66	0.3 to 12.7
Ammonia	none	BDL (10 ppmv)	BDL (10 ppmv)	BDL (10 ppmv)	BDL (10 ppmv)
Total Bacteria# per 100SCF	none	$2.46x10^4$- $3.29x10^8$	$3.28x10^3$ -$1.02x10^7$	$9.85x10^5$ to $2.14x10^6$	$3.47x10^4$ to $6.39x10^7$
Mercuryµg/m^3	none	BDL (0.01) to 0.3	BDL (0.01)	BDL (0.01)	BDL (0.01) to 0.06
Other Volatile Metals3 µg/m^3	none	BDL (30) to 250 (Cr, Cu, Mn, Pb, Sb, Zn)	BDL	BDL to 229 (Zn)	BDL (30) to 213 (As, Cu, Pb, Zn)
Siloxanes (D4) mg Si/m^3	none	BDL[1] to 6.0	BDL(0.5-1.0 mg/m^3)	BDL (0.5-1.0 mg/m^3)	BDL[1]
Non-Halogenated Semi-Volatile and Volatile Compounds (ppmv)	none	BDL[2] to 1.4 (BTEX, phthalates)	BDL[2] to 0.1 (BTEX,N-nitroso-di-n-propylamine, benzyl alcohol)	BDL[2] to 6 ppbv (phthalate)	BDL[2] to 471 (1,3-butadiene, acrylonitrile, BTEX)
Halocarbons(ppmv)	none	BDL (0.1) to 3.6 Freons,chloroethane, vinyl chloride)	BDL (0.1)	BDL (0.1)	BDL (0.1)
Aldehyde/Ketones3 ppbv	none	BDL(10 to 522	not tested	BDL (10)	BDL (10) to 103
PCBs (ppbv)	none	BDL (0.01 ppbv)	BDL (0.01 ppbv)	BDL (0.01 ppbv)	BDL (0.01 ppbv)
Pesticides (ppbv)	none	BDL (0.0006 to 0.003) (4,4'-DDT)	BDL (0.0004) to 0.5 (gamma-chlordane)	BDL (0.0006) to 0.006 (4,4'-DDT)	BDL (0.0006)

The How……

- ✓ Establish trace constituent product equivalency
- ✓ Explore opportunities & common ground
- ✓ Willingness to understand each others concerns & work towards solutions
- ✓ Finding ways to say “yes” rather than imposing overly restrictive requirements based on operational uncertainty

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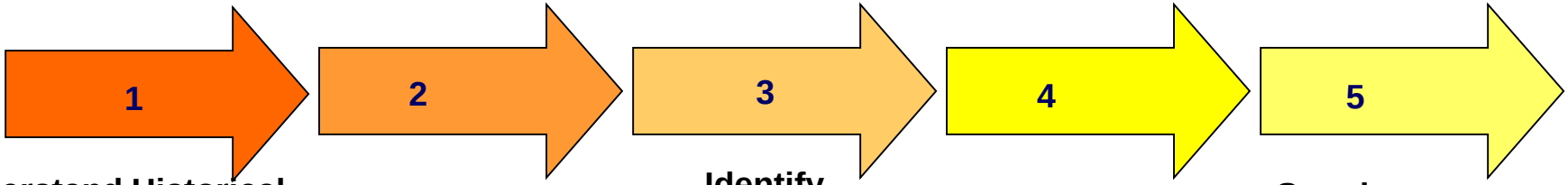
RNG Interchangeability Implementation Process



1 — Understand Historical Supply

- Work with Pipelines to establish system adjustment gas

2 — Understand "Zone of Influence"

- Work with pipeline to determine optimum injection point
- Establish reasonable supply compositions
- Pipeline to model influence on system including therm zones

3 — Identify "Potential Sensitive Receptors"

- LDC's catalog potential sensitive customer equipment

4 — Assessment

- Assess sensitive equipment
- Establish extent of retrofits
- Negotiate fixes

5 — Supply Agreement

- Establish interchangeability GSA parameters
- Establish most economical & balanced retrofit strategy if necessary

How to Achieve Success……..

- ✓ Don't rely on published tariff values alone, gas within distribution systems may be historically different than broad ranges in pipeline tariffs
- ✓ Work with Utilities to understand chemical properties of gas in the area of anticipated injection (adjustment gas).
- ✓ Work with Utilities to balance processing requirements and potential opportunities for contractual blending to meet HHV requirements.
- ✓ Share as much information as possible to provide operational certainty that the processed gas stream is similar to pipeline gas flowing in the area of injection.

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How to Achieve Success……..

- Optimize start-up and operational monitoring protocols.
- Develop “surrogate” monitoring parameters as process indicators that drive the need for more exotic testing if necessary.
- Leverage application of similar processes in similar situations – don’t reinvent the wheel!
- Establish mutually agreeable testing and monitoring parameters, limits, test methods and procedures to deal with anomalies.

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The Guideline Combines *Good Science & Common Sense……*

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