EMPACT ANALYTICAL SYSTEMS INC.
365 S. MAIN ST.
BRIGHTON, CO
80601

**303-637-0150**

## EXTENDED NATURAL GAS LIQUID ANALYSIS (*DHA)

### MAIN PAGE

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201401066 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | CARRIZO OIL & GAS | ANALYSIS DATE: | JANUARY 17, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | JANUARY 15, 2014 |
| PRODUCER : | | CYLINDER NO. : | 2064 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | TREATER @ 12:40 | | EMPACT |
| | KONIG 2-31-11-59 | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 120 |
| SAMPLE PRES. : | 31 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE | | |

| COMPONENT | MOLE % | MASS % | VOL % |
|---|---|---|---|
| NITROGEN (AIR) | 0.0549 | 0.0138 | 0.0127 |
| CARBON DIOXIDE | 0.0282 | 0.0111 | 0.0101 |
| METHANE | 0.2004 | 0.0288 | 0.0716 |
| ETHANE | 0.1878 | 0.0506 | 0.1059 |
| PROPANE | 0.5391 | 0.2131 | 0.3134 |
| I-BUTANE | 0.1723 | 0.0898 | 0.1189 |
| N-BUTANE | 0.8633 | 0.4497 | 0.5741 |
| I-PENTANE | 0.4683 | 0.3028 | 0.3614 |
| N-PENTANE | 0.8396 | 0.5429 | 0.6413 |
| HEXANES PLUS | 96.6461 | 98.2974 | 97.7906 |
| TOTALS | 100.0000 | 100.0000 | 100.0000 |

| **BTEX COMPONENTS** | **MOLE%** | **MASS%** |
|---|---|---|
| BENZENE | 1.6417 | 1.1493 |
| TOLUENE | 3.5125 | 2.9007 |
| ETHYLBENZENE | 0.6955 | 0.6618 |
| XYLENE | 2.2832 | 2.1726 |
| TOTAL BTEX | 8.1329 | 6.8844 |

(CALC: GPA STD 2145-94 & TP-17 @14.696 & 60 F)

| | **TOTAL SAMPLE** | **C6+ FRACTION** | |
|---|---|---|---|
| Specific Gravity (H2O=1) = | 0.7457 | 0.7495 | 60/60 |
| API Gravity = | 58.25 | 57.29 | 60/60 |
| Molecular Weight = | 111.57 | 114.115 | |
| Absolute Density = | 6.22 | 6.25 | LBS/GAL |
| Heating Value Liq. Idl Gas= | 126370 | 127287 | BTU/GAL |
| Vapor/Liquid = | 21.15 | 20.84 | CUFT/GAL |
| Vapor Pressure = | 15.05 | 1.72 | PSIA @100 F |

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

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## EXTENDED NATURAL GAS LIQUID ANALYSIS (*DHA)

## E & P TANK / GLYCALC INFORMATION

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201401066 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | CARRIZO OIL & GAS | ANALYSIS DATE: | JANUARY 17, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | JANUARY 15, 2014 |
| PRODUCER : | | CYLINDER NO. : | 2064 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | TREATER @ 12:40 | | EMPACT |
| | KONIG 2-31-11-59 | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 120 |
| SAMPLE PRES. : | 31 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE | | |

| COMPONENT | Mole % | | Wt % | | LV % | |
|---|---|---|---|---|---|---|
| CARBON DIOXIDE | 0.0282 | | 0.0111 | | 0.0101 | |
| NITROGEN (AIR) | 0.0549 | | 0.0138 | | 0.0127 | |
| METHANE | 0.2004 | | 0.0288 | | 0.0716 | |
| ETHANE | 0.1878 | | 0.0506 | | 0.1059 | |
| PROPANE | 0.5391 | | 0.2131 | | 0.3134 | |
| I-BUTANE | 0.1723 | | 0.0898 | | 0.1189 | |
| N-BUTANE | 0.8633 | | 0.4497 | | 0.5741 | |
| I-PENTANE | 0.4683 | | 0.3028 | | 0.3614 | |
| N-PENTANE | 0.8396 | | 0.5429 | | 0.6413 | |
| CYCLOPENTANE (N-C5) | 1.3857 | | 0.8710 | | 0.8542 | |
| N-HEXANE | 7.0308 | | 5.4302 | | 6.0995 | |
| CYCLOHEXANE (OTHER C6) | 2.9961 | | 2.2600 | | 2.1506 | |
| OTHER HEXANES | 10.4785 | | 8.0081 | | 8.5277 | |
| OTHER HEPTANES | 14.8577 | | 13.2514 | | 13.8896 | |
| METHYLCYCLOHEXANE (OTHER C7) | 4.2350 | | 3.7270 | | 3.5866 | |
| 2,2,4 TRIMETHYLPENTANE | 0.8218 | | 0.7232 | | 0.7156 | |
| BENZENE | 1.6417 | | 1.1493 | | 0.9705 | |
| TOLUENE | 3.5125 | | 2.9007 | | 2.4736 | |
| ETHYLBENZENE | 0.6955 | | 0.6618 | | 0.5643 | |
| XYLENES | 2.2832 | | 2.1726 | | 1.8556 | |
| OTHER OCTANES | 12.1873 | | 12.4759 | | 12.5262 | |
| OCTANES PLUS | ---- | 50.5081 | ---- | 60.6997 | ---- | 59.2383 |
| NONANES | 12.1205 | | 13.7848 | | 13.6304 | |
| DECANES PLUS | 22.3998 | | 30.8814 | | 29.9462 | |
| SUB TOTAL | 100.0000 | | 100.0000 | | 100.0000 | |
| TOTAL | 100.0000 | | 100.0000 | | 100.0000 | |

| | | |
|---|---|---|
| API Gravity = | **58.25** | 60/60 |
| Vapor Pressure = | **15.05** | PSIA & 100 F |
| Average Molecular Weight of Decanes plus = | **153.82** | |
| Average Specific Gravity of Decanes plus = | **0.7700** | |

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## EXTENDED NATURAL GAS LIQUID ANALYSIS (*DHA)

## BY CARBON NUMBER

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201401066 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | CARRIZO OIL & GAS | ANALYSIS DATE: | JANUARY 17, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | JANUARY 15, 2014 |
| PRODUCER : | | CYLINDER NO. : | 2064 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | TREATER @ 12:40 | | EMPACT |
| | KONIG 2-31-11-59 | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 120 |
| SAMPLE PRES. : | 31 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE | | |

| COMPONENT / CARBON NUMBER | MOLE% | MASS % | VOLUME % |
|---|---|---|---|
| NITROGEN | 0.0549 | 0.0138 | 0.0127 |
| CARBON DIOXIDE | 0.0282 | 0.0111 | 0.0101 |
| C1 | 0.2004 | 0.0288 | 0.0716 |
| C2 | 0.1878 | 0.0506 | 0.1059 |
| C3 | 0.5391 | 0.2131 | 0.3134 |
| C4 | 1.0356 | 0.5395 | 0.6930 |
| C5 | 2.6936 | 1.7167 | 1.8569 |
| C6 | 22.1471 | 16.8476 | 17.7483 |
| C7 | 22.6052 | 19.8791 | 19.9498 |
| C8 | 15.9878 | 16.0335 | 15.6617 |
| C9 | 12.1205 | 13.7848 | 13.6304 |
| C10 | 11.2730 | 13.9502 | 13.5944 |
| C11 | 4.9920 | 6.7500 | 6.4861 |
| C12 | 2.6213 | 3.8174 | 3.6982 |
| C13 | 1.1767 | 1.9169 | 1.8663 |
| C14 | 0.8661 | 1.5400 | 1.5041 |
| C15 | 0.8707 | 1.6577 | 1.6005 |
| C16 | 0.3698 | 0.7505 | 0.7199 |
| C17 | 0.2103 | 0.4533 | 0.4334 |
| C18 | 0.0199 | 0.0454 | 0.0433 |
| C19 | 0.0000 | 0.0000 | 0.0000 |
| C20 | 0.0000 | 0.0000 | 0.0000 |
| C21 | 0.0000 | 0.0000 | 0.0000 |
| C22 | 0.0000 | 0.0000 | 0.0000 |
| C23 | 0.0000 | 0.0000 | 0.0000 |
| C24 | 0.0000 | 0.0000 | 0.0000 |
| C25 | 0.0000 | 0.0000 | 0.0000 |
| C26 | 0.0000 | 0.0000 | 0.0000 |
| C27 | 0.0000 | 0.0000 | 0.0000 |
| C28 | 0.0000 | 0.0000 | 0.0000 |
| C29 | 0.0000 | 0.0000 | 0.0000 |
| C30+ | 0.0000 | 0.0000 | 0.0000 |
| **Total** | 100.0000 | 100.0000 | 100.0000 |

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## EXTENDED NATURAL GAS LIQUID ANALYSIS (*DHA)

### DHA COMPONENT LIST

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201401066 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | CARRIZO OIL & GAS | ANALYSIS DATE: | JANUARY 17, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | JANUARY 15, 2014 |
| PRODUCER : | | CYLINDER NO. : | 2064 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | TREATER @ 12:40 KONIG 2-31-11-59 | | EMPACT |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 120 |
| SAMPLE PRES. : | 31 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE | | |

| COMPONENT | PIANO # | MOLE % | MASS % | VOL % |
|---|---|---|---|---|
| Nitrogen | NHC | 0.0549 | 0.0138 | 0.0127 |
| Carbon Dioxide | NHC | 0.0282 | 0.0111 | 0.0101 |
| Methane | P1 | 0.2004 | 0.0288 | 0.0716 |
| Ethane | P2 | 0.1878 | 0.0506 | 0.1059 |
| Propane | P3 | 0.5391 | 0.2131 | 0.3134 |
| i-Butane | I4 | 0.1723 | 0.0898 | 0.1189 |
| n-Butane | P4 | 0.8633 | 0.4497 | 0.5741 |
| i-Pentane | I5 | 0.4683 | 0.3028 | 0.3614 |
| n-Pentane | P5 | 0.8396 | 0.5429 | 0.6413 |
| 2,2-Dimethylbutane | I6 | 0.0348 | 0.0269 | 0.0307 |
| Cyclopentane | N5 | 1.3857 | 0.8710 | 0.8542 |
| 2,3-Dimethylbutane | I6 | 0.3115 | 0.2406 | 0.2689 |
| 2-Methylpentane | I6 | 3.3689 | 2.6022 | 2.9494 |
| 3-Methylpentane | I6 | 2.0360 | 1.5726 | 1.7527 |
| n-Hexane | P6 | 7.0308 | 5.4302 | 6.0995 |
| 2,2-Dimethylpentane | I7 | 0.0151 | 0.0136 | 0.0149 |
| Methylcyclopentane | N6 | 4.7273 | 3.5658 | 3.5260 |
| 2,4-Dimethylpentane | I7 | 0.2815 | 0.2528 | 0.2787 |
| 2,2,3-Trimethylbutane | I7 | 0.0363 | 0.0326 | 0.0350 |
| Benzene | A6 | 1.6417 | 1.1493 | 0.9705 |
| 3,3-Dimethylpentane | I7 | 0.0171 | 0.0154 | 0.0165 |
| Cyclohexane | N6 | 2.9961 | 2.2600 | 2.1506 |
| 2-Methylhexane | I7 | 1.1123 | 0.9989 | 1.0914 |
| 2,3-Dimethylpentane | I7 | 0.9081 | 0.8155 | 0.8656 |
| 1,1-Dimethylcyclopentane | N7 | 0.4021 | 0.3539 | 0.3475 |
| 3-Methylhexane | I7 | 1.9079 | 1.7134 | 1.8438 |
| 1c,3-Dimethylcyclopentane | N7 | 0.8964 | 0.7889 | 0.7847 |
| 1t,3-Dimethylcyclopentane | N7 | 0.8218 | 0.7232 | 0.7156 |
| 3-Ethylpentane | I7 | 0.0405 | 0.0364 | 0.0385 |
| 1t,2-Dimethylcyclopentane | N7 | 1.8932 | 1.6661 | 1.6428 |
| 2,2,4-Trimethylpentane | I8 | 0.1892 | 0.1937 | 0.2065 |
| n-Heptane | P7 | 5.4382 | 4.8839 | 5.2905 |
| 1c,2-Dimethylcyclopentane | N7 | 0.1419 | 0.1249 | 0.1198 |
| Methylcyclohexane | N7 | 4.2350 | 3.7270 | 3.5866 |
| 2,2-Dimethylhexane | I8 | 0.4066 | 0.4163 | 0.4433 |
| Ethylcyclopentane | N7 | 0.9453 | 0.8319 | 0.8043 |
| 2,5-Dimethylhexane | I8 | 0.1101 | 0.1127 | 0.1203 |
| 2,2,3-Trimethylpentane | I8 | 0.0460 | 0.0471 | 0.0488 |
| 2,4-Dimethylhexane | I8 | 0.2776 | 0.2842 | 0.3020 |
| 1c,2t,4-Trimethylcyclopentane | N8 | 0.4124 | 0.4148 | 0.4027 |
| 3,3-Dimethylhexane | I8 | 0.0645 | 0.0660 | 0.0689 |

| | | | | |
|---|---|---|---|---|
| 2,3,4-Trimethylpentane | I8 | 0.0832 | 0.0852 | 0.0877 |
| 2,3,3-Trimethylpentane | I8 | 0.0414 | 0.0424 | 0.0433 |
| Toluene | A7 | 3.5125 | 2.9007 | 2.4736 |
| 2,3-Dimethylhexane | I8 | 0.1338 | 0.1370 | 0.1426 |
| 2-Methyl-3-ethylpentane | I8 | 0.2352 | 0.2408 | 0.2480 |
| 1,1,2-Trimethylcyclopentane | N8 | 0.0517 | 0.0520 | 0.0499 |
| 2-Methylheptane | I8 | 1.3600 | 1.3924 | 1.4754 |
| 4-Methylheptane | I8 | 0.4640 | 0.4751 | 0.4913 |
| 3-Methyl-3-ethylpentane | I8 | 0.1669 | 0.1709 | 0.1742 |
| 3,4-Dimethylhexane | I8 | 0.1281 | 0.1312 | 0.1351 |
| 1c,2c,4-Trimethylcyclopentane | N8 | 0.0600 | 0.0603 | 0.0579 |
| 1c,3-Dimethylcyclohexane | N8 | 0.0459 | 0.0462 | 0.0447 |
| 3-Methylheptane | I8 | 0.0800 | 0.0819 | 0.0860 |
| 1c,2t,3-Trimethylcyclopentane | N8 | 1.1163 | 1.1227 | 1.0801 |
| 3-Ethylhexane | I8 | 0.3459 | 0.3541 | 0.3681 |
| 1t,4-Dimethylcyclohexane | N8 | 0.7434 | 0.7476 | 0.7266 |
| 1,1-Dimethylcyclohexane | N8 | 0.1400 | 0.1408 | 0.1337 |
| 3c-Ethylmethylcyclopentane | N8 | 0.0128 | 0.0129 | 0.0125 |
| 3t-Ethylmethylcyclopentane | N8 | 0.2842 | 0.2858 | 0.2763 |
| 2t-Ethylmethylcyclopentane | N8 | 0.2130 | 0.2142 | 0.2065 |
| 1,1-Methylethylcyclopentane | N8 | 0.8591 | 0.8640 | 0.8202 |
| 2,2,4-Trimethylhexane | I9 | 0.0703 | 0.0808 | 0.0837 |
| 1t,2-Dimethylcyclohexane | N8 | 0.6070 | 0.6105 | 0.5834 |
| 1t,3-Dimethylcyclohexane | N8 | 0.0022 | 0.0022 | 0.0021 |
| n-Octane | P8 | 2.1943 | 2.2466 | 2.3692 |
| 1c,4-Dimethylcyclohexane | N8 | 0.8895 | 0.8946 | 0.8471 |
| i-Propylcyclopentane | I8 | 0.1310 | 0.1318 | 0.1258 |
| 2,4,4-Trimethylhexane | I9 | 0.0233 | 0.0268 | 0.0275 |
| 2,2,3,4-Tetramethylpentane | I9 | 0.0843 | 0.0969 | 0.0998 |
| 2,3,4-Trimethylhexane | I9 | 0.0174 | 0.0200 | 0.0205 |
| 1c,2-Dimethylcyclohexane | N8 | 0.1733 | 0.1743 | 0.1623 |
| 2,3,5-Trimethylhexane | I9 | 0.0593 | 0.0682 | 0.0700 |
| 2,2-Dimethylheptane | I9 | 0.0220 | 0.0253 | 0.0264 |
| 1,1,4-Trimethylcyclohexane | N9 | 1.1061 | 1.2515 | 1.2020 |
| 2,2,3-Trimethylhexane | I9 | 0.3641 | 0.4186 | 0.4254 |
| 2,4-Dimethylheptane | I9 | 0.0743 | 0.0854 | 0.0885 |
| 4,4-Dimethylheptane | I9 | 0.1366 | 0.1570 | 0.1626 |
| Ethylcyclohexane | N8 | 0.7117 | 0.7158 | 0.6737 |
| n-Propylcyclopentane | N8 | 0.1796 | 0.1806 | 0.1724 |
| 1c,3c,5-Trimethylcyclohexane | N9 | 0.0588 | 0.0665 | 0.0639 |
| 2,5-Dimethylheptane | I9 | 0.1272 | 0.1462 | 0.1512 |
| 3,3-Dimethylheptane | I9 | 0.1065 | 0.1224 | 0.1266 |
| 3,5-Dimethylheptane | I9 | 0.0802 | 0.0922 | 0.0953 |
| 2,6-Dimethylheptane | I9 | 0.0437 | 0.0502 | 0.0525 |
| 1,1,3-Trimethylcyclohexane | N9 | 0.0842 | 0.0953 | 0.0915 |
| Ethylbenzene | A8 | 0.6955 | 0.6618 | 0.5643 |
| 1c,2t,4t-Trimethylcyclohexane | N9 | 0.4765 | 0.5391 | 0.5079 |
| 2,3-Dimethylheptane | I9 | 0.0102 | 0.0117 | 0.0119 |
| 1,3-Dimethylbenzene (m-Xylene) | A8 | 0.7224 | 0.6874 | 0.5895 |
| 1,4-Dimethylbenzene (p-Xylene) | A8 | 0.8748 | 0.8324 | 0.7161 |
| 3,4-Dimethylheptane | I9 | 0.2313 | 0.2659 | 0.2695 |
| 3,4-Dimethylheptane (2) | I9 | 0.2505 | 0.2880 | 0.2919 |
| 4-Ethylheptane | I9 | 0.0973 | 0.1119 | 0.1159 |
| 4-Methyloctane | I9 | 0.2892 | 0.3325 | 0.3420 |
| 2-Methyloctane | I9 | 0.2621 | 0.3013 | 0.3130 |
| 1c,2t,4c-Trimethylcyclohexane | I9 | 0.0824 | 0.0947 | 0.0967 |
| 3-Ethylheptane | I9 | 0.0832 | 0.0956 | 0.0975 |
| 3-Methyloctane | I9 | 0.2919 | 0.3356 | 0.3451 |
| 3,3-Diethylpentane | I9 | 0.0947 | 0.1089 | 0.1070 |
| 1c,2t,3-Trimethylcyclohexane | N9 | 0.1421 | 0.1608 | 0.1515 |
| 1,1,2-Trimethylcyclohexane | N9 | 0.0672 | 0.0760 | 0.0716 |
| 1,2-Dimethylbenzene (o-Xylene) | A8 | 0.6860 | 0.6528 | 0.5500 |
| i-Butylcyclopentane | N9 | 0.3050 | 0.3451 | 0.3276 |
| UnknownC8s | U8 | 0.0492 | 0.0504 | 0.0532 |
| n-Nonane | P9 | 1.0472 | 1.2038 | 1.2434 |
| 1,1-Methylethylcyclohexane | N9 | 0.8599 | 0.9885 | 1.0240 |
| i-Propylbenzene | A9 | 0.2774 | 0.2988 | 0.2565 |
| i-Propylcyclohexane | N9 | 0.0915 | 0.1035 | 0.0957 |
| 2,2-Dimethyloctane | I10 | 0.0430 | 0.0548 | 0.0549 |
| 2,4-Dimethyloctane | I10 | 0.0501 | 0.0639 | 0.0641 |
| 2,6-Dimethyloctane | I10 | 0.0175 | 0.0223 | 0.0231 |
| 2,5-Dimethyloctane | I10 | 0.0341 | 0.0435 | 0.0436 |
| n-Butylcyclopentane | N9 | 0.1955 | 0.2458 | 0.2281 |

| | | | | |
|---|---|---|---|---|
| 3,3-Dimethyloctane | I10 | 0.1365 | 0.1741 | 0.1747 |
| n-Propylbenzene | A9 | 0.2439 | 0.2627 | 0.2256 |
| 3,6-Dimethyloctane | I10 | 0.1905 | 0.2429 | 0.2435 |
| 3-Methyl-5-ethylheptane | I10 | 0.3950 | 0.4541 | 0.4639 |
| 1,3-Methylethylbenzene | A9 | 0.2615 | 0.2817 | 0.2399 |
| 1,4-Methylethylbenzene | A9 | 0.2948 | 0.3176 | 0.2704 |
| 1,3,5-Trimethylbenzene | A9 | 0.0985 | 0.1061 | 0.0910 |
| 2,3-Dimethyloctane | I10 | 0.0568 | 0.0724 | 0.0726 |
| 5-Methylnonane | I10 | 0.3872 | 0.4938 | 0.4997 |
| 1,2-Methylethylbenzene | A9 | 0.2641 | 0.2845 | 0.2410 |
| 2-Methylnonane | I10 | 0.1172 | 0.1495 | 0.1526 |
| 3-Ethyloctane | I10 | 0.1067 | 0.1361 | 0.1364 |
| 3-Methylnonane | I10 | 0.1766 | 0.2252 | 0.2276 |
| 1,2,4-Trimethylbenzene | A9 | 0.0741 | 0.0798 | 0.0676 |
| t-Butylbenzene | A10 | 0.1930 | 0.2322 | 0.1988 |
| i-Butylcyclohexane | N10 | 0.1670 | 0.2100 | 0.1918 |
| 1t-Methyl-2-n-propylcyclohexane | I10 | 0.1057 | 0.1215 | 0.1241 |
| i-Butylbenzene | A10 | 0.0656 | 0.0789 | 0.0686 |
| sec-Butylbenzene | A10 | 0.1192 | 0.1434 | 0.1234 |
| UnknownC9s | U9 | 3.0244 | 3.4768 | 3.5910 |
| n-Decane | P10 | 1.1011 | 1.4042 | 1.4259 |
| 1,2,3-Trimethylbenzene | A9 | 0.2458 | 0.2648 | 0.2197 |
| 1,3-Methyl-i-propylbenzene | A10 | 0.0964 | 0.1039 | 0.0880 |
| 1,4-Methyl-i-propylbenzene | A10 | 0.1005 | 0.1083 | 0.0917 |
| Sec-Butylcyclohexane | N10 | 0.2412 | 0.3032 | 0.2766 |
| 1,2-Methyl-i-propylbenzene | A10 | 0.1872 | 0.2252 | 0.1906 |
| 3-Ethylnonane | I10 | 0.0705 | 0.0899 | 0.0917 |
| 1,3-Diethylbenzene | A10 | 0.1408 | 0.1694 | 0.1455 |
| 1,3-Methyl-n-propylbenzene | A10 | 0.0565 | 0.0680 | 0.0586 |
| 1,4-Diethylbenzene | A10 | 0.1886 | 0.2269 | 0.1953 |
| 1,4-Methyl-n-propylbenzene | A10 | 0.0682 | 0.0820 | 0.0708 |
| n-Butylbenzene | A10 | 0.0775 | 0.0932 | 0.0802 |
| 1,3-Dimethyl-5-ethylbenzene | A10 | 0.1155 | 0.1389 | 0.1191 |
| 1,2-Diethylbenzene | A10 | 0.0707 | 0.0850 | 0.0717 |
| 1,2-Methyl-n-propylbenzene | A10 | 0.0745 | 0.0896 | 0.0761 |
| 1,4-Dimethyl-2-ethylbenzene | A10 | 0.0801 | 0.0964 | 0.0815 |
| 1,3-Dimethyl-4-ethylbenzene | A10 | 0.1593 | 0.1916 | 0.1622 |
| 1,2-Dimethyl-4-ethylbenzene | A10 | 0.1405 | 0.1690 | 0.1434 |
| 1,3-Dimethyl-2-ethylbenzene | A10 | 0.0886 | 0.1066 | 0.0888 |
| 1t,2c,4-Trimethylcyclopentane | A10 | 0.5291 | 0.5321 | 0.5277 |
| 1,2-Dimethyl-3-ethylbenzene | A10 | 0.1594 | 0.1918 | 0.1595 |
| 1,2-Ethyl-i-propylbenzene | A10 | 0.1213 | 0.1459 | 0.1235 |
| 1,4-Methyl-t-butylbenzene | A11 | 0.0851 | 0.1024 | 0.0867 |
| UnknownC10s | U10 | 4.8087 | 6.1322 | 6.2271 |
| n-Undecane | P11 | 0.5866 | 0.8218 | 0.8230 |
| 1,4-Ethyl-i-propylbenzene | A11 | 0.3126 | 0.3761 | 0.3183 |
| 1,2,4,5-Tetramethylbenzene | A11 | 0.0874 | 0.1051 | 0.0880 |
| 1,2-Methyl-n-butylbenzene | A11 | 0.0662 | 0.0796 | 0.0674 |
| 1,2,3,5-Tetramethylbenzene | A11 | 0.0493 | 0.0593 | 0.0494 |
| 1,2-Methyl-t-butylbenzene | A11 | 0.0415 | 0.0499 | 0.0422 |
| 5-Methylindan | A11 | 0.0135 | 0.0206 | 0.0204 |
| 4-Methylindan | A11 | 0.0242 | 0.0369 | 0.0365 |
| 1,2-Ethyl-n-propylbenzene | A11 | 0.1616 | 0.1944 | 0.1645 |
| 2-Methylindan | A11 | 0.0895 | 0.1366 | 0.1353 |
| 1,3-Methyl-n-butylbenzene | A11 | 0.0714 | 0.0859 | 0.0727 |
| 1,3-Di-i-propylbenzene | A11 | 0.0334 | 0.0402 | 0.0340 |
| sec-Pentylbenzene | A11 | 0.0520 | 0.0626 | 0.0530 |
| n-Pentylbenzene | A11 | 0.0713 | 0.0947 | 0.0818 |
| 1t-M-2-(4MP)cyclopentane | P12 | 0.0776 | 0.1185 | 0.1174 |
| 1,2-Di-n-propylbenzene | A11 | 0.1114 | 0.1340 | 0.1134 |
| 1,4-Di-i-propylbenzene | A11 | 0.0762 | 0.0917 | 0.0776 |
| Tetrahydronaphthalene | A10 | 0.0436 | 0.0525 | 0.0444 |
| t-Decahydronaphthalene | A10 | 0.1069 | 0.1286 | 0.1088 |
| Naphthalene | A10 | 0.0846 | 0.0972 | 0.0823 |
| 1-t-Butyl-3,5-dimethylbenzene | A12 | 0.0395 | 0.0475 | 0.0402 |
| 1,4-Ethyl-t-butylbenzene | A11 | 0.0618 | 0.0743 | 0.0629 |
| UnknownC11s | U11 | 2.8799 | 4.0347 | 4.0404 |
| n-Dodecane | P12 | 0.5395 | 0.8237 | 0.8158 |
| 1,3-Di-n-propylbenzene | A12 | 0.0594 | 0.0715 | 0.0605 |
| 1,3,5-Triethylbenzene | A12 | 0.0571 | 0.0615 | 0.0527 |
| 1,2,4-Triethylbenzene | A12 | 0.2266 | 0.2441 | 0.2067 |
| 1,4-Methyl-n-pentylbenzene | A12 | 0.0641 | 0.0771 | 0.0652 |
| n-Hexylbenzene | A12 | 0.0604 | 0.0878 | 0.0759 |

| | | | | |
|---|---|---|---|---|
| 1,2,3,4,5-Pentamethylbenzene | A13 | 0.0610 | 0.0734 | 0.0621 |
| 2-Methylnaphthalene | A11 | 0.0663 | 0.0845 | 0.0715 |
| 1-Methylnaphthalene | A11 | 0.0508 | 0.0647 | 0.0471 |
| UnknownC12s | U12 | 1.4971 | 2.2857 | 2.2638 |
| n-Tridecane | P13 | 0.1642 | 0.2713 | 0.2655 |
| UnknownC13s | U13 | 0.9515 | 1.5722 | 1.5387 |
| n-Tetradecane | P14 | 0.4051 | 0.7203 | 0.7035 |
| UnknownC14s | U14 | 0.4610 | 0.8197 | 0.8006 |
| n-Pentadecane | P15 | 0.2112 | 0.4021 | 0.3882 |
| UnknownC15s | U15 | 0.6595 | 1.2556 | 1.2123 |
| n-Hexadecane | P16 | 0.0921 | 0.1869 | 0.1793 |
| UnknownC16s | U16 | 0.2777 | 0.5636 | 0.5406 |
| n-Heptadecane | P17 | 0.0219 | 0.0472 | 0.0451 |
| UnknownC17s | U17 | 0.1884 | 0.4061 | 0.3883 |
| n-Octadecane | P18 | 0.0040 | 0.0091 | 0.0087 |
| UnknownC18s | U18 | 0.0159 | 0.0363 | 0.0346 |
| TOTAL | | 100.0000 | 100.0000 | 100.0000 |

EMPACT ANALYTICAL SYSTEMS INC.
365 S. MAIN ST.
BRIGHTON, CO
80601

**303-637-0150**

## EXTENDED NATURAL GAS ANALYSIS (*DHA)

### MAIN PAGE

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201401066 | ANALYSIS NO. : | 02 |
| COMPANY NAME : | CARRIZO OIL & GAS | ANALYSIS DATE: | JANUARY 20, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | JANUARY 15, 2014 |
| PRODUCER : | | CYLINDER NO. : | 1173 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER-EMPACT |
| NAME/DESCRIP : | SALES GAS @ 12:50<br>KONIG 2-31-11-59 | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 105 |
| SAMPLE PRES. : | 31 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE; LENGTH OF H2S STAIN @ 6.5 PPM (1-7 PPM) @ 13:05 | | |

| COMPONENT | MOLE % | MASS % | GPM @ 14.650 | GPM @ 14.730 |
|---|---|---|---|---|
| ALCOHOLS | 0.0090 | 0.0192 | | |
| HELIUM | 0.02 | 0.00 | --- | --- |
| HYDROGEN | 0.01 | 0.00 | --- | --- |
| OXYGEN/ARGON | 0.01 | 0.01 | --- | --- |
| NITROGEN | 1.21 | 1.23 | --- | --- |
| CARBON DIOXIDE | 2.60 | 4.15 | --- | --- |
| METHANE | 64.25210 | 37.42210 | --- | --- |
| ETHANE | 10.0749 | 10.9985 | 2.6939 | 2.7086 |
| PROPANE | 10.0799 | 16.1371 | 2.7760 | 2.7912 |
| I-BUTANE | 1.1803 | 2.4906 | 0.3858 | 0.3879 |
| N-BUTANE | 4.6663 | 9.8467 | 1.4702 | 1.4782 |
| I-PENTANE | 1.2934 | 3.3742 | 0.4600 | 0.4625 |
| N-PENTANE | 1.7007 | 4.4548 | 0.6163 | 0.6197 |
| HEXANES PLUS | 2.8934 | 9.8668 | 1.2013 | 1.2075 |
| TOTALS | 100.00000 | 100.00000 | 9.6035 | 9.6556 |

| **BTEX COMPONENTS** | **MOLE%** | **WT%** |
|---|---|---|
| BENZENE | 0.1074 | 0.3046 |
| TOLUENE | 0.0843 | 0.2820 |
| ETHYLBENZENE | 0.0092 | 0.0355 |
| XYLENES | 0.0224 | 0.0863 |
| TOTAL BTEX | 0.2233 | 0.7084 |

| | **BTU @** | 14.650 | 14.730 |
|---|---|---|---|
| **LOW** | NET DRY REAL : | 1405.5 **/scf** | 1413.1 **/scf** |
| | NET WET REAL : | 1380.9 **/scf** | 1388.6 **/scf** |
| **HIGH** | GROSS DRY REAL : | 1540.6 **/scf** | 1549.0 **/scf** |
| | GROSS WET REAL : | 1513.7 **/scf** | 1522.0 **/scf** |
| | NET DRY REAL : | 19414.1 **/lb** | 19520.1 **/lb** |
| | GROSS DRY REAL : | 21267.0 **/lb** | 21383.1 **/lb** |
| | RELATIVE DENSITY (AIR=1): | | 0.9498 |
| | COMPRESSIBILITY FACTOR : | | 0.99470 |

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

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

EMPACT ANALYTICAL SYSTEMS INC.
365 S. MAIN ST.
BRIGHTON, CO
80601

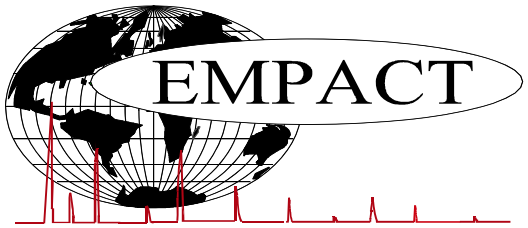
**303-637-0150**

## EXTENDED NATURAL GAS ANALYSIS (*DHA)

## GLYCALC INFORMATION

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201401066 | ANALYSIS NO. : | 02 |
| COMPANY NAME : | CARRIZO OIL & GAS | ANALYSIS DATE: | JANUARY 20, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | JANUARY 15, 2014 |
| PRODUCER : | | CYLINDER NO. : | 1173 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER-EMPACT |
| NAME/DESCRIP : | SALES GAS @ 12:50<br>KONIG 2-31-11-59 | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 105 |
| SAMPLE PRES. : | 31 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE; LENGTH OF H2S STAIN @ 6.5 PPM (1-7 PPM) @ 13:05 | | |

| Componet | Mole % | Wt % |
|---|---|---|
| Helium | 0.02 | 0.00 |
| Hydrogen | 0.01 | 0.00 |
| Carbon Dioxide | 2.60 | 4.15 |
| Nitrogen | 1.21 | 1.23 |
| Methane | 64.25210 | 37.42210 |
| Ethane | 10.0749 | 10.9985 |
| Propane | 10.0799 | 16.1371 |
| Isobutane | 1.1803 | 2.4906 |
| n-Butane | 4.6663 | 9.8467 |
| Isopentane | 1.1051 | 2.8947 |
| n-Pentane | 1.7007 | 4.4548 |
| Cyclopentane | 0.1883 | 0.4795 |
| n-Hexane | 0.5326 | 1.6663 |
| Cyclohexane | 0.1535 | 0.4690 |
| Other Hexanes | 0.8780 | 2.7232 |
| Heptanes | 0.5743 | 2.0753 |
| Methycyclohexane | 0.1259 | 0.4488 |
| 2,2,4 Trimethylpentane | 0.0002 | 0.0008 |
| Benzene | 0.1074 | 0.3046 |
| Toluene | 0.0843 | 0.2820 |
| Ethylbenzene | 0.0092 | 0.0355 |
| Xylenes | 0.0224 | 0.0863 |
| C8+ Heavies | 0.4056 | 1.7750 |
| ***Subtotal*** | 99.98100 | 99.97080 |
| Oxygen/Argon | 0.01 | 0.01 |
| Alcohols | 0.0090 | 0.0192 |
| **Total** | 100.00000 | 100.00000 |




## EXTENDED NATURAL GAS ANALYSIS (*DHA)

## DHA COMPONENT LIST

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201401066 | ANALYSIS NO. : | 02 |
| COMPANY NAME : | CARRIZO OIL & GAS | ANALYSIS DATE: | JANUARY 20, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | JANUARY 15, 2014 |
| PRODUCER : | | CYLINDER NO. : | 1173 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER-EMPACT |
| NAME/DESCRIP : | SALES GAS @ 12:50<br>KONIG 2-31-11-59 | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 105 |
| SAMPLE PRES. : | 31 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE; LENGTH OF H2S STAIN @ 6.5 PPM (1-7 PPM) @ 13:05 | | |

| COMPONENT | PIANO # | MOLE % | MASS % | GPM @ 14.650 | GPM @ 14.730 |
|---|---|---|---|---|---|
| Helium | --- | 0.02 | 0.00 | --- | --- |
| Hydrogen | --- | 0.01 | 0.00 | --- | --- |
| Oxygen/Argon | --- | 0.01 | 0.01 | --- | --- |
| Nitrogen | --- | 1.21 | 1.23 | --- | --- |
| Carbon Dioxide | --- | 2.60 | 4.15 | --- | --- |
| Methane | P1 | 64.25210 | 37.42210 | --- | --- |
| Ethane | P2 | 10.0749 | 10.9985 | 2.694 | 2.709 |
| Propane | P3 | 10.0799 | 16.1371 | 2.776 | 2.791 |
| i-Butane | I4 | 1.1803 | 2.4906 | 0.386 | 0.388 |
| n-Butane | P4 | 4.6663 | 9.8467 | 1.470 | 1.478 |
| 2,2-Dimethylpropane | I5 | 0.0035 | 0.0092 | 0.001 | 0.001 |
| Ethanol | X2 | 0.0004 | 0.0007 | 0.000 | 0.000 |
| i-Pentane | I5 | 1.1016 | 2.8855 | 0.403 | 0.405 |
| Acetone | X3 | 0.0067 | 0.0141 | 0.002 | 0.002 |
| i-Propanol | X3 | 0.0013 | 0.0028 | 0.000 | 0.000 |
| n-Pentane | P5 | 1.7007 | 4.4548 | 0.616 | 0.620 |
| t-Butanol | X4 | 0.0006 | 0.0016 | 0.000 | 0.000 |
| 2,2-Dimethylbutane | I6 | 0.0036 | 0.0113 | 0.001 | 0.001 |
| Cyclopentane | N5 | 0.1883 | 0.4795 | 0.056 | 0.056 |
| 2,3-Dimethylbutane | I6 | 0.0283 | 0.0885 | 0.012 | 0.012 |
| 2-Methylpentane | I6 | 0.3395 | 1.0622 | 0.141 | 0.142 |
| 3-Methylpentane | I6 | 0.1814 | 0.5676 | 0.074 | 0.075 |
| n-Hexane | P6 | 0.5326 | 1.6663 | 0.219 | 0.220 |
| 2,2-Dimethylpentane | I7 | 0.0012 | 0.0044 | 0.001 | 0.001 |
| Methylcyclopentane | N6 | 0.3249 | 0.9927 | 0.115 | 0.116 |
| 2,4-Dimethylpentane | I7 | 0.0130 | 0.0473 | 0.006 | 0.006 |
| 2,2,3-Trimethylbutane | I7 | 0.0003 | 0.0011 | 0.000 | 0.000 |
| Benzene | A6 | 0.1074 | 0.3046 | 0.030 | 0.030 |
| 3,3-Dimethylpentane | I7 | 0.0010 | 0.0036 | 0.000 | 0.000 |
| Cyclohexane | N6 | 0.1535 | 0.4690 | 0.052 | 0.052 |
| 2-Methylhexane | I7 | 0.0675 | 0.2456 | 0.031 | 0.031 |
| 2,3-Dimethylpentane | I7 | 0.0321 | 0.1168 | 0.015 | 0.015 |
| 1,1-Dimethylcyclopentane | N7 | 0.0096 | 0.0342 | 0.004 | 0.004 |
| 3-Methylhexane | I7 | 0.0800 | 0.2910 | 0.037 | 0.037 |
| 1c,3-Dimethylcyclopentane | N7 | 0.0378 | 0.1348 | 0.017 | 0.017 |
| 1t,3-Dimethylcyclopentane | N7 | 0.0342 | 0.1219 | 0.016 | 0.016 |



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| | | | | | |
|---|---|---|---|---|---|
| 3-Ethylpentane | I7 | 0.0058 | 0.0211 | 0.003 | 0.003 |
| 1t,2-Dimethylcyclopentane | N7 | 0.0761 | 0.2713 | 0.035 | 0.035 |
| 2,2,4-Trimethylpentane | I8 | 0.0002 | 0.0008 | 0.000 | 0.000 |
| UnknownC6s | U6 | 0.0003 | 0.0009 | 0.000 | 0.000 |
| n-Heptane | P7 | 0.1809 | 0.6581 | 0.083 | 0.084 |
| 1c,2-Dimethylcyclopentane | N7 | 0.0053 | 0.0189 | 0.002 | 0.002 |
| Methylcyclohexane | N7 | 0.1259 | 0.4488 | 0.050 | 0.050 |
| 2,2-Dimethylhexane | I8 | 0.0062 | 0.0257 | 0.003 | 0.003 |
| Ethylcyclopentane | N7 | 0.0293 | 0.1045 | 0.012 | 0.012 |
| 2,5-Dimethylhexane | I8 | 0.0039 | 0.0162 | 0.002 | 0.002 |
| 2,2,3-Trimethylpentane | I8 | 0.0006 | 0.0025 | 0.000 | 0.000 |
| 2,4-Dimethylhexane | I8 | 0.0068 | 0.0282 | 0.003 | 0.003 |
| 1c,2t,4-Trimethylcyclopentane | N8 | 0.0117 | 0.0477 | 0.005 | 0.005 |
| 3,3-Dimethylhexane | I8 | 0.0006 | 0.0025 | 0.000 | 0.000 |
| 1t,2c,4-Trimethylcyclopentane | N8 | 0.0143 | 0.0583 | 0.007 | 0.007 |
| 2,3,4-Trimethylpentane | I8 | 0.0030 | 0.0125 | 0.001 | 0.001 |
| 2,3,3-Trimethylpentane | I8 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| Toluene | A7 | 0.0843 | 0.2820 | 0.028 | 0.028 |
| 2,3-Dimethylhexane | I8 | 0.0055 | 0.0228 | 0.003 | 0.003 |
| 2-Methyl-3-ethylpentane | I8 | 0.0038 | 0.0158 | 0.002 | 0.002 |
| 2-Methylheptane | I8 | 0.0332 | 0.1377 | 0.017 | 0.017 |
| 4-Methylheptane | I8 | 0.0094 | 0.0390 | 0.005 | 0.005 |
| 3-Methyl-3-ethylpentane | I8 | 0.0009 | 0.0037 | 0.000 | 0.000 |
| 3,4-Dimethylhexane | I8 | 0.0011 | 0.0046 | 0.001 | 0.001 |
| 1c,2c,4-Trimethylcyclopentane | N8 | 0.0006 | 0.0024 | 0.000 | 0.000 |
| 1c,3-Dimethylcyclohexane | N8 | 0.0006 | 0.0024 | 0.000 | 0.000 |
| 3-Methylheptane | I8 | 0.0157 | 0.0651 | 0.008 | 0.008 |
| 1c,2t,3-Trimethylcyclopentane | N8 | 0.0180 | 0.0733 | 0.009 | 0.009 |
| 3-Ethylhexane | I8 | 0.0019 | 0.0079 | 0.001 | 0.001 |
| 1t,4-Dimethylcyclohexane | N8 | 0.0059 | 0.0240 | 0.003 | 0.003 |
| 1,1-Dimethylcyclohexane | N8 | 0.0023 | 0.0094 | 0.001 | 0.001 |
| 3t-Ethylmethylcyclopentane | N8 | 0.0058 | 0.0236 | 0.003 | 0.003 |
| 2t-Ethylmethylcyclopentane | N8 | 0.0051 | 0.0208 | 0.003 | 0.003 |
| 1,1-Methylethylcyclopentane | N8 | 0.0163 | 0.0664 | 0.008 | 0.008 |
| 2,2,4-Trimethylhexane | I9 | 0.0006 | 0.0028 | 0.000 | 0.000 |
| 1t,2-Dimethylcyclohexane | N8 | 0.0093 | 0.0379 | 0.005 | 0.005 |
| 1t,3-Dimethylcyclohexane | N8 | 0.0001 | 0.0004 | 0.000 | 0.000 |
| UnknownC7s | U7 | 0.0002 | 0.0007 | 0.000 | 0.000 |
| n-Octane | P8 | 0.0525 | 0.2177 | 0.027 | 0.027 |
| 1c,4-Dimethylcyclohexane | N8 | 0.0038 | 0.0155 | 0.002 | 0.002 |
| i-Propylcyclopentane | I8 | 0.0015 | 0.0061 | 0.001 | 0.001 |
| 2,4,4-Trimethylhexane | I9 | 0.0003 | 0.0014 | 0.000 | 0.000 |
| 2,3,5-Trimethylhexane | I9 | 0.0006 | 0.0028 | 0.000 | 0.000 |
| 2,2,3,4-Tetramethylpentane | I9 | 0.0003 | 0.0014 | 0.000 | 0.000 |
| 2,3,4-Trimethylhexane | I9 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| 1c,2-Dimethylcyclohexane | N8 | 0.0036 | 0.0147 | 0.002 | 0.002 |
| 2,2-Dimethylheptane | I9 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| 1,1,4-Trimethylcyclohexane | N9 | 0.0142 | 0.0651 | 0.007 | 0.007 |
| 2,2,3-Trimethylhexane | I9 | 0.0057 | 0.0265 | 0.003 | 0.003 |
| 2,4-Dimethylheptane | I9 | 0.0015 | 0.0070 | 0.001 | 0.001 |
| 4,4-Dimethylheptane | I9 | 0.0004 | 0.0019 | 0.000 | 0.000 |
| Ethylcyclohexane | N8 | 0.0079 | 0.0322 | 0.004 | 0.004 |
| n-Propylcyclopentane | N8 | 0.0030 | 0.0122 | 0.001 | 0.001 |
| 1c,3c,5-Trimethylcyclohexane | N9 | 0.0004 | 0.0018 | 0.000 | 0.000 |
| 2,5-Dimethylheptane | I9 | 0.0011 | 0.0051 | 0.001 | 0.001 |
| 3,3-Dimethylheptane | I9 | 0.0012 | 0.0056 | 0.001 | 0.001 |
| 3,5-Dimethylheptane | I9 | 0.0009 | 0.0042 | 0.001 | 0.001 |
| 2,6-Dimethylheptane | I9 | 0.0010 | 0.0047 | 0.001 | 0.001 |
| 1,1,3-Trimethylcyclohexane | N9 | 0.0020 | 0.0092 | 0.001 | 0.001 |
| Ethylbenzene | I8 | 0.0092 | 0.0355 | 0.004 | 0.004 |

| | | | | | |
|---|---|---|---|---|---|
| 1c,2t,4t-Trimethylcyclohexane | N9 | 0.0038 | 0.0174 | 0.002 | 0.002 |
| 2,3-Dimethylheptane | I9 | 0.0035 | 0.0163 | 0.002 | 0.002 |
| 1,3-Dimethylbenzene (m-Xylene) | A8 | 0.0128 | 0.0493 | 0.005 | 0.005 |
| 1,4-Dimethylbenzene (p-Xylene) | A8 | 0.0026 | 0.0100 | 0.001 | 0.001 |
| 3,4-Dimethylheptane | I9 | 0.0006 | 0.0028 | 0.000 | 0.000 |
| 3,4-Dimethylheptane (2) | I9 | 0.0017 | 0.0079 | 0.001 | 0.001 |
| 4-Ethylheptane | I9 | 0.0005 | 0.0023 | 0.000 | 0.000 |
| 4-Methyloctane | I9 | 0.0034 | 0.0158 | 0.002 | 0.002 |
| 2-Methyloctane | I9 | 0.0040 | 0.0186 | 0.002 | 0.002 |
| 1c,2t,3-Trimethylcyclohexane | N9 | 0.0010 | 0.0046 | 0.001 | 0.001 |
| 3-Ethylheptane | I9 | 0.0008 | 0.0037 | 0.000 | 0.000 |
| 3-Methyloctane | I9 | 0.0049 | 0.0228 | 0.003 | 0.003 |
| 1c,2t,4c-Trimethylcyclohexane | I9 | 0.0003 | 0.0014 | 0.000 | 0.000 |
| 1,1,2-Trimethylcyclohexane | N9 | 0.0002 | 0.0009 | 0.000 | 0.000 |
| 3,3-Diethylpentane | I9 | 0.0007 | 0.0033 | 0.000 | 0.000 |
| 1,2-Dimethylbenzene (o-Xylene) | A8 | 0.0070 | 0.0270 | 0.003 | 0.003 |
| i-Butylcyclopentane | N9 | 0.0028 | 0.0128 | 0.001 | 0.001 |
| UnknownC8s | U8 | 0.0002 | 0.0008 | 0.000 | 0.000 |
| n-Nonane | P9 | 0.0142 | 0.0661 | 0.008 | 0.008 |
| 1,1-Methylethylcyclohexane | N9 | 0.0015 | 0.0069 | 0.001 | 0.001 |
| i-Propylbenzene | A9 | 0.0028 | 0.0122 | 0.001 | 0.001 |
| i-Propylcyclohexane | N9 | 0.0007 | 0.0032 | 0.000 | 0.000 |
| 2,2-Dimethyloctane | I10 | 0.0007 | 0.0036 | 0.000 | 0.000 |
| 2,4-Dimethyloctane | I10 | 0.0005 | 0.0026 | 0.000 | 0.000 |
| 2,5-Dimethyloctane | I10 | 0.0003 | 0.0016 | 0.000 | 0.000 |
| n-Butylcyclopentane | N9 | 0.0027 | 0.0124 | 0.002 | 0.002 |
| 3,3-Dimethyloctane | I10 | 0.0007 | 0.0036 | 0.000 | 0.000 |
| n-Propylbenzene | A9 | 0.0027 | 0.0118 | 0.001 | 0.001 |
| 3,6-Dimethyloctane | I10 | 0.0024 | 0.0124 | 0.001 | 0.001 |
| 3-Methyl-5-ethylheptane | I10 | 0.0027 | 0.0139 | 0.002 | 0.002 |
| 1,3-Methylethylbenzene | A9 | 0.0021 | 0.0092 | 0.001 | 0.001 |
| 1,4-Methylethylbenzene | A9 | 0.0006 | 0.0026 | 0.000 | 0.000 |
| 1,3,5-Trimethylbenzene | A9 | 0.0005 | 0.0022 | 0.000 | 0.000 |
| 2,3-Dimethyloctane | I10 | 0.0005 | 0.0026 | 0.000 | 0.000 |
| 5-Methylnonane | I10 | 0.0012 | 0.0062 | 0.001 | 0.001 |
| 1,2-Methylethylbenzene | A9 | 0.0016 | 0.0070 | 0.001 | 0.001 |
| 2-Methylnonane | I10 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 3-Ethyloctane | I10 | 0.0004 | 0.0021 | 0.000 | 0.000 |
| 3-Methylnonane | I10 | 0.0011 | 0.0057 | 0.001 | 0.001 |
| 1,2,4-Trimethylbenzene | A9 | 0.0003 | 0.0013 | 0.000 | 0.000 |
| t-Butylbenzene | A10 | 0.0016 | 0.0078 | 0.001 | 0.001 |
| i-Butylcyclohexane | N10 | 0.0009 | 0.0046 | 0.000 | 0.000 |
| 1t-Methyl-2-n-propylcyclohexane | I10 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| i-Butylbenzene | A10 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| sec-Butylbenzene | A10 | 0.0006 | 0.0029 | 0.000 | 0.000 |
| UnknownC9s | U9 | 0.0125 | 0.0582 | 0.007 | 0.007 |
| n-Decane | P10 | 0.0045 | 0.0232 | 0.003 | 0.003 |
| 1,2,3-Trimethylbenzene | A9 | 0.0009 | 0.0039 | 0.001 | 0.001 |
| 1,3-Methyl-i-propylbenzene | A10 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| 1,4-Methyl-i-propylbenzene | A10 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| Sec-Butylcyclohexane | A10 | 0.0010 | 0.0051 | 0.001 | 0.001 |
| 1,2-Methyl-i-propylbenzene | A10 | 0.0005 | 0.0024 | 0.000 | 0.000 |
| 3-Ethylnonane | I10 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| 1,3-Diethylbenzene | A10 | 0.0005 | 0.0024 | 0.000 | 0.000 |
| 1,3-Methyl-n-propylbenzene | A10 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,4-Diethylbenzene | A10 | 0.0006 | 0.0029 | 0.000 | 0.000 |
| n-Butylbenzene | A10 | 0.0004 | 0.0020 | 0.000 | 0.000 |
| 1,3-Dimethyl-5-ethylbenzene | A10 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 1,2-Diethylbenzene | A10 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| t-Decahydronaphthalene | A9 | 0.0004 | 0.0023 | 0.000 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| 1,2-Methyl-n-propylbenzene | A10 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| 1,4-Dimethyl-2-ethylbenzene | A10 | 0.0003 | 0.0015 | 0.000 | 0.000 |
| 1,2-Dimethyl-4-ethylbenzene | A10 | 0.0004 | 0.0020 | 0.000 | 0.000 |
| 1,3-Dimethyl-2-ethylbenzene | A10 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 1,2-Dimethyl-3-ethylbenzene | A10 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 1,2-Ethyl-i-propylbenzene | A10 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,4-Methyl-t-butylbenzene | A11 | 0.0003 | 0.0016 | 0.000 | 0.000 |
| UnknownC10s | U10 | 0.0112 | 0.0579 | 0.007 | 0.007 |
| n-Undecane | P11 | 0.0017 | 0.0097 | 0.001 | 0.001 |
| 1,4-Ethyl-i-propylbenzene | A11 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,2,4,5-Tetramethylbenzene | A11 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 1,2-Methyl-n-butylbenzene | A11 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,2,3,5-Tetramethylbenzene | A11 | 0.0002 | 0.0010 | 0.000 | 0.000 |
| 1,2-Methyl-t-butylbenzene | A11 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,2-Ethyl-n-propylbenzene | A11 | 0.0002 | 0.0011 | 0.000 | 0.000 |
| 2-Methylindan | A11 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,3-Methyl-n-butylbenzene | A11 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,3-Di-i-propylbenzene | A11 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| sec-Pentylbenzene | A11 | 0.0002 | 0.0011 | 0.000 | 0.000 |
| n-Pentylbenzene | A11 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1,2-Di-n-propylbenzene | A11 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| 1,4-Di-i-propylbenzene | A11 | 0.0003 | 0.0018 | 0.000 | 0.000 |
| Naphthalene | A10 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| 1-t-Butyl-3,5-dimethylbenzene | A12 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| 1,4-Ethyl-t-butylbenzene | A11 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| 1,3-Di-n-propylbenzene | A12 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| UnknownC11s | U11 | 0.0043 | 0.0244 | 0.003 | 0.003 |
| n-Dodecane | P12 | 0.0007 | 0.0043 | 0.001 | 0.001 |
| 1,2,4-Triethylbenzene | A12 | 0.0001 | 0.0006 | 0.000 | 0.000 |
| 2-Methylnaphthalene | A11 | 0.0001 | 0.0005 | 0.000 | 0.000 |
| UnknownC12s | U12 | 0.0022 | 0.0125 | 0.001 | 0.001 |
| n-Tridecane | P13 | 0.0003 | 0.0020 | 0.000 | 0.000 |
| UnknownC13s | U13 | 0.0002 | 0.0013 | 0.000 | 0.000 |
| n-Tetradecane | P14 | 0.0001 | 0.0007 | 0.000 | 0.000 |
| UnknownC14s | U14 | 0.0001 | 0.0007 | 0.000 | 0.000 |
| TOTAL | | 100.00000 | 100.00000 | 9.6055 | 9.6576 |

| **BTEX COMPONENTS** | **MOLE%** | **WT%** |
|---|---|---|
| BENZENE | 0.1074 | 0.3046 |
| TOLUENE | 0.0843 | 0.2820 |
| ETHYLBENZENE | 0.0092 | 0.0355 |
| XYLENES | 0.0224 | 0.0863 |
| TOTAL BTEX | 0.2233 | 0.7084 |

| | | | | |
|---|---|---|---|---|
| | **BTU @** | 14.650 | | 14.730 | |
| **LOW** | NET DRY REAL : | 1405.5 | **/scf** | 1413.1 | **/scf** |
| | NET WET REAL : | 1380.9 | **/scf** | 1388.6 | **/scf** |
| **HIGH** | GROSS DRY REAL : | 1540.6 | **/scf** | 1549.0 | **/scf** |
| | GROSS WET REAL : | 1513.7 | **/scf** | 1522.0 | **/scf** |
| | NET DRY REAL : | 19414.1 | **/lb** | 19520.1 | **/lb** |
| | GROSS DRY REAL : | 21267.0 | **/lb** | 21383.1 | **/lb** |

RELATIVE DENSITY (AIR=1): 0.9498

COMPRESSIBILITY FACTOR : 0.99470

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

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

*THIS DATA HAS BEEN ACQUIRED THROUGH APPLICATION OF CURRENT STATE-OF-THE-ART ANALYTICAL TECHNIQUES. THE USE OF THIS INFORMATION IS THE RESPONSIBLITY OF THE USER. EMPACT ANALYTICAL SYSTEMS, ASSUMES NO RESPONSIBLITY FOR ACCURACY OF THE REPORTED INFORMATION NOR ANY CONSEQUENCES OF IT'S APPLICATION.*



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

# CRUDE OIL ASSAY

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201401066 | ANALYSIS NO. : | 03 |
| COMPANY NAME : | CARRIZO OIL & GAS | ANALYSIS DATE: | JANUARY 15, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | |
| PRODUCER : | | CYLINDER NO. : | JANUARY 17, 2014 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | PRODUCTION TANK @ 13:15<br>KONIG 2-31-11-59 | | EMPACT |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 74 |
| SAMPLE PRES. : | | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT | | |

| SPECIFICATION | TEST METHOD | UNITS | RESULTS |
|---|---|---|---|
| API GRAVITY | | API 60/60 | 30.3 |
| RVP @100 DEG F | D323 | PSIG | 4.6 |
| TOTAL SULFUR | D2622 | WT % | N/A |
| TOTAL CHLORIDE | D4929 | ug/g | N/A |
| ORGANIC CHLORIDE | D4929 | ug/g | N/A |
| FLASH POINT | D93 | ° F | N/A |
| HEATING VALUE | D4809 | BTU/ LB | N/A |
| VISUAL APPEARANCE | | | DARK BROWN/BLACK |
| BS&W | D96 | | |
| Crude Oil | | VOL % | N/A |
| Water | | VOL % | N/A |
| Emulsion | | VOL % | N/A |
| Sediment | | VOL % | N/A |
| DISTILLATION: | D86 | | |
| INITIAL POINT | | DEG F | N/A |
| 50% | | DEG F | N/A |
| 90% | | DEG F | N/A |
| END POINT | | DEG F | N/A |
| DISTILLATION: | @TEMP D445 | | |
| Average Centipoise | 20°C | | N/A |
| Average Centipoise | 30°C | | N/A |
| Average Centipoise | 80°C | | N/A |
| Kinetic Viscosity | 20°C | cSt (mm2/s) | N/A |
| Kinetic Viscosity | 30°C | cSt (mm2/s) | N/A |
| Kinetic Viscosity | 80°C | cSt (mm2/s) | N/A |

***ND: NOT DETECTED***

***N/A: NO TEST PREFORMED FOR THIS PARAMETER***