

NATURAL GAS ANALYSES
Chain of Custody 84422

REPORT PREPARED FOR:
BLADE ENERGY PARTNERS, LTD

Dr. Ravi M. Krishnamurthy

March 22, 2017

by

Mr. Damien Terry, MSc

For:

Texas Oil Tech Laboratories, Inc.
10630 Fallstone Road, Houston, TX 77099



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EXECUTIVE SUMMARY

This report contains results for samples taken from three natural gas wells on the SoCal Gas Aliso Canyon site. The three wells are P69E, P68A, and P72A. The samples include a natural gas sample, activated carbon sample and an impinged water sample for each site. The purpose for the analysis is to obtain a relatively full chemical composition of the natural gas from each well. Generally, the gases from each well were similar in chemical composition. However, there were some slight variations in the types and concentration some sulfur containing compounds.

INTRODUCTION

The gas sample from each well was used for the Natural Gas Composition (ASTM D1945), Sulfur Compounds in Natural Gas (ASTM D5504), Volatile Organics by GC/MS (EPA 8260) Gaseous Fuels Heating Value (ASTM D3588) and PCB's in Gas by GC/ECD (TOL 6061). The activated carbon sample was used for the analysis of siloxanes (TOL 7081) and any other heavy chemical compounds present in the gas. The impinged water samples were used for analyzing Trace Metals by ICP/MS (ASTM D5673) and Anions in Water by Ion Chromatography (ASTM D4327).

SAMPLES

Thirteen different samples were tested. **Table 1** lists the samples used in this report for results discussion.

Table 1— Sample Identification		Phases Tested
84422-01	P-69E (4819,4287,4242) 03/01/17	Natural Gas
84422-04	P-68A (4293,5291) 03/01/17	Natural Gas
84422-07	P-72A (5259,4290,4233) 03/01/2017	Natural Gas

Respectfully submitted
For Texas OilTech Laboratories, L.P.



A. Phillip Sorurbakhsh
Director of Laboratory Operations

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CLIENT:	Blade Energy Partners, Ltd	REQUESTED BY:	Mr. Brent Sherar
CLIENT PROJECT:		PURCHASE ORDER NO:	SCG-001_12
LABORATORY NO:	84422-001	REPORT DATE:	March 22, 2017
SAMPLE:	P-69E (4819,4287,4242) 2017-03-01 01:30		

TEST

RESULT

3.1.1 Composition of Natural Gas by Gas Chromatography, extended, ASTM D 1945.b

	<u>Results, Mol %</u>
Hydrogen	0.0000
Oxygen	0.0690
Nitrogen	0.4738
Carbon Dioxide	0.6374
Methane	94.3644
Ethane	3.0960
Propane	0.8380
iso-Butane	0.1373
n-Butane	0.2073
iso-Pentane	0.0675
n-Pentane	0.0579
Hexanes	0.0158
Heptane	0.0161
Octane	0.0104
Nonane	0.0042
Decane	0.0016
Undecane	0.0000
Dodecane	0.0000
Tridecane	0.0000
Benzene	0.0010
Toluene	0.0014
Ethylbenzene	0.0001
m,p-Xylene	0.0006
o-Xylene	0.0002
Propylbenzenes	0.0000
Butylbenzene	0.0000
TOTAL	100.000

Natural gas is introduced into a gas chromatograph filling the sample loop. The light gases are separated from the heavier gases on a molecular sieve column and detected by TCD. The heavier gases are separated from the lighter gases on a capillary column and detected by FID.

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LABORATORY NO:	84422-001 Page 2 of 7	REPORT DATE:	March 22, 2017
SAMPLE:	P-69E (4819,4287,4242) 2017-03-01 01:30		

TEST

RESULT

3.1.2 Specific Gravity of Gases, ASTM D 3588, 14.696 psia, 60°F:

Specific Gravity at 60°F (air=1) Ideal Gas	0.5942
--	--------

3.1.3 Calculated Heating Value of Gaseous Fuels, ASTM D 3588, 14.696 psia, 60°F:

Calculated Gross Heat Value (HHV) (Btu/ft ³).....	1,047.65
Calculated Net Heat Value (LHV) (Btu/ft ³).....	944.57
Calculated Gross Heat Value (HHV) (Btu/lb).....	23,102.35
Calculated Net Heat Value (LHV) (Btu/lb).....	20,828.08
Calculated Molecular Weight (grams/mole).....	17.21
Total Hydrogen Sulfide Content, ASTM D 4810, ppm	1
Water Content by Length of Stain, ASTM D4888, lbs/MM scf	7
Mercaptans by Length of Stain, ASTM D 1988, ppm	<0.5
Carbon Monoxide Content by Length of Stain, Draeger # 67 33 051, ppm	<2.0
Mercury Content by Length of Stain, Draeger # CH23101, mg/m ³	<0.05

3.1.4 PCB in Gas by GC/ECD, TOL 6061

	<u>Results</u>	<u>Reporting Limits</u>
PCB, ppmwt	<0.1	0.1

A known amount natural gas sample is impinged into hexane. This hexane is then introduced into a gas chromatograph, separated on a capillary column, and the polychlorinated biphenyls (PCB's), if present, are detected by ECD.

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SAMPLE:	P-69E (4819,4287,4242) 2017-03-01 01:30		

TEST

RESULT

3.1.5 Sulfur Compounds in Natural Gas by GC, ASTM D 5504(m)

	<u>Results, ppm</u>
Hydrogen Sulfide	<0.1
Carbonyl Sulfide	<0.1
Sulfur Dioxide	0.8
Methyl Mercaptan	<0.1
Ethyl Mercaptan	<0.1
Dimethylsulfide	<0.1
Carbon Disulfide	<0.1
Isopropyl Mercaptan	<0.1
Ethylene Sulfide	<0.1
Tert-Butyl mercaptan	1.7
Propyl Mercaptan	<0.1
Ethylmethylsulfide	<0.1
Propylene sulfide	<0.1
Methyl-isobutyl Sulfide	<0.1
Sec-Butyl mercaptan	<0.1
Diethylsulfide	<0.1
Thiophene	0.1
Isobutyl Mercaptan	<0.1
n-Butyl Mercaptan	<0.1
Dimethyldisulfide	<0.1
Methyl isopropyl Sulfide	<0.1
Methyl-n-Propyl Sulfide	<0.1
Methyl-t-butyl Sulfide	<0.1
Ethyl-n-Propyl Sulfide	<0.1
Methyl sec-butyl Sulfide	<0.1
2-Pentyl Mercaptan	<0.1
2-Methyl Thiophene	<0.1
3-Methyl Thiophene	<0.1
Tetra-Hydro Thiophene	2.5
Ethylthiophene	<0.1
Ethyl Methyl Disulfide	<0.1
Methyl Ethyl Thiophene	<0.1
Methyl isopropyl disulfide	<0.1
Propyl methyl disulfide	<0.1

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CLIENT PROJECT:		PURCHASE ORDER NO:	SCG-001_12
LABORATORY NO:	84422-001	REPORT DATE:	March 22, 2017
SAMPLE:	P-69E (4819,4287,4242) 2017-03-01 01:30		

TEST

RESULT

3.1.5 Sulfur Compounds in Natural Gas by GC. ASTM D 5504(m)

	<u>Results, ppm</u>
Diethylsulfide	<0.1
Methyl-t-butyl disulfide	<0.1
Ethyl isopropyl disulfide	<0.1
Ethyl propyl disulfide	<0.1
Methyl sec-butyl disulfide	<0.1
Ethyl sec-butyl disulfide	<0.1
Tert-butyl disulfide	<0.1
Tris(Methylthio) methane	<0.1
Benzothiophene	<0.1
Methylethylsulfide	<0.1
Isopropyl disulfide	<0.1
Isopropyl n-propyl disulfide	<0.1
Dibenzothiophene	<0.1

An aliquot of the natural gas sample is introduced into a gas chromatograph as received and separated on a capillary column. Sulfur compounds, if present in the gas, are detected by chemiluminescence.

3.1.6 Siloxanes in Gas, by GC/MS. TOL -7081

	Approximate Concentration mg/Kg in Gas
Hexamethyldisiloxane	<1.0
Octamethylcyclotetrasiloxane	<1.0
Decamethylcyclopentasiloxane	<1.0
Other silicon containing chromatographable compounds	<1.0

On site, a sampling apparatus is constructed so that the natural gas sample under pressure flows through a bed of activated carbon for a prolonged period of time. The hydrocarbon components of the gas are extracted from the activated carbon using carbon disulfide and analyzed by GC/MS for siloxanes.

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LABORATORY NO:	84422-001	REPORT DATE:	March 22, 2017
SAMPLE:	P-69E (4819,4287,4242) 2017-03-01 01:30		

TEST

RESULT

3.1.7 Volatile Organic Compounds, Purge-and-Trap, GC-MS, EPA 8260B.a

	<u>Results, ppb</u>
Dichlorodifluoromethane	<10
Chloromethane	<10
Vinyl chloride	<10
Bromomethane	<10
Chloroethane	<10
Trichlorofluoromethane	<10
Methyl Ethyl Ketone	<10
2-Propanone	<10
1,1-Dichloroethene	<10
Methylene chloride	<10
trans-1,2-Dichloroethene	<10
1,1-Dichloroethane	<10
cis-1,2-Dichloroethene	<10
2,2-Dichloropropane	<10
Bromochloromethane	<10
Chloroform	<10
1,1,1-Trichloroethane	<10
1,2-Dichloroethane	<10
1,1-Dichloropropene	<10
Benzene	110
Carbon Tetrachloride	<10
1,2-Dichloropropane	<10
Trichloroethene	<10
Dibromomethane	<10
Bromodichloromethane	<10
Cis-1,3-Dichloropropene	<10
Trans-1,3-Dichloropropene	<10
Toluene	90.3
1,1,2-Trichloroethane	<10
1,3-Dichloropropane	<10
Dibromochloromethane	<10
1,2-Dibromoethane	<10
Tetrachloroethene	<10
Chlorobenzene	<10

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LABORATORY NO:	84422-001	REPORT DATE:	March 22, 2017
SAMPLE:	P-69E (4819,4287,4242) 2017-03-01 01:30		

TEST

RESULT

3.1.7 Volatile Organic Compounds, Purge-and-Trap, GC-MS, EPA 8260B.a

	<u>Results, ppb</u>
1,1,1,2-Tetrachloroethane	<10
Ethyl Benzene	<10
1,2,4-Trimethylbenzene	<10
1,3,5-Trimethylbenzene	<10
m&p-Xylene	27.9
Bromoform	<10
Styrene	<10
o-Xylene	<10
1,1,1,2-Tetrachloroethane	<10
1,2,3-Trichloropropane	<10
isopropylbenzene	<10
Bromobenzene	<10
2-Chlorotoluene	<10
n-Propylbenzene	<10
4-Chlorotoluene	<10
tert-Butylbenzene	<10
1,3-Dichlorobenzene	<10
sec-Butylbenzene	<10
1,4-Dichlorobenzene	<10
p-Isopropyltoluene	<10
1,2-Dichlorobenzene	<10
n-Butylbenzene	<10
1,2-Dibromo-3-chloropropane	<10
1,2,4-Trichlorobenzene	<10
Naphthalene	<10
1,2,3-Trichlorobenzene	<10
Hexachlorobutadiene	<10

An aliquot of natural gas is introduced into the purge and trap chamber of a gas chromatograph and purged with helium. The purged compounds are then desorbed and separated on a capillary column to be detected by GC/MS.

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CLIENT PROJECT:		PURCHASE ORDER NO:	SCG-001_12
LABORATORY NO:	84422-001	REPORT DATE:	March 22, 2017
SAMPLE:	P-69E Impinged Water (100psi 20%flow 5minutes) 2017-03-01 01:30		

3.1.8 Anions in Water by Chemically Suppressed Ion Chromatography. ASTM D 4327.a

	<u>Results. ppm</u>
Fluoride	<1.0
Chloride	<1.0
Nitrite	<1.0
Bromide	<1.0
Nitrate	<1.0
Phosphate	<1.0
Sulfate	<1.0

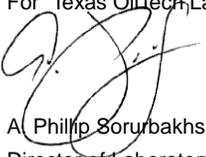
Natural gas, under pressure, was impinged into DI water for a known amount of time on site. The anions in this water sample, if present, are separated by a packed column and detected by a conductivity detector.

3.1.9 Trace Metals by ICP/MS. ASTM D 5673.c

	<u>Results. PPMwt</u>
Aluminum	<0.05
Arsenic	<0.05
Barium	<0.05
Cadmium	<0.05
Cobalt	<0.05
Copper	<0.05
Iron	<0.05
Mercury	<0.05
Manganese	<0.05
Molybdenum	<0.05
Lead	<0.05
Antimony	<0.05
Selenium	<0.05
Strontium	<0.05
Vanadium	<0.05
Nickel	<0.05

Natural gas, under pressure, was impinged into an aqueous nitric acid solution for a known amount of time on site. The preserved sample was digested in Nitric acid (HNO₃) and analyzed utilizing an Inductively Coupled Plasma, Mass Spectrometer (ICP-MS). The characteristics elemental light wave emissions are measured to determine the relative concentrations of the elements.

Respectfully submitted
For Texas OilTech Laboratories, L.P.



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Director of Laboratory Operations

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CLIENT PROJECT:		PURCHASE ORDER NO:	SCG-001_12
LABORATORY NO:	84422-004	REPORT DATE:	March 22, 2017
SAMPLE:	P-68A (4293,5291) 2017-03-01 03:00		

3.2.1 Composition of Natural Gas by Gas Chromatography, extended. ASTM D 1945.b

	<u>Results, Mol %</u>
Hydrogen	0.0000
Oxygen	0.0993
Nitrogen	0.4476
Carbon Dioxide	0.8099
Methane	95.0299
Ethane	2.8876
Propane	0.4636
iso-Butane	0.0675
n-Butane	0.0957
iso-Pentane	0.0299
n-Pentane	0.0271
Hexanes	0.0154
Heptane	0.0145
Octane	0.0069
Nonane	0.0023
Decane	0.0006
Undecane	0.0001
Dodecane	0.0000
Tridecane	0.0000
Benzene	0.0009
Toluene	0.0009
Ethylbenzene	0.0000
m,p-Xylene	0.0002
o-Xylene	0.0001
Propylbenzenes	0.0000
Butylbenzene	0.0000
TOTAL	100.000

Natural gas is introduced into a gas chromatograph filling the sample loop. The light gases are separated from the heavier gases on a molecular sieve column and detected by TCD. The heavier gases are separated from the lighter gases on a capillary column and detected by FID.

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LABORATORY NO:	84422-004 Page 2 of 7	REPORT DATE:	March 22, 2017
SAMPLE:	P-68A (4293,5291) 2017-03-01 03:00		

3.2.2 Specific Gravity of Gases, ASTM D 3588, 14.696 psig, 60°F:

Specific Gravity at 60°F (air=1) Ideal Gas	0.5871
--	--------

3.2.3 Calculated Heating Value of Gaseous Fuels, ASTM D 3588, 14.696 psig, 60°F:

Calculated Gross Heat Value (HHV) (Btu/ft ³).....	1,032.17
Calculated Net Heat Value (LHV) (Btu/ft ³).....	930.17
Calculated Gross Heat Value (HHV) (Btu/lb).....	23,036.16
Calculated Net Heat Value (LHV) (Btu/lb).....	20,758.73
Calculated Molecular Weight (grams/mole).....	17.00
Total Hydrogen Sulfide Content, ASTM D 4810, ppm	0.5
Water Content by Length of Stain, ASTM D4888, lbs/MM scf	10
Mercaptans by Length of Stain, ASTM D 1988, ppm	<0.5
Carbon Monoxide Content by Length of Stain, Draeger # 67 33 051, ppm	<2.0
Mercury Content by Length of Stain, Draeger # CH23101, mg/m ³	<0.05

3.2.4 PCB in Gas by GC/ECD, TOL 6061

	<u>Results</u>	<u>Reporting Limits</u>
PCB, ppmwt	<0.1	0.1

A known amount natural gas sample is impinged into hexane. This hexane is then introduced into a gas chromatograph, separated on a capillary column, and the polychlorinated biphenyls (PCB's), if present, are detected by ECD.



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FAX: (281) 495-2410

CLIENT:	Blade Energy Partners, Ltd	REQUESTED BY:	Mr. Brent Sherar
CLIENT PROJECT:		PURCHASE ORDER NO:	SCG-001_12
LABORATORY NO:	84422-004	REPORT DATE:	March 22, 2017
SAMPLE:	P-68A (4293,5291) 2017-03-01 03:00		

TEST

RESULT

3.2.5 Sulfur Compounds in Natural Gas by GC, ASTM D 5504(m)

	<u>Results, ppm</u>
Hydrogen Sulfide	<0.1
Carbonyl Sulfide	<0.1
Sulfur Dioxide	0.4
Methyl Mercaptan	<0.1
Ethyl Mercaptan	<0.1
Dimethylsulfide	<0.1
Carbon Disulfide	<0.1
Isopropyl Mercaptan	<0.1
Ethylene Sulfide	<0.1
Tert-Butyl mercaptan	2.8
Propyl Mercaptan	<0.1
Ethylmethylsulfide	<0.1
Propylene sulfide	<0.1
Methyl-isobutyl Sulfide	<0.1
Sec-Butyl mercaptan	<0.1
Diethylsulfide	<0.1
Thiophene	0.2
Isobutyl Mercaptan	<0.1
n-Butyl Mercaptan	<0.1
Dimethyldisulfide	<0.1
Methyl isopropyl Sulfide	<0.1
Methyl-n-Propyl Sulfide	<0.1
Methyl-t-butyl Sulfide	<0.1
Ethyl-n-Propyl Sulfide	<0.1
Methyl sec-butyl Sulfide	<0.1
2-Pentyl Mercaptan	<0.1
2-Methyl Thiophene	<0.1
3-Methyl Thiophene	<0.1
Tetra-Hydro Thiophene	3.6
Ethylthiophene	<0.1
Ethyl Methyl Disulfide	<0.1
Methyl Ethyl Thiophene	<0.1
Methyl isopropyl disulfide	<0.1
Propyl methyl disulfide	<0.1

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SAMPLE:	P-68A (4293,5291) 2017-03-01 03:00		

TEST

RESULT

3.2.5 Sulfur Compounds in Natural Gas by GC. ASTM D 5504(m)

	<u>Results, ppm</u>
Diethyldisulfide	<0.1
Methyl-t-butyl disulfide	<0.1
Ethyl isopropyl disulfide	<0.1
Ethyl propyl disulfide	<0.1
Methyl sec-butyl disulfide	<0.1
Ethyl sec-butyl disulfide	<0.1
Tert-butyl disulfide	<0.1
Tris(Methylthio) methane	<0.1
Benzothiophene	<0.1
Methylethylsulfide	<0.1
Isopropyl disulfide	<0.1
Isopropyl n-propyl disulfide	<0.1
Dibenzothiophene	<0.1

An aliquot of the natural gas sample is introduced into a gas chromatograph as received and separated on a capillary column. Sulfur compounds, if present in the gas, are detected by chemiluminescence.

3.2.6 Siloxanes in Gas. by GC/MS. TOL -7081

	Approximate Concentration mg/Kg in Gas
Hexamethyldisiloxane	<1.0
Octamethylcyclotetrasiloxane	<1.0
Decamethylcyclopentasiloxane	<1.0
Other silicon containing chromatographable compounds	<1.0

On site, a sampling apparatus is constructed so that the natural gas sample under pressure flows through a bed of activated carbon for a prolonged period of time. The hydrocarbon components of the gas are extracted from the activated carbon using carbon disulfide and analyzed by GC/MS for siloxanes.

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LABORATORY NO:	84422-004	REPORT DATE:	March 22, 2017
SAMPLE:	P-68A (4293,5291) 2017-03-01 03:00		

TEST

RESULT

3.2.7 Volatile Organic Compounds, Purge-and-Trap, GC-MS, EPA 8260B.a

	<u>Results, ppb</u>
Dichlorodifluoromethane	<10
Chloromethane	<10
Vinyl chloride	<10
Bromomethane	<10
Chloroethane	<10
Trichlorofluoromethane	<10
Methyl Ethyl Ketone	<10
2-Propanone	<10
1,1-Dichloroethene	<10
Methylene chloride	<10
trans-1,2-Dichloroethene	<10
1,1-Dichloroethane	<10
cis-1,2-Dichloroethene	<10
2,2-Dichloropropane	<10
Bromochloromethane	<10
Chloroform	<10
1,1,1-Trichloroethane	<10
1,2-Dichloroethane	<10
1,1-Dichloropropene	<10
Benzene	196.3
Carbon Tetrachloride	<10
1,2-Dichloropropane	<10
Trichloroethene	<10
Dibromomethane	<10
Bromodichloromethane	<10
Cis-1,3-Dichloropropene	<10
Trans-1,3-Dichloropropene	<10
Toluene	197.6
1,1,2-Trichloroethane	<10
1,3-Dichloropropane	<10
Dibromochloromethane	<10
1,2-Dibromoethane	<10
Tetrachloroethene	<10
Chlorobenzene	<10

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SAMPLE:	P-68A (4293,5291) 2017-03-01 03:00		

TEST

RESULT

3.2.7 Volatile Organic Compounds, Purge-and-Trap, GC-MS, EPA 8260B.a

	<u>Results, ppb</u>
1,1,1,2-Tetrachloroethane	<10
Ethyl Benzene	15.9
1,2,4-Trimethylbenzene	11.5
1,3,5-Trimethylbenzene	<10
m&p-Xylene	80.4
Bromoform	<10
Styrene	<10
o-Xylene	19.6
1,1,2,2-Tetrachloroethane	<10
1,2,3-Trichloropropane	<10
isopropylbenzene	<10
Bromobenzene	<10
2-Chlorotoluene	<10
n-Propylbenzene	<10
4-Chlorotoluene	<10
tert-Butylbenzene	<10
1,3-Dichlorobenzene	<10
sec-Butylbenzene	<10
1,4-Dichlorobenzene	<10
p-Isopropyltoluene	<10
1,2-Dichlorobenzene	<10
n-Butylbenzene	<10
1,2-Dibromo-3-chloropropane	<10
1,2,4-Trichlorobenzene	<10
Naphthalene	<10
1,2,3-Trichlorobenzene	<10
Hexachlorobutadiene	<10

An aliquot of natural gas is introduced into the purge and trap chamber of a gas chromatograph and purged with helium. The purged compounds are then desorbed and separated on a capillary column to be detected by GC/MS.

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CLIENT PROJECT:		PURCHASE ORDER NO:	SCG-001_12
LABORATORY NO:	84422-004	REPORT DATE:	March 22, 2017
SAMPLE:	P-68A Impinged Water (700psi 10-20% flow 5min 2017-03-01 03:00)		

3.2.8 Anions in Water by Chemically Suppressed Ion Chromatography. ASTM D 4327.a

	<u>Results. ppm</u>
Fluoride	<1.0
Chloride	<1.0
Nitrite	<1.0
Bromide	<1.0
Nitrate	<1.0
Phosphate	<1.0
Sulfate	<1.0

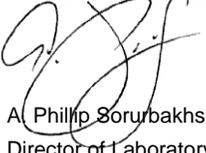
Natural gas, under pressure, was impinged into DI water for a known amount of time on site. The anions in this water sample, if present, are separated by a packed column and detected by a conductivity detector.

3.2.9 Trace Metals by ICP/MS. ASTM D 5673.c

	<u>Results. PPMwt</u>
Aluminum	<0.05
Arsenic	<0.05
Barium	<0.05
Cadmium	<0.05
Cobalt	<0.05
Copper	<0.05
Iron	<0.05
Mercury	<0.05
Manganese	<0.05
Molybdenum	<0.05
Lead	<0.05
Antimony	<0.05
Selenium	<0.05
Strontium	<0.05
Vanadium	<0.05
Nickel	<0.05

Natural gas, under pressure, was impinged into an aqueous nitric acid solution for a known amount of time on site. The preserved sample was digested in Nitric acid (HNO₃) and analyzed utilizing an Inductively Coupled Plasma, Mass Spectrometer (ICP-MS). The characteristics elemental light wave emissions are measured to determine the relative concentrations of the elements.

Respectfully submitted
For Texas OilTech Laboratories, L.P.



A. Phillip Sorurbakhsh
Director of Laboratory Operations

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CLIENT PROJECT:		PURCHASE ORDER NO:	SCG-001_12
LABORATORY NO:	84422-007	REPORT DATE:	March 22, 2017
SAMPLE:	P-72A (5259,4290,4233) 2017-03-01 04:00		

3.3.1 Composition of Natural Gas by Gas Chromatography, extended. ASTM D 1945.b

	<u>Results, Mol %</u>
Hydrogen	0.0000
Oxygen	0.0847
Nitrogen	0.4120
Carbon Dioxide	0.9132
Methane	95.1185
Ethane	2.9876
Propane	0.3337
iso-Butane	0.0486
n-Butane	0.0592
iso-Pentane	0.0174
n-Pentane	0.0140
Hexanes	0.0038
Heptane	0.0034
Octane	0.0017
Nonane	0.0007
Decane	0.0006
Undecane	0.0000
Dodecane	0.0000
Tridecane	0.0000
Benzene	0.0003
Toluene	0.0004
Ethylbenzene	0.0000
m,p-Xylene	0.0002
o-Xylene	0.0000
Propylbenzenes	0.0000
Butylbenzene	0.0000
TOTAL	100.000

Natural gas is introduced into a gas chromatograph filling the sample loop. The light gases are separated from the heavier gases on a molecular sieve column and detected by TCD. The heavier gases are separated from the lighter gases on a capillary column and detected by FID.

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LABORATORY NO:	84422-007	REPORT DATE:	March 22, 2017
SAMPLE:	P-72A (5259,4290,4233) 2017-03-01 04:00		

3.3.2 Specific Gravity of Gases, ASTM D 3588, 14.696 psia, 60°F:

Specific Gravity at 60°F (air=1) Ideal Gas	0.5851
--	--------

3.3.3 Calculated Heating Value of Gaseous Fuels, ASTM D 3588, 14.696 psia, 60°F:

Calculated Gross Heat Value (HHV) (Btu/ft ³).....	1,027.27
Calculated Net Heat Value (LHV) (Btu/ft ³).....	925.62
Calculated Gross Heat Value (HHV) (Btu/lb).....	23,007.17
Calculated Net Heat Value (LHV) (Btu/lb).....	20,729.50
Calculated Molecular Weight (grams/mole).....	16.94
Total Hydrogen Sulfide Content, ASTM D 4810, ppm	1
Water Content by Length of Stain, ASTM D4888, lbs/MM scf	3
Mercaptans by Length of Stain, ASTM D 1988, ppm	<0.5
Carbon Monoxide Content by Length of Stain, Draeger # 67 33 051, ppm	<2.0
Mercury Content by Length of Stain, Draeger # CH23101, mg/m ³	<0.05

3.3.4 PCB in Gas by GC/ECD, TOL 6061

	<u>Results</u>	<u>Reporting Limits</u>
PCB, ppmwt	<0.1	0.1

A known amount natural gas sample is impinged into hexane. This hexane is then introduced into a gas chromatograph, separated on a capillary column, and the polychlorinated biphenyls (PCB's), if present, are detected by ECD.



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SAMPLE:	P-72A (5259,4290,4233) 2017-03-01 04:00		

TEST

RESULT

3.3.5 Sulfur Compounds in Natural Gas by GC, ASTM D 5504(m)

	<u>Results, ppm</u>
Hydrogen Sulfide	<0.1
Carbonyl Sulfide	<0.1
Sulfur Dioxide	0.3
Methyl Mercaptan	<0.1
Ethyl Mercaptan	<0.1
Dimethylsulfide	<0.1
Carbon Disulfide	<0.1
Isopropyl Mercaptan	<0.1
Ethylene Sulfide	<0.1
Tert-Butyl mercaptan	1.3
Propyl Mercaptan	<0.1
Ethylmethylsulfide	<0.1
Propylene sulfide	<0.1
Methyl-isobutyl Sulfide	<0.1
Sec-Butyl mercaptan	<0.1
Diethylsulfide	<0.1
Thiophene	<0.1
Isobutyl Mercaptan	<0.1
n-Butyl Mercaptan	<0.1
Dimethyldisulfide	<0.1
Methyl isopropyl Sulfide	<0.1
Methyl-n-Propyl Sulfide	<0.1
Methyl-t-butyl Sulfide	<0.1
Ethyl-n-Propyl Sulfide	<0.1
Methyl sec-butyl Sulfide	<0.1
2-Pentyl Mercaptan	<0.1
2-Methyl Thiophene	<0.1
3-Methyl Thiophene	<0.1
Tetra-Hydro Thiophene	0.9
Ethylthiophene	<0.1
Ethyl Methyl Disulfide	<0.1
Methyl Ethyl Thiophene	<0.1
Methyl isopropyl disulfide	<0.1
Propyl methyl disulfide	<0.1

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TEST

RESULT

3.3.5 Sulfur Compounds in Natural Gas by GC. ASTM D 5504(m)

	<u>Results, ppm</u>
Diethylsulfide	<0.1
Methyl-t-butyl disulfide	<0.1
Ethyl isopropyl disulfide	<0.1
Ethyl propyl disulfide	<0.1
Methyl sec-butyl disulfide	<0.1
Ethyl sec-butyl disulfide	<0.1
Tert-butyl disulfide	<0.1
Tris(Methylthio) methane	<0.1
Benzothiophene	<0.1
Methylethylsulfide	<0.1
Isopropyl disulfide	<0.1
Isopropyl n-propyl disulfide	<0.1
Dibenzothiophene	<0.1

An aliquot of the natural gas sample is introduced into a gas chromatograph as received and separated on a capillary column. Sulfur compounds, if present in the gas, are detected by chemiluminescence.

3.3.6 Siloxanes in Gas. by GC/MS. TOL -7081

	Approximate Concentration mg/Kg in Gas
Hexamethyldisiloxane	<1.0
Octamethylcyclotetrasiloxane	<1.0
Decamethylcyclopentasiloxane	<1.0
Other silicon containing chromatographable compounds	<1.0

On site, a sampling apparatus is constructed so that the natural gas sample under pressure flows through a bed of activated carbon for a prolonged period of time. The hydrocarbon components of the gas are extracted from the activated carbon using carbon disulfide and analyzed by GC/MS for siloxanes.

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SAMPLE:	P-72A (5259,4290,4233) 2017-03-01 04:00		

TEST

RESULT

3.3.7 Volatile Organic Compounds, Purge-and-Trap, GC-MS, EPA 8260B.a

	<u>Results, ppb</u>
Dichlorodifluoromethane	<10
Chloromethane	<10
Vinyl chloride	<10
Bromomethane	<10
Chloroethane	<10
Trichlorofluoromethane	<10
Methyl Ethyl Ketone	<10
2-Propanone	<10
1,1-Dichloroethene	<10
Methylene chloride	<10
trans-1,2-Dichloroethene	<10
1,1-Dichloroethane	<10
cis-1,2-Dichloroethene	<10
2,2-Dichloropropane	<10
Bromochloromethane	<10
Chloroform	<10
1,1,1-Trichloroethane	<10
1,2-Dichloroethane	<10
1,1-Dichloropropene	<10
Benzene	121.1
Carbon Tetrachloride	<10
1,2-Dichloropropane	<10
Trichloroethene	<10
Dibromomethane	<10
Bromodichloromethane	<10
Cis-1,3-Dichloropropene	<10
Trans-1,3-Dichloropropene	<10
Toluene	95.4
1,1,2-Trichloroethane	<10
1,3-Dichloropropane	<10
Dibromochloromethane	<10
1,2-Dibromoethane	<10
Tetrachloroethene	<10
Chlorobenzene	<10

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TEST

RESULT

3.3.7 Volatile Organic Compounds, Purge-and-Trap, GC-MS, EPA 8260B.a

	<u>Results, ppb</u>
1,1,1,2-Tetrachloroethane	<10
Ethyl Benzene	<10
1,2,4-Trimethylbenzene	<10
1,3,5-Trimethylbenzene	<10
m&p-Xylene	31.7
Bromoform	<10
Styrene	<10
o-Xylene	<10
1,1,1,2-Tetrachloroethane	<10
1,2,3-Trichloropropane	<10
isopropylbenzene	<10
Bromobenzene	<10
2-Chlorotoluene	<10
n-Propylbenzene	<10
4-Chlorotoluene	<10
tert-Butylbenzene	<10
1,3-Dichlorobenzene	<10
sec-Butylbenzene	<10
1,4-Dichlorobenzene	<10
p-Isopropyltoluene	<10
1,2-Dichlorobenzene	<10
n-Butylbenzene	<10
1,2-Dibromo-3-chloropropane	<10
1,2,4-Trichlorobenzene	<10
Naphthalene	<10
1,2,3-Trichlorobenzene	<10
Hexachlorobutadiene	<10

An aliquot of natural gas is introduced into the purge and trap chamber of a gas chromatograph and purged with helium. The purged compounds are then desorbed and separated on a capillary column to be detected by GC/MS.

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Certificate of Analysis



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P.O. BOX 741905, HOUSTON, TEXAS 77274

TEL: (281) 495-2400

FAX: (281) 495-2410

CLIENT:	Blade Energy Partners, Ltd	REQUESTED BY:	Mr. Brent Sherar
CLIENT PROJECT:		PURCHASE ORDER NO:	.SCG-001_12
LABORATORY NO:	84422-007	REPORT DATE:	March 22, 2017
SAMPLE:	P-74A Impinged Water (700psi 10-20%) 2017-03-01 04:00		

3.3.8 Anions in Water by Chemically Suppressed Ion Chromatography. ASTM D 4327.a

	<u>Results, ppm</u>
Fluoride	<1.0
Chloride	<1.0
Nitrite	<1.0
Bromide	<1.0
Nitrate	<1.0
Phosphate	<1.0
Sulfate	<1.0

Natural gas, under pressure, was impinged into DI water for a known amount of time on site. The anions in this water sample, if present, are separated by a packed column and detected by a conductivity detector.

3.3.9 Trace Metals by ICP/MS. ASTM D 5673.c

	<u>Results, PPMwt</u>
Aluminum	<0.05
Arsenic	<0.05
Barium	<0.05
Cadmium	<0.05
Cobalt	<0.05
Copper	<0.05
Iron	<0.05
Mercury	<0.05
Manganese	<0.05
Molybdenum	<0.05
Lead	<0.05
Antimony	<0.05
Selenium	<0.05
Strontium	<0.05
Vanadium	<0.05
Nickel	<0.05

Natural gas, under pressure, was impinged into an aqueous nitric acid solution for a known amount of time on site. The preserved sample was digested in Nitric acid (HNO₃) and analyzed utilizing an Inductively Coupled Plasma, Mass Spectrometer (ICP-MS). The characteristics elemental light wave emissions are measured to determine the relative concentrations of the elements.

Respectfully submitted
For Texas OilTech Laboratories, L.P.



A. Phillip Sorurbakhsh
Director of Laboratory Operations

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Sampling Point



This sampling point (1/2-MPT) was used at all sites including P-69E, P-68A, and P-72A.

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