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

303-637-0150

## EXTENDED NATURAL GAS LIQUID ANALYSIS (*DHA)

### MAIN PAGE

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201411042 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | MULL DRILLING COMPANY | ANALYSIS DATE: | NOVEMBER 10, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | NOVEMBER 6, 2014 |
| PRODUCER : | | CYLINDER NO. : | 6842 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | OIL TREATOR 08:05<br>MUSF BATTERY 3 | | EMPACT |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 105 |
| SAMPLE PRES. : | 26 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE | | |

| COMPONENT | MOLE % | MASS % | VOL % |
|---|---|---|---|
| ALCOHOLS | 0.0077 | 0.0042 | 0.0039 |
| NITROGEN (AIR) | 0.0620 | 0.0158 | 0.0145 |
| CARBON DIOXIDE | 0.0510 | 0.0204 | 0.0185 |
| METHANE | 0.1230 | 0.0179 | 0.0443 |
| ETHANE | 0.3540 | 0.0968 | 0.2015 |
| PROPANE | 0.9670 | 0.3878 | 0.5673 |
| I-BUTANE | 0.2300 | 0.1216 | 0.1602 |
| N-BUTANE | 1.0150 | 0.5365 | 0.6813 |
| I-PENTANE | 0.5533 | 0.3630 | 0.4313 |
| N-PENTANE | 0.9780 | 0.6417 | 0.7540 |
| HEXANES PLUS | 95.6590 | 97.7943 | 97.1232 |
| TOTALS | 100.0000 | 100.0000 | 100.0000 |

| BTEX COMPONENTS | MOLE% | MASS% |
|---|---|---|
| BENZENE | 0.8111 | 0.5761 |
| TOLUENE | 1.8909 | 1.5844 |
| ETHYLBENZENE | 0.5089 | 0.4913 |
| XYLENE | 1.3650 | 1.3178 |
| TOTAL BTEX | 4.5759 | 3.9696 |

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

| | TOTAL SAMPLE | C6+ FRACTION |
|---|---|---|
| Specific Gravity (H2O=1) = | 0.7414 | 0.7467 60/60 |
| API Gravity = | 59.36 | 58 60/60 |
| Molecular Weight = | 109.96 | 112.797 |
| Absolute Density = | 6.18 | 6.23 LBS/GAL |
| Heating Value Liq. Idl Gas= | 125873 | 126953 BTU/GAL |
| Vapor/Liquid = | 21.39 | 21.05 CUFT/GAL |
| Vapor Pressure = | 13.45 | 1.77 PSIA @100 F |

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

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303-637-0150

## EXTENDED NATURAL GAS LIQUID ANALYSIS (*DHA)

## E & P TANK / GLYCALC INFORMATION

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201411042 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | MULL DRILLING COMPANY | ANALYSIS DATE: | NOVEMBER 10, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | NOVEMBER 6, 2014 |
| PRODUCER : | | CYLINDER NO. : | 6842 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | OIL TREATOR 08:05<br>MUSF BATTERY 3 | | EMPACT |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 105 |
| SAMPLE PRES. : | 26 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE | | |

| COMPONENT | Mole % | | Wt % | | LV % | |
|---|---|---|---|---|---|---|
| CARBON DIOXIDE | 0.0510 | | 0.0204 | | 0.0185 | |
| NITROGEN (AIR) | 0.0620 | | 0.0158 | | 0.0145 | |
| METHANE | 0.1230 | | 0.0179 | | 0.0443 | |
| ETHANE | 0.3540 | | 0.0968 | | 0.2015 | |
| PROPANE | 0.9670 | | 0.3878 | | 0.5673 | |
| I-BUTANE | 0.2300 | | 0.1216 | | 0.1602 | |
| N-BUTANE | 1.0150 | | 0.5365 | | 0.6813 | |
| I-PENTANE | 0.5533 | | 0.3630 | | 0.4313 | |
| N-PENTANE | 0.9780 | | 0.6417 | | 0.7540 | |
| CYCLOPENTANE (N-C5) | 0.8480 | | 0.5408 | | 0.5276 | |
| N-HEXANE | 6.3691 | | 4.9916 | | 5.5772 | |
| CYCLOHEXANE (OTHER C6) | 3.9665 | | 3.0357 | | 2.8736 | |
| OTHER HEXANES | 10.1000 | | 7.8408 | | 8.3558 | |
| OTHER HEPTANES | 16.4497 | | 14.8803 | | 15.5080 | |
| METHYLCYCLOHEXANE (OTHER C7) | 6.7810 | | 6.0545 | | 5.7960 | |
| 2,2,4 TRIMETHYLPENTANE | 1.2605 | | 1.1255 | | 1.1078 | |
| BENZENE | 0.8111 | | 0.5761 | | 0.4839 | |
| TOLUENE | 1.8909 | | 1.5844 | | 1.3440 | |
| ETHYLBENZENE | 0.5089 | | 0.4913 | | 0.4167 | |
| XYLENES | 1.3650 | | 1.3178 | | 1.1171 | |
| OTHER OCTANES | 14.5750 | | 15.1964 | | 15.3163 | |
| OCTANES PLUS | ---- | 48.4427 | ---- | 58.2901 | ---- | 56.6571 |
| NONANES | 11.2690 | | 13.0082 | | 12.8102 | |
| DECANES PLUS | 19.4643 | | 27.1509 | | 25.8890 | |
| SUB TOTAL | 99.9923 | | 99.9958 | | 99.9961 | |
| ALCOHOLS | 0.0077 | | 0.0042 | | 0.0039 | |
| TOTAL | 100.0000 | | 100.0000 | | 100.0000 | |

| | | | |
|---|---|---|---|
| API Gravity | = | 59.36 | 60/60 |
| Vapor Pressure | = | 13.45 | PSIA & 100 F |
| Average Molecular Weight of Decanes plus | = | 153.39 | |
| Average Specific Gravity of Decanes plus | = | 0.7800 | |

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## EXTENDED NATURAL GAS LIQUID ANALYSIS (*DHA)

## BY CARBON NUMBER

PROJECT NO. : 201411042
COMPANY NAME : MULL DRILLING COMPANY
ACCOUNT NO. :
PRODUCER :
LEASE NO. :
NAME/DESCRIP : OIL TREATOR 08:05
MUSF BATTERY 3
***FIELD DATA***
SAMPLE PRES. : 26
VAPOR PRES. :
COMMENTS : SPOT; NO PROBE

ANALYSIS NO. : 01
ANALYSIS DATE: NOVEMBER 10, 2014
SAMPLE DATE : NOVEMBER 6, 2014
CYLINDER NO. : 6842
SAMPLED BY : JOHN MOSER
EMPACT

SAMPLE TEMP. : 105
AMBIENT TEMP.:
GRAVITY :

| COMPONENT / CARBON NUMBER | MOLE% | MASS % | VOLUME % |
|---|---|---|---|
| ALCOHOLS | 0.0077 | 0.0042 | 0.0039 |
| NITROGEN | 0.0620 | 0.0158 | 0.0145 |
| CARBON DIOXIDE | 0.0510 | 0.0204 | 0.0185 |
| C1 | 0.1230 | 0.0179 | 0.0443 |
| C2 | 0.3540 | 0.0968 | 0.2015 |
| C3 | 0.9670 | 0.3878 | 0.5673 |
| C4 | 1.2450 | 0.6581 | 0.8415 |
| C5 | 2.3793 | 1.5455 | 1.7129 |
| C6 | 21.2467 | 16.4442 | 17.2905 |
| C7 | 25.1216 | 22.5192 | 22.6480 |
| C8 | 17.7094 | 18.1310 | 17.9579 |
| C9 | 11.2690 | 13.0082 | 12.8102 |
| C10 | 9.1758 | 11.3764 | 10.8921 |
| C11 | 4.2223 | 5.7236 | 5.3557 |
| C12 | 2.5905 | 3.7430 | 3.5748 |
| C13 | 1.5144 | 2.4584 | 2.3651 |
| C14 | 0.9380 | 1.6923 | 1.6442 |
| C15 | 0.5026 | 0.9709 | 0.9324 |
| C16 | 0.0637 | 0.1312 | 0.1251 |
| C17 | 0.1696 | 0.3709 | 0.3528 |
| C18 | 0.1765 | 0.4085 | 0.3875 |
| C19 | 0.0748 | 0.1827 | 0.1722 |
| C20 | 0.0343 | 0.0881 | 0.0825 |
| C21 | 0.0018 | 0.0049 | 0.0046 |
| 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. : | 201411042 | ANALYSIS NO. : | 01 |
| COMPANY NAME : | MULL DRILLING COMPANY | ANALYSIS DATE: | NOVEMBER 10, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | NOVEMBER 6, 2014 |
| PRODUCER : | | CYLINDER NO. : | 6842 |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER |
| NAME/DESCRIP : | OIL TREATOR 08:05<br>MUSF BATTERY 3 | | EMPACT |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 105 |
| SAMPLE PRES. : | 26 | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT; NO PROBE | | |

| COMPONENT | PIANO # | MOLE % | MASS % | VOL % |
|---|---|---|---|---|
| Nitrogen | NHC | 0.0620 | 0.0158 | 0.0145 |
| Carbon Dioxide | NHC | 0.0510 | 0.0204 | 0.0185 |
| Methane | P1 | 0.1230 | 0.0179 | 0.0443 |
| Ethane | P2 | 0.3540 | 0.0968 | 0.2015 |
| Propane | P3 | 0.9670 | 0.3878 | 0.5673 |
| i-Butane | I4 | 0.2300 | 0.1216 | 0.1602 |
| n-Butane | P4 | 1.0150 | 0.5365 | 0.6813 |
| 2,2-Dimethylpropane | I5 | 0.0093 | 0.0061 | 0.0076 |
| i-Pentane | I5 | 0.5440 | 0.3569 | 0.4237 |
| Acetone | X2 | 0.0017 | 0.0009 | 0.0008 |
| i-Propanol | X3 | 0.0060 | 0.0033 | 0.0031 |
| n-Pentane | P5 | 0.9780 | 0.6417 | 0.7540 |
| 2,2-Dimethylbutane | I6 | 0.0513 | 0.0402 | 0.0456 |
| Cyclopentane | N5 | 0.8480 | 0.5408 | 0.5276 |
| 2,3-Dimethylbutane | I6 | 0.3536 | 0.2771 | 0.3081 |
| 2-Methylpentane | I6 | 3.3976 | 2.6627 | 3.0022 |
| 3-Methylpentane | I6 | 2.2283 | 1.7464 | 1.9362 |
| n-Hexane | P6 | 6.3691 | 4.9916 | 5.5772 |
| 2,2-Dimethylpentane | I7 | 0.0353 | 0.0322 | 0.0350 |
| Methylcyclopentane | N6 | 4.0665 | 3.1123 | 3.0614 |
| 2,4-Dimethylpentane | I7 | 0.2261 | 0.2060 | 0.2259 |
| Benzene | A6 | 0.8111 | 0.5761 | 0.4839 |
| 3,3-Dimethylpentane | I7 | 0.0235 | 0.0214 | 0.0228 |
| Cyclohexane | N6 | 3.9665 | 3.0357 | 2.8736 |
| 2-Methylhexane | I7 | 1.3079 | 1.1918 | 1.2953 |
| 2,3-Dimethylpentane | I7 | 0.5717 | 0.5209 | 0.5500 |
| 1,1-Dimethylcyclopentane | N7 | 0.7231 | 0.6457 | 0.6307 |
| 3-Methylhexane | I7 | 2.0445 | 1.8630 | 1.9944 |
| 1c,3-Dimethylcyclopentane | N7 | 1.2850 | 1.1474 | 1.1353 |
| 1t,3-Dimethylcyclopentane | N7 | 1.2605 | 1.1255 | 1.1078 |
| 3-Ethylpentane | I7 | 0.1893 | 0.1725 | 0.1817 |
| 1t,2-Dimethylcyclopentane | N7 | 2.1701 | 1.9378 | 1.9007 |
| 2,2,4-Trimethylpentane | I8 | 0.1329 | 0.1381 | 0.1465 |
| UnknownC6s | U6 | 0.0027 | 0.0021 | 0.0023 |
| n-Heptane | P7 | 5.7865 | 5.2727 | 5.6818 |
| 1c,2-Dimethylcyclopentane | N7 | 0.1957 | 0.1747 | 0.1667 |
| Methylcyclohexane | N7 | 6.7810 | 6.0545 | 5.7960 |
| 2,2-Dimethylhexane | I8 | 1.2248 | 1.2723 | 1.3478 |
| Ethylcyclopentane | N7 | 0.3184 | 0.2843 | 0.2734 |
| 2,5-Dimethylhexane | I8 | 0.1181 | 0.1227 | 0.1303 |
| 2,2,3-Trimethylpentane | I8 | 0.0461 | 0.0479 | 0.0493 |
| 2,4-Dimethylhexane | I8 | 0.2012 | 0.2090 | 0.2209 |

| | | | | |
|---|---|---|---|---|
| 1c,2t,4-Trimethylcyclopentane | N8 | 0.7045 | 0.7189 | 0.6942 |
| 3,3-Dimethylhexane | I8 | 0.1254 | 0.1303 | 0.1353 |
| 2,3,4-Trimethylpentane | I8 | 0.0631 | 0.0655 | 0.0671 |
| 2,3,3-Trimethylpentane | I8 | 0.0014 | 0.0015 | 0.0015 |
| Toluene | A7 | 1.8909 | 1.5844 | 1.3440 |
| 2,3-Dimethylhexane | I8 | 0.3752 | 0.3898 | 0.4037 |
| 2-Methyl-3-ethylpentane | I8 | 0.1166 | 0.1211 | 0.1241 |
| 1,1,2-Trimethylcyclopentane | N8 | 0.0319 | 0.0325 | 0.0310 |
| 2-Methylheptane | I8 | 1.6498 | 1.7138 | 1.8065 |
| 4-Methylheptane | I8 | 0.4635 | 0.4815 | 0.4953 |
| 3-Methyl-3-ethylpentane | I8 | 0.1465 | 0.1522 | 0.1543 |
| 3,4-Dimethylhexane | I8 | 0.1293 | 0.1343 | 0.1375 |
| 1c,2c,4-Trimethylcyclopentane | N8 | 0.0481 | 0.0491 | 0.0469 |
| 1c,3-Dimethylcyclohexane | N8 | 0.0591 | 0.0603 | 0.0580 |
| 3-Methylheptane | I8 | 0.5900 | 0.6129 | 0.6405 |
| 1c,2t,3-Trimethylcyclopentane | N8 | 1.5047 | 1.5354 | 1.4694 |
| 3-Ethylhexane | I8 | 0.3435 | 0.3568 | 0.3689 |
| 1t,4-Dimethylcyclohexane | N8 | 0.8547 | 0.8722 | 0.8433 |
| 1,1-Dimethylcyclohexane | N8 | 0.1955 | 0.1995 | 0.1884 |
| 3c-Ethylmethylcyclopentane | N8 | 0.0106 | 0.0108 | 0.0104 |
| 3t-Ethylmethylcyclopentane | N8 | 0.1304 | 0.1331 | 0.1280 |
| 2t-Ethylmethylcyclopentane | N8 | 0.1038 | 0.1059 | 0.1016 |
| 1,1-Methylethylcyclopentane | N8 | 0.3131 | 0.3195 | 0.3017 |
| 2,2,4-Trimethylhexane | I9 | 0.0536 | 0.0625 | 0.0644 |
| 1t,2-Dimethylcyclohexane | N8 | 0.8144 | 0.8310 | 0.7899 |
| 1c,2c,3-Trimethylcyclopentane | N8 | 0.0059 | 0.0060 | 0.0057 |
| 1t,3-Dimethylcyclohexane | N8 | 0.0123 | 0.0125 | 0.0117 |
| UnknownC7s | U7 | 0.3121 | 0.2844 | 0.3065 |
| n-Octane | P8 | 2.9375 | 3.0515 | 3.2012 |
| 1c,4-Dimethylcyclohexane | N8 | 1.2411 | 1.2665 | 1.1930 |
| i-Propylcyclopentane | I8 | 0.1034 | 0.1055 | 0.1002 |
| 2,4,4-Trimethylhexane | I9 | 0.0416 | 0.0485 | 0.0495 |
| 2,2,3,4-Tetramethylpentane | I9 | 0.0218 | 0.0254 | 0.0260 |
| 2,3,4-Trimethylhexane | I9 | 0.0345 | 0.0402 | 0.0411 |
| 1c,2-Dimethylcyclohexane | N8 | 0.1732 | 0.1767 | 0.1637 |
| 2,3,5-Trimethylhexane | I9 | 0.1553 | 0.1811 | 0.1850 |
| 2,2-Dimethylheptane | I9 | 0.0342 | 0.0399 | 0.0414 |
| 1,1,4-Trimethylcyclohexane | N9 | 1.0081 | 1.1573 | 1.1057 |
| 2,2,3-Trimethylhexane | I9 | 0.5443 | 0.6349 | 0.6419 |
| 2,4-Dimethylheptane | I9 | 0.0190 | 0.0222 | 0.0229 |
| 4,4-Dimethylheptane | I9 | 0.0734 | 0.0856 | 0.0882 |
| Ethylcyclohexane | N8 | 0.3998 | 0.4080 | 0.3820 |
| n-Propylcyclopentane | N8 | 0.2604 | 0.2657 | 0.2523 |
| 1c,3c,5-Trimethylcyclohexane | N9 | 0.0531 | 0.0610 | 0.0583 |
| 2,5-Dimethylheptane | I9 | 0.0640 | 0.0747 | 0.0768 |
| 3,3-Dimethylheptane | I9 | 0.0881 | 0.1028 | 0.1058 |
| 3,5-Dimethylheptane | I9 | 0.0505 | 0.0589 | 0.0606 |
| 2,6-Dimethylheptane | I9 | 0.0484 | 0.0565 | 0.0588 |
| 1,1,3-Trimethylcyclohexane | N9 | 0.1136 | 0.1304 | 0.1246 |
| Ethylbenzene | A8 | 0.5089 | 0.4913 | 0.4167 |
| 1c,2t,4t-Trimethylcyclohexane | N9 | 0.1493 | 0.1714 | 0.1606 |
| 2,3-Dimethylheptane | I9 | 0.7468 | 0.8710 | 0.8847 |
| 1,3-Dimethylbenzene (m-Xylene) | A8 | 0.3525 | 0.3403 | 0.2903 |
| 1,4-Dimethylbenzene (p-Xylene) | A8 | 0.4399 | 0.4247 | 0.3635 |
| 3,4-Dimethylheptane | I9 | 0.0773 | 0.0902 | 0.0909 |
| 3,4-Dimethylheptane (2) | I9 | 0.1550 | 0.1808 | 0.1823 |
| 4-Ethylheptane | I9 | 0.0357 | 0.0416 | 0.0429 |
| 4-Methyloctane | I9 | 0.2364 | 0.2757 | 0.2821 |
| 2-Methyloctane | I9 | 0.3946 | 0.4603 | 0.4756 |
| 1c,2t,4c-Trimethylcyclohexane | I9 | 0.0944 | 0.1101 | 0.1119 |
| 3-Ethylheptane | I9 | 0.0724 | 0.0844 | 0.0857 |
| 3-Methyloctane | I9 | 0.4921 | 0.5740 | 0.5872 |
| 3,3-Diethylpentane | I9 | 0.0836 | 0.0975 | 0.0953 |
| 1c,2t,3-Trimethylcyclohexane | N9 | 0.0643 | 0.0738 | 0.0692 |
| 1,1,2-Trimethylcyclohexane | N9 | 0.0525 | 0.0603 | 0.0565 |
| 1,2-Dimethylbenzene (o-Xylene) | A8 | 0.5726 | 0.5528 | 0.4633 |
| i-Butylcyclopentane | N9 | 0.2645 | 0.3036 | 0.2867 |
| UnknownC8s | U8 | 0.2037 | 0.2116 | 0.2220 |
| n-Nonane | P9 | 1.8916 | 2.2063 | 2.2669 |
| 1,1-Methylethylcyclohexane | N9 | 0.4733 | 0.5520 | 0.5689 |
| i-Propylbenzene | A9 | 0.2210 | 0.2416 | 0.2063 |
| i-Propylcyclohexane | N9 | 0.1029 | 0.1181 | 0.1086 |
| 2,2-Dimethyloctane | I10 | 0.0414 | 0.0536 | 0.0535 |
| 2,4-Dimethyloctane | I10 | 0.0611 | 0.0791 | 0.0789 |

| | | | | |
|---|---|---|---|---|
| 2,6-Dimethyloctane | I10 | 0.0112 | 0.0145 | 0.0149 |
| 2,5-Dimethyloctane | I10 | 0.0430 | 0.0556 | 0.0555 |
| n-Butylcyclopentane | N9 | 0.1924 | 0.2454 | 0.2265 |
| 3,3-Dimethyloctane | I10 | 0.0830 | 0.1074 | 0.1072 |
| n-Propylbenzene | A9 | 0.2426 | 0.2652 | 0.2265 |
| 3,6-Dimethyloctane | I10 | 0.1639 | 0.2121 | 0.2115 |
| 3-Methyl-5-ethylheptane | I10 | 0.2274 | 0.2652 | 0.2695 |
| 1,3-Methylethylbenzene | A9 | 0.2643 | 0.2889 | 0.2447 |
| 1,4-Methylethylbenzene | A9 | 0.2215 | 0.2421 | 0.2051 |
| 1,3,5-Trimethylbenzene | A9 | 0.1432 | 0.1565 | 0.1335 |
| 2,3-Dimethyloctane | I10 | 0.0664 | 0.0859 | 0.0857 |
| 5-Methylnonane | I10 | 0.1775 | 0.2297 | 0.2312 |
| 1,2-Methylethylbenzene | A9 | 0.3027 | 0.3309 | 0.2788 |
| 2-Methylnonane | I10 | 0.0665 | 0.0860 | 0.0873 |
| 3-Ethyloctane | I10 | 0.1036 | 0.1341 | 0.1337 |
| 3-Methylnonane | I10 | 0.2014 | 0.2606 | 0.2621 |
| 1,2,4-Trimethylbenzene | A9 | 0.0349 | 0.0381 | 0.0321 |
| t-Butylbenzene | A10 | 0.5662 | 0.6911 | 0.5887 |
| i-Butylcyclohexane | N10 | 0.1895 | 0.2417 | 0.2196 |
| 1t-Methyl-2-n-propylcyclohexane | I10 | 0.0745 | 0.0869 | 0.0883 |
| i-Butylbenzene | A10 | 0.0343 | 0.0419 | 0.0362 |
| sec-Butylbenzene | A10 | 0.0275 | 0.0336 | 0.0288 |
| UnknownC9s | U9 | 1.6036 | 1.8704 | 1.9218 |
| n-Decane | P10 | 1.4651 | 1.8957 | 1.9150 |
| 1,2,3-Trimethylbenzene | A9 | 0.2526 | 0.2761 | 0.2279 |
| 1,3-Methyl-i-propylbenzene | A10 | 0.0764 | 0.0835 | 0.0704 |
| 1,4-Methyl-i-propylbenzene | A10 | 0.1031 | 0.1127 | 0.0950 |
| Sec-Butylcyclohexane | N10 | 0.3239 | 0.4132 | 0.3750 |
| 1,2-Methyl-i-propylbenzene | A10 | 0.1875 | 0.2289 | 0.1927 |
| 3-Ethylnonane | I10 | 0.0448 | 0.0580 | 0.0589 |
| 1,3-Diethylbenzene | A10 | 0.1051 | 0.1283 | 0.1096 |
| 1,3-Methyl-n-propylbenzene | A10 | 0.0522 | 0.0637 | 0.0546 |
| 1,4-Diethylbenzene | A10 | 0.1044 | 0.1274 | 0.1091 |
| 1,4-Methyl-n-propylbenzene | A10 | 0.1625 | 0.1983 | 0.1704 |
| n-Butylbenzene | A10 | 0.0569 | 0.0695 | 0.0595 |
| 1,3-Dimethyl-5-ethylbenzene | A10 | 0.0423 | 0.0516 | 0.0440 |
| 1,2-Diethylbenzene | A10 | 0.1430 | 0.1745 | 0.1464 |
| 1,2-Methyl-n-propylbenzene | A10 | 0.0925 | 0.1129 | 0.0954 |
| 1,4-Dimethyl-2-ethylbenzene | A10 | 0.1133 | 0.1383 | 0.1163 |
| 1,3-Dimethyl-4-ethylbenzene | A10 | 0.0079 | 0.0096 | 0.0081 |
| 1,2-Dimethyl-4-ethylbenzene | A10 | 0.1631 | 0.1991 | 0.1680 |
| 1,3-Dimethyl-2-ethylbenzene | A10 | 0.0864 | 0.1055 | 0.0874 |
| 1t,2c,4-Trimethylcyclopentane | A10 | 0.8558 | 0.8733 | 0.8615 |
| 1,2-Dimethyl-3-ethylbenzene | A10 | 0.1031 | 0.1258 | 0.1041 |
| 1,2-Ethyl-i-propylbenzene | A10 | 0.0559 | 0.0682 | 0.0574 |
| 1,4-Methyl-t-butylbenzene | A11 | 0.1401 | 0.1710 | 0.1439 |
| UnknownC10s | U10 | 2.4263 | 3.1394 | 3.1713 |
| n-Undecane | P11 | 1.1480 | 1.6319 | 1.6257 |
| 1,4-Ethyl-i-propylbenzene | A11 | 0.0574 | 0.0701 | 0.0590 |
| 1,2,4,5-Tetramethylbenzene | A11 | 0.0861 | 0.1051 | 0.0875 |
| 1,2-Methyl-n-butylbenzene | A11 | 0.0688 | 0.0840 | 0.0707 |
| 1,2,3,5-Tetramethylbenzene | A11 | 0.0443 | 0.0541 | 0.0449 |
| 1,2-Methyl-t-butylbenzene | A11 | 0.1007 | 0.1229 | 0.1035 |
| 5-Methylindan | A11 | 0.0164 | 0.0254 | 0.0250 |
| 4-Methylindan | A11 | 0.0116 | 0.0180 | 0.0177 |
| 1,2-Ethyl-n-propylbenzene | A11 | 0.1349 | 0.1647 | 0.1386 |
| 2-Methylindan | A11 | 0.0455 | 0.0705 | 0.0695 |
| 1,3-Methyl-n-butylbenzene | A11 | 0.0565 | 0.0690 | 0.0581 |
| 1,3-Di-i-propylbenzene | A11 | 0.0493 | 0.0602 | 0.0507 |
| sec-Pentylbenzene | A11 | 0.1055 | 0.1288 | 0.1084 |
| n-Pentylbenzene | A11 | 0.0462 | 0.0623 | 0.0535 |
| 1t-M-2-(4MP)cyclopentane | P12 | 0.0434 | 0.0672 | 0.0662 |
| 1,2-Di-n-propylbenzene | A11 | 0.0653 | 0.0797 | 0.0671 |
| 1,4-Di-i-propylbenzene | A11 | 0.1674 | 0.2043 | 0.1720 |
| Tetrahydronaphthalene | A10 | 0.1122 | 0.1370 | 0.1153 |
| t-Decahydronaphthalene | A10 | 0.0700 | 0.0854 | 0.0719 |
| Naphthalene | A10 | 0.0837 | 0.0976 | 0.0822 |
| 1-t-Butyl-3,5-dimethylbenzene | A12 | 0.0360 | 0.0439 | 0.0370 |
| 1,4-Ethyl-t-butylbenzene | A11 | 0.0838 | 0.1023 | 0.0861 |
| UnknownC11s | U11 | 1.3930 | 1.9801 | 1.9725 |
| n-Dodecane | P12 | 0.9052 | 1.4022 | 1.3815 |
| 1,3-Di-n-propylbenzene | A12 | 0.0757 | 0.0924 | 0.0778 |
| 1,3,5-Triethylbenzene | A12 | 0.0704 | 0.0769 | 0.0656 |
| 1,2,4-Triethylbenzene | A12 | 0.3850 | 0.4208 | 0.3544 |

| | | | | |
|---|---|---|---|---|
| 1,4-Methyl-n-pentylbenzene | A12 | 0.0621 | 0.0758 | 0.0638 |
| n-Hexylbenzene | A12 | 0.0661 | 0.0975 | 0.0839 |
| 1,2,3,4,5-Pentamethylbenzene | A13 | 0.1767 | 0.2157 | 0.1816 |
| 2-Methylnaphthalene | A11 | 0.1674 | 0.2165 | 0.1823 |
| 1-Methylnaphthalene | A11 | 0.2341 | 0.3027 | 0.2190 |
| UnknownC12s | U12 | 0.9466 | 1.4663 | 1.4446 |
| n-Tridecane | P13 | 0.3976 | 0.6666 | 0.6490 |
| UnknownC13s | U13 | 0.9401 | 1.5761 | 1.5345 |
| n-Tetradecane | P14 | 0.0625 | 0.1128 | 0.1096 |
| UnknownC14s | U14 | 0.8755 | 1.5795 | 1.5346 |
| n-Pentadecane | P15 | 0.0205 | 0.0396 | 0.0380 |
| UnknownC15s | U15 | 0.4821 | 0.9313 | 0.8944 |
| n-Hexadecane | P16 | 0.0419 | 0.0863 | 0.0823 |
| UnknownC16s | U16 | 0.0218 | 0.0449 | 0.0428 |
| n-Heptadecane | P17 | 0.1006 | 0.2200 | 0.2093 |
| UnknownC17s | U17 | 0.0690 | 0.1509 | 0.1435 |
| n-Octadecane | P18 | 0.0295 | 0.0683 | 0.0648 |
| UnknownC18s | U18 | 0.1470 | 0.3402 | 0.3227 |
| n-Nonadecane | P19 | 0.0174 | 0.0425 | 0.0401 |
| UnknownC19s | U19 | 0.0574 | 0.1402 | 0.1321 |
| n-Eicosane | P20 | 0.0122 | 0.0313 | 0.0293 |
| UnknownC20s | U20 | 0.0221 | 0.0568 | 0.0532 |
| UnknownC21s | U21 | 0.0018 | 0.0049 | 0.0046 |
| TOTAL | | 100.0000 | 100.0000 | 100.0000 |



## CRUDE OIL ASSAY

| | | | |
|---|---|---|---|
| PROJECT NO. : | 201411042 | ANALYSIS NO. : | 02 |
| COMPANY NAME : | MULL DRILLING COMPANY | ANALYSIS DATE: | NOVEMBER 12, 2014 |
| ACCOUNT NO. : | | SAMPLE DATE : | NOVEMBER 6, 2014 |
| PRODUCER : | | CYLINDER NO. : | 1L GLASS JAR |
| LEASE NO. : | | SAMPLED BY : | JOHN MOSER EMPACT |
| NAME/DESCRIP : | PRODUCTION TANK 08:20 MUSF BATTERY 3 | | |
| ***FIELD DATA*** | | SAMPLE TEMP. : | 66 |
| SAMPLE PRES. : | | AMBIENT TEMP.: | |
| VAPOR PRES. : | | GRAVITY : | |
| COMMENTS : | SPOT | | |

| SPECIFICATION | | TEST METHOD | UNITS | RESULTS |
|---|---|---|---|---|
| API GRAVITY | | | API 60/60 | 39.9 |
| RVP @100 DEG F | | D323 | PSIG | 7 |
| 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 | | | | 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***

EMPACT

NATURAL GAS ANALYSIS

| | | | |
|---|---|---|---|
| PRIMARY DB KEY: | | NAME/DESCRIP : | MUSF 17 |
| LEASE #: | | | CASING GAS |
| FIELD/ AREA: | MUSF | | |
| PROJECT NO. : | 201903031 | ANALYSIS NO. : | 03 |
| COMPANY NAME : | MULL DRILLING COMPANY INC | ANALYSIS DATE: | MARCH 06, 2019 14:43 |
| OFFICE / BRANCH: | CHEYENNE WELLS, CO | SAMPLE DATE : | FEBRUARY 26, 2019 |
| CUSTOMER REF: | | TO: | |
| PRODUCER : | | EFFECTIVE DATE: | |
| ***FIELD DATA*** | | | |
| SAMPLE CYCLE: | | SAMPLE TYPE: | SPOT |
| SAMPLE PRES. : | 20 psig | PROBE : | NO |
| FLOW PRES. : | psig | CYLINDER NO. : | 0409 |
| LAB PRES: | psig | SAMPLED BY : | BILL STUTZ |
| SAMPLE TEMP. : | 50 °f | SAMPLING COMPANY: | MULL |
| AMBIENT TEMP.: | °f | H2S BY STAIN TUBE: | - ppm |
| H2O BY STAIN TUBE | - #/mmcf | CO2 BY STAIN TUBE: | - Mol % |
| FIELD COMMENTS: | | | |
| LAB COMMENTS: | | | |

| COMPONENTS | NORM. MOLE% | GPM @ 14.65 | GPM @ 14.73 |
|---|---|---|---|
| HELIUM | 0.12 | - | - |
| HYDROGEN | 0.01 | - | - |
| OXYGEN/ARGON | 0.60 | - | - |
| NITROGEN | 78.11 | - | - |
| CO2 | 1.65 | - | - |
| METHANE | 6.32 | - | - |
| ETHANE | 3.25 | 0.8653 | 0.8700 |
| PROPANE | 4.21 | 1.1547 | 1.1610 |
| ISOBUTANE | 0.56 | 0.1826 | 0.1836 |
| N-BUTANE | 1.73 | 0.5429 | 0.5459 |
| ISOPENTANE | 0.33 | 0.1198 | 0.1204 |
| N-PENTANE | 0.41 | 0.1477 | 0.1485 |
| HEXANES+ | 2.70 | 1.1667 | 1.1731 |
| TOTAL | 100.00 | 4.1797 | 4.2025 |

| BTU @ 60 DEG F | | 14.65 | | 14.73 | |
|---|---|---|---|---|---|
| | GROSS DRY REAL = | 468.9 | /scf | 471.4 | /scf |
| | GROSS SATURATED REAL = | 460.7 | /scf | 463.2 | /scf |

| | |
|---|---|
| RELATIVE DENSITY (AIR=1 @14.696 PSIA 60F) | 1.0714 |
| GRAVITY (LB/SCF) | 0.08177 |
| COMPRESSIBILITY FACTOR : | 0.99882 |

**NOTE: REFERENCE GPA 2261(ASTM D1945 & ASME-PTC), 2145, & 2172 CURRENT PUBLICATIONS**

**Reference:** Per GPA 2172-14 sec 9

***The C6+ is derived from the following ratios of C6, C7 & C8+ respectively:*** **60% 30% 10%**

COPY

EMPACT

NATURAL GAS ANALYSIS

| | | | |
|---|---|---|---|
| PRIMARY DB KEY: | | NAME/DESCRIP : | MUSF 18 |
| LEASE #: | | | CASING GAS |
| FIELD/ AREA: | MUSF | | |
| PROJECT NO. : | 201903031 | ANALYSIS NO. : | 06 |
| COMPANY NAME : | MULL DRILLING COMPANY INC | ANALYSIS DATE: | MARCH 06, 2019 15:56 |
| OFFICE / BRANCH: | CHEYENNE WELLS, CO | SAMPLE DATE : | FEBRUARY 26, 2019 |
| CUSTOMER REF: | | TO: | |
| PRODUCER : | | EFFECTIVE DATE: | |
| ***FIELD DATA*** | | | |
| SAMPLE CYCLE: | | SAMPLE TYPE: | SPOT |
| SAMPLE PRES. : | 11 psig | PROBE : | NO |
| FLOW PRES. : | psig | CYLINDER NO. : | 1200 |
| LAB PRES: | psig | SAMPLED BY : | BILL STUTZ |
| SAMPLE TEMP. : | 50 °f | SAMPLING COMPANY: | MULL |
| AMBIENT TEMP.: | °f | H2S BY STAIN TUBE: | - ppm |
| H2O BY STAIN TUBE | - #/mmcf | CO2 BY STAIN TUBE: | - Mol % |
| FIELD COMMENTS: | | | |
| LAB COMMENTS: | | | |

| COMPONENTS | NORM. MOLE% | GPM @ 14.65 | GPM @ 14.73 |
|---|---|---|---|
| HELIUM | 0.12 | - | - |
| HYDROGEN | 0.01 | - | - |
| OXYGEN/ARGON | 0.60 | - | - |
| NITROGEN | 78.22 | - | - |
| CO2 | 1.61 | - | - |
| METHANE | 5.82 | - | - |
| ETHANE | 3.05 | 0.8125 | 0.8169 |
| PROPANE | 4.16 | 1.1409 | 1.1471 |
| ISOBUTANE | 0.60 | 0.1956 | 0.1967 |
| N-BUTANE | 2.08 | 0.6528 | 0.6564 |
| ISOPENTANE | 0.54 | 0.1966 | 0.1977 |
| N-PENTANE | 0.83 | 0.2994 | 0.3011 |
| HEXANES+ | 2.36 | 1.0191 | 1.0247 |
| TOTAL | 100.00 | 4.3169 | 4.3406 |

| BTU @ 60 DEG F | 14.65 | | 14.73 | |
|---|---|---|---|---|
| GROSS DRY REAL = | 480.0 | /scf | 482.6 | /scf |
| GROSS SATURATED REAL = | 471.6 | /scf | 474.2 | /scf |

| | |
|---|---|
| RELATIVE DENSITY (AIR=1 @14.696 PSIA 60F) | 1.0789 |
| GRAVITY (LB/SCF) | 0.08235 |
| COMPRESSIBILITY FACTOR : | 0.99872 |

**NOTE: REFERENCE GPA 2261(ASTM D1945 & ASME-PTC), 2145, & 2172 CURRENT PUBLICATIONS**

**Reference:** Per GPA 2172-14 sec 9

***The C6+ is derived from the following ratios of C6, C7 & C8+ respectively:*** **60% 30% 10%**