

EXHIBIT “A”

RTAP LIST/FRACKED GAS COMPARISON

22 toxic air pollutants on [RTAP List](#) (beginning at page 15) are associated with fracked gas, either as additives or produced by combustion of this gas (VOCs).

15 of these are Toxicity Class I (most toxic); 6 are Toxicity Class II, 1 is Toxicity Class III.

10 RTAPs - 5 Toxicity Class I, 4 Toxicity Class II, 1 Toxicity Class III - are on EPA list of frequent additives to fracked gas

Sources: [RTAP List](#) (beginning at page 15) and Table 9, at p. 36, of [“Analysis of Hydraulic Fracturing Fluid Data from the FracFocus Chemical Disclosure Registry 1.0,” by the EPA \(March 2015\)](#); *see also* [EPA website](#)

Methanol: RTAP CAS No. 67 – 56 – 1, Toxicity Class II

Ethanol: RTAP CAS No. 64 – 17 – 5, Toxicity Class II

Propargyl alcohol : RTAP CAS No. 107 – 19 – 7, Toxicity Class I

Glutaraldehyde: RTAP CAS No. 111 – 30 – 8, Toxicity Class I

Ethylene glycol (aerosol): RTAP CAS No. 107 – 21 – 1, Toxicity Class II

2-Butoxyethanol: RTAP CAS No. 111 – 76 – 2, Toxicity Class I

Napthalene: RTAP CAS No. 91 – 20 – 3, Toxicity Class I

1,2,4-Trimethylbenzene: RTAP CAS No. 95 – 63 – 6, Toxicity Class II

Dimethylformamide: RTAP CAS No. 68 – 12 – 2, Toxicity Class I

Polyethylene glycol: RTAP CAS No. 25322 – 68 – 3, Toxicity Class III

11 more RTAPs - 9 Toxicity Class I, 2 Toxicity Class II – are identified Table 7 VOCs from fracked gas

Sources: [RTAP List](#) (beginning at page 15) and Table 7, at p. 21, of [“Gas Patch Roulette: How Shale Gas Development Risks Public Health in Pennsylvania,” by Nadia Steinzor, et. al. \(October 2012\)](#)

Acetone: RTAP CAS No. 67 – 64 – 1, Toxicity Class I

1,1,2-Trichloro-1,2,2-Trifluoroethane: RTAP CAS No. 76–13–1 , Toxicity Class II

Carbon tetrachloride: RTAP CAS No. 56 – 23 – 5, Toxicity Class I

Toluene: RTAP CAS No. 108 – 88 – 3, Toxicity Class I

n-Hexane: RTAP CAS No. 110 – 54 – 3, Toxicity Class II

Benzene: RTAP CAS 71 – 43 – 2, Toxicity I

Methylene chloride (dichloromethane): RTAP CAS No. 75 – 09 – 2, Toxicity Class I

Trichloroethylene: RTAP CAS No. 79 – 01 – 6, Toxicity Class I

Xylene m-isomers: RTAP CAS No. 108 – 38 – 3, Toxicity Class I

Xylene p-isomers: RTAP CAS No. 106 – 42 – 3, Toxicity Class I

Xylene o-isomers: RTAP CAS No. 95 – 47 – 6, Toxicity Class I

A 22nd RTAP, the VOC Formaldehyde - Toxicity Class I – is also found in fracked gas

Sources: pp. 18-19 at [“Madison County, New York Department of Health Comments to the Federal Energy Regulatory Committee,” prepared for Madison County Department of Health by Thimble Creek Research \(September 30, 2014\);](#) pp. 26-27 and Appendix B, pp. 2-6 and Table 12 at p. 10, of [ATSDR/CDC Health Consultation Report \(Jan. 29, 2016\)\(asthmatics, elderly and others at risk from compressor stations\);](#) p. 5 and Appendix 1 at p. 19 of [“California’s Fracking Fluids: the Chemical Recipe,” by Tasha Stoiber, et. al. \(EWG; August 2015\)](#)

NOTE: Formaldehyde does not appear in the Table 7 VOC list because sampling for that study was done with Summa canisters. Badges are generally used for formaldehyde monitoring. Formaldehyde is a carcinogen. [Union Leader, December 18, 2015 online article by Meghan Pierce](#)

Compiled by Liz Fletcher for NH Pipeline Health Study Group, May 2016

EXHIBIT “B”

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

DG 17-152

Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-1

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Please identify the sources of all forms of gas to be distributed at the proposed Keene facility being considered under Docket DG 17-068, *i.e.*, the Marcellus shale fields and otherwise.

RESPONSE:

The Company is proposing to serve customers in Keene with natural gas supplies in the form of compressed natural gas (CNG) or liquefied natural gas (LNG). Over time, these supplies would replace existing propane supplies used to serve Keene customers. As with the propane supplied to customers today, the Company solicits supplies through requests for proposals aimed at providing the needed supply at the lowest cost. Both the propane and natural gas supplies to serve end users would come from a variety of different geographic locations and extraction methods. The Company is not aware of the initial source of the molecules that would comprise the future propane, CNG or LNG supply sources.

The Company is not proposing to serve Keene customers via capacity on an interstate pipeline.

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

DG 17-152
Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-2

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Please identify the approximate percentage of gas used at the proposed Keene facility being considered under Docket DG 17-068 which will be conventional natural gas versus hydraulically fractured ("fracked") natural gas.

RESPONSE:

Please see the response to Clark 1-1.

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

DG 17-152

Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-3

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Please identify the complete chemical composition of the conventional natural gas that will be distributed from the proposed Keene facility being considered under Docket DG 17-068, or, alternatively, attach a representative sample complete chemical analysis of the gas, or the last three such analyses of the gas whether Liberty considers them to be representative analyses or not.

RESPONSE:

Please refer to the Company's response to Clark 1-1. The Company solicits natural gas supplies through requests for proposals aimed at providing the needed supply at the lowest cost. The natural gas supply to serve customers in Keene could come from a variety of different geographic locations and extraction methods. Until such time as the Company begins to provide natural gas service to its Keene customers, it has not purchased said natural gas and is therefore not in possession of the specific natural gas and cannot provide its chemical composition.

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

DG 17-152
Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-4

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Please identify the complete chemical composition of the fracked natural gas that will be distributed from the proposed Keene facility being considered under Docket DG 17-068, or, alternatively, attach a representative sample complete chemical analysis of the gas, or the last three such analyses of the gas whether Liberty considers them to be representative analyses or not.

RESPONSE:

The Company disagrees with the premise of the question that the natural gas that will be distributed from Keene will be “fracked.” Please see the Company’s responses to Clark 1-1 and 1-3.

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

DG 17-152

Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-5

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

If Liberty's prior response did not disclose the complete chemical composition of the fracked natural gas that will be distributed from the proposed Keene facility being considered under Docket DG 17-068, please identify the approximate percentage of chemicals in the gas that were not identified.

RESPONSE:

Please see the Company's responses to Clark 1-1 and 1-3.

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

DG 17-152

Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-6

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Please identify the complete chemical composition of the propane-air gas that has been distributed to customers under Liberty's Keene franchise, or, alternatively, attach a representative sample complete chemical analysis of the gas, or the last three such analyses of the gas whether Liberty considers them to be representative analyses or not.

RESPONSE:

See Attachment Clark 1-6 for a representative analysis of the typical chemical composition of natural gas distributed by the Company.



Microbac Laboratories, Inc. - Erie

CERTIFICATE OF ANALYSIS

17K0766

Powell Controls

John Rafferty
3 Baldwin Green Common, #201
Woburn, MA 01801

Project Name: LIB001 (Londonderry AES)

Project / PO Number: LIB001-103117GC
Received: 11/07/2017
Reported: 11/29/2017

Analytical Testing Parameters

Client Sample ID:

Sample Matrix:

Lab Sample ID:

Collection Date:

	Result	RL	Units	Note	Prepared	Analyzed	
	Result	UNC	MDA	Units	Note	Prepared	Analyzed

Surrogate:

% Rec

% Rec

Definitions

Report Comments

Samples were received in proper condition and the reported results conform to applicable accreditation standard unless otherwise noted.

The data and information on this, and other accompanying documents, represents only the sample(s) analyzed. This report is incomplete unless all pages indicated in the footnote are present and an authorized signature is included.

Reviewed and Approved By:

Yesenia Rosa
Project Manager

Reported: 11/29/2017 17:00

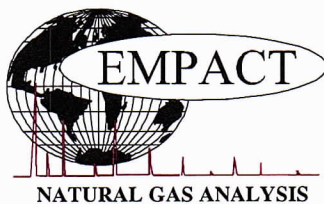
Microbac Laboratories, Inc.

QC473 V1

PA DEP# 25-00067, NY DOH# 10121, 1962 Wager Road | Erie, PA 16509 | 814.825.8533 p | microbac.co

Page 1 of 8

[illegible]



PRIMARY NAME/DESCRIP : ENV-AIR
DB KEY: 17K0766-01
LIB001-1
PROJECT NO. : 201711052 ANALYSIS NO.: 01
COMPANY NAME : MICROBAC LABORATORIES ANALYSIS DATE: NOVEMBER 13, 2017 11:29
OFFICE / BRANCH: ERIE, PA SAMPLE START: NOVEMBER 2, 2017 14:14
CUSTOMER REF: 17K0766 TO:

FIELD DATA

SAMPLE CYCLE: SAMPLE TYPE:
SAMPLE PRES. : - "WC CYLINDER NO. : 1L TEDLAR
SAMPLE TEMP. : - °f SAMPLED BY :
AMBIENT TEMP.: - °f SAMPLING COMPANY:
LAB PRESSURE: - psig H2S BY STAIN TUBE: - ppm

FIELD COMMENTS

LAB COMMENTS:

COMPONENTS	NORM. MOLE%	GPM @ 14.73	GPM @ 14.696
HELIUM	0.00	-	-
HYDROGEN	0.00	-	-
OXYGEN/ARGON	0.57	-	-
NITROGEN	1.58	-	-
CO2	0.10	-	-
METHANE	95.54	-	-
ETHANE	2.14	0.572	0.571
PROPANE	0.07	0.019	0.019
ISOBUTANE	0.00	0.000	0.000
N-BUTANE	0.00	0.000	0.000
ISOPENTANE	0.00	0.000	0.000
N-PENTANE	0.00	0.000	0.000
HEXANES+	0.00	0.000	0.000
TOTAL	100.00	0.591	0.590
BTU @ 60 DEG F		14.73	14.696
LOW NET DRY REAL=		909.0	906.9
NET SATURATED REAL=		893.2	891.1
HIGH GROSS DRY REAL =		1009.0	1006.6
GROSS SATURATED REAL =		991.5	989.1

RELATIVE DENSITY (AIR=1 @ 14.696 PSIA 60F) : 0.5765
COMPRESSIBILITY FACTOR : 0.99797

NOTE: REFERENCE GPA 2261(ASM D1945 & ASME-PTC), 2145, & 2172 CURRENT PUBLICATIONS

The data presented herein has been acquired by means of current analytical techniques and represents the judicious conclusion EMPACT Analytical Systems, Inc. Results of the analysis can be affected by the sampling conditions, therefore, are only warranted through proper lab protocol. EMPACT assumes no responsibility for interpretation or any consequences from application of the reported information and is the sole liability of the user. The reproduction in any media of this reported information may not be made, in portion or as a whole, without the written permission of EMPACT Analytical Systems, Inc.



SULFUR IN NATURAL GAS ANALYSIS

LEASE #: NAME/DESCRIP : ENV-AIR
17K0766-01
PROJECT NO. : 201711052 ANALYSIS NO. : 01
COMPANY NAME : MICROBAC LABORATORIES ANALYSIS DATE: NOVEMBER 13, 2017 12:24
OFFICE / BRANCH: ERIE, PA SAMPLE DATE : NOVEMBER 2, 2017 14:14
CUSTOMER REF: 17K0766 TO:

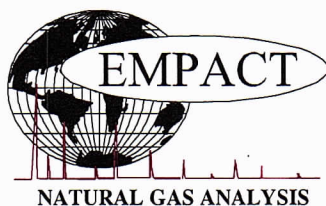
*****FIELD DATA*****

SAMPLE CYCLE: SAMPLE TYPE:
SAMPLE PRES. : - psig CYLINDER NO. : 1L TEDLAR
SAMPLE TEMP. : - °f SAMPLED BY :
AMBIENT TEMP.: - °f SAMPLING COMPANY:
LAB PRES: - psig H2S BY STAIN TUBE: - ppm
FIELD COMMENTS:
LAB COMMENTS:

COMPONENT	SULFUR	
	ppm mol (ul/L)	ppm wt (ug/g)
Hydrogen Sulfide (H2S)	0.2	0.4
Carbonyl Sulfide (COS)/Sulfur Dioxide (SO2)	BDL	
Methanethiol (MeSH)	BDL	
Ethanethiol (EtSH)	BDL	
Dimethylsulfide (DMS)	BDL	
Carbon Disulfide (CS2)	BDL	
i-Propanethiol (i-PrSH)	0.2	0.4
t-Butanethiol (t-BuSH)	1.0	2.7
n-Propanethiol (n-PrSH)	BDL	
Methylethylsulfide (MES)	BDL	
s-Butanethiol (s-BuSH)	BDL	
i-Butanethiol (i-BuSH)	BDL	
Thiophene (TP)	BDL	
Diethylsulfide (DES)	BDL	
n-Butanethiol (n-BuSH)	BDL	
Dimethyldisulfide (DMDS)	BDL	
Unidentified Sulfurs - Light Ends	BDL	
Methylthiophenes (MTP)	BDL	
2-Ethylthiophene (2-ETP)	BDL	
Methylethylsulfide (MEDS)	BDL	
Dimethylthiophenes (DMTP)	BDL	
Diethyldisulfide (DEDS)	BDL	
Benzothiophene (BzTP)	BDL	
Unidentified Sulfurs - Mid Range	BDL	
Methylbenzothiophenes (MBzTP)	BDL	
Dimethylbenzothiophenes (DMBzTP)	BDL	
Trimethylbenzothiophenes (TMBzTP)	BDL	
Dibenzothiophenes (DBzTP)	BDL	
Methyldibenzothiophenes (MDBzTP)	BDL	
<u>Unidentified Sulfurs - Heavy Ends</u>	<u>BDL</u>	
TOTAL SULFUR	1.4	3.5

GRAINS OF H2S	0.0123 / 100 scf	TOTAL GRAINS OF SULFUR	0.1078 / 100 scf
POUNDS OF H2S	0.0000 / 1000 scf	TOTAL POUNDS OF SULFUR	0.0002 / 1000 scf
WT% OF H2S	0.00004 / 1000 scf	TOTAL WT% OF SULFUR	0.00035 / 1000 scf

* ASTM D5504 ** DETECTION LIMIT DETERMINED TO BE 0.1 ppm (ul/L) Sulfur - BDL (BELOW DETECTION LIMIT)
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PRIMARY NAME/DESCRIP : ENV-AIR
DB KEY: 17K0766-02
LIB001-2
PROJECT NO. : 201711052 ANALYSIS NO.: 02
COMPANY NAME : MICROBAC LABORATORIES ANALYSIS DATE: NOVEMBER 13, 2017 11:52
OFFICE / BRANCH: ERIE, PA SAMPLE START: NOVEMBER 2, 2017 14:15
CUSTOMER REF: 17K0766 TO:

FIELD DATA

SAMPLE CYCLE: SAMPLE TYPE:
SAMPLE PRES. : "WC CYLINDER NO. : 1L TEDLAR
SAMPLE TEMP. : °f SAMPLED BY :
AMBIENT TEMP.: °f SAMPLING COMPANY:
LAB PRESSURE: - psig H2S BY STAIN TUBE: - ppm

FIELD COMMENTS

LAB COMMENTS:

COMPONENTS	NORM. MOLE%	GPM @ 14.73	GPM @ 14.696
HELIUM	0.00	-	-
HYDROGEN	0.00	-	-
OXYGEN/ARGON	4.84	-	-
NITROGEN	16.83	-	-
CO2	0.10	-	-
METHANE	76.33	-	-
ETHANE	1.84	0.492	0.491
PROPANE	0.06	0.017	0.016
ISOBUTANE	0.00	0.000	0.000
N-BUTANE	0.00	0.000	0.000
ISOPENTANE	0.00	0.000	0.000
N-PENTANE	0.00	0.000	0.000
HEXANES+	0.00	0.000	0.000
TOTAL	100.00	0.509	0.507
BTU @ 60 DEG F		14.73	14.696
LOW NET DRY REAL=		728.2	726.5
NET SATURATED REAL=		715.5	713.8
HIGH GROSS DRY REAL =		808.2	806.3
GROSS SATURATED REAL =		794.1	792.2

RELATIVE DENSITY (AIR=1 @ 14.696 PSIA 60F) : 0.6614
COMPRESSIBILITY FACTOR : 0.99840

NOTE: REFERENCE GPA 2261(ASTM D1945 & ASME-PTC), 2145, & 2172 CURRENT PUBLICATIONS

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SULFUR IN NATURAL GAS ANALYSIS

LEASE #: NAME/DESCRIP : ENV-AIR
17K0766-02
PROJECT NO. : 201711052 ANALYSIS NO. : 02
COMPANY NAME : MICROBAC LABORATORIES ANALYSIS DATE: NOVEMBER 13, 2017 12:42
OFFICE / BRANCH: ERIE, PA SAMPLE DATE : NOVEMBER 2, 2017 14:15
CUSTOMER REF: 17K0766 TO:

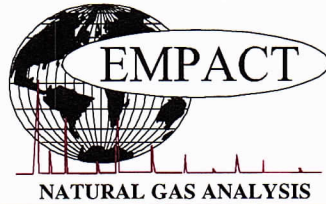
*****FIELD DATA*****

SAMPLE CYCLE: SAMPLE TYPE:
SAMPLE PRES. : - psig CYLINDER NO. : 1L TEDLAR
SAMPLE TEMP. : - °f SAMPLED BY :
AMBIENT TEMP.: - °f SAMPLING COMPANY:
LAB PRES: - psig H2S BY STAIN TUBE: - ppm
FIELD COMMENTS:
LAB COMMENTS:

COMPONENT	SULFUR	
	ppm mol (ul/L)	ppm wt (ug/g)
Hydrogen Sulfide (H2S)	0.2	0.4
Carbonyl Sulfide (COS)/Sulfur Dioxide (SO2)	BDL	
Methanethiol (MeSH)	BDL	
Ethanethiol (EtSH)	BDL	
Dimethylsulfide (DMS)	BDL	
Carbon Disulfide (CS2)	BDL	
i-Propanethiol (i-PrSH)	0.2	0.3
t-Butanethiol (t-BuSH)	1.0	2.3
n-Propanethiol (n-PrSH)	BDL	
Methylethylsulfide (MES)	BDL	
s-Butanethiol (s-BuSH)	BDL	
i-Butanethiol (i-BuSH)	BDL	
Thiophene (TP)	BDL	
Diethylsulfide (DES)	BDL	
n-Butanethiol (n-BuSH)	BDL	
Dimethyldisulfide (DMDS)	BDL	
Unidentified Sulfurs - Light Ends	BDL	
Methylthiophenes (MTP)	BDL	
2-Ethylthiophene (2-ETP)	BDL	
Methylethylsulfide (MEDS)	BDL	
Dimethylthiophenes (DMTP)	BDL	
Diethyldisulfide (DEDS)	BDL	
Benzothiophene (BzTP)	BDL	
Unidentified Sulfurs - Mid Range	BDL	
Methylbenzothiophenes (MBzTP)	BDL	
Dimethylbenzothiophenes (DMBzTP)	BDL	
Trimethylbenzothiophenes (TMBzTP)	BDL	
Dibenzothiophenes (DBzTP)	BDL	
Methyldibenzothiophenes (MDBzTP)	BDL	
Unidentified Sulfurs - Heavy Ends	BDL	
TOTAL SULFUR	1.4	3.0

GRAINS OF H2S	0.0141 / 100 scf	TOTAL GRAINS OF SULFUR	0.1060 / 100 scf
POUNDS OF H2S	0.0000 / 1000 scf	TOTAL POUNDS OF SULFUR	0.0002 / 1000 scf
WT% OF H2S	0.00004 / 1000 scf	TOTAL WT% OF SULFUR	0.00030 / 1000 scf

* ASTM D5504 ** DETECTION LIMIT DETERMINED TO BE 0.1 ppm (ul/L) Sulfur - BDL (BELOW DETECTION LIMIT)
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PRIMARY NAME/DESCRIP : ENV-AIR
DB KEY: 17K0766-03
LIB001-3
PROJECT NO. : 201711052 ANALYSIS NO.: 03
COMPANY NAME : MICROBAC LABORATORIES ANALYSIS DATE: NOVEMBER 13, 2017 12:15
OFFICE / BRANCH: ERIE, PA SAMPLE START: NOVEMBER 2, 2017 14:18
CUSTOMER REF: 17K0766 TO:

FIELD DATA

SAMPLE CYCLE: SAMPLE TYPE:
SAMPLE PRES. : "WC CYLINDER NO. : 1L TEDLAR
SAMPLE TEMP. : °f SAMPLED BY :
AMBIENT TEMP.: °f SAMPLING COMPANY:
LAB PRESSURE: - psig H2S BY STAIN TUBE: - ppm

FIELD COMMENTS

LAB COMMENTS:

COMPONENTS	NORM. MOLE%	GPM @ 14.73	GPM @ 14.696
HELIUM	0.01	-	-
HYDROGEN	0.00	-	-
OXYGEN/ARGON	0.74	-	-
NITROGEN	1.95	-	-
CO2	0.13	-	-
METHANE	94.97	-	-
ETHANE	2.13	0.569	0.568
PROPANE	0.07	0.019	0.019
ISOBUTANE	0.00	0.000	0.000
N-BUTANE	0.00	0.000	0.000
ISOPENTANE	0.00	0.000	0.000
N-PENTANE	0.00	0.000	0.000
HEXANES+	0.00	0.000	0.000
TOTAL	100.00	0.588	0.587

BTU @ 60 DEG F	14.73	14.696
LOW NET DRY REAL=	903.7	901.6
NET SATURATED REAL=	888.0	885.9
HIGH GROSS DRY REAL =	1003.0	1000.7
GROSS SATURATED REAL =	985.6	983.3

RELATIVE DENSITY (AIR=1 @14.696 PSIA 60F) : 0.5792
COMPRESSIBILITY FACTOR : 0.99798

NOTE: REFERENCE GPA 2261(ASTM D1945 & ASME-PTC), 2145, & 2172 CURRENT PUBLICATIONS
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SULFUR IN NATURAL GAS ANALYSIS

LEASE #: NAME/DESCRIP : ENV-AIR
17K0766-03
PROJECT NO. : 201711052 ANALYSIS NO. : 03
COMPANY NAME : MICROBAC LABORATORIES ANALYSIS DATE: NOVEMBER 13, 2017 12:59
OFFICE / BRANCH: ERIE, PA SAMPLE DATE : NOVEMBER 2, 2017 14:18
CUSTOMER REF: 17K0766 TO:

*****FIELD DATA*****

SAMPLE CYCLE: SAMPLE TYPE:
SAMPLE PRES. : - psig CYLINDER NO. : 1L TEDLAR
SAMPLE TEMP. : - °f SAMPLED BY :
AMBIENT TEMP.: - °f SAMPLING COMPANY:
LAB PRES: - psig H2S BY STAIN TUBE: - ppm
FIELD COMMENTS:
LAB COMMENTS:

COMPONENT	SULFUR	
	ppm mol (ul/L)	ppm wt (ug/g)
Hydrogen Sulfide (H2S)	0.2	0.4
Carbonyl Sulfide (COS)/Sulfur Dioxide (SO2)	BDL	
Methanethiol (MeSH)	BDL	
Ethanethiol (EtSH)	BDL	
Dimethylsulfide (DMS)	BDL	
Carbon Disulfide (CS2)	BDL	
i-Propanethiol (i-PrSH)	0.2	0.4
t-Butanethiol (t-BuSH)	1.0	2.7
n-Propanethiol (n-PrSH)	BDL	
Methylethylsulfide (MES)	BDL	
s-Butanethiol (s-BuSH)	BDL	
i-Butanethiol (i-BuSH)	BDL	
Thiophene (TP)	BDL	
Diethylsulfide (DES)	BDL	
n-Butanethiol (n-BuSH)	BDL	
Dimethyldisulfide (DMDS)	BDL	
Unidentified Sulfurs - Light Ends	BDL	
Methylthiophenes (MTP)	BDL	
2-Ethylthiophene (2-ETP)	BDL	
Methylethyldisulfide (MEDS)	BDL	
Dimethylthiophenes (DMTP)	BDL	
Diethyldisulfide (DEDS)	BDL	
Benzothiophene (BzTP)	BDL	
Unidentified Sulfurs - Mid Range	BDL	
Methylbenzothiophenes (MBzTP)	BDL	
Dimethylbenzothiophenes (DMBzTP)	BDL	
Trimethylbenzothiophenes (TMBzTP)	BDL	
Dibenzothiophenes (DBzTP)	BDL	
Methyldibenzothiophenes (MDBzTP)	BDL	
<u>Unidentified Sulfurs - Heavy Ends</u>	<u>BDL</u>	
TOTAL SULFUR	1.4	3.5

GRAINS OF H2S	0.0124 / 100 scf	TOTAL GRAINS OF SULFUR	0.1083 / 100 scf
POUNDS OF H2S	0.0000 / 1000 scf	TOTAL POUNDS OF SULFUR	0.0002 / 1000 scf
WT% OF H2S	0.00004 / 1000 scf	TOTAL WT% OF SULFUR	0.00035 / 1000 scf

* ASTM D5504 ** DETECTION LIMIT DETERMINED TO BE 0.1 ppm (ul/L) Sulfur - BDL (BELOW DETECTION LIMIT)
The data presented herein has been acquired by means of current analytical techniques and represents the judicious conclusion EMPACT Analytical Systems, Inc. Results of the analysis can be affected by the sampling conditions, therefore, are only warranted through proper lab protocol. EMPACT assumes no responsibility for interpretation or any consequences from application of the reported information and is the sole liability of the user. The reproduction in any media of this reported information may not be made, in portion or as a whole, without the written permission of EMPACT Analytical Systems, Inc.

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

DG 17-152

Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18

Request No. Clark 1-7

Date of Response: 4/23/18

Respondent: William R. Killeen

REQUEST:

Please identify the complete chemical composition of the gas that was first distributed under the Keene gas franchise at issue in Docket DG 17-068 when the franchise was first awarded in or circa 1860. Should the composition be unclear at this time, please identify the likely composition to the best of Liberty's ability, identifying the supporting source(s).

RESPONSE:

The Company's records do not contain the requested information.

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

DG 17-152
Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-8

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Reference Liberty's Amended Petition in Docket DG 17-068, ¶ 16. Please identify the likely complete chemical composition of any water gas that was sold to Keene customers under the Keene gas franchise, as of 1913 and otherwise.

RESPONSE:

The Company does not have this information.

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

DG 17-152
Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-9

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Reference Liberty's Amended Petition in Docket DG 17-068, ¶ 16. Please identify the likely complete chemical composition of any coal gas that was sold to Keene customers under the Keene gas franchise, as of 1913 and otherwise.

RESPONSE:

The Company does not have this information.

EXHIBIT “C”

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

DG 17-152
Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-10

Date of Response: 4/23/18
Respondent: William R. Killeen
William J. Clark

REQUEST:

Reference RSA 162-H:2, VII(a). Please state the total onsite gas storage capacity of the proposed Keene facility being considered under Docket DG 17-068 and identify how many days of continuous operation at a rate equivalent to the energy requirements of a 30 megawatt electric generating station the facility will be able to operate with a full complement of gas stored at the site.

RESPONSE:

A new, high-efficiency 30 megawatt electric generating station would consume an equivalent of approximately 325,000 gallons of LNG over seven days, or approximately 46,400 gallons of LNG per day, operating continuously at full capacity, assuming a heat rate of 7,100 Btu/kWh.

The proposed facilities at Keene, assuming full build out, would include storage facilities for an equivalent of 100,000 gallons of LNG. Thus, the proposed Keene storage would be capable of fueling a 30 MW electric generating facility for approximately 2.2 days.

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

DG 17-152
Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-11

Date of Response: 4/23/18
Respondent: William R. Killeen
William J. Clark

REQUEST:

Reference RSA 162-H:2, VII(a). Please state how many days of continuous operation at a rate equivalent to the energy requirements of a 30 megawatt electric generating station the proposed Lebanon facility being considered under Docket DG 16-852 will be able to operate with a full complement of gas stored at the site.

RESPONSE:

A new, high-efficiency 30 megawatt electric generating station would consume an equivalent of approximately 325,000 gallons of LNG over seven days, or approximately 46,400 gallons of LNG per day, operating continuously at full capacity, assuming a heat rate of 7,100 Btu/kWh.

The proposed facilities at Lebanon, assuming full build out, would include storage facilities for an equivalent of 240,000 gallons of LNG. Thus, the proposed Lebanon storage would be capable of fueling a 30 MW electric generating facility for approximately 5.2 days.

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

DG 17-152

Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-12

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Reference RSA 162-H:2, VII(a). Please state how many days of continuous operation at a rate equivalent to the energy requirements of a 30 megawatt electric generating station the proposed Epping facility being considered under Docket DG 17-198 will be able to operate with a full complement of gas stored at the site.

RESPONSE:

A new, high-efficiency 30 megawatt electric generating station would consume an equivalent of approximately 325,000 gallons of LNG over seven days, or approximately 46,400 gallons of LNG per day, operating continuously at full capacity, assuming a heat rate of 7,100 Btu/kWh.

The proposed storage facility at Epping is a 2 Bcf LNG tank, which is equivalent to approximately 25 million gallons of LNG. Thus, the proposed Granite Bridge LNG tank would be capable of fueling a 30 MW electric generating facility for approximately 77 weeks or 1.5 years.

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

DG 17-152

Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-13

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Will the proposed Keene facility being considered under Docket DG 17-068 ever receive or otherwise have access to any of the gas being processed and/or stored at the proposed Epping facility being considered under Docket DG 17-198 or the proposed Lebanon facility being considered under Docket DG 16-852? If so, please identify all such quantities of gas that the proposed Keene facility may receive or will have access to, and under what circumstances.

RESPONSE:

The proposed LNG facility at Epping has not been designed to supply the needs of Keene or Hanover-Lebanon. The supply needs for Keene and Hanover-Lebanon are yet to be finalized. The Company will identify a range of supply alternatives, including a competitive solicitation of supply from third parties, and determine which is the best-cost supply alternative to meet the needs of the Company's customers in these locations.

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

DG 17-152

Least Cost Integrated Resource Plan

Clark Data Requests - Set 1

Date Request Received: 4/9/18
Request No. Clark 1-14

Date of Response: 4/23/18
Respondent: William R. Killeen

REQUEST:

Please identify all planned and potential interaction between the facilities being considered for Keene under Docket DG 17-068, Lebanon under Docket DG 16-852 and Epping under Docket DG 17-198, including, but not limited to, the potential sharing of gas stored at any of the facilities.

RESPONSE:

As stated in the Company's response to Clark 1-13, the proposed Granite Bridge LNG facility has been designed to serve the needs of EnergyNorth's current and future customers within the Company's existing service territories and the potential franchise areas along the Granite Bridge pipeline.

LNG required at the smaller LNG facilities proposed in Keene and Lebanon would be received by truck from several potential LNG suppliers in the region. While LNG supplies could also be physically received from the Granite Bridge LNG facility, it has not been designed for that purpose. No other physical interaction is anticipated besides personnel used to maintain and operate each of these facilities, as required for safe operation and to cover for employees on vacation and sick leave.

EXHIBIT “D”

Subject: RE: DES Toxic Air Regulations

From: "Milbury, Gary" <Gary.MilburyJr@des.nh.gov>

Date: 8/25/2017 4:06 PM

To: 'Richard Husband' <rmhusband@gmail.com>

CC: Liz Fletcher <lizfletcher@jacqcad.com>, Bev Edwards <nadesha@msn.com>,

"dwhitbeck@hotmail.com" <dwhitbeck@hotmail.com>, MLearner <mzlearner@gmail.com>, Sue

Durling <sueldu@gmail.com>, Julia Steed Mawson <islandview999@gmail.com>, Gwen Whitbeck

<gwenwhitbeck@gmail.com>, "North, Pat" <Patricia.North@des.nh.gov>

Good Afternoon,

Thank you for your patience on the update; it's just been very busy here over the past few weeks.

Just to back up a bit - as you may recall, after we received your comments on the list of compounds proposed for sampling/analysis, Pat North prepared a request for information (RFI) that was sent out to a number of labs around the country. The RFI was intended to receive feedback from labs on their qualifications/certifications, the compounds they can (or cannot) analyze, how low a level these compounds can be detected at, and other information along these lines. This was intended to help us get an idea on sampling methods, equipment, etc. so we can prepare a more comprehensive Request for Bids (RFB). The goal was to solicit bids by around mid-April, with subsequent sampling likely around early to mid-summer, with the intent of sampling when we expect close to 100% of the gas to be coming from the PA area.

Due to the uniqueness of this sampling effort, we reached out to as many laboratories as possible; we ultimately sent the RFI to 27 labs around the U.S. Not all of the labs initially responded, so Pat North reached out to encourage them to reply. We found that nine of the labs ultimately do not perform natural gas analyses. Of the remaining labs, we made multiple attempts to contact them for a response but did not ultimately hear back; not sure if this was due to their lack of lab capability.

We are currently trying to figure out a number of challenges based on our research and discussions with labs to date:

- No single laboratory has the capability of analyzing natural gas for all of the constituents of interest. This means each class of analyte may require collection of multiple containers to be sent to multiple laboratories. In addition, the gas volumes needed for some analyses may require multiple containers per sample.
- Special shipping and handling requirements:
 - Gaseous samples normally have a 24 to 48 hour holding time before analysis must commence or the sample results become suspect. Natural gas cannot be shipped by air due to regulations enacted after 9/11, therefore these samples must be shipped by truck (i.e. ground). The short sample holding time requirements make shipping by ground to laboratories located out west inexpedient.
 - The person packaging and filling out the sample shipping paperwork requires a hazardous material shipper certification. No one here at DES possesses this certification and the shipping company (such as FedEx or UPS) will not take the responsibility of packaging and completing the shipping papers. While we obviously need to coordinate with the gas utility for sampling purposes, we may need them to be more involved in the sample shipping process.
- Samples of natural gas cannot be analyzed directly for metals or for Formaldehyde, Acetaldehyde, Gluteraldehyde, and Propionaldehyde (aldehydes) but must be collected in a sampling media.

- For metals, the natural gas must first be passed through a filter followed by aqueous acidic solutions to trap the metal components. These filters and solutions would then be sent for analysis of the metals of interest. The volume of natural gas that would be required to collect a viable metals sample would be in excess of 850 cubic feet (this would equate to over one hour of sampling).
- For the aldehydes, sampling would require passing the natural gas through solid sorbent tubes coated with a special chemical, or through a special chemical solution. The tubes/solution would then be sent for analysis.
- Natural gas is flammable and explosive and given the amount of gas needed to collect samples for metals and aldehydes, this is of significant concern for staff. We need to have further conversations with the gas utility on how this can be addressed appropriately/safely. The sampling pumps used will have to be intrinsically safe (i.e. suitable for sampling explosive and flammable gases).
- The sample collection methods for metals and aldehydes are for emission stack and ambient air sampling, and there is a multitude of information on the effects of the gas matrix on the sampling media (i.e. possible analytical interferences). Given that these sample collection methods have not been validated for pipeline natural gas samples, there is no information on possible adverse effects on the sampling media which may hinder the gathering of quality analytical data.
- Due to the concentration of methane in pipeline natural gas (typically greater than 95% methane), samples that will be analyzed for VOCs must be diluted by the laboratory so that the analytical detector is not overwhelmed and possibly damaged. The more the sample is diluted, the higher the detection limit for the target VOCs become. For example, if the normal detection limit for 1,3-Butadiene by gas chromatography/mass spectrometry is 0.005 part per million (ppm), and the concentration of methane in natural gas is 98,000,000 ppm (i.e., 98%); to protect the analytical equipment from damage, the natural gas sample would require a dilution of 5,000,000 times with clean dry air prior to analysis. If 1,3-Butadiene were not detected in the diluted sample (i.e. less than 0.005 ppm), the detection limit would be 25,000 ppm ($0.005 \text{ ppm} \times 5,000,000$; or $<1\%$) which would yield no useful information.
- We received one comment from a lab that regularly does natural gas analyses. They stated that "We routinely analyze natural gas, but as far as we know, we account for all compound in the gas, including the hydrocarbons and the fixed gases such as N₂, CO₂, Ar, H₂, and He. The one "vague" component we detect is "C₆+", which is the total of all combustible compounds larger than nC₅. So, fracking compounds could be included in that, but we don't know." This is helpful in that it tells us that we could perhaps look at the list of compounds (that we originally indicated we would sample for) and focus the list down to those that fall into the C₆+ group. That may help ameliorate some of the issues/concerns above with regard to sampling volumes and shipping restrictions.

Given all of the logistical and safety issues noted above, we have been spending some our time digging more into recent studies, data collection and sampling efforts, etc. to see if existing/new information can help us further focus our sampling effort. We hope to have a little more to say in the next few weeks.

Feel free to call me if you want to discuss any particulars.

Best,

Gary
Gary Milbury
Permitting and Environmental Health Bureau Administrator
NH Department of Environmental Services

Air Resources Division
phone: (603) 271-2630
fax: (603) 271-1381
email: gary.milbury@des.nh.gov

From: Richard Husband [mailto:rmhusband@gmail.com]
Sent: Wednesday, August 9, 2017 9:21 AM
To: Milbury, Gary
Cc: Liz Fletcher; Bev Edwards; dwhitbeck@hotmail.com; M Learner; Sue Durling; Julia Steed Mawson; Gwen Whitbeck; North, Pat
Subject: Re: DES Toxic Air Regulations

We know that you haven't forgotten us.

Thanks, Gary.

Richard

On Wed, Aug 9, 2017 at 9:01 AM, Milbury, Gary <Gary.MilburyJr@des.nh.gov> wrote:
Just a note that I haven't forgotten about you, I plan to get you an update ASAP.

Gary

-----Original Message-----

From: Milbury, Gary
Sent: Wednesday, August 2, 2017 9:28 AM
To: 'Richard Husband'
Cc: Liz Fletcher; Bev Edwards; dwhitbeck@hotmail.com; M Learner; Sue Durling; Julia Steed Mawson; Gwen Whitbeck; North, Pat
Subject: RE: DES Toxic Air Regulations

Hi Richard,

Thanks for reaching out; it has been some time since the last update. I have a few things going on at the moment, but will get back to you with an update ASAP.

Thanks

Gary

-----Original Message-----

From: Richard Husband [mailto:rmhusband@gmail.com]

Sent: Tuesday, August 1, 2017 8:17 AM

To: Milbury, Gary

Cc: Liz Fletcher; Bev Edwards; dwhitbeck@hotmail.com; M Learner; Sue Durling; Julia Steed Mawson; Gwen Whitbeck

Subject: Re: DES Toxic Air Regulations

Hi, Gary:

I thought that I would check in and see where you are at on your end in the gas analysis. When you have time, we would greatly appreciate an update.

Thank you,

Richard Husband