

**EXTENDED NATURAL GAS ANALYSIS (\*DHA)**

**MAIN PAGE**

LEASE #: NAME/DESCRIP : **ARIKAREE CREEK, BLACK COMB 3-14 SPERGEN FORMATION**

PROJECT NO. : **201611156** ANALYSIS NO. : **01**  
 COMPANY NAME : **NIGHTHAWK PRODUCTION COMPANY** ANALYSIS DATE: **DECEMBER 01, 2016 12:08**  
 OFFICE / BRANCH: **HIGHLANDS RANCH, CO** SAMPLE DATE : **NOVEMBER 29, 2016**  
 CUSTOMER REF: TO:  
 PRODUCER : EFFECTIVE DATE:

**\*\*\*FIELD DATA\*\*\***

SAMPLE CYCLE: SAMPLE TYPE: **SPOT**  
 SAMPLE PRES. : 23.5 psig CYLINDER NO. : **1037**  
 LAB PRES: psig SAMPLED BY : **JOHN MOSER**  
 SAMPLE TEMP. : 56.3 °f SAMPLING COMPANY: **EMPACT**  
 AMBIENT TEMP.: °f H2S BY STAIN TUBE: **8** ppm  
 H2O BY STAIN TUBE: #/mmcf CO2 BY STAIN TUBE: Mol %  
 FIELD COMMENTS: **NO PROBE; H2S SAMPLED 1-1-17 16:45**  
 LAB COMMENTS: **POSSIBLE MOISTURE IN SAMPLE; TRACE OLEFINS**

<u>COMPONENT</u>	<u>MOLE %</u>	<u>MASS %</u>	<u>GPM @ 14.730</u>	<u>GPM @ 14.650</u>
ALCOHOLS	0.0001	0.0002		
HELIUM	0.59	0.08	---	---
HYDROGEN	0.04	0.00	---	---
OXYGEN/ARGON	0.48	0.54	---	---
NITROGEN	51.4100	50.9800	---	---
CARBON DIOXIDE	2.02	3.15	---	---
METHANE	27.95640	15.87070	---	---
ETHANE	5.7718	6.1436	1.5469	1.5385
PROPANE	5.4790	8.5524	1.5128	1.5045
I-BUTANE	0.9266	1.9064	0.3034	0.3017
N-BUTANE	2.9448	6.0588	0.9302	0.9251
I-PENTANE	0.6203	1.5826	0.2260	0.2248
N-PENTANE	0.8769	2.2396	0.3174	0.3157
HEXANES PLUS	0.8841	2.8957	0.3643	0.3628
<b>TOTALS</b>	<b>100.00000</b>	<b>100.00000</b>	<b>5.2010</b>	<b>5.1731</b>

<u>BTEX COMPONENTS</u>	<u>MOLE%</u>	<u>WT%</u>	<u>BTU @</u>	<u>14.730</u>	<u>14.650</u>
BENZENE	0.0016	0.0044	<b>LOW NET DRY REAL :</b>	690.0 /scf	686.2 /scf
TOLUENE	0.0015	0.0049	NET WET REAL :	678.0 /scf	674.2 /scf
ETHYLBENZENE	0.0003	0.0011	<b>HIGH GROSS DRY REAL :</b>	755.5 /scf	751.4 /scf
XYLENES	0.0015	0.0056	GROSS WET REAL :	742.4 /scf	738.2 /scf
<b>TOTAL BTEX</b>	<b>0.0049</b>	<b>0.0160</b>	NET DRY REAL :	9288.0 /lb	9237.5 /lb
			GROSS DRY REAL :	10169.0 /lb	10113.8 /lb

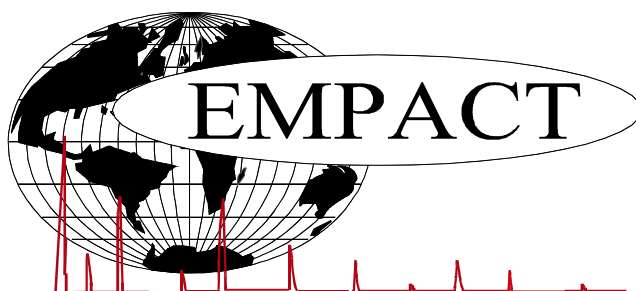
(CALC: GPA STD 2145 & TP-17 @14.696 & 60 F)

\*(DETAILED HYDROCARBON ANALYSIS/NJ 1993) ; ASTM D6730

**RELATIVE DENSITY (AIR=1):** 0.9745

**COMPRESSIBILITY FACTOR :** 0.99784

*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.*



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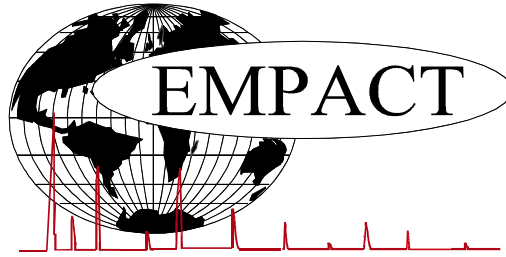
**GLYCALC INFORMATION**

PROJECT NO. :	201611156	ANALYSIS NO. :	01
COMPANY NAME :	NIGHTHAWK PRODUCTION COMPANY	ANALYSIS DATE:	DECEMBER 01, 2016 12:08
ACCOUNT NO. :		SAMPLE DATE :	NOVEMBER 29, 2016
PRODUCER :		CYLINDER NO. :	1037
LEASE NO. :		SAMPLED BY :	JOHN MOSER
NAME/DESCRIP :	ARIKAREE CREEK, BLACK COMB 3-14 SPERGEN FORMATION		

***FIELD DATA***		SAMPLE TEMP. :	56.3
SAMPLE PRES. :	23.5	AMBIENT TEMP.:	
COMMENTS :	NO PROBE; H2S SAMPLED 1-1-17 16:45 POSSIBLE MOISTURE IN SAMPLE; TRACE OLEFINS SPOT		

<u>Componet</u>	<u>Mole %</u>	<u>Wt %</u>
Helium	0.59	0.08
Hydrogen	0.04	0.00
Carbon Dioxide	2.02	3.15
Nitrogen	51.41	50.98
Methane	27.95640	15.87070
Ethane	5.7718	6.1436
Propane	5.4790	8.5524
Isobutane	0.9266	1.9064
n-Butane	2.9448	6.0588
Isopentane	0.5979	1.5270
n-Pentane	0.8769	2.2396
Cyclopentane	0.0224	0.0556
n-Hexane	0.2127	0.6489
Cyclohexane	0.0511	0.1522
Other Hexanes	0.3037	0.9221
Heptanes	0.1696	0.5981
Methycyclohexane	0.0482	0.1675
2,2,4 Trimethylpentane	0.0001	0.0004
Benzene	0.0016	0.0044
Toluene	0.0015	0.0049
Ethylbenzene	0.0003	0.0011
Xylenes	0.0015	0.0056
C8+ Heavies	0.0938	0.3905
<u>Subtotal</u>	<u>99.51990</u>	<u>99.45980</u>
Oxygen/Argon	0.48	0.54
Alcohols	0.0001	0.0002
<b>Total</b>	<b>100.00000</b>	<b>100.00000</b>

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**EXTENDED NATURAL GAS ANALYSIS (\*DHA)**

**DHA COMPONENT LIST**

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 NAME/DESCRIP : ARIKAREE CREEK, BLACK COMB 3-14  
 SPERGEN FORMATION

\*\*\*FIELD DATA\*\*\* SAMPLE TEMP. : 56.3  
 SAMPLE PRES. : 23.5 AMBIENT TEMP.:  
 COMMENTS : NO PROBE; H2S SAMPLED 1-1-17 16:45  
 POSSIBLE MOISTURE IN SAMPLE; TRACE OLEFINS  
 SPOT

<u>COMPONENT</u>	<u>PIANO #</u>	<u>MOLE %</u>	<u>MASS %</u>	<u>GPM @ 14.730</u>	<u>GPM @ 14.650</u>
Helium	---	0.59	0.08	---	---
Hydrogen	---	0.04	0.00	---	---
Oxygen/Argon	---	0.48	0.54	---	---
Nitrogen	---	51.41	50.98	---	---
Carbon Dioxide	---	2.02	3.15	---	---
Methane	P1	27.95640	15.87070	---	---
Ethane	P2	5.7718	6.1436	1.547	1.539
Propane	P3	5.4790	8.5524	1.513	1.505
i-Butane	I4	0.9266	1.9064	0.303	0.302
n-Butane	P4	2.9447	6.0586	0.930	0.925
2,2-Dimethylpropane	I5	0.0053	0.0135	0.002	0.002
i-Pentane	I5	0.5926	1.5135	0.217	0.216
i-Propanol	X3	0.0001	0.0002	0.000	0.000
UnknownC4s	U4	0.0001	0.0002	0.000	0.000
n-Pentane	P5	0.8753	2.2355	0.317	0.316
2,2-Dimethylbutane	I6	0.0040	0.0122	0.002	0.002
Cyclopentane	N5	0.0224	0.0556	0.007	0.007
2,3-Dimethylbutane	I6	0.0162	0.0494	0.007	0.007
2-Methylpentane	I6	0.1479	0.4512	0.061	0.061
3-Methylpentane	I6	0.0729	0.2224	0.030	0.030
UnknownC5s	U5	0.0016	0.0041	0.001	0.001
n-Hexane	P6	0.2127	0.6489	0.087	0.087
2,2-Dimethylpentane	I7	0.0004	0.0014	0.000	0.000
Methylcyclopentane	N6	0.0612	0.1823	0.022	0.022
2,4-Dimethylpentane	I7	0.0040	0.0142	0.002	0.002
2,2,3-Trimethylbutane	I7	0.0002	0.0007	0.000	0.000
Benzene	A6	0.0016	0.0044	0.000	0.000
3,3-Dimethylpentane	I7	0.0004	0.0014	0.000	0.000
Cyclohexane	N6	0.0511	0.1522	0.017	0.017
2-Methylhexane	I7	0.0225	0.0798	0.010	0.010
2,3-Dimethylpentane	I7	0.0063	0.0223	0.003	0.003
1,1-Dimethylcyclopentane	N7	0.0049	0.0170	0.002	0.002
3-Methylhexane	I7	0.0268	0.0951	0.012	0.012
1c,3-Dimethylcyclopentane	N7	0.0097	0.0337	0.004	0.004
1t,3-Dimethylcyclopentane	N7	0.0111	0.0386	0.005	0.005
3-Ethylpentane	I7	0.0018	0.0064	0.001	0.001

1t,2-Dimethylcyclopentane	N7	0.0162	0.0563	0.007	0.007
2,2,4-Trimethylpentane	I8	0.0001	0.0004	0.000	0.000
UnknownC6s	U6	0.0015	0.0046	0.001	0.001
n-Heptane	P7	0.0602	0.2135	0.028	0.028
1c,2-Dimethylcyclopentane	N7	0.0019	0.0066	0.001	0.001
Methylcyclohexane	N7	0.0482	0.1675	0.019	0.019
2,2-Dimethylhexane	I8	0.0052	0.0210	0.002	0.002
Ethylcyclopentane	N7	0.0026	0.0090	0.001	0.001
2,5-Dimethylhexane	I8	0.0010	0.0040	0.001	0.001
2,2,3-Trimethylpentane	I8	0.0002	0.0008	0.000	0.000
2,4-Dimethylhexane	I8	0.0018	0.0073	0.001	0.001
1c,2t,4-Trimethylcyclopentane	N8	0.0035	0.0139	0.002	0.002
3,3-Dimethylhexane	I8	0.0004	0.0016	0.000	0.000
1t,2c,4-Trimethylcyclopentane	N8	0.0048	0.0191	0.002	0.002
2,3,4-Trimethylpentane	I8	0.0002	0.0008	0.000	0.000
Toluene	A7	0.0015	0.0049	0.001	0.001
2,3-Dimethylhexane	I8	0.0018	0.0073	0.001	0.001
2-Methyl-3-ethylpentane	I8	0.0004	0.0016	0.000	0.000
1,1,2-Trimethylcyclopentane	N8	0.0001	0.0004	0.000	0.000
2-Methylheptane	I8	0.0097	0.0392	0.005	0.005
4-Methylheptane	I8	0.0025	0.0101	0.001	0.001
3-Methyl-3-ethylpentane	I8	0.0005	0.0020	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	0.0002	0.0008	0.000	0.000
3-Methylheptane	I8	0.0048	0.0194	0.002	0.002
1c,2t,3-Trimethylcyclopentane	N8	0.0066	0.0262	0.003	0.003
3-Ethylhexane	I8	0.0010	0.0040	0.001	0.001
1t,4-Dimethylcyclohexane	N8	0.0022	0.0087	0.001	0.001
1,1-Dimethylcyclohexane	N8	0.0007	0.0028	0.000	0.000
3c-Ethylmethylcyclopentane	N8	0.0001	0.0004	0.000	0.000
3t-Ethylmethylcyclopentane	N8	0.0007	0.0028	0.000	0.000
2t-Ethylmethylcyclopentane	N8	0.0006	0.0024	0.000	0.000
1,1-Methylethylcyclopentane	N8	0.0015	0.0060	0.001	0.001
2,2,4-Trimethylhexane	I9	0.0002	0.0009	0.000	0.000
1t,2-Dimethylcyclohexane	N8	0.0024	0.0095	0.001	0.001
1t,3-Dimethylcyclohexane	N8	0.0001	0.0004	0.000	0.000
UnknownC7s	U7	0.0006	0.0021	0.000	0.000
n-Octane	P8	0.0139	0.0562	0.007	0.007
1c,4-Dimethylcyclohexane	N8	0.0015	0.0060	0.001	0.001
i-Propylcyclopentane	I8	0.0003	0.0012	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	0.0027	0.0121	0.001	0.001
2,2,3-Trimethylhexane	I9	0.0015	0.0068	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	0.0008	0.0032	0.000	0.000
1c,3c,5-Trimethylcyclohexane	N9	0.0001	0.0005	0.000	0.000
2,5-Dimethylheptane	I9	0.0001	0.0005	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
2,6-Dimethylheptane	I9	0.0002	0.0009	0.000	0.000
1,1,3-Trimethylcyclohexane	N9	0.0006	0.0027	0.000	0.000
Ethylbenzene	I8	0.0003	0.0011	0.000	0.000

1c,2t,4t-Trimethylcyclohexane	N9	0.0006	0.0027	0.000	0.000
2,3-Dimethylheptane	I9	0.0002	0.0009	0.000	0.000
1,3-Dimethylbenzene (m-Xylene)	A8	0.0009	0.0034	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-Methyloctane	I9	0.0007	0.0032	0.000	0.000
2-Methyloctane	I9	0.0008	0.0037	0.000	0.000
3-Ethylheptane	I9	0.0004	0.0018	0.000	0.000
3-Methyloctane	I9	0.0012	0.0055	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	0.0003	0.0011	0.000	0.000
i-Butylcyclopentane	N9	0.0005	0.0022	0.000	0.000
UnknownC8s	U8	0.0001	0.0004	0.000	0.000
n-Nonane	P9	0.0029	0.0132	0.002	0.002
1,1-Methylethylcyclohexane	N9	0.0003	0.0014	0.000	0.000
i-Propylbenzene	A9	0.0002	0.0009	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
2,5-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
n-Butylcyclopentane	N9	0.0004	0.0018	0.000	0.000
3,3-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
n-Propylbenzene	A9	0.0001	0.0004	0.000	0.000
3,6-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
2,3-Dimethyloctane	I10	0.0001	0.0005	0.000	0.000
5-Methylnonane	I10	0.0001	0.0005	0.000	0.000
3-Ethylcane	I10	0.0001	0.0005	0.000	0.000
3-Methylnonane	I10	0.0001	0.0005	0.000	0.000
t-Butylbenzene	A10	0.0002	0.0010	0.000	0.000
i-Butylcyclohexane	N10	0.0001	0.0005	0.000	0.000
UnknownC9s	U9	0.0015	0.0068	0.001	0.001
n-Decane	P10	0.0005	0.0025	0.000	0.000
1,3-Methyl-i-propylbenzene	A10	0.0001	0.0005	0.000	0.000
1,4-Methyl-i-propylbenzene	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-Diethylbenzene	A10	0.0001	0.0005	0.000	0.000
UnknownC10s	U10	0.0017	0.0086	0.001	0.001
n-Undecane	P11	0.0001	0.0006	0.000	0.000
UnknownC11s	U11	0.0001	0.0006	0.000	0.000
n-Dodecane	P12	0.0001	0.0006	0.000	0.000
<b>TOTAL</b>		<b>100.00000</b>	<b>100.00000</b>	<b>5.2020</b>	<b>5.1741</b>

<b>BTEX COMPONENTS</b>	<b>MOLE%</b>	<b>WT%</b>	<b>BTU @</b>	<b>14.730</b>	<b>14.650</b>
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XYLENES	0.0015	0.0056	GROSS WET REAL :	742.4 /scf	738.2 /scf
<b>TOTAL BTEX</b>	<b>0.0049</b>	<b>0.0160</b>	NET DRY REAL :	9288.0 /lb	9237.5 /lb
			GROSS DRY REAL :	10169.0 /lb	10113.8 /lb

RELATIVE DENSITY (AIR=1): 0.9745  
 COMPRESSIBILITY FACTOR : 0.99784

(CALC: GPA STD 2145 & TP-17 @ 14.696 & 60 F)  
 \*(DETAILED HYDROCARBON ANALYSIS/NJ 1993) ; ASTM D6730

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