

G3516 LE

GAS COMPRESSION APPLICATION

GAS ENGINE SITE SPECIFIC TECHNICAL DATA**CATERPILLAR®**

ENGINE SPEED (rpm): 1400
 COMPRESSION RATIO: 8:1
 AFTERCOOLER WATER INLET (°F): 130
 JACKET WATER OUTLET (°F): 210
 COOLING SYSTEM: JW+OC, AC
 IGNITION SYSTEM: ADEM3
 EXHAUST MANIFOLD: ASWC
 COMBUSTION: Low Emission
 NOx EMISSION LEVEL (g/bhp-hr NOx): 2.0
 SET POINT TIMING: 33.0

FUEL SYSTEM:

HPG IMPCO
 WITH AIR FUEL RATIO CONTROL

SITE CONDITIONS:

FUEL: Williams Springfield
 FUEL PRESSURE RANGE (psig): 35.0-40.0
 FUEL METHANE NUMBER: 87.6
 FUEL LHV (Btu/scf): 929
 ALTITUDE (ft): 500
 MAXIMUM INLET AIR TEMPERATURE (°F): 77
 NAMEPLATE RATING: 1340 bhp@1400rpm

RATING	NOTES	LOAD	MAXIMUM RATING	SITE RATING AT MAXIMUM INLET AIR TEMPERATURE		
			100%	100%	75%	50%
ENGINE POWER	(1)	bhp	1340	1340	1005	670
INLET AIR TEMPERATURE		°F	77	77	77	77

ENGINE DATA						
FUEL CONSUMPTION (LHV)	(2)	Btu/bhp-hr	7547	7547	7775	8326
FUEL CONSUMPTION (HHV)	(2)	Btu/bhp-hr	8377	8377	8629	9241
AIR FLOW	(3)(4)	lb/hr	12619	12619	9519	6566
AIR FLOW WET (77°F, 14.7 psia)	(3)(4)	scfm	2846	2846	2147	1481
INLET MANIFOLD PRESSURE	(5)	in Hg(abs)	70.9	70.9	55.8	39.8
EXHAUST STACK TEMPERATURE	(6)	°F	873	873	873	877
EXHAUST GAS FLOW (@ stack temp, 14.5 psia)	(7)(4)	ft ³ /min	7646	7646	5774	4003
EXHAUST GAS MASS FLOW	(7)(4)	lb/hr	13095	13095	9887	6828

EMISSIONS DATA						
NOx (as NO ₂)	(8)	g/bhp-hr	2.00	2.00	2.00	2.00
CO	(8)	g/bhp-hr	1.85	1.85	1.94	2.09
THC (mol. wt. of 15.84)	(8)	g/bhp-hr	2.63	2.63	2.76	2.95
NMHC (mol. wt. of 15.84)	(8)	g/bhp-hr	0.40	0.40	0.41	0.44
NMNEHC (VOCs) (mol. wt. of 15.84)	(8)(9)	g/bhp-hr	0.26	0.26	0.28	0.29
HCHO (Formaldehyde)	(8)	g/bhp-hr	0.26	0.26	0.27	0.29
CO ₂	(8)	g/bhp-hr	470	470	478	503
EXHAUST OXYGEN	(10)	% DRY	8.1	8.1	8.0	7.8

HEAT REJECTION						
HEAT REJ. TO JACKET WATER (JW)	(11)	Btu/min	42218	42218	35156	29041
HEAT REJ. TO ATMOSPHERE	(11)	Btu/min	5313	5313	4428	3543
HEAT REJ. TO LUBE OIL (OC)	(11)	Btu/min	6296	6296	5243	4331
HEAT REJ. TO AFTERCOOLER (AC)	(11)(12)	Btu/min	9535	9535	6174	2150

HEAT EXCHANGER SIZING CRITERIA			
TOTAL JACKET WATER CIRCUIT (JW+OC)	(12)	Btu/min	53996
TOTAL AFTERCOOLER CIRCUIT (AC)	(12)(13)	Btu/min	10012
A cooling system safety factor of 0% has been added to the heat exchanger sizing criteria.			

CONDITIONS AND DEFINITIONS

Engine rating obtained and presented in accordance with ISO 3046/1, adjusted for fuel, site altitude and site inlet air temperature.
 100% rating at maximum inlet air temperature is the maximum engine capability for the specified fuel at site altitude and maximum site inlet air temperature.
 Max. rating is the maximum capability for the specified fuel at site altitude and reduced inlet air temperature.
 Lowest load point is the lowest continuous duty operating load allowed. No overload permitted at rating shown.

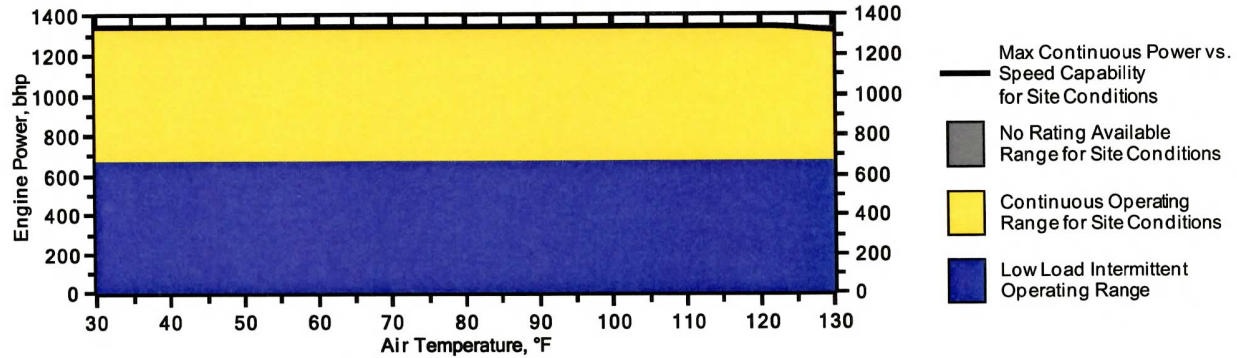
For notes information consult page three.

PREPARED BY:

Data generated by Gas Engine Rating Pro Version 3.03.00
 Ref. Data Set DM8618-01-001, Printed 30Sep2009

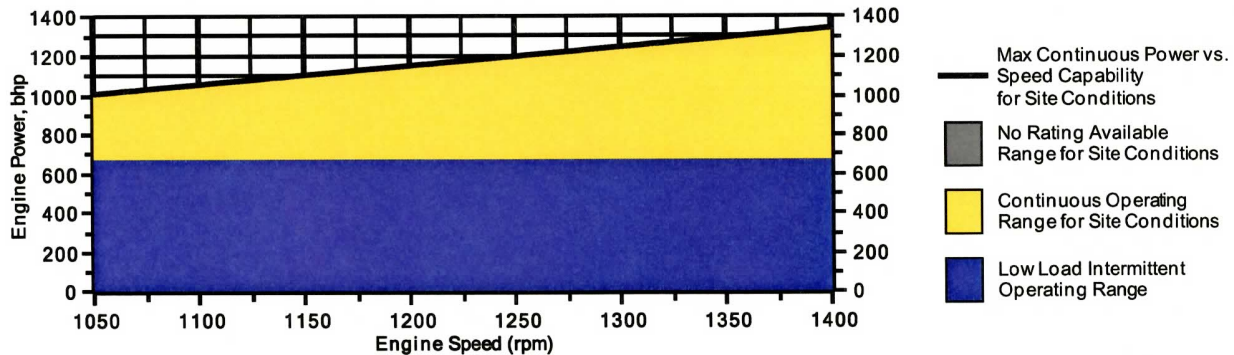
Engine Power vs. Inlet Air Temperature

Data represents temperature sweep at 500 ft and 1400 rpm



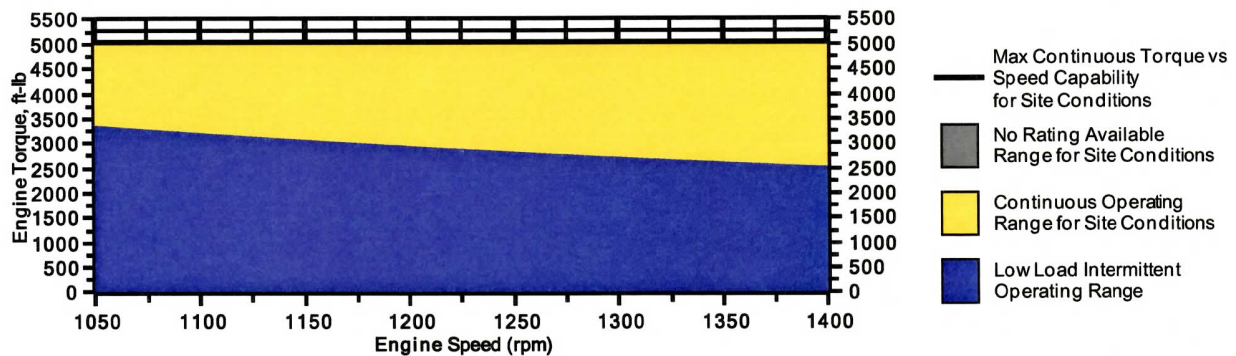
Engine Power vs. Engine Speed

Data represents speed sweep at 500 ft and 77 °F



Engine Torque vs. Engine Speed

Data represents speed sweep at 500 ft and 77 °F



Note: At site conditions of 500 ft and 77°F inlet air temp., constant torque can be maintained down to 1050 rpm. The minimum speed for loading at these conditions is 1050 rpm.

NOTES

1. Engine rating is with two engine driven water pumps. Tolerance is $\pm 3\%$ of full load.
2. Fuel consumption tolerance is $\pm 3.0\%$ of full load data.
3. Undried air. Flow is a nominal value with a tolerance of $\pm 5\%$.
4. Inlet and Exhaust Restrictions must not exceed A&I limits based on full load flow rates from the standard technical data sheet.
5. Inlet manifold pressure is a nominal value with a tolerance of $\pm 5\%$.
6. Exhaust stack temperature is a nominal value with a tolerance of $(+)63^{\circ}\text{F}$, $(-)54^{\circ}\text{F}$.
7. Exhaust flow value is on a "wet" basis. Flow is a nominal value with a tolerance of $\pm 6\%$.
8. Emission levels are at engine exhaust flange prior to any after treatment. Values are based on engine operating at steady state conditions, adjusted to the specified NOx level at 100% load. Fuel methane number cannot vary more than ± 3 . Values listed are higher than nominal levels to allow for instrumentation, measurement, and engine-to-engine variations. They indicate "Not to Exceed" values. THC, NMHC, and NMNEHC do not include aldehydes. An oxidation catalyst may be required to meet Federal, State or local CO or HC requirements.
9. VOCs - Volatile organic compounds as defined in US EPA 40 CFR 60, subpart JJJJ
10. Exhaust Oxygen level is the result of adjusting the engine to operate at the specified NOx level. Tolerance is ± 0.5 .
11. Heat rejection values are nominal. Tolerances, based on treated water, are $\pm 10\%$ for jacket water circuit, $\pm 50\%$ for radiation, $\pm 20\%$ for lube oil circuit, and $\pm 5\%$ for aftercooler circuit.
12. Aftercooler heat rejection includes an aftercooler heat rejection factor for the site elevation and inlet air temperature specified. Aftercooler heat rejection values at part load are for reference only. Do not use part load data for heat exchanger sizing.
13. Heat exchanger sizing criteria are maximum circuit heat rejection for the site, with applied tolerances.

PREPARED BY:

Data generated by Gas Engine Rating Pro Version 3.03.00
Ref. Data Set DM8618-01-001, Printed 30Sep2009

Constituent	Abbrev	Mole %	Norm
Water Vapor	H2O	0.0000	0.0000
Methane	CH4	96.7637	96.7637
Ethane	C2H6	2.0705	2.0705
Propane	C3H8	0.1603	0.1603
Isobutane	iso-C4H10	0.0165	0.0165
Norbutane	nor-C4H10	0.0298	0.0298
Isopentane	iso-C5H12	0.0636	0.0636
Norpentane	nor-C5H12	0.0305	0.0305
Hexane	C6H14	0.1184	0.1184
Heptane	C7H16	0.0000	0.0000
Nitrogen	N2	0.5440	0.5440
Carbon Dioxide	CO2	0.1814	0.1814
Hydrogen Sulfide	H2S	0.0000	0.0000
Carbon Monoxide	CO	0.0000	0.0000
Hydrogen	H2	0.0000	0.0000
Oxygen	O2	0.0213	0.0213
Helium	HE	0.0000	0.0000
Neopentane	neo-C5H12	0.0000	0.0000
Octane	C8H18	0.0000	0.0000
Nonane	C9H20	0.0000	0.0000
Ethylene	C2H4	0.0000	0.0000
Propylene	C3H6	0.0000	0.0000
TOTAL (Volume %)		100.0000	100.0000

Fuel Makeup: Williams Springfield
Unit of Measure: English

Calculated Fuel Properties

Caterpillar Methane Number: 87.6

Lower Heating Value (Btu/scf): 929
Higher Heating Value (Btu/scf): 1031
WOBBE Index (Btu/scf): 1225

THC: Free Inert Ratio: 153.83
RPC (%) (To 905 Btu/scf Fuel): 100%

Compressibility Factor: 0.998
Stoich A/F Ratio (Vol/Vol): 9.71
Stoich A/F Ratio (Mass/Mass): 16.88
Specific Gravity (Relative to Air): 0.575
Specific Heat Constant (K): 1.312

CONDITIONS AND DEFINITIONS

Caterpillar Methane Number represents the knock resistance of a gaseous fuel. It should be used with the Caterpillar Fuel Usage Guide for the engine and rating to determine the rating for the fuel specified. A Fuel Usage Guide for each rating is included on page 2 of its standard technical data sheet.

RPC always applies to naturally aspirated (NA) engines, and turbocharged (TA or LE) engines only when they are derated for altitude and ambient site conditions.

Project specific technical data sheets generated by the Caterpillar Gas Engine Rating Pro program take the Caterpillar Methane Number and RPC into account when generating a site rating.

Fuel properties for Btu/scf calculations are at 60F and 14.696 psia.

Caterpillar shall have no liability in law or equity, for damages, consequently or otherwise, arising from use of program and related material or any part thereof.

FUEL LIQUIDS

Field gases, well head gases, and associated gases typically contain liquid water and heavy hydrocarbons entrained in the gas. To prevent detonation and severe damage to the engine, hydrocarbon liquids must not be allowed to enter the engine fuel system. To remove liquids, a liquid separator and coalescing filter are recommended, with an automatic drain and collection tank to prevent contamination of the ground in accordance with local codes and standards.

To avoid water condensation in the engine or fuel lines, limit the relative humidity of water in the fuel to 80% at the minimum fuel operating temperature.

LAUREL MOUNTAIN MIDSTREAM, LLC
Springhill Compressor Station
General Permit BAQ-GPA/GP-5 Application
Glycol Reboiler Emission Calculations

Notes:

- 1 - Assumed glycol reboiler operates 8760 hours per year.
- 2 - Fire box emissions based on Fire Tube emissions factors
- 3 - Used GRI-GLYCalc Version 4.0 to calculate emissions from reboiler still column
- 4 - Maximum calculated emissions (6.156) occur at contactor pressure of 1440, temperature of 88F and throughput of 10 MMSCFD
- 5 - Represent 8 tons/year VOC from reboiler vent to account for inlet gas changes and additional wells

GRI-GLYCalc Emissions Summary				
NATCO TEG Dehydrator Input			Output Data	
Operating Temperature (F)	Operating Pressure (psig)	Dry Gas Flow Rate (MMscf / day)	VOC Emission Rate (lb/hr)	VOC Emission Rate (tpy)
90	700	10	1.25	5.48
130	1440	25	1.26	5.53

Average operating
Maximum design

*note: see attached GRI GlyCalc run

TEG Reboiler	MMBtu/hr	lbs/hr	NOx tpy	CO lbs/hr	Non-Methane/Ethane VOC tpy
Fire Box	0.25	0.025	0.109	0.016	0.010
Still Column Vent	NA	NA	NA	NA	0.6272
Totals		0.025	0.109	0.016	0.071
				1.84	8.04

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Springhill GlyCalc Run

File Name: K:\Williams Laurel Mountain Midstream\009263 LMM Phase II Permits,
Plans and Compliance\Pennsylvania\Springhill 009263\GlyCalc Runs\Springfield 1440
psi 88F 10MMSCFD.ddf

Date: October 23, 2009

DESCRIPTION:

Description: 10MMSCFD

Contactor 1440 psig and 88F

0.08 acfm

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	83.1781	1996.274	364.3201
Ethane	4.2210	101.304	18.4880
Propane	0.6100	14.639	2.6717
Isobutane	0.1035	2.485	0.4535
n-Butane	0.2709	6.501	1.1865
Isopentane	0.0674	1.617	0.2952
n-Pentane	0.0504	1.209	0.2207
n-Hexane	0.1018	2.443	0.4459
Other Hexanes	0.0568	1.363	0.2488
Heptanes	0.0436	1.046	0.1909
C8+ Heavies	0.1006	2.414	0.4405
Total Emissions	88.8040	2131.297	388.9617
Total Hydrocarbon Emissions	88.8040	2131.297	388.9617
Total VOC Emissions	1.4049	33.719	6.1536
Total HAP Emissions	0.1018	2.443	0.4459

EQUIPMENT REPORTS:

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages: 1.25
 Calculated Dry Gas Dew Point: 1.18 lbs. H₂O/MMSCF

Temperature: 88.0 deg. F
 Pressure: 1440.0 psig
 Dry Gas Flow Rate: 10.0000 MMSCF/day
 Glycol Losses with Dry Gas: 0.2182 lb/hr
 Wet Gas Water Content: Saturated
 Calculated Wet Gas Water Content: 32.21 lbs. H₂O/MMSCF
 Calculated Lean Glycol Recirc. Ratio: 16.24 gal/lb H₂O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	3.66%	96.34%
Carbon Dioxide	99.31%	0.69%
Nitrogen	99.94%	0.06%
Methane	99.95%	0.05%
Ethane	99.85%	0.15%
Propane	99.81%	0.19%
Isobutane	99.76%	0.24%
n-Butane	99.69%	0.31%
Isopentane	99.73%	0.27%
n-Pentane	99.64%	0.36%
n-Hexane	99.46%	0.54%
Other Hexanes	99.58%	0.42%
Heptanes	99.12%	0.88%
C8+ Heavies	98.65%	1.35%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	69.45%	30.55%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%

Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.19%	99.81%
n-Pentane	0.23%	99.77%
n-Hexane	0.28%	99.72%
Other Hexanes	0.49%	99.51%
Heptanes	0.34%	99.66%
C8+ Heavies	9.30%	90.70%

STREAM REPORTS:

WET GAS STREAM

Temperature: 88.00 deg. F
 Pressure: 1454.70 psia
 Flow Rate: 4.17e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.79e-002	1.34e+001
Carbon Dioxide	1.77e-001	8.56e+001
Nitrogen	5.10e-001	1.57e+002
Methane	9.67e+001	1.71e+004
Ethane	2.19e+000	7.24e+002
Propane	2.02e-001	9.79e+001
Isobutane	2.40e-002	1.53e+001
n-Butane	5.70e-002	3.64e+001
Isopentane	1.20e-002	9.51e+000
n-Pentane	7.99e-003	6.34e+000
n-Hexane	1.10e-002	1.04e+001
Other Hexanes	7.00e-003	6.63e+000
Heptanes	3.00e-003	3.30e+000
C8+ Heavies	3.00e-003	5.61e+000
Total Components	100.00	1.82e+004

DRY GAS STREAM

Temperature: 88.00 deg. F
 Pressure: 1454.70 psia
 Flow Rate: 4.17e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
-----	-----	-----
Water	2.49e-003	4.92e-001
Carbon Dioxide	1.76e-001	8.50e+001
Nitrogen	5.10e-001	1.57e+002
Methane	9.68e+001	1.70e+004
Ethane	2.19e+000	7.23e+002
Propane	2.02e-001	9.77e+001
Isobutane	2.40e-002	1.53e+001
n-Butane	5.69e-002	3.63e+001
Isopentane	1.20e-002	9.49e+000
n-Pentane	7.98e-003	6.32e+000
n-Hexane	1.09e-002	1.04e+001
Other Hexanes	6.97e-003	6.60e+000
Heptanes	2.98e-003	3.27e+000
C8+ Heavies	2.96e-003	5.54e+000
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Total Components	100.00	1.82e+004

LEAN GLYCOL STREAM

Temperature: 88.00 deg. F
 Flow Rate: 3.50e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
-----	-----	-----
TEG	9.85e+001	1.94e+003
Water	1.50e+000	2.96e+001
Carbon Dioxide	3.01e-012	5.93e-011
Nitrogen	4.99e-013	9.83e-012
Methane	1.50e-017	2.95e-016
Ethane	2.54e-008	5.01e-007
Propane	3.78e-010	7.46e-009
Isobutane	5.59e-011	1.10e-009
n-Butane	1.41e-010	2.78e-009
Isopentane	6.61e-006	1.30e-004
n-Pentane	5.80e-006	1.14e-004
n-Hexane	1.44e-005	2.84e-004
Other Hexanes	1.43e-005	2.82e-004
Heptanes	7.45e-006	1.47e-004
C8+ Heavies	5.23e-004	1.03e-002
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Total Components 100.00 1.97e+003

RICH GLYCOL AND PUMP GAS STREAM

Temperature: 88.00 deg. F
 Pressure: 1454.70 psia
 Flow Rate: 3.73e+000 gpm
 NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.36e+001	1.94e+003
Water	2.05e+000	4.26e+001
Carbon Dioxide	4.66e-002	9.66e-001
Nitrogen	3.78e-002	7.84e-001
Methane	4.01e+000	8.32e+001
Ethane	2.04e-001	4.22e+000
Propane	2.94e-002	6.10e-001
Isobutane	4.99e-003	1.04e-001
n-Butane	1.31e-002	2.71e-001
Isopentane	3.26e-003	6.75e-002
n-Pentane	2.44e-003	5.05e-002
n-Hexane	4.92e-003	1.02e-001
Other Hexanes	2.75e-003	5.71e-002
Heptanes	2.11e-003	4.37e-002
C8+ Heavies	5.35e-003	1.11e-001
Total Components	100.00	2.07e+003

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 2.32e+003 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.18e+001	1.30e+001
Carbon Dioxide	3.59e-001	9.66e-001
Nitrogen	4.57e-001	7.84e-001
Methane	8.47e+001	8.32e+001
Ethane	2.29e+000	4.22e+000
Propane	2.26e-001	6.10e-001
Isobutane	2.91e-002	1.04e-001
n-Butane	7.61e-002	2.71e-001

Isopentane	1.53e-002	6.74e-002
n-Pentane	1.14e-002	5.04e-002
n-Hexane	1.93e-002	1.02e-001
Other Hexanes	1.08e-002	5.68e-002
Heptanes	7.10e-003	4.36e-002
C8+ Heavies	9.64e-003	1.01e-001

Total Components	100.00	1.04e+002

GRI-GLYCalc VERSION 4.0 - EMISSIONS SUMMARY

Case Name: Springhill GlyCalc Run

File Name: K:\Williams Laurel Mountain Midstream\009263 LMM Phase II Permits,
Plans and Compliance\Pennsylvania\Springhill 009263\GlyCalc Runs\Springfield 1440
psi 88F 10MMSCFD.ddf

Date: October 23, 2009

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	83.1781	1996.274	364.3201
Ethane	4.2210	101.304	18.4880
Propane	0.6100	14.639	2.6717
Isobutane	0.1035	2.485	0.4535
n-Butane	0.2709	6.501	1.1865
Isopentane	0.0674	1.617	0.2952
n-Pentane	0.0504	1.209	0.2207
n-Hexane	0.1018	2.443	0.4459
Other Hexanes	0.0568	1.363	0.2488
Heptanes	0.0436	1.046	0.1909
C8+ Heavies	0.1006	2.414	0.4405
Total Emissions	88.8040	2131.297	388.9617
Total Hydrocarbon Emissions	88.8040	2131.297	388.9617
Total VOC Emissions	1.4049	33.719	6.1536
Total HAP Emissions	0.1018	2.443	0.4459

Value for Firetube Emissions Chart

$$\frac{\frac{250000}{1000} \cdot \frac{1000 \cdot \text{BTU}}{\text{hr}}}{3529.16 \cdot \text{in}^2} = 0.071 \frac{1 \times 10^3 \cdot \text{BTU}}{\text{hr} \cdot \text{in}^2}$$

Value from Firetube Emissions Chart for NOx

$$n := 0.1 \cdot \frac{\text{lb}}{10^6 \cdot \text{BTU}}$$

Value from Firetube Emissions Chart for CO

$$c := 0.065 \cdot \frac{\text{lb}}{10^6 \cdot \text{BTU}}$$

Value from Firetube Emissions Chart for HC

$$h := 0.04 \cdot \frac{\text{lb}}{10^6 \cdot \text{BTU}}$$

$$\text{NOx} := \frac{n \cdot \frac{250000}{10^6} \cdot \frac{10^6 \cdot \text{BTU}}{\text{hr}} \cdot 8760 \cdot \frac{\text{hr}}{\text{yr}}}{2000 \cdot \frac{\text{lb}}{\text{ton}}} \quad \text{CO} := \frac{c \cdot \frac{250000}{10^6} \cdot \frac{10^6 \cdot \text{BTU}}{\text{hr}} \cdot 8760 \cdot \frac{\text{hr}}{\text{yr}}}{2000 \cdot \frac{\text{lb}}{\text{ton}}}$$

$$\text{NOx} = 0.109 \frac{\text{ton}}{\text{yr}}$$

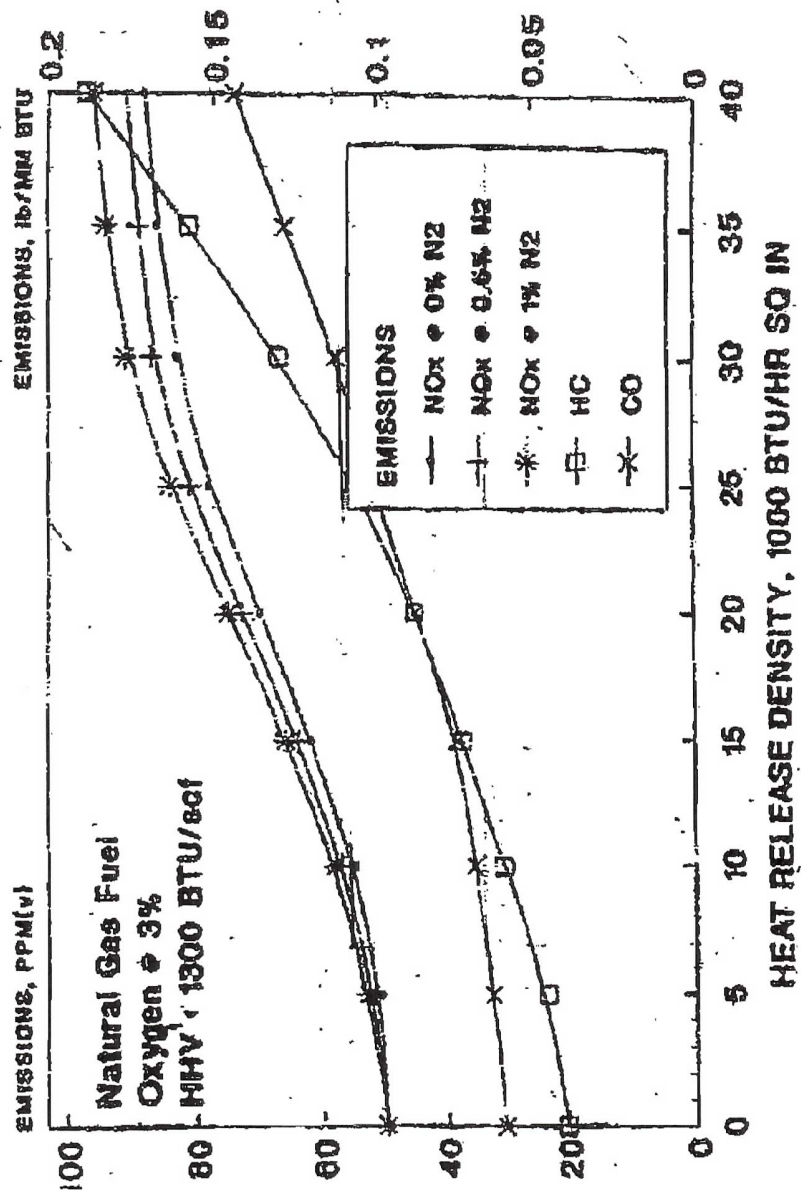
$$\text{CO} = 0.071 \frac{\text{ton}}{\text{yr}}$$

$$\text{HC} := \frac{h \cdot \frac{250000}{10^6} \cdot \frac{10^6 \cdot \text{BTU}}{\text{hr}} \cdot 8760 \cdot \frac{\text{hr}}{\text{yr}}}{2000 \cdot \frac{\text{lb}}{\text{ton}}}$$

$$\text{HC} = 0.044 \frac{\text{ton}}{\text{yr}}$$

FIRETUBE EMISSIONS

NOx, CO, Unburned HC





LAFAYETTE LABORATORY
500 AMBASSADOR GALLERY PKWY
SUITE 1 LOUISIANA 70065-1799
PHONE (504) 237-8775
FAX (504) 237-8005

Certificate of Analysis Number: 2009100041-002A

FOR: Air Compliance Consultants
Rob Frey
1050 William Pitt Way
Pittsburgh, PA 15238

CUSTOMER: Air Compliance Consultants
FIELD : Williams
LOCATION : Springhill Station
SAMPLE POINT:
REPORT DATE: 10/8/2009
SAMPLE DATE: 9/23/09 @ 13:15
SAMPLED BY: CWB - Air Compliance
REMARKS1: Spot Sample
REMARKS2:

TYPE: Gas
REPORT: C10+ (GPA Method 2286)
CYLINDER: 2622
PRESSURE: 130
TEMPERATURE: 78

<u>COMPONENT</u>	<u>MOL %</u>	<u>WEIGHT %</u>	<u>GPM's @ 15.025</u>
N2	0.510	0.862	
CO2	0.177	0.470	
METHANE	96.794	93.633	
ETHANE	2.192	3.974	0.598
PROPANE	0.202	0.537	0.057
I-BUTANE	0.024	0.084	0.008
N-BUTANE	0.057	0.199	0.018
I-PENTANE	0.012	0.054	0.005
N-PENTANE	0.008	0.036	0.003
I-HEXANES	0.007	0.034	0.003
N-HEXANE	0.011	0.021	0.002
I-HEPTANES	0.002	0.021	0.002
N-HEPTANE	0.001	0.009	0.001
BENZENE	NIL	NIL	NIL
CYCLOHEXANE	NIL	0.002	NIL
TOLUENE	NIL	0.001	NIL
I-OCTANES	0.001	0.012	0.001
N-OCTANE	0.001	0.005	NIL
*E-BENZENE	NIL	NIL	NIL
*m,o,&p-XYLENE	NIL	NIL	NIL
I-NONANES	NIL	0.006	NIL
N-NONANE	NIL	0.004	NIL
I-DECANES	NIL	0.014	0.001
N-DECANE	NIL	0.004	NIL
I-UNDECANES +	0.001	0.018	0.001
TOTALS	100.000	100.000	0.700



LAFAYETTE LABORATORY
500 AMBASSADOR CAFE'RY PKWY.
SCOTT, LOUISIANA 70583-1700
PHONE (337) 237-4775
FAX (337) 237-8905

Certificate of Analysis Number: 2009100041-002A

FOR: Air Compliance Consultants
Rob Frey
1050 William Pitt Way
Pittsburgh, PA 15238

CUSTOMER: Air Compliance Consultants
FIELD : Williams
LOCATION : Springhill Station
SAMPLE POINT:
REPORT DATE: 10/8/2009
SAMPLE DATE: 9/23/09 @ 13:15
SAMPLED BY: CWB - Air Compliance
REMARKS1: Spot Sample
REMARKS2:

TYPE: Gas
REPORT: C6+
CYLINDER: 2622
PRESSURE: 130
TEMPERATURE: 78

<u>COMPONENT</u>	<u>MOL %</u>	<u>WEIGHT %</u>	<u>GPM's @ 15.025</u>
N2	0.510	0.862	
CO2	0.177	0.470	
METHANE	96.794	93.633	
ETHANE	2.192	3.974	0.598
PROPANE	0.202	0.537	0.057
I-BUTANE	0.024	0.084	0.008
N-BUTANE	0.057	0.199	0.018
I-PENTANE	0.012	0.054	0.005
N-PENTANE	0.008	0.036	0.003
HEXANES PLUS	0.024	0.151	0.011
TOTALS	100.000	100.000	0.700

CALCULATED VALUES

MOLECULAR WEIGHT

<u>TOTAL</u>	<u>C6+</u>	<u>C7+</u>
16.583	102.249	114.777

REAL DRY BTU AT 15.025 PSIA, 60 DEG.F

1051.5 5639.0 6260.0

REAL WET BTU AT 15.025 PSIA, 60 DEG.F

1034.4 5543.6 6154.0

RELATIVE DENSITY

0.5734 3.5233 3.9526

GPM's AT 15.025

<u>C2+</u>	<u>IC5+</u>
0.700	0.019

COMPRESSIBILITY FACTOR

0.99790



LAFAYETTE LABORATORY
500 AMBASSADOR CAFE'RY PKWY.
SCOTTE LOUISIANA 70582-1700
PHONE (337) 257-1775
FAX (337) 257-8005

Certificate of Analysis Number: 2009100041-002A

FOR: Air Compliance Consultants
Rob Frey
1050 William Pitt Way
Pittsburgh, PA 15238

CUSTOMER: Air Compliance Consultants
FIELD : Williams
LOCATION : Springhill Station
SAMPLE POINT:
REPORT DATE: 10/8/2009
SAMPLE DATE: 9/23/09 @ 13:15
SAMPLED BY: CWB - Air Compliance
REMARKS1: Spot Sample
REMARKS2:

TYPE: Gas
REPORT: C7+
CYLINDER: 2622
PRESSURE: 130
TEMPERATURE: 78

<u>COMPONENT</u>	<u>MOL %</u>	<u>WEIGHT %</u>	<u>GPM's @ 14.73</u>
N2	0.510	0.862	
CO2	0.177	0.470	
METHANE	96.794	93.633	
ETHANE	2.192	3.974	0.598
PROPANE	0.202	0.537	0.057
I-BUTANE	0.024	0.084	0.008
N-BUTANE	0.057	0.199	0.018
I-PENTANE	0.012	0.054	0.005
N-PENTANE	0.008	0.036	0.003
HEXANES	0.018	0.055	0.005
HEPTANES PLUS	0.006	0.096	0.006
TOTALS	100.000	100.000	0.700

CALCULATED VALUES

MOLECULAR WEIGHT

<u>TOTAL</u>	<u>C6+</u>	<u>C7+</u>
16.583	102.249	114.777

REAL DRY BTU AT 14.73 PSIA, 60 DEG.F

1030.8	5528.0	6137.0
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REAL WET BTU AT 14.73 PSIA, 60 DEG.F

1014.1	5434.5	6033.1
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RELATIVE DENSITY

0.5734	3.5233	3.9526
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GPM's AT 15.025

<u>C2+</u>	<u>IC5+</u>
0.700	0.019

COMPRESSIBILITY FACTOR

0.9979

LAUREL MOUNTAIN MIDSTREAM, LLC
Springhill Compressor Station
General Permit BAQ-GPA/GP-5 Application
Fugitive Emission Calculations

- Notes:
- 1 - Assumed 8760 hours per year of fugitive emissions.
 - 2 - Gas/Vapor emissions calculated using API 4516 factors (1995).
 - 3 - Total HC = Total Hydrocarbons including methane/ethane
 - 4 - NM/E VOC = Non-Methane/Ethane Volatile Organic Carbons
 - 5 - Non-methane/ethane VOC weight percent of 1.0728 weight % based on the 10/08/2009 gas analysis.
 - 6 - Component counts are based on the gas/vapor components at a Laurel Mountain Midstream gas plant
 - 7 - Estimated fugitive emissions are believed to be conservatively, representative of potential fugitive emission losses

Stream	Component Type	Component Count	Emission Factor (lb HC per component per day)	HC Emissions (lb/hr)	NM/NE VOC Emissions (lb/hr)	NM/NE VOC Emissions (tpy)
Gas/Vapor	Valves	205	0.204	1.74	0.02	0.08
	Flanges	68	0.0145	0.04	0.00	0.00
	Connectors	0	0.011	0.00	0.00	0.00
	Pumps	0	0	0.00	0.00	0.00
	Other	0	0.257	0.00	0.00	0.00
					0.02	0.08

Inlet Gas Composition
October 15, 2009
Springhill Compressor Station

Compound	Mole %	Mole Fraction (M%/EM%)	MW	lb/lb mol (MW*MF)	Weight % (M%*MW/Elb/lbmole)
Nitrogen	0.51	0.0051000	28.01	0.1429	0.8613
CO2	0.177	0.0017700	44.01	0.0779	0.4696
CO	0	0.0000000	32.01	0.0000	0.0000
methane	96.794	0.9679400	16.043	15.5287	93.6225
ethane	2.192	0.0219200	30.07	0.6591	3.9738
propane	0.202	0.0020200	44.10	0.0891	0.5370
i-butane	0.024	0.0002400	58.12	0.0139	0.0841
N-butane	0.057	0.0005700	58.12	0.0331	0.1997
i-pentane	0.012	0.0001200	72.15	0.0087	0.0522
n-pentane	0.008	0.0000800	72.15	0.0058	0.0348
hexanes +	0.024	0.0002400	114.00	0.0274	0.1650
benzene	0	0.0000000	78.11	0.0000	0.0000
toluene	0	0.0000000	92.14	0.0000	0.0000
ethylbenzene	0	0.0000000	106.17	0.0000	0.0000
xylenes	0	0.0000000	106.16	0.0000	0.0000
Totals	100	1		16.5865	100.0000

MW of Gas = 16.5865

Weight % NM/E VOCs = 1.0728

Weight % Methane/Ethane = 97.5963

Weight % of total VOCs = 98.6691

hexanes + assume mw of 114 (average of hexanes-decanes)

Universal Gas Content = 379.4/lb-mol @ 60 F and 14.696 psia

Calculation:

Pound "X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.4 scf

lbs NM/E VOC/scf = 0.0005

lbs Methane/Ethane/scf = 0.0427

lbs total VOC/scf = 0.0431

Tested by: SPL 10/8/2009

LAUREL MOUNTAIN MIDSTREAM, LLC
Springhill Compressor Station
General Permit BAQ-GPA/GP-5 Application
Tank Emission Calculations

Notes:

- 1 - Four tanks store condensate and drip/lube oil
- 2 - Tank emissions were calculated by E & P TANK V2.0.
- 3 -Used "Stable Oil" program and EP Tanks default data (e.g. API gravity, specific gravity, vapor pressure)
- 4 - Analysis of produced water indicates API gravity < 30 and vapor pressure <1 ps
- 5 - Used higher API gravity and Reid vapor pressure for conservative estimate of emission:

Tank Identification		E & P TANK V2.0 Data Input					
		Tank Input Information					
No. of Tanks	Capacity per Tank (bbls)	Diameter (ft)	Height (ft)	Cone Roof Slope	Avg. Liquid Height (ft)	Breather Vent Pressure (psi)	Paint Condition
2	100	8.5	10	0.06	5	0.06	Good
1	100	8.5	10	0.06	5	0.06	Good
1	50	8.5	5	0.06	3	0.06	Good
						Material Stored	
						Produced Water	
						Produced Water	
						Reboiler Condensate	

Tank Identification		E & P TANK V2.0 Data Input				
		Tank Output Information (Sales Oil)				
No. of Tanks	Capacity per Tank (bbls)	Production Rate per Tank (bbl/day)	Days of Annual Operation (days/year)	Annual Production Rate (bbls/year/tank)	API Gravity	Reid Vapor Pressure (psia)
2	100	4.11	365	1500	46	7.7
1	100	4.11	365	1500	46	7.7
1	50	1.37	365	500	46	7.7
						Bulk Temperature (F)
						60
						60
						60

Tank Identification		E & P TANK V2.0 Data Output			Controlled Emission Rates for all Tanks		
		Uncontrolled Emission Rates per Tank			Controlled Emission Rates per Tank		
No. of Tanks	Capacity per Tank (bbls)	VOC (lb/hr)	VOC (tpy)	Control (%)	VOC (lb/hr)	VOC (tpy)	VOC (tpy)
2	100	0.114	0.50	0	0.11	0.50	1.00
1	100	0.11	0.50	0	0.11	0.50	0.50
1	50	0.026	0.11	0	0.026	0.11	0.11
						0.37	1.61