

STATE OF NEW HAMPSHIRE
PUBLIC UTILITIES COMMISSION

DG 18-140

In the Matter of:
Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty Utilities
Renewable Natural Gas Supply and Transportation Contract

Direct Testimony

of

Randall S. Knepper
Director – Safety Division

February 22, 2019

New Hampshire Public Utilities Commission

Liberty Utilities (EnergyNorth Natural Gas) Corp. d/b/a Liberty Utilities

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Q. Please state your name, occupation, and business address.

A. My name is Randall Knepper and I am employed by the New Hampshire Public Utilities Commission (Commission) as Director of Safety & Security. My business address is 21 S. Fruit Street, Suite 10, Concord, New Hampshire 03301.

Q. Please summarize your educational and professional experience.

A. In December 2004, I became Director Safety Division and in 2010 the Director of Safety & Security. I have testified in numerous dockets at the Commission including: DW 04-048, DG 08-048, DG11-040, DG 11-106, DG11-196, DG 13-149, DG 14-041, DG 14-155, DG 15-104, DG15-121, DE 15-459, DE 15-460, DE 15-461, DE 15-462, DE15-463, DG16-449, DG 17-048, DG17-063, DG18-064, DG 18-092.

I have been in numerous rulemakings including: Puc 800 Rules for Underground Damage Prevention in December 2008 and again in February 2017; Puc 500 Gas Rules in January 2005, and again in May 2013; Puc 300 Electric Rules in May 2014; Puc 1400 Rules for Pipeline Public Utilities in July 2013; Puc 1300 Rules for Pole Attachments in December

1 2009.

2 I have been the principal investigation in numerous after actions and investigations including:

3 Liberty Keene Plant Malfunction Investigation 2015, Unitil Hampton Locke Rd
4 Investigation 2015, December 2008 Ice Storm After Action Review, October 2011
5 Snowstorm After Action Review, 2014 Thanksgiving Storm After Action Review,
6 Benton Logging Incident 2015, Eversource Keene Fatality 2014, and Eversource Phase 2
7 System Investigation 2016.

8 I have written dozens of recommendations for Commission consideration in a number of
9 Commission dockets and can provide those cases upon request.

10 Prior to joining the Commission, I worked as an environmental engineer, staff
11 engineer for a gas utility, and project engineer for an electrical (high voltage transmission)
12 equipment provider. My professional work experience spans greater than 30 years. I have a
13 Bachelor of Science in Mechanical Engineering from the University of Rochester and a
14 Master's in Civil Engineering from the University of Massachusetts and am a registered
15 professional engineer in New Hampshire.

16 I am a member of the Association of Energy Engineers (AEE). I am a member of the
17 Governor's Advisory Council on Emergency Preparedness. I serve on multiple committees of
18 the National Association of Pipeline Safety Representatives (NAPSR) including prior
19 positions of Chair and Past Chair. I served as editor of each of the biennial editions of
20 NAPSR's *Compendium of State Pipeline Safety Requirements & Initiatives Providing*
21 *Increased Public Safety Levels Compared to Code of Federal Regulations*. I currently chair
22 the Staff Pipeline Safety subcommittee of the National Association of Regulatory

Commissioners (NARUC); I serve on the Common Ground Alliance Technology committee; I am appointed as a member of the Gas Technology Institute's Public Interest Advisory Committee; and I am a board member of the New Hampshire Public Works Standards and Training Council. Finally, I have testified before the United States Congress on pipeline safety issues.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to present Staff's analysis, comments and recommendations regarding operational aspects of the Liberty Utilities (EnergyNorth Natural Gas) Corp., d/b/a Liberty Utilities (Liberty or Company) proposal to enter into a renewable natural gas supply and transportation agreement (Agreement) under which Liberty agrees to buy renewable natural gas (RNG) from RUDARPA, Inc. (RUDARPA).

Q. Please summarize Staff's findings.

A. The Agreement raises a number of concerns regarding gas reliability and associated gas quality of Liberty's proposed renewable gas supply project (RNG Project or Project). There are certain clauses within the Agreement that require Liberty to purchase the Project's methane gas processing equipment which is located outside its franchise territory. This large investment should not be undertaken without a thorough study, engineering analysis and presentation of the gas quality to be produced, the precise manner in which it will be introduced into each distribution system, identification of each potential vulnerability of such a project with minimization mitigation and of perceived gas reliability concerns. The Agreement also allows Liberty to purchase the renewable processing equipment at any time after commencement of processing the biogas. There are issues with the gas specification

standards cited. The filing does not go into great detail on the operational aspects of the RNG Project, potential operational risks or potential negative impacts associated with using this sole source of supply.

Q. Please briefly describe the Liberty filing.

A. On September 7, 2018, Liberty filed for approval of the Agreement for the purchase of processed, “pipeline quality” RNG produced from a landfill located in Bethlehem, New Hampshire, to be compressed to approximately 4,000 psig and delivered into Liberty’s existing distribution systems via mobile storage trailers. Liberty’s filing also includes a proposal that the RNG be transported in certain locations to be used as a sole source of supply. RUDARPA will initially have exclusive responsibility for the design, construction, financing and operation of the processing/production facilities and delivery of RNG to Liberty’s distribution systems at three designated delivery points. Under the Agreement, Liberty will be responsible for the construction, operation and maintenance of the infrastructure needed to receive and inject the RNG into its distribution systems. The Agreement requires RUDARPA to provide a minimum annual supply quantity (MASQ) of RNG at a fixed price¹ for seventeen years from when service commences. If RUDARPA delivers the minimum volumes in year one or two, **Liberty is required** to purchase the processing/production facilities at a fixed price. Liberty **has the option** under this Agreement to purchase the processing facilities at any time. According to Liberty, if Liberty is required or elects to purchase the facilities, RUDARPA will continue to operate and maintain the facility for Liberty. According to Liberty this would be accomplished by incorporating into

1 the price of the RNG on a per dekatherm basis the operational and maintenance costs of
2 running the landfill gas facility. In addition, Liberty expects additional annual costs of
3 monitoring the expenses by hiring an outside consulting or engineering firm to oversee the
4 operational costs of RUDARPA regardless of whether Liberty is required or elects to
5 purchase the facilities.

6 **Q. How does the size and amount of methane produced of the Bethlehem, NH landfill**
7 **compare to the Turnkey landfill in Rochester, NH?**

8 **A.** There are only two landfills in New Hampshire that the Safety Division is familiar with that
9 are connected to pipelines to be used by end users. Neither is regulated by the PUC as a
10 utility but both are inspected by the PUC's Safety Division as part of its pipeline safety
11 oversight responsibilities. One is the Mount Carberry landfill in Success, NH and the other is
12 the large Turnkey landfill in Rochester, NH.

13 The Bethlehem facility is currently 50 acres² and is scheduled to close in 2021. The
14 Bethlehem facility had applied to expand by another 100 acres but that possibility looks
15 dubious. After 2021, Casella Waste Systems subsidiary, North Country Environmental
16 Services, (NCES) that owns the landfill will not be allowed to add to the facility and it will be
17 capped. Facility expansion was sought by NCES but was voted down at the most recent town
18 meeting held in March 2018. This disallows further expansion of the landfill. Two other
19 votes in the past rejected requests to expand the landfill. The amount of gas produced at the
20 Bethlehem landfill is projected by Liberty's consultants to be a maximum of 2400 scfm.

¹ The Caledonian Record approximates the fixed price to be approximately \$15 million. Reference Caledonian Record – December 3, 2018 by Robert Blechl "Bethlehem Planners, Zoners Approve Landfill Gas Conversion Plant"

² WasteDive 3/18/2018 <https://www.wastedive.com/news/casella-landfill-town-election-new-hampshire/518954/>

1 Theoretically 2400 scfm, which is equivalent to 144 mcf/hr or 3,456 mcf/day but Liberty's
2 Exhibit B projects only 1/3 of that will be produced a day. Exhibit B states 1100 Dk/day
3 (approximately 1,100 mcf/day). This indicates the gas will vary in flow rate throughout the
4 day and will be typically on average 800 cfm. At the minimum of 930 bth/mcf, Liberty
5 contractual requirement of 490,000 dk/yr equates to 526,000 mcf/yr.

6 The Turnkey Landfill in Rochester is 1,200 acres in size in its entirety, but only a
7 portion of the landfill area is designated or reserved for the collection system dedicated to
8 producing methane for the University of New Hampshire owned gas pipeline that feeds a
9 campus electric generator, boiler system and duct burner. The total of the Turnkey landfill
10 gas production rate was 12,000 scfm in 2007 but now has dwindled to 6,000 scfm in 2017.
11 The Turnkey Landfill portion supplying UNH varies every day and throughout the day with
12 land fill gas flow rate and Staff seen it vary from 2,000 cfm to 700 cfm.

13 **Q. Describe the steps in processing the renewable gas as you understand it from Liberty's**
14 **petition.**

15 **A.** The processing technology envisioned for the Bethlehem facility utilizes four technologies to
16 attain pipeline quality gas. Reference BP 56 (Facility Design Specifications Exhibit D of
17 Liberty/RUDARPA agreement)

18 The first step in the process is to remove sulfur and hydrogen sulfides from the gas
19 stream. This is accomplished by using **activate carbon vessels** where the sulfur is removed
20 in stages. Equipment includes the carbon vessels, appurtenances, pumps, drivers and controls.
21 This is then trimmed further to attain the final specification as measured through landfill
22 chromatograph measurements. Liberty has stated that the RNG specification will be between

1 .25 ppm and 1.0 ppm for Hydrogen Sulfide with total sulfur between 0.5 grains and 20 grains
2 per 100 cfh. Liberty appears to have incorrectly copied this information from the GTI
3 guidance document and inserted this as Exhibit B of the Liberty/ RUDARPA Agreement. For
4 comparison TGP specifies sulfur will be less than 5 grains per 100 cubic ft, with hydrogen
5 sulfide 0.25 grains per 100 cubic feet thus RNG could contain levels up to 4 times the level
6 typically of sulfur or hydrogen sulfide compared to the gas quality of the TGP interstate
7 pipeline. (Reference Staff Response 2-49).

8 The second major step in the process is to remove water content, Volatile Organic
9 Compounds (VOC), Siloxanes, and other non-methane organic compounds using the second
10 technology called **Temperature Swing Adsorption**.³ It also includes using a molecular
11 sieve and medias. The equipment involved includes using blowers, separators, vessels,
12 piping, chiller systems, panels, drives, starter, associated instrumentation and control.
13 Liberty's Exhibit B lists the amount of water vapor allowed as 4 pounds per 1,000,000 cubic
14 feet. For comparison, TGP specifies water vapor will be less than 7 pounds per 1,000,000
15 cubic ft, at standard conditions thus RNG is expected to be dryer than the maximum allowed
16 by TGP. Staff did not request what the actual levels were that were being delivered daily by
17 TGP for comparison. RNG states the siloxane level allowed is 1.5 ppm. TGP does not
18 typically have any siloxanes within its gas components. For Non Methane Organic
19 Compounds Exhibit B for RNG states that 2 ppm is the limit. It is not a direct comparison to
20 TGP tariff pipeline natural gas quality. These non methane organic compounds such as

³ Exhibit D BP 56 incorrectly describes this as absorption. The correct term is Adsorption. (Accumulation on the surface rather than the volume of the material)

1 hydrocarbons hexane and propane (C2 and C3 molecules) (i Butane, n Butane, i pentane, n
2 pentane, (C4 and higher) are not typically found in landfill gas but are found as part of natural
3 gas wells and thus transported in TGP pipelines. TGP further breaks these down as to they
4 should be no more than 12% by volume of the total natural gas for the lower hydrocarbons
5 and 1.5% by volume of the higher hydrocarbons.

6 The third major step in the process is to remove carbon dioxide by separating it from
7 the methane molecules. This uses a Carborex **multistage membrane separation system** that
8 uses many hollow fibers made of polymers and takes advantage of differences in diffusion
9 rates the molecular structure of carbon dioxide and methane. This in a sense purifies the
10 methane (upgrades it) and eliminates the harmful carbon dioxides. The equipment involved
11 includes membranes, instrumentation, vessels, valves, piping, a compressor, drives, panels,
12 starters and controls for monitoring. Liberty has stated in Exhibit B that the RNG
13 specification will be less than 2.2% and TGP states it should be less than 2% so these are
14 comparable.

15 The fourth major step is to remove nitrogen, oxygen and other trace elements from the
16 gas in a Nitrogen Rejection Unit using a fourth technology called **Pressure Swing**
17 **Adsorption** with molecular sieves. An adsorbant is used that separates the nitrogen from the
18 methane but because they are similar size molecules it has to selectively discriminate the
19 nitrogen from the methane and the methane becomes regenerated using pressure fluctuations.
20 This requires compressors, drives, vessels, media, piping controls, starters, instrumentation,
21 devices and panels. Liberty has stated in Exhibit B that the RNG specification for nitrogen
22 will be allowed to be between 0.5% and 6% of volume. TGP limits this even further saying

1 the combined nitrogen and oxygen must be less than 2.75% by volume. For oxygen alone,
2 Liberty has stated in Exhibit B that the RNG specification should be between 0.1% and 0.9%
3 while TGP limits oxygen to be 0.2%.

4 In addition to the processing equipment the refined gas then needs to be compressed to
5 approximately 4,000 psig and a loading operation needs to be built so that mobile transfers
6 can be made to Liberty's receipt points in Concord, Keene and Lebanon. At those points a
7 decompression skid with associated heat exchangers and regulators needs to be built at each
8 of the locations to reduce the pressures to distribution system levels (100 psig, and 55 psig)
9 and injected into the distribution pipelines. This involves installing a structure and
10 compressor units similar to the ones found in configuration at Broken Bridge, Concord that
11 involved coordination between INAT GAS and Liberty.

12 **Q. What risks did Liberty identify with this project?**

13 **A.** The Company identified three material risks associated with the project:

- 14 1) construction costs of the required processing plant
- 15 2) RNG production quantities and
- 16 3) RNG production quality.

17 **Q. Describe Liberty's risk assessment and measures to mitigate those risks?**

18 **A.** These three risks identified are indeed real and are the result of RNG being introduced as a
19 source of supply to supplant traditional interstate pipeline gas. Liberty has taken certain
20 measures to partially address those risks in an effort to mitigate and lessen the identified risks.
21 The mitigation of the first risk was to have cost over runs be absorbed by RUDARPA using a
22 fixed estimated amount so it limits escalation of construction costs. Liberty believes they

1 mitigated the production quantity estimates by using past flare amounts with a conservative
2 factor applied so that the production of RNG quantities can have greater certainty which
3 became a factor for minimum quantities to be purchased. Liberty believes they mitigated the
4 quality issues by using GTI documents as a standard. But there are other material risks as
5 well, related to the economics of the project and operational risks associated with the
6 introduction RNG into a gas distribution system that Staff believes should be highlighted and
7 brought to the attention of the Commission.

8 **Q. Are there some of those other operational risks that Liberty did not identify or provide**
9 **sufficient detailed information of the project?**

10 **A.** The Staff identified 7 additional risks that may play an important role in the success or
11 nonsuccess of the proposed Project.

12 1) First, Liberty has no experience with operating an RNG facility. There are presently no
13 personnel on the Company's staff that the Safety Division regularly interacts with or is aware
14 of that has operated an RNG facility as part of their daily duties and that has great familiarity
15 with the type of equipment used to process methane gas required to attain a state of "pipeline
16 quality" renewable gas. While the contract states RUDARPA will provide the labor,
17 equipment knowledge, skills and ability to handle day to day operations of the facility, Staff is
18 concerned if RUDARPA goes out of business or can no longer provide those services, Liberty
19 does not have a backup workforce identified that can handle those duties. This is a critical
20 operational risk.

21 2) A second risk is the apparent inexperience RUDARPA has with landfill RNG production
22 and supply based on the company size, experience number of landfill RNG projects that

1 RUDARPA has financed, owned, and operated in the northeast United States. Staff's
2 research of RUDARPA from its website displays only three people in the company, all of
3 whom are headquartered in Utah and does not indicate that RUDARPA has experience as a
4 developer of any similar landfill projects. They do not have a presence in New Hampshire
5 and the apparent lack of project experience with developing these landfill RNG production
6 facilities concerns Staff and increases the risk of an unsuccessful outcome of the proposed
7 Project. The RUDARPA website lists only the New Hampshire project and no others.

8 3) The required landfill gas processing equipment is made up of four major processes required
9 to produce the pipeline quality gas. Each of these processes requires equipment that needs to
10 be operate constantly without interruption. Each has mechanical equipment that is subject to
11 wear and tear and breakdowns. The Bethlehem facility will be comprised of skid mounted
12 processes but each is sequential so the breakdown affects the operation of the next. Most of
13 these landfill projects have parts and equipment from vendors that are located far away,
14 increasing back order times, and there is not a plethora of alternative suppliers that can meet
15 the customized configurations and equipment specifications of the manufacturers.

16 4) A fourth risk is raised by Liberty's plan for deployment of the RNG. Two of the three
17 receipt points identified do not have a backup interstate pipeline supply to supplement system
18 needs if the RNG supply that is projected to be delivered on any given day is interrupted.
19 Liberty's plan is to not intermix the RNG with potential CNG supplied within each of the City
20 of Keene and the towns of Lebanon and Hanover. Nearly all RNG landfill projects in the
21 United State use RNG in a blended fashion with most introducing RNG directly into
22 transmission pipelines that carry large volumes of traditional gas. Variations of RNG gas

1 quality have such a small impact on the overall gas quality and quantity amounts that lessens
2 risks. This is not the case with the Liberty/RUDARPA Project.

3 5) Based on my professional understanding, modeling programs that project how much
4 methane will be available can produce variable results.⁴ Multiple variable inputs that are
5 involved impact the modeling outputs and results can vary widely. Past behavior of landfills
6 are not necessarily indicative of what future behaviors of landfills will provide in methane
7 production rates given the varying nature of the landfills, including geography as well as
8 contents.⁵ The unknown rate of methane extraction is predicated on an accurate model and
9 thus these become inputs into much of the design, operations, equipment selection,
10 installation cost, maintenance cost and the processing quantities. Factors that need to be
11 considered are organic content, future landfill disposal rates, the site closure date, how the
12 extraction wells are configured, gas collection efficiency assumptions, limited waste disposal
13 data, accuracy of flow data necessary for model calibration, and variations of waste
14 composition over time are some of the factors that will involve accurate modeling.⁶ To my
15 knowledge, these factors were not addressed in Liberty's filing.

16 6) The rate of extraction for RNG is subject to many externalities that the developer can
17 control. For instance, a loss of power can affect the pumps used to extract the gas and this
18 can be caused by a storm or an accident upstream of the site. The amount of rainfall or lack
19 of rainfall if there is temporary drought effects the extraction rate. The location of facility and
20 being subject to freezing temperatures can affect the sumps used in the extraction process as

4 Discussions between Safety Division and UNH facility department personnel, D Bouley at NEPSR Oct 2018 Pipeline Safety Seminar. (Liberty operations personnel were in attendance)

5 The Turnkey Landfill is producing half of the amount of methane it was 10 years ago and the daily swings in methane extraction can be seen on UNH

1 well as affecting the overall landfill site.

2 7) A seventh risk is the location of the facility in Bethlehem. Liberty's closest area work
3 center or "yard" is located in Tilton. The distance from Bethlehem is approximately 65 miles.

4 If an instrumentation or control issue arose, the Liberty control room located in Londonderry
5 is more than 100 miles away. Bethlehem is located north of the White Mountains so weather
6 impacts can negatively affect travel times as well as all of the other risks identified above.

7 The site location impacts on emergency response actions was not discussed within the
8 petition. Internet access and high speed connections may not be as strong in Bethlehem as
9 they are in Londonderry.

10 **Q. AGA and Liberty have stated that RNG is "interchangeable" with natural gas. Do you**
11 **agree?**

12 **A.** On a theoretical basis when all concerns and risk factors have been mitigated and are
13 behaving ideally and all equipment is running smoothly then RNG can be somewhat
14 considered equivalent to natural gas but not exactly. However, conditions need to be ideal to
15 achieve this. Practically speaking, it is somewhat unrealistic to think that a single supply of
16 RNG from a landfill is equivalent to traditional gas supplied from an interstate pipeline. An
17 interstate pipeline and its reliability is analogous to an interstate highway connected to
18 multiple major sources of supply in diverse parts of the country. This "highway" is built with
19 many on ramps and off ramps that diffuse the impact of any single interruption. Conversely,
20 the RNG supply in this petition is equivalent to a single source and is more like a small one-
21 way road to reach its final destination of serving customers. The interstate pipeline in New

Hampshire has historically (in excess of over 60 years) proven to have an extremely high level of reliability without having interruptions or questionable gas quality. The interstate pipeline system is part of a larger more diverse network and itself is not dependent on a single source as a supply. Currently, the measured delivered Btu content from the interstate pipeline, Tennessee Gas Pipeline (TGP), in New Hampshire ranges from 1020 to 1040 Btu per cubic foot.⁷ The TGP Tariff states that the minimum is 967 Btu per cubic foot and the maximum is 1,110 Btu per cubic foot.⁸ The minimum specification Liberty provides for RNG based on what Liberty refers to as a national GTI specification is as low as 930 Btu per cubic foot with a maximum of 1010 Btu per cubic foot. This is a variance of approximately 10% if considered TGP max to RNG max or actual TGP measured delivered with the minimum required by Liberty for this RNG supply. In order to achieve that result, all the processes for refining the gas impurities must be functioning properly for RNG “pipeline quality gas” to be considered equivalent. “Interchangeability” of RNG for natural gas is comprised of equivalent reliability and equivalent gas quality. The two factors are inherently related and should not be separated.

Q. Are there any inconsistencies between the GTI document and the way it is represented in the Liberty/RUDARPA agreement?

A. Yes, I found in numerous places where these inconsistencies are found between the intended use of the GTI document and Liberty’s inclusion within testimony and within the Liberty/RUDARPA Agreement itself. The 2012 GTI report “Guidance Document for the Introduction of Landfill-Derived Renewable Gas into Natural Gas Pipelines” is exactly as titled, a guidance document with all kinds of cautions and disclaimers to not refer to it as a standard. It does not purport to establish a “standard” but is described as such in

⁶ LFG Energy Project Development Handbook, Department of Energy, June 2017

⁷Reference Staff Response 2-2.

⁸ Reference Staff Response 2-49.

Liberty/RUDAPRA agreement (definition of terms, reference BP022). GTI is not a standards making organization such as ASTM or ANSI and the document should not be described as such, yet Liberty incorrectly does. Specifically, on BP115 of the GTI document, the purpose of the guidance document is stated as “to identify criteria that stakeholders should consider...,” but “This document will not provide specific operational parameters for high-Btu landfill-derived renewable gas”. Further the GTI document warns on BP 117 that “*Each system operator is advised to conduct an overall interchangeability assessment*”. This would include modeling a zone of influence and assessing any sensitive receptors that may be within. Again on BP 119 of the GTI document it states “*Caution needs to be exercised when using tariff value ranges highlighted in the report to assess interchangeability*”. It goes on further to state Tables 1A and 1B of the GTI document are:

provided solely to illustrate components and parameters that could be considered during contract or tariff negotiations for the introduction of renewable gas not to propose actual values. Individual tariffs may not include all the properties listed in the table and/or may include others not listed, e.g., interchangeability criteria, trace constituents, helium, specific hydrocarbon limits, and others. Readers are advised to consult with appropriate technical and engineering support personnel in an effort to make an informed decision regarding specific contract or tariff specification criteria for a specific market area. This should take into consideration the nature of historical supplies, end use applications within the market area.

When questioned about interchangeability, Liberty in its response to Staff 3-11 simply quotes an AGA statement that RNG is interchangeable with pipeline quality gas and provides a link to the AGA website. It states:

The Company has employees that sit on the AGA Sustainability Committee and have discussed RNG with other members. In fact, the AGA states renewable gas is “pipeline quality biomethane” that is “produced from existing waste streams and a variety of renewable and sustainable biomass sources, including animal waste, landfills, crop residuals, and food waste.” Once processed, it is “interchangeable” with traditional pipeline-quality natural gas. “It is carbon neutral, extremely versatile, and fully compatible with the US pipeline infrastructure.” A link to the AGA website regarding RNG can be found here:
https://www.aga.org/sites/default/files/legacy-assets/our-issues/renewablegas/Documents/AGA_RenewableGas_Summary_3.pdf.

Liberty’s response to Staff 3-11 and the GTI witness Wiley testimony could easily be misinterpreted to assert that GTI has reviewed and approved the language used in the Liberty/RUDARPA Agreement. In actuality, GTI appears to have reviewed only Appendix

D, a two-page document that describes the technologies to be employed in the gas processing or cleaning system, while Exhibit B of the Liberty/RUDARPA Agreement references RNG Specifications as a GTI standard.

Q. What standards does the PUC have in its rules regarding gas quality?

A. The PUC's 500 rules are rather limited with respect to gas quality standards. PUC Part 504 Quality of Gas Service discusses the following seven elements:

- 1) heating value of gas,
- 2) purity of gas in terms of maximum sulfur limit,
- 3) pressure of gas,
- 4) emergency notification,
- 5) emergency response,
- 6) incident reporting, and
- 7) emergency response

As one can see, only two of those elements actually relate to quality of gas. The heating value of gas rule allows the Company to establish its own standard for the heating value of gas. It requires the use of a chromatograph or calorimeter but must be measured at least daily to determine the daily average. Daily averages are then used to determine monthly averages for billing purposes. The requirement pertaining to the purity of gas mentions only sulfur limits. All gas distributed in New Hampshire shall contain not more than 20 grains of total sulphur per 100 cubic feet nor more than one fourth of one grain of hydrogen sulphide per 100 cubic feet.

Q. How does Liberty's RNG specification as listed in Appendix D comport with Puc

1 **504.04?**

2 A. Liberty has stated the limit of total sulfur for RNG could vary from 0.5 grains per 100 cubic
3 feet to 20 grains per 100 cubic feet. This would be in compliance with Puc 504.04 (b).
4 Liberty has stated the limit of hydrogen sulfide for RNG could vary from 0.25 ppm to 1 ppm.
5 I calculate this to be equivalent to .0625 grains per 100 cubic feet (Using a density of 0.0895
6 pound per cubic foot. and 7000 grains per pound)⁹. This would be in compliance with Puc
7 504.04 (b).

8 **Q. Does the staff believe the PUC 500 rules regarding quality of gas need to be amended?**

9 A. The PUC 500 gas rules did not contemplate renewable of landfill gas as part of the types of
10 gas used by utilities. In fact, the methane and landfill gas applicability portion is segregated
11 from the utility portion because the PUC only looks at the safety aspect of the non-utility
12 systems, not the gas quality. If Liberty is going to introduce RNG gas as one of the regular
13 gas supply components then the Safety Division believes it would be appropriate to research,
14 determine impacts on customer equipment, distribution systems and update these minimal
15 rules that are now in place to reflect any findings that may be relevant.

16 **Q. Please compare the force majeure language in the Liberty/RUDARPA Agreement and**
17 **force majeure language of the main interstate pipeline, Tennessee Gas Pipeline,**
18 **supplying Liberty's other communities.**

19 A. The Liberty/RUDARPA Agreement defines a Force Majeure Event as in section (b) as "*the*
20 *elements including storms, **lightening**, landslides, hurricanes, floods, earthquakes, tornados,*

⁹ Staff notes Response to Staff 2-49 incorrectly shows that the RNG could have a higher percentage of Hydrogen Sulfide.

1 *freezing of equipment or lines of pipe and threats of any of the foregoing.*” I am concerned
2 that lightning could cause a power outage which in turn could cause some of the processing
3 equipment or gas extraction equipment (pumps, instrumentation, starters and controls, drivers
4 and other such equipment to be able to not operate properly and thus the reliability is
5 threatened. The electric supply to the landfill, for example, is on a long circuit¹⁰ that could
6 suffer from a lightning strike and cause an outage. If this were to occur during a wide scale
7 storm it could take days to get power restored. I am also concerned about the phrase “*freezing*
8 *of equipment or lines of pipe*” since the location of the landfill west of the northern White
9 Mountains where temperatures are regularly below freezing for long periods and thus if RNG
10 production is effected, could be considered a force majeure event. I question the
11 consequences of a “force majeure” clause where the listed threats include distinct possibilities
12 rather than unusual events.

13 In comparing the TGP tariff and Liberty’s tariff provisions (attachment RSK -2) I
14 don’t see TGP’s equivalent force majeure provision to be as broad in scope as that which is
15 included in the Liberty/ RUDARPA Agreement. My knowledge of Liberty’s New Hampshire
16 operations leads me to believe that TGP has not declared a force majeure situation supplying
17 Liberty in the past and has consistently been able to meet the tariff requirements and
18 obligations.

19 **Q. Of the 79 Renewable Projects referred to in David Cox testimony DC Attachment 1 (BP**
20 **99 and 100) can you put some context as to how many landfills in operation directly feed**
21 **residential customers and small commercial customers. Is it a small or large quantity?**

¹⁰ Eversource 348X3 34.5kv/7.2 kv circuit out of Bethlehem switching station (approximately 5 miles from the landfill)

1 **A.** David Cox testimony DC Attachment 1 (BP 99 and 100) contains a table which indicates
2 there are 119 RNG projects in the US but some of those are under construction and are not
3 operating. This includes all types of RNG, not just landfill. Of the 119, 79 are listed as
4 Pipeline Injected, again this includes all type of RNG not just landfill. Of the 79 listed there
5 are 67 that are landfill and pipe line injected but may not be operating. Of the 67 listed there
6 are only 51 that are landfill, pipeline injected and are operating. Of those 51 3 are listed as
7 pipeline and the remaining are listed renewable. If I am interpreting this table correctly, I only
8 see three that are going directly to residential and commercial business through a distribution
9 system labeled as “Pipeline”. If it includes the remaining 48 that go to residential and
10 commercial as well as CNG/LNG transportation fuel it should be more clearly identified.

11 **Q.** **Do the two customers that have LOIs for renewable gas have options for attaining the**
12 **renewable gas outside the regulated Liberty supply and distribution system?**

13 **A.** Yes, the two customers with LOIs can purchase landfill gas and have it compressed from
14 alternative sites besides the Bethlehem landfill, compressed and decompressed at their own
15 location and injected directly into their customer owned gas piping. This would ensure that
16 the renewable gas they purchase actually is consumed by the end user and not just mixed in
17 within the overall system gas as part of the portfolio of supply.

18 **Q.** **Are there customers in New Hampshire that procure their own gas and have it delivered**
19 **to their facilities.**

20 **A.** Dartmouth Hitchcock Medical Center in Lebanon and Cheshire Medical Center in Keene
21 purchase their own gas supplies independent of Liberty and have it delivered to their facilities
22 independent of Liberty. My understanding is that those customers have not done this with

1 RNG although it could be a possibility if they choose.

2 **Q. Does that conclude your written testimony?**

3 **A.** Yes. However, Staff is continuing to research testing methods for gas component detection
4 and is reviewing the AGA Gas Quality Manual that it only recently obtained as reference
5 material.

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