## EXTENDED NATURAL GAS ANALYSIS (*DHA)

## MAIN PAGE

| | | | |
|---|---|---|---|
| LEASE #: | | NAME/DESCRIP : | **JONES 18-14-10-59 SEPARATOR GAS** |
| PROJECT NO. : | **201703033** | ANALYSIS NO. : | **01** |
| COMPANY NAME : | **CARRIZO OIL & GAS, INC** | ANALYSIS DATE: | MARCH 09, 2017 10:05 |
| OFFICE / BRANCH: | HOUSTON, TX | SAMPLE DATE : | MARCH 6, 2017 15:50 |
| CUSTOMER REF: | | TO: | |
| PRODUCER : | | EFFECTIVE DATE: | |
| ***FIELD DATA*** | | | |
| SAMPLE CYCLE: | | SAMPLE TYPE: | SPOT |
| SAMPLE PRES. : | 23.5 psig | CYLINDER NO. : | 1590 |
| LAB PRES: | psig | SAMPLED BY : | JOHN MOSER |
| SAMPLE TEMP. : | 58.4 ºf | SAMPLING COMPANY: | EMPACT |
| AMBIENT TEMP.: | ºf | H2S BY STAIN TUBE: | **35.0** ppm |
| H2O BY STAIN TUBE: | - #/mmcf | CO2 BY STAIN TUBE: | - Mol % |
| FIELD COMMENTS: | NO PROBE | | |
| LAB COMMENTS: | | | |

| COMPONENT | MOLE % | MASS % | GPM @ 14.730 | GPM @ 14.650 |
|---|---|---|---|---|
| HELIUM | 0.02 | 0.00 | --- | --- |
| HYDROGEN | 0.00 | 0.00 | --- | --- |
| OXYGEN/ARGON | 0.01 | 0.01 | --- | --- |
| NITROGEN | 0.9900 | 1.0600 | --- | --- |
| CARBON DIOXIDE | 3.36 | 5.65 | --- | --- |
| METHANE | 65.00590 | 39.87080 | --- | --- |
| ETHANE | 10.5875 | 12.1715 | 2.8454 | 2.8299 |
| PROPANE | 10.7316 | 18.0922 | 2.9713 | 2.9552 |
| I-BUTANE | 1.1741 | 2.6090 | 0.3859 | 0.3838 |
| N-BUTANE | 4.5790 | 10.1752 | 1.4509 | 1.4430 |
| I-PENTANE | 1.1154 | 3.0670 | 0.4010 | 0.3989 |
| N-PENTANE | 1.4696 | 4.0537 | 0.5350 | 0.5321 |
| HEXANES PLUS | 0.9569 | 3.2406 | 0.3785 | 0.3766 |
| TOTALS | 100.00000 | 100.00000 | 8.9680 | 8.9195 |

| BTEX COMPONENTS | MOLE% | WT% |
|---|---|---|
| BENZENE | 0.0381 | 0.1138 |
| TOLUENE | 0.0082 | 0.0289 |
| ETHYLBENZENE | 0.0000 | 0.0000 |
| XYLENES | 0.0017 | 0.0068 |
| TOTAL BTEX | 0.0480 | 0.1495 |

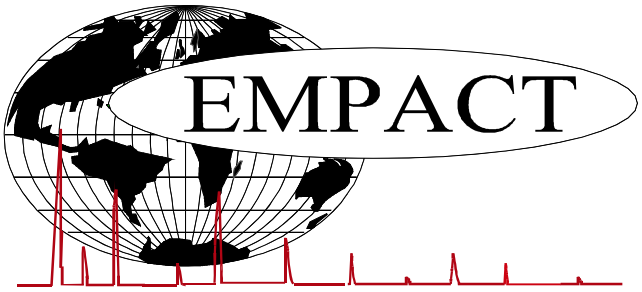
| | BTU @ | 14.730 | 14.650 |
|---|---|---|---|
| LOW | NET DRY REAL : | 1331.7 /scf | 1324.5 /scf |
| | NET WET REAL : | 1308.5 /scf | 1301.3 /scf |
| HIGH | GROSS DRY REAL : | 1460.5 /scf | 1452.6 /scf |
| | GROSS WET REAL : | 1435.1 /scf | 1427.2 /scf |
| | NET DRY REAL : | 19337.2 /lb | 19232.2 /lb |
| | GROSS DRY REAL : | 21214.6 /lb | 21099.3 /lb |

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

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

**RELATIVE DENSITY (AIR=1):** 0.9024

**COMPRESSIBILITY FACTOR :** 0.99478

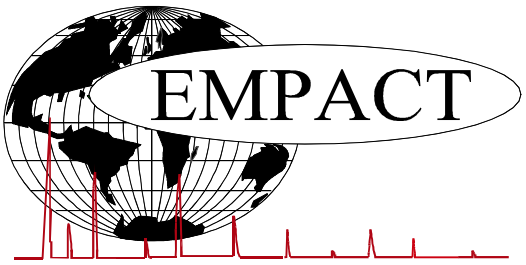



**EXTENDED NATURAL GAS ANALYSIS (*DHA)**

**GLYCALC INFORMATION**

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201703033 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | CARRIZO OIL & GAS, INC | ANALYSIS DATE: | MARCH 09, 2017 10:05 |
| ACCOUNT NO. : | | SAMPLE DATE : | MARCH 6, 2017 15:50 |
| PRODUCER : | | CYLINDER NO. : | 1590 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | JONES 18-14-10-59<br>SEPARATOR GAS | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 58.4 |
| SAMPLE PRES. : | 23.5 | AMBIENT TEMP.: | |
| COMMENTS : | NO PROBE<br>SPOT | | |

| Componet | Mole % | Wt % |
|---|---|---|
| Helium | 0.02 | 0.00 |
| Hydrogen | 0.00 | 0.00 |
| Carbon Dioxide | 3.36 | 5.65 |
| Nitrogen | 0.99 | 1.06 |
| Methane | 65.00590 | 39.87080 |
| Ethane | 10.5875 | 12.1715 |
| Propane | 10.7316 | 18.0922 |
| Isobutane | 1.1741 | 2.6090 |
| n-Butane | 4.5790 | 10.1752 |
| Isopentane | 0.9883 | 2.7262 |
| n-Pentane | 1.4696 | 4.0537 |
| Cyclopentane | 0.1271 | 0.3408 |
| n-Hexane | 0.2512 | 0.8276 |
| Cyclohexane | 0.0492 | 0.1583 |
| Other Hexanes | 0.4499 | 1.4719 |
| Heptanes | 0.1111 | 0.4225 |
| Methycyclohexane | 0.0098 | 0.0368 |
| 2,2,4 Trimethylpentane | 0.0028 | 0.0122 |
| Benzene | 0.0381 | 0.1138 |
| Toluene | 0.0082 | 0.0289 |
| Ethylbenzene | 0.0000 | 0.0000 |
| Xylenes | 0.0017 | 0.0068 |
| C8+ Heavies | 0.0349 | 0.1618 |
| ***Subtotal*** | 99.99000 | 99.99000 |
| Oxygen/Argon | 0.01 | 0.01 |
| **Total** | 100.00000 | 100.00000 |




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

**DHA COMPONENT LIST**

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201703033 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | CARRIZO OIL & GAS, INC | ANALYSIS DATE: | MARCH 09, 2017 10:05 |
| ACCOUNT NO. : | | SAMPLE DATE : | MARCH 6, 2017 15:50 |
| PRODUCER : | | CYLINDER NO. : | 1590 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | JONES 18-14-10-59<br>SEPARATOR GAS | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 58.4 |
| SAMPLE PRES. : | 23.5 | AMBIENT TEMP.: | |
| COMMENTS : | NO PROBE<br>SPOT | | |

| COMPONENT | PIANO # | MOLE % | MASS % | GPM @ 14.730 | GPM @ 14.650 |
|---|---|---|---|---|---|
| Helium | --- | 0.02 | 0.00 | --- | --- |
| Oxygen/Argon | --- | 0.01 | 0.01 | --- | --- |
| Nitrogen | --- | 0.99 | 1.06 | --- | --- |
| Carbon Dioxide | --- | 3.36 | 5.65 | --- | --- |
| Methane | P1 | 65.00590 | 39.87080 | --- | --- |
| Ethane | P2 | 10.5875 | 12.1715 | 2.845 | 2.830 |
| Propane | P3 | 10.7316 | 18.0922 | 2.971 | 2.955 |
| i-Butane | I4 | 1.1741 | 2.6090 | 0.386 | 0.384 |
| n-Butane | P4 | 4.5790 | 10.1752 | 1.451 | 1.443 |
| 2,2-Dimethylpropane | I5 | 0.0031 | 0.0086 | 0.001 | 0.001 |
| i-Pentane | I5 | 0.9852 | 2.7176 | 0.362 | 0.360 |
| n-Pentane | P5 | 1.4693 | 4.0529 | 0.535 | 0.532 |
| 2,2-Dimethylbutane | I6 | 0.0020 | 0.0066 | 0.001 | 0.001 |
| Cyclopentane | N5 | 0.1271 | 0.3408 | 0.038 | 0.038 |
| 2,3-Dimethylbutane | I6 | 0.0150 | 0.0494 | 0.006 | 0.006 |
| 2-Methylpentane | I6 | 0.1999 | 0.6586 | 0.084 | 0.083 |
| 3-Methylpentane | I6 | 0.0992 | 0.3268 | 0.040 | 0.040 |
| UnknownC5s | U5 | 0.0003 | 0.0008 | 0.000 | 0.000 |
| n-Hexane | P6 | 0.2512 | 0.8276 | 0.104 | 0.103 |
| 2,2-Dimethylpentane | I7 | 0.0002 | 0.0008 | 0.000 | 0.000 |
| Methylcyclopentane | N6 | 0.1334 | 0.4292 | 0.047 | 0.047 |
| 2,4-Dimethylpentane | I7 | 0.0035 | 0.0134 | 0.002 | 0.002 |
| 2,2,3-Trimethylbutane | I7 | 0.0009 | 0.0034 | 0.000 | 0.000 |
| Benzene | A6 | 0.0381 | 0.1138 | 0.011 | 0.011 |
| 3,3-Dimethylpentane | I7 | 0.0002 | 0.0008 | 0.000 | 0.000 |
| Cyclohexane | N6 | 0.0492 | 0.1583 | 0.017 | 0.017 |
| 2-Methylhexane | I7 | 0.0110 | 0.0421 | 0.005 | 0.005 |
| 2,3-Dimethylpentane | I7 | 0.0128 | 0.0491 | 0.006 | 0.006 |
| 1,1-Dimethylcyclopentane | N7 | 0.0043 | 0.0161 | 0.002 | 0.002 |
| 3-Methylhexane | I7 | 0.0195 | 0.0747 | 0.009 | 0.009 |
| 1c,3-Dimethylcyclopentane | N7 | 0.0041 | 0.0154 | 0.002 | 0.002 |
| 1t,3-Dimethylcyclopentane | N7 | 0.0072 | 0.0270 | 0.003 | 0.003 |
| 3-Ethylpentane | I7 | 0.0015 | 0.0057 | 0.001 | 0.001 |
| 1t,2-Dimethylcyclopentane | N7 | 0.0208 | 0.0781 | 0.010 | 0.010 |
| 2,2,4-Trimethylpentane | I8 | 0.0028 | 0.0122 | 0.001 | 0.001 |



EMPACT Analytical Systems, Inc 365 S. Main Street, Brighton, CO 80601 303-637-0150

| | | | | | |
|---|---|---|---|---|---|
| UnknownC6s | U6 | 0.0004 | 0.0013 | 0.000 | 0.000 |
| n-Heptane | P7 | 0.0116 | 0.0444 | 0.005 | 0.005 |
| 1c,2-Dimethylcyclopentane | N7 | 0.0004 | 0.0015 | 0.000 | 0.000 |
| Methylcyclohexane | N7 | 0.0098 | 0.0368 | 0.004 | 0.004 |
| 2,2-Dimethylhexane | I8 | 0.0004 | 0.0018 | 0.000 | 0.000 |
| 1,1,3-Trimethylcyclopentane | N7 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| Ethylcyclopentane | N7 | 0.0025 | 0.0094 | 0.001 | 0.001 |
| 2,5-Dimethylhexane | I8 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| 2,2,3-Trimethylpentane | I8 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| 2,4-Dimethylhexane | I8 | 0.0004 | 0.0018 | 0.000 | 0.000 |
| 1c,2t,4-Trimethylcyclopentane | N8 | 0.0008 | 0.0034 | 0.000 | 0.000 |
| 3,3-Dimethylhexane | I8 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| 1t,2c,4-Trimethylcyclopentane | N8 | 0.0009 | 0.0039 | 0.000 | 0.000 |
| 2,3,4-Trimethylpentane | I8 | 0.0004 | 0.0018 | 0.000 | 0.000 |
| 2,3,3-Trimethylpentane | I8 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| Toluene | A7 | 0.0082 | 0.0289 | 0.003 | 0.003 |
| 2,3-Dimethylhexane | I8 | 0.0004 | 0.0018 | 0.000 | 0.000 |
| 2-Methyl-3-ethylpentane | I8 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| 1,1,2-Trimethylcyclopentane | N8 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| 2-Methylheptane | I8 | 0.0024 | 0.0105 | 0.001 | 0.001 |
| 4-Methylheptane | I8 | 0.0009 | 0.0039 | 0.000 | 0.000 |
| 3-Methyl-3-ethylpentane | I8 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| 3,4-Dimethylhexane | I8 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| 1c,2c,4-Trimethylcyclopentane | N8 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| 3-Methylheptane | I8 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| 1c,2t,3-Trimethylcyclopentane | N8 | 0.0024 | 0.0103 | 0.001 | 0.001 |
| 3-Ethylhexane | I8 | 0.0005 | 0.0022 | 0.000 | 0.000 |
| 1t,4-Dimethylcyclohexane | N8 | 0.0006 | 0.0026 | 0.000 | 0.000 |
| 1,1-Dimethylcyclohexane | N8 | 0.0002 | 0.0008 | 0.000 | 0.000 |
| 3t-Ethylmethylcyclopentane | N8 | 0.0006 | 0.0026 | 0.000 | 0.000 |
| 2t-Ethylmethylcyclopentane | N8 | 0.0005 | 0.0021 | 0.000 | 0.000 |
| 1,1-Methylethylcyclopentane | N8 | 0.0013 | 0.0056 | 0.001 | 0.001 |
| 1t,2-Dimethylcyclohexane | N8 | 0.0007 | 0.0030 | 0.000 | 0.000 |
| 1c,2c,3-Trimethylcyclopentane | N8 | 0.0002 | 0.0008 | 0.000 | 0.000 |
| UnknownC7s | U7 | 0.0105 | 0.0402 | 0.005 | 0.005 |
| n-Octane | P8 | 0.0043 | 0.0188 | 0.002 | 0.002 |
| 1c,4-Dimethylcyclohexane | N8 | 0.0006 | 0.0026 | 0.000 | 0.000 |
| 2,4,4-Trimethylhexane | I9 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 2,3,5-Trimethylhexane | I9 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1c,2-Dimethylcyclohexane | N8 | 0.0002 | 0.0008 | 0.000 | 0.000 |
| 1,1,4-Trimethylcyclohexane | N9 | 0.0016 | 0.0077 | 0.001 | 0.001 |
| 2,2,3-Trimethylhexane | I9 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| 2,4-Dimethylheptane | I9 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 4,4-Dimethylheptane | I9 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| Ethylcyclohexane | N8 | 0.0005 | 0.0021 | 0.000 | 0.000 |
| n-Propylcyclopentane | N8 | 0.0002 | 0.0008 | 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 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 2,6-Dimethylheptane | I9 | 0.0009 | 0.0044 | 0.000 | 0.000 |
| 1,1,3-Trimethylcyclohexane | N9 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| 2,3-Dimethylheptane | I9 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 1,3-Dimethylbenzene (m-Xylene) | A8 | 0.0007 | 0.0028 | 0.000 | 0.000 |
| 1,4-Dimethylbenzene (p-Xylene) | A8 | 0.0003 | 0.0012 | 0.000 | 0.000 |
| 3,4-Dimethylheptane | I9 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 3,4-Dimethylheptane (2) | I9 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| 4-Ethylheptane | I9 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 4-Methyloctane | I9 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 2-Methyloctane | I9 | 0.0003 | 0.0015 | 0.000 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 1c,2t,3-Trimethylcyclohexane | N9 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 3-Methyloctane | I9 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 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 |
| 1,2-Dimethylbenzene (o-Xylene) | A8 | 0.0007 | 0.0028 | 0.000 | 0.000 |
| i-Butylcyclopentane | N9 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| UnknownC8s | U8 | 0.0005 | 0.0022 | 0.000 | 0.000 |
| n-Nonane | P9 | 0.0012 | 0.0059 | 0.001 | 0.001 |
| 1,1-Methylethylcyclohexane | N9 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| i-Propylbenzene | A9 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| i-Propylcyclohexane | N9 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| n-Butylcyclopentane | N9 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 3,3-Dimethyloctane | I10 | 0.0002 | 0.0011 | 0.000 | 0.000 |
| n-Propylbenzene | A9 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| 3-Methyl-5-ethylheptane | I10 | 0.0002 | 0.0011 | 0.000 | 0.000 |
| 1,3-Methylethylbenzene | A9 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| 5-Methylnonane | I10 | 0.0002 | 0.0011 | 0.000 | 0.000 |
| 1,2-Methylethylbenzene | A9 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| t-Butylbenzene | A10 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| UnknownC9s | U9 | 0.0028 | 0.0137 | 0.002 | 0.002 |
| n-Decane | P10 | 0.0002 | 0.0011 | 0.000 | 0.000 |
| Sec-Butylcyclohexane | A10 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,2-Methyl-i-propylbenzene | A10 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| UnknownC10s | U10 | 0.0005 | 0.0027 | 0.000 | 0.000 |
| n-Undecane | P11 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| UnknownC11s | U11 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| n-Tetradecane | P14 | 0.0001 | 0.0008 | 0.000 | 0.000 |
| n-Pentadecane | P15 | 0.0001 | 0.0008 | 0.000 | 0.000 |
| n-Hexadecane | P16 | 0.0001 | 0.0009 | 0.000 | 0.000 |
| n-Heptadecane | P17 | 0.0001 | 0.0009 | 0.000 | 0.000 |
| UnknownC18s | U18 | 0.0001 | 0.0010 | 0.000 | 0.000 |
| TOTAL | | 100.00000 | 100.00000 | 8.9680 | 8.9195 |

| **BTEX COMPONENTS** | **MOLE%** | **WT%** |
|---|---|---|
| BENZENE | 0.0381 | 0.1138 |
| TOLUENE | 0.0082 | 0.0289 |
| ETHYLBENZENE | 0.0000 | 0.0000 |
| XYLENES | 0.0017 | 0.0068 |
| TOTAL BTEX | 0.0480 | 0.1495 |

| | | | |
|---|---|---|---|
| | **BTU @** | 14.730 | 14.650 |
| **LOW** | NET DRY REAL : | 1331.7 **/scf** | 1324.5 **/scf** |
| | NET WET REAL : | 1308.5 **/scf** | 1301.3 **/scf** |
| **HIGH** | GROSS DRY REAL : | 1460.5 **/scf** | 1452.6 **/scf** |
| | GROSS WET REAL : | 1435.1 **/scf** | 1427.2 **/scf** |
| | NET DRY REAL : | 19337.2 **/lb** | 19232.2 **/lb** |
| | GROSS DRY REAL : | 21214.6 **/lb** | 21099.3 **/lb** |
| | RELATIVE DENSITY (AIR=1): | | 0.9024 |
| | COMPRESSIBILITY FACTOR : | | 0.99478 |

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

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