EMPACT

EXTENDED NATURAL GAS ANALYSIS (*DHA)

MAIN PAGE

PRIMARY DB KEY:		NAME/DESCRIP :	**BLACK COMB 3-14**
LEASE #:			**GAS AT SEPARATOR**

PROJECT NO. :	**201712120**	ANALYSIS NO. :	**04**
COMPANY NAME :	**NIGHTHAWK PRODUCTION COMPANY**	ANALYSIS DATE:	DECEMBER 22, 2017 11:21
OFFICE / BRANCH:	HIGHLANDS RANCH, CO	SAMPLE DATE :	DECEMBER 20, 2017 10:50
CUSTOMER REF:		TO:	
PRODUCER :		EFFECTIVE DATE:	

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

SAMPLE CYCLE:			SAMPLE TYPE:	SPOT	
SAMPLE PRES. :	27	psig	PROBE :	NO	
FLOW PRES. :		psig	CYLINDER NO. :	0681	
LAB PRES:		psig	SAMPLED BY :	JOHN MOSER	
SAMPLE TEMP. :	71.6	ºf	SAMPLING COMPANY:	EMPACT	
AMBIENT TEMP.:		ºf	H2S BY STAIN TUBE:	**6.5**	ppm
H2O BY STAIN TUBE:	-	#/mmcf	CO2 BY STAIN TUBE:	-	Mol %

FIELD COMMENTS:

LAB COMMENTS:

COMPONENT	MOLE %	MASS %	GPM @ 14.730	GPM @ 14.650
HELIUM	0.68	0.10	---	---
HYDROGEN	0.04	0.00	---	---
OXYGEN/ARGON	0.45	0.51	---	---
NITROGEN	52.8300	52.8200	---	---
CARBON DIOXIDE	1.96	3.08	---	---
METHANE	27.26850	15.61780	---	---
ETHANE	5.9888	6.4278	1.6049	1.5962
PROPANE	5.2850	8.3185	1.4583	1.4504
I-BUTANE	0.7827	1.6238	0.2561	0.2547
N-BUTANE	2.4722	5.1290	0.7804	0.7761
I-PENTANE	0.7853	2.0212	0.2872	0.2857
N-PENTANE	0.6559	1.6892	0.2370	0.2357
HEXANES PLUS	0.8016	2.6627	0.3281	0.3268
TOTALS	100.00000	100.00000	4.9520	4.9256

BTEX COMPONENTS	MOLE%	WT%
BENZENE	0.0014	0.0039
TOLUENE	0.0013	0.0043
ETHYLBENZENE	0.0006	0.0023
XYLENES	0.0015	0.0056
TOTAL BTEX	0.0048	0.0161

	BTU @	14.730	14.650
LOW	NET DRY REAL :	658.2 /scf	654.7 /scf
	NET WET REAL :	646.8 /scf	643.2 /scf
HIGH	GROSS DRY REAL :	721.2 /scf	717.3 /scf
	GROSS WET REAL :	708.7 /scf	704.8 /scf
	NET DRY REAL :	8934.7 /lb	8886.2 /lb
	GROSS DRY REAL :	9786.1 /lb	9733.0 /lb
	RELATIVE DENSITY (AIR=1):		0.9664
	DENSITY		0.07383 lb/scf
	COMPRESSIBILITY FACTOR :		0.99798
	REGULAR WOBBE INDEX		732.0

**(DETAILED HYDROCARBON ANALYSIS/NJ 1993) ; ASTM D6730, GPA 2261 & GPA 2286.*

(CALC: GPA 2172, GPA STD 2145 & TP-17 @14.696 & 60 F)

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.

EXTENDED NATURAL GAS ANALYSIS (*DHA)

GLYCALC INFORMATION

PROJECT NO. :	201712120	ANALYSIS NO. :	04
COMPANY NAME :	NIGHTHAWK PRODUCTION COMPANY	ANALYSIS DATE:	DECEMBER 22, 2017 11:25
ACCOUNT NO. :		SAMPLE DATE :	DECEMBER 20, 2017 10:50
PRODUCER :		CYLINDER NO. :	0681
LEASE NO. :		SAMPLED BY :	JOHN MOSER
NAME/DESCRIP :	BLACK COMB 3-14 GAS AT SEPARATOR		
FIELD DATA		SAMPLE TEMP. :	71.6
SAMPLE PRES. :	27	AMBIENT TEMP.:	
COMMENTS :	SPOT NO PROBE		

Componet	Mole %	Wt %
Helium	0.68	0.10
Hydrogen	0.04	0.00
Carbon Dioxide	1.96	3.08
Nitrogen	52.83	52.82
Methane	27.26850	15.61780
Ethane	5.9888	6.4278
Propane	5.2850	8.3185
Isobutane	0.7827	1.6238
n-Butane	2.4722	5.1290
Isopentane	0.7696	1.9819
n-Pentane	0.6559	1.6892
Cyclopentane	0.0157	0.0393
n-Hexane	0.2145	0.6598
Cyclohexane	0.0448	0.1346
Other Hexanes	0.2475	0.7574
Heptanes	0.1529	0.5439
Methycyclohexane	0.0419	0.1468
2,2,4 Trimethylpentane	0.0002	0.0008
Benzene	0.0014	0.0039
Toluene	0.0013	0.0043
Ethylbenzene	0.0006	0.0023
Xylenes	0.0015	0.0056
C8+ Heavies	0.0950	0.4033
Subtotal	99.55000	99.49000
Oxygen/Argon	0.45	0.51
Total	100.00000	100.00000

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EXTENDED NATURAL GAS ANALYSIS (*DHA)

DHA COMPONENT LIST

PRIMARY DB KEY:		NAME/DESCRIP :	**BLACK COMB 3-14**
LEASE #:			**GAS AT SEPARATOR**
PROJECT NO. :	**201712120**	ANALYSIS NO. :	**04**
COMPANY NAME :	**NIGHTHAWK PRODUCTION COMPANY**	ANALYSIS DATE:	DECEMBER 22, 2017 11:21
OFFICE / BRANCH:	HIGHLANDS RANCH, CO	SAMPLE DATE :	DECEMBER 20, 2017 10:50
CUSTOMER REF:		TO:	
PRODUCER :		EFFECTIVE DATE	
*****FIELD DATA*****			
SAMPLE CYCLE:		SAMPLE TYPE:	SPOT
SAMPLE PRES. :	27 psig	PROBE :	NO
FLOW PRES. :	psig	CYLINDER NO. :	0681
LAB PRES:	psig	SAMPLED BY :	JOHN MOSER
SAMPLE TEMP. :	71.6 ºf	SAMPLING COMPANY:	EMPACT
AMBIENT TEMP.:	ºf	H2S BY STAIN TUBE:	**6.5** ppm
H2O BY STAIN TUBE:	- #/mmcf	CO2 BY STAIN TUBE:	- Mol %
FIELD COMMENTS:			
LAB COMMENTS:			

COMPONENT	PIANO #	MOLE %	MASS %	GPM @ **14.730**	GPM @ **14.650**
Helium	---	0.68	0.10	---	---
Hydrogen	---	0.04	0.00	---	---
Oxygen/Argon	---	0.45	0.51	---	---
Nitrogen	---	52.83	52.82	---	---
Carbon Dioxide	---	1.96	3.08	---	---
Methane	P1	27.26850	15.61780	---	---
Ethane	P2	5.9888	6.4278	1.605	1.596
Propane	P3	5.2850	8.3185	1.458	1.450
i-Butane	I4	0.7827	1.6238	0.256	0.255
n-Butane	P4	2.4721	5.1288	0.780	0.776
2,2-Dimethylpropane	I5	0.0049	0.0126	0.002	0.002
i-Pentane	I5	0.7647	1.9693	0.280	0.279
UnknownC4s	U4	0.0001	0.0002	0.000	0.000
n-Pentane	P5	0.6538	1.6838	0.237	0.236
2,2-Dimethylbutane	I6	0.0030	0.0092	0.001	0.001
Cyclopentane	N5	0.0157	0.0393	0.005	0.005
2,3-Dimethylbutane	I6	0.0122	0.0375	0.005	0.005
2-Methylpentane	I6	0.1099	0.3381	0.045	0.045
3-Methylpentane	I6	0.0670	0.2061	0.027	0.027
UnknownC5s	U5	0.0021	0.0054	0.001	0.001
n-Hexane	P6	0.2145	0.6598	0.088	0.088
2,2-Dimethylpentane	I7	0.0013	0.0046	0.001	0.001
Methylcyclopentane	N6	0.0542	0.1628	0.019	0.019
2,4-Dimethylpentane	I7	0.0038	0.0136	0.002	0.002
2,2,3-Trimethylbutane	I7	0.0002	0.0007	0.000	0.000
Benzene	A6	0.0014	0.0039	0.000	0.000

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3,3-Dimethylpentane	I7	0.0005	0.0018	0.000	0.000
Cyclohexane	N6	0.0448	0.1346	0.015	0.015
2-Methylhexane	I7	0.0204	0.0730	0.009	0.009
2,3-Dimethylpentane	I7	0.0057	0.0204	0.003	0.003
1,1-Dimethylcyclopentane	N7	0.0044	0.0154	0.002	0.002
3-Methylhexane	I7	0.0242	0.0866	0.011	0.011
1c,3-Dimethylcyclopentane	N7	0.0085	0.0298	0.004	0.004
1t,3-Dimethylcyclopentane	N7	0.0098	0.0343	0.005	0.005
3-Ethylpentane	I7	0.0018	0.0064	0.001	0.001
1t,2-Dimethylcyclopentane	N7	0.0141	0.0494	0.006	0.006
2,2,4-Trimethylpentane	I8	0.0002	0.0008	0.000	0.000
UnknownC6s	U6	0.0012	0.0037	0.000	0.000
n-Heptane	P7	0.0539	0.1928	0.025	0.025
1c,2-Dimethylcyclopentane	N7	0.0017	0.0060	0.001	0.001
Methylcyclohexane	N7	0.0419	0.1468	0.017	0.017
2,2-Dimethylhexane	I8	0.0047	0.0192	0.002	0.002
Ethylcyclopentane	N7	0.0022	0.0077	0.001	0.001
2,5-Dimethylhexane	I8	0.0011	0.0045	0.001	0.001
2,4-Dimethylhexane	I8	0.0016	0.0065	0.001	0.001
1c,2t,4-Trimethylcyclopentane	N8	0.0031	0.0124	0.001	0.001
3,3-Dimethylhexane	I8	0.0003	0.0012	0.000	0.000
1t,2c,4-Trimethylcyclopentane	N8	0.0043	0.0172	0.002	0.002
2,3,4-Trimethylpentane	I8	0.0001	0.0004	0.000	0.000
Toluene	A7	0.0013	0.0043	0.000	0.000
2,3-Dimethylhexane	I8	0.0007	0.0029	0.000	0.000
2-Methyl-3-ethylpentane	I8	0.0008	0.0033	0.000	0.000
1,1,2-Trimethylcyclopentane	N8	0.0005	0.0020	0.000	0.000
2-Methylheptane	I8	0.0091	0.0371	0.005	0.005
4-Methylheptane	I8	0.0025	0.0102	0.001	0.001
3-Methyl-3-ethylpentane	I8	0.0002	0.0008	0.000	0.000
3,4-Dimethylhexane	I8	0.0004	0.0016	0.000	0.000
1c,2c,4-Trimethylcyclopentane	N8	0.0003	0.0012	0.000	0.000
1c,3-Dimethylcyclohexane	N8	0.0001	0.0004	0.000	0.000
3-Methylheptane	I8	0.0045	0.0184	0.002	0.002
1c,2t,3-Trimethylcyclopentane	N8	0.0053	0.0212	0.003	0.003
3-Ethylhexane	I8	0.0009	0.0037	0.000	0.000
1t,4-Dimethylcyclohexane	N8	0.0020	0.0080	0.001	0.001
1,1-Dimethylcyclohexane	N8	0.0006	0.0024	0.000	0.000
3t-Ethylmethylcyclopentane	N8	0.0006	0.0024	0.000	0.000
2t-Ethylmethylcyclopentane	N8	0.0005	0.0020	0.000	0.000
1,1-Methylethylcyclopentane	N8	0.0013	0.0052	0.001	0.001
2,2,4-Trimethylhexane	I9	0.0001	0.0005	0.000	0.000
1t,2-Dimethylcyclohexane	N8	0.0022	0.0088	0.001	0.001
UnknownC7s	U7	0.0004	0.0014	0.000	0.000
n-Octane	P8	0.0138	0.0563	0.007	0.007
1c,4-Dimethylcyclohexane	N8	0.0012	0.0048	0.001	0.001
i-Propylcyclopentane	I8	0.0002	0.0008	0.000	0.000
2,4,4-Trimethylhexane	I9	0.0001	0.0005	0.000	0.000
2,3,5-Trimethylhexane	I9	0.0002	0.0009	0.000	0.000
2,2,3,4-Tetramethylpentane	I9	0.0002	0.0009	0.000	0.000
2,3,4-Trimethylhexane	I9	0.0001	0.0005	0.000	0.000
1c,2-Dimethylcyclohexane	N8	0.0008	0.0032	0.000	0.000
2,2-Dimethylheptane	I9	0.0001	0.0005	0.000	0.000
1,1,4-Trimethylcyclohexane	N9	0.0025	0.0113	0.001	0.001
2,2,3-Trimethylhexane	I9	0.0016	0.0073	0.001	0.001
2,4-Dimethylheptane	I9	0.0002	0.0009	0.000	0.000
4,4-Dimethylheptane	I9	0.0001	0.0005	0.000	0.000
Ethylcyclohexane	N8	0.0013	0.0052	0.001	0.001
n-Propylcyclopentane	N8	0.0010	0.0040	0.000	0.000

1c,3c,5-Trimethylcyclohexane	N9	0.0002	0.0009	0.000	0.000
2,5-Dimethylheptane	I9	0.0002	0.0009	0.000	0.000
3,3-Dimethylheptane	I9	0.0002	0.0009	0.000	0.000
3,5-Dimethylheptane	I9	0.0001	0.0005	0.000	0.000
1,1,3-Trimethylcyclohexane	N9	0.0002	0.0009	0.000	0.000
Ethylbenzene	I8	0.0006	0.0023	0.000	0.000
1c,2t,4t-Trimethylcyclohexane	N9	0.0006	0.0027	0.000	0.000
2,3-Dimethylheptane	I9	0.0003	0.0014	0.000	0.000
1,3-Dimethylbenzene (m-Xylene)	A8	0.0008	0.0030	0.000	0.000
1,4-Dimethylbenzene (p-Xylene)	A8	0.0003	0.0011	0.000	0.000
3,4-Dimethylheptane	I9	0.0001	0.0005	0.000	0.000
3,4-Dimethylheptane (2)	I9	0.0003	0.0014	0.000	0.000
4-Ethylheptane	I9	0.0002	0.0009	0.000	0.000
4-Methyloctane	I9	0.0008	0.0037	0.000	0.000
2-Methyloctane	I9	0.0010	0.0046	0.001	0.001
1c,2t,3-Trimethylcyclohexane	N9	0.0001	0.0005	0.000	0.000
3-Ethylheptane	I9	0.0004	0.0018	0.000	0.000
3-Methyloctane	I9	0.0015	0.0069	0.001	0.001
1c,2t,4c-Trimethylcyclohexane	I9	0.0001	0.0005	0.000	0.000
1,1,2-Trimethylcyclohexane	N9	0.0001	0.0005	0.000	0.000
3,3-Diethylpentane	I9	0.0001	0.0005	0.000	0.000
1,2-Dimethylbenzene (o-Xylene)	A8	0.0004	0.0015	0.000	0.000
i-Butylcyclopentane	N9	0.0006	0.0027	0.000	0.000
UnknownC8s	U8	0.0006	0.0025	0.000	0.000
n-Nonane	P9	0.0040	0.0183	0.002	0.002
1,1-Methylethylcyclohexane	N9	0.0004	0.0018	0.000	0.000
i-Propylbenzene	A9	0.0003	0.0013	0.000	0.000
i-Propylcyclohexane	N9	0.0001	0.0005	0.000	0.000
2,2-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
2,4-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
2,6-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
n-Butylcyclopentane	N9	0.0005	0.0023	0.000	0.000
3,3-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
n-Propylbenzene	A9	0.0007	0.0030	0.000	0.000
3,6-Dimethyloctane	I10	0.0002	0.0010	0.000	0.000
3-Methyl-5-ethylheptane	I10	0.0002	0.0010	0.000	0.000
1,3-Methylethylbenzene	A9	0.0002	0.0009	0.000	0.000
1,4-Methylethylbenzene	A9	0.0001	0.0004	0.000	0.000
2,3-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
5-Methylnonane	I10	0.0004	0.0020	0.000	0.000
2-Methylnonane	I10	0.0003	0.0015	0.000	0.000
3-Methylnonane	I10	0.0002	0.0010	0.000	0.000
t-Butylbenzene	A10	0.0003	0.0014	0.000	0.000
i-Butylcyclohexane	N10	0.0001	0.0005	0.000	0.000
UnknownC9s	U9	0.0024	0.0110	0.001	0.001
n-Decane	P10	0.0010	0.0051	0.001	0.001
1,2,3-Trimethylbenzene	A9	0.0001	0.0004	0.000	0.000
1,3-Methyl-i-propylbenzene	A10	0.0002	0.0010	0.000	0.000
1,2-Methyl-i-propylbenzene	A10	0.0003	0.0014	0.000	0.000
1,3-Diethylbenzene	A10	0.0001	0.0005	0.000	0.000
1,3-Methyl-n-propylbenzene	A10	0.0001	0.0005	0.000	0.000
1,4-Methyl-n-propylbenzene	A10	0.0001	0.0005	0.000	0.000
1,3-Dimethyl-5-ethylbenzene	A10	0.0001	0.0005	0.000	0.000
1,2-Diethylbenzene	A10	0.0001	0.0005	0.000	0.000
1,2-Methyl-n-propylbenzene	A10	0.0001	0.0005	0.000	0.000
1,2-Dimethyl-4-ethylbenzene	A10	0.0001	0.0005	0.000	0.000
UnknownC10s	U10	0.0021	0.0107	0.001	0.001
n-Undecane	P11	0.0003	0.0017	0.000	0.000
1,2-Methyl-t-butylbenzene	A11	0.0001	0.0005	0.000	0.000

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UnknownC11s	U11	0.0002	0.0011	0.000	0.000
n-Dodecane	P12	0.0001	0.0006	0.000	0.000
n-Tridecane	P13	0.0001	0.0006	0.000	0.000
TOTAL		100.00000	100.00000	4.9530	4.9266

BTEX COMPONENTS	MOLE%	WT%
BENZENE	0.0014	0.0039
TOLUENE	0.0013	0.0043
ETHYLBENZENE	0.0006	0.0023
XYLENES	0.0015	0.0056
TOTAL BTEX	0.0048	0.0161

**(DETAILED HYDROCARBON ANALYSIS/NJ 1993) ; ASTM D6730, GPA 2261 & GPA 2286.*

(CALC: GPA 2172, GPA STD 2145 & TP-17 @14.696 & 60 F)

	BTU @	14.730	14.650
LOW	NET DRY REAL :	658.2 /scf	654.7 /scf
	NET WET REAL :	646.8 /scf	643.2 /scf
HIGH	GROSS DRY REAL :	721.2 /scf	717.3 /scf
	GROSS WET REAL :	708.7 /scf	704.8 /scf
	NET DRY REAL :	8934.7 /lb	8886.2 /lb
	GROSS DRY REAL :	9786.1 /lb	9733.0 /lb
	RELATIVE DENSITY (AIR=1):		0.9664
	DENSITY		0.07383 lb/scf
	COMPRESSIBILITY FACTOR :		0.99798
	REGULAR WOBBE INDEX		732.0

C6+ Fraction of DHA Gas Analysis @60°F, 14.696 psia

Net Dry Ideal BTU	4705.5 /scf	Relative Density - SG (Air=1)	3.2101		***C6+factors***
Gross Dry Ideal BTU	5072.8 /scf	**Z** Compressiblity Factor	0.99109		0.99031
Net Dry Ideal BTU	19430.3 /lb	Density Factor	245.043	lbm/1000 ft3	
Gross Dry Ideal BTU	20944.4 /lb	Molar Mass or MW	92.994	g/mol	
		Volume Liquid Ideal gas	0.328	scf/gal	22.9

This hexanes plus fraction may be applied in place of published C6+ factors. The Z & GPM need additional calc for C6+ factors.

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