

**MULTI-STAGE SEPARATOR TEST**

**BP**  
**POOL: .**  
**FIELD: .**  
**WELL: .**

**FINAL REPORT**

Prepared for

**BP**

By

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**II - MULTI-STAGE SEPARATOR TEST**

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**RESULTS AND DISCUSSION**

The multi-stage separator test was conducted on a BOTTOMHOLE sample prepared from separator oil and separator gas collected from Well . of . reservoir.

The sample collection data is provided in Table 1 and the sample validation data of the reservoir fluid used in this study is given in Appendix A.

Table 2 provides the compositional analysis of the BOTTOMHOLE sample.

Table 3 contains various oil property measurements performed on the multi-stage separator test including live oil density, oil formation volume factor and gas-oil ratios.

Table 4 contains a summary of the gas properties including gas gravities, deviation factors, gas formation volume factors and gas expansion factors.

Table 5 presents the compositional analysis of the residual oil at completion of the experiment.

Appendix B contains the material balance check performed for this experiment. It is displayed as formation volume factors so that the balance can be checked on a point by point basis. Appendix C contains the compositional analyses of the liberated gases from the multi-stage separator test.



**SUMMARY**

**MAIN PVT RESULTS**

**INITIAL RESERVOIR CONDITIONS**

|                        |            |           |
|------------------------|------------|-----------|
| Reservoir Pressure     | 13500 psia | 93.08 MPa |
| Reservoir Temperature: | 243.0 F    | 390.4 K   |
| Saturation Pressure    | 6438 psia  | 44.39 MPa |

**MULTI-STAGE SEPARATOR TEST**

|                             |                    |                  |
|-----------------------------|--------------------|------------------|
| At Saturation Pressure      |                    |                  |
| Oil Formation Volume Factor | 2.3875 res.bbl/STB | 2.3875 res.m3/m3 |
| Solution Gas-Oil Ratio      | 2747.13 scf/STB    | 489.27 m3/m3     |
| Oil Density                 | 0.5322 g/cm3       | 532.2 kg/m3      |
| At Ambient Pressure         |                    |                  |
| Residual Oil Density        | 0.8331 g/cm3       | 833.1 kg/m3      |
| At Stock Tank Conditions    |                    |                  |
| Residual Oil Density        | 0.8378 g/cm3       | 837.8 kg/m3      |
| API Gravity                 | 37.4               | 37.4             |

**SINGLE-STAGE SEPARATOR TEST**

|                             |                    |                  |
|-----------------------------|--------------------|------------------|
| At Saturation Pressure      |                    |                  |
| Oil Formation Volume Factor | 2.5104 res.bbl/STB | 2.5104 res.m3/m3 |
| Solution Gas-Oil Ratio      | 2830.86 scf/STB    | 504.18 m3/m3     |
| At Stock Tank Conditions    |                    |                  |
| Residual Oil Density        | 0.8467 g/cm3       | 846.7 kg/m3      |
| API Gravity                 | 35.6               | 35.6             |



*WTC-10-001812 - BP - . . . . - BOTTOMHOLE FLUID*

**TABLE 1  
SAMPLE COLLECTION DATA**

|                                 |               |           |
|---------------------------------|---------------|-----------|
| Project File:                   | WTC-10-001812 |           |
| Operator Name:                  | BP            |           |
| Pool or Zone:                   | .             |           |
| Field or Area:                  | .             |           |
| Well Location:                  | .             |           |
| Fluid Sample:                   | BOTTOMHOLE    |           |
| Sampling Company:               | .             |           |
| Name of Sampler:                | .             |           |
| Sampling Date:                  | .             |           |
| Sampling Point:                 | SEPARATOR     |           |
| Sampling Temperature:           | 243.0 F       | 390.4 K   |
| Sampling Pressure:              | 70.0 psia     | 0.48 MPa  |
| Reservoir Temperature:          | 243.0 F       | 390.4 K   |
| Reservoir Pressure:             | 13500.0 psia  | 93.08 MPa |
| Initial Reservoir Pressure (Pi) | 13500.0 psia  | 93.08 MPa |
| Depth of Reported Pi            | N/A mMD       | N/A mss   |

**TABLE 2  
COMPOSITIONAL ANALYSIS OF RESERVOIR FLUID**

| Component Name        | Chemical Symbol  | Mole Fraction | Mass Fraction | Calculated Properties           |
|-----------------------|------------------|---------------|---------------|---------------------------------|
| Nitrogen              | N <sub>2</sub>   | 0.0049        | 0.0026        | <b>Total Sample</b>             |
| Carbon Dioxide        | CO <sub>2</sub>  | 0.0092        | 0.0076        |                                 |
| Hydrogen Sulphide     | H <sub>2</sub> S | 0.0000        | 0.0000        | Molecular Weight 53.45          |
| Methane               | C <sub>1</sub>   | 0.6485        | 0.1947        | <b>C<sub>6-</sub> Fraction</b>  |
| Ethane                | C <sub>2</sub>   | 0.0639        | 0.0360        |                                 |
| Propane               | C <sub>3</sub>   | 0.0459        | 0.0379        |                                 |
| i-Butane              | i-C <sub>4</sub> | 0.0094        | 0.0102        | Molecular Weight 199.81         |
| n-Butane              | n-C <sub>4</sub> | 0.0215        | 0.0234        |                                 |
| i-Pentane             | i-C <sub>5</sub> | 0.0088        | 0.0119        | Mole Fraction 0.1768            |
| n-Pentane             | n-C <sub>5</sub> | 0.0110        | 0.0149        | Density (g/cc) 0.8036           |
| Hexanes               | C <sub>6</sub>   | 0.0195        | 0.0315        | <b>C<sub>7+</sub> Fraction</b>  |
| Heptanes              | C <sub>7</sub>   | 0.0173        | 0.0315        |                                 |
| Octanes               | C <sub>8</sub>   | 0.0268        | 0.0539        |                                 |
| Nonanes               | C <sub>9</sub>   | 0.0142        | 0.0341        | Molecular Weight 213.92         |
| Decanes               | C <sub>10</sub>  | 0.0119        | 0.0316        |                                 |
| Undecanes             | C <sub>11</sub>  | 0.0093        | 0.0256        | Mole Fraction 0.1573            |
| Dodecanes             | C <sub>12</sub>  | 0.0076        | 0.0229        | Density (g/cc) 0.8183           |
| Tridecanes            | C <sub>13</sub>  | 0.0075        | 0.0247        | <b>C<sub>12+</sub> Fraction</b> |
| Tetradecanes          | C <sub>14</sub>  | 0.0066        | 0.0233        |                                 |
| Pentadecanes          | C <sub>15</sub>  | 0.0056        | 0.0214        |                                 |
| Hexadecanes           | C <sub>16</sub>  | 0.0048        | 0.0199        | Molecular Weight 311.11         |
| Heptadecanes          | C <sub>17</sub>  | 0.0042        | 0.0185        |                                 |
| Octadecanes           | C <sub>18</sub>  | 0.0039        | 0.0183        | Mole Fraction 0.0778            |
| Nonadecanes           | C <sub>19</sub>  | 0.0035        | 0.0175        | Density (g/cc) 0.8672           |
| Eicosanes             | C <sub>20</sub>  | 0.0028        | 0.0145        |                                 |
| Heneicosanes          | C <sub>21</sub>  | 0.0026        | 0.0140        |                                 |
| Docosanes             | C <sub>22</sub>  | 0.0022        | 0.0127        |                                 |
| Tricosanes            | C <sub>23</sub>  | 0.0020        | 0.0121        |                                 |
| Tetracosanes          | C <sub>24</sub>  | 0.0018        | 0.0113        |                                 |
| Pentacosanes          | C <sub>25</sub>  | 0.0017        | 0.0108        |                                 |
| Hexacosanes           | C <sub>26</sub>  | 0.0015        | 0.0099        |                                 |
| Heptacosanes          | C <sub>27</sub>  | 0.0014        | 0.0098        |                                 |
| Octacosanes           | C <sub>28</sub>  | 0.0013        | 0.0097        |                                 |
| Nonacosanes           | C <sub>29</sub>  | 0.0011        | 0.0086        |                                 |
| Tricontanes           | C <sub>30</sub>  | 0.0011        | 0.0083        |                                 |
| Hentriacontanes       | C <sub>31</sub>  | 0.0010        | 0.0077        |                                 |
| Dotriacontanes        | C <sub>32</sub>  | 0.0009        | 0.0072        |                                 |
| Tritriacontanes       | C <sub>33</sub>  | 0.0008        | 0.0066        |                                 |
| Tetratriacontanes     | C <sub>34</sub>  | 0.0008        | 0.0067        |                                 |
| Pentatriacontanes     | C <sub>35</sub>  | 0.0006        | 0.0059        |                                 |
| Hexatriacontanes plus | C <sub>36+</sub> | 0.0105        | 0.1304        |                                 |
|                       |                  | <b>1.0000</b> | <b>1.0000</b> |                                 |



**TABLE 3  
MULTI-STAGE SEPARATOR OIL PROPERTIES**

| Pressure               |       | Temperature |       | Oil Density (g/cm <sup>3</sup> ) | Oil Formation Volume Factor [1] | Total Formation Volume Factor [2] | Gas-Oil Ratio      |                     | Gas-Oil Ratio                              |   |
|------------------------|-------|-------------|-------|----------------------------------|---------------------------------|-----------------------------------|--------------------|---------------------|--|---|
| (psia)                 | (MPa) | (F)         | (K)   |                                  |                                 |                                   | Solution (scf/STB) | Liberated (scf/STB) | Solution (m <sup>3</sup> /m <sup>3</sup> ) | Liberated (m <sup>3</sup> /m <sup>3</sup> ) |
| 6.438 P <sub>sat</sub> | 44.39 | 243         | 390.4 | 0.5322                           | 2.3875                          | 2.3875                            | 2747.13            | 0.00                | 489.27                                     | 0.00  |
| 1235                   | 8.52  | 130         | 327.6 | 0.7228                           | 1.3073                          | 5.8198                            | 530.76             | 2216.37             | 94.53                                      | 394.74                                      |
| 435                    | 3.00  | 120         | 322.0 | 0.7827                           | 1.1439                          | 16.4362                           | 230.49             | 2516.64             | 41.05                                      | 448.22                                      |
| 135                    | 0.93  | 120         | 322.0 | 0.8126                           | 1.0748                          | 47.0171                           | 113.54             | 2633.59             | 20.22                                      | 469.04                                      |
| 15                     | 0.10  | 66          | 292.0 | 0.8331                           | 1.0035                          | 171.4413                          | 0.00               | 2747.13             | 0.00                                       | 489.27                                      |

Density of Residual Oil = 0.8378 g/cm<sup>3</sup> (837.8 kg/m<sup>3</sup>) @ 60 F (288.7K)  
 API Gravity of Residual Oil = 37.4

[1] Barrels (Cubic meters) of oil at indicated pressure and temperature per barrel (cubic meter) of residual oil @ 60 F (288.7 K).  
 [2] Total barrels (cubic meters) of oil and liberated gas at the indicated pressure and temperature per barrel (cubic meter) of residual oil @ 60 F (288.7 K).  
 P<sub>sat</sub> - Saturation Pressure  
 - Standard conditions: 60 F (288.7 K) @ 14.696 psia (0.101325 MPa).





MULTI-STAGE SEPARATOR TEST



WTC-10-001812 - BP - . . . - BOTTOMHOLE FLUID

TABLE 4  
MULTI-STAGE SEPARATOR GAS PROPERTIES

| Pressure<br>(psia)    | Pressure<br>(MPa) | Temperature |       | Gas Gravity              |                         | Gas<br>Density<br>(g/cm <sup>3</sup> ) | Gas Deviation<br>Factor<br>(-) | Gas Formation<br>Volume Factor<br>[1] | Gas Expansion<br>Factor<br>[2] |
|-----------------------|-------------------|-------------|-------|--------------------------|-------------------------|--|--------------------------------|---------------------------------------|--------------------------------|
|                       |                   | (F)         | (K)   | Incremental<br>(Air = 1) | Cumulative<br>(Air = 1) |  |                                |                                       |                                |
| 6438 P <sub>sat</sub> | 44.39             | 243         | 390.4 |                          |                         |  |                                |                                       |                                |
| 1235                  | 8.52              | 130         | 327.6 | 0.6681                   | 0.6681                  | 0.0706                                 | 0.8567                         | 0.0114                                | 87.477                         |
| 435                   | 3.00              | 120         | 322.0 | 0.7130                   | 0.6734                  | 0.0247                                 | 0.9359                         | 0.0341                                | 29.310                         |

[1] Cubic feet (meters) of gas at indicated pressure and temperature per cubic feet (meter) @ standard conditions

[2] Cubic feet (meters) of gas @ standard conditions per cubic feet (meter) @ indicated pressure and temperature.

P<sub>sat</sub> - Saturation pressure

- Standard conditions: 60 F (288.7 K) @ 14.696 psia (0.101325 MPa)

**TABLE 5  
COMPOSITIONAL ANALYSIS OF RESIDUAL OIL**

| Component Name        | Chemical Symbol  | Mole Fraction | Mass Fraction | Calculated Properties           |
|-----------------------|------------------|---------------|---------------|---------------------------------|
| Nitrogen              | N <sub>2</sub>   | 0.0000        | 0.0000        | <b>Total Sample</b>             |
| Carbon Dioxide        | CO <sub>2</sub>  | 0.0000        | 0.0000        |                                 |
| Hydrogen Sulphide     | H <sub>2</sub> S | 0.0000        | 0.0000        |                                 |
| Methane               | C <sub>1</sub>   | 0.0000        | 0.0000        | Molecular Weight 195.10         |
| Ethane                | C <sub>2</sub>   | 0.0007        | 0.0001        | <b>C<sub>6+</sub> Fraction</b>  |
| Propane               | C <sub>3</sub>   | 0.0113        | 0.0026        |                                 |
| i-Butane              | i-C <sub>4</sub> | 0.0091        | 0.0027        |                                 |
| n-Butane              | n-C <sub>4</sub> | 0.0327        | 0.0098        | Molecular Weight 212.47         |
| i-Pentane             | i-C <sub>5</sub> | 0.0274        | 0.0101        | Mole Fraction 0.8844            |
| n-Pentane             | n-C <sub>5</sub> | 0.0344        | 0.0127        | Density (g/cc) 0.8085           |
| Hexanes               | C <sub>6</sub>   | 0.0609        | 0.0269        | <b>C<sub>7+</sub> Fraction</b>  |
| Heptanes              | C <sub>7</sub>   | 0.0940        | 0.0475        |                                 |
| Octanes               | C <sub>8</sub>   | 0.1100        | 0.0623        |                                 |
| Nonanes               | C <sub>9</sub>   | 0.0761        | 0.0500        | Molecular Weight 221.81         |
| Decanes               | C <sub>10</sub>  | 0.0640        | 0.0467        | Mole Fraction 0.8235            |
| Undecanes             | C <sub>11</sub>  | 0.0504        | 0.0380        | Density (g/cc) 0.8177           |
| Dodecanes             | C <sub>12</sub>  | 0.0413        | 0.0340        | <b>C<sub>12+</sub> Fraction</b> |
| Tridecanes            | C <sub>13</sub>  | 0.0409        | 0.0367        |                                 |
| Tetradecanes          | C <sub>14</sub>  | 0.0357        | 0.0348        |                                 |
| Pentadecanes          | C <sub>15</sub>  | 0.0304        | 0.0321        | Molecular Weight 314.53         |
| Hexadecanes           | C <sub>16</sub>  | 0.0262        | 0.0298        | Mole Fraction 0.4291            |
| Heptadecanes          | C <sub>17</sub>  | 0.0229        | 0.0278        | Density (g/cc) 0.8684           |
| Octadecanes           | C <sub>18</sub>  | 0.0213        | 0.0275        |                                 |
| Nonadecanes           | C <sub>19</sub>  | 0.0189        | 0.0254        |                                 |
| Eicosanes             | C <sub>20</sub>  | 0.0162        | 0.0228        |                                 |
| Heneicosanes          | C <sub>21</sub>  | 0.0141        | 0.0211        | 0.00                            |
| Docosanes             | C <sub>22</sub>  | 0.0122        | 0.0191        |                                 |
| Tricosanes            | C <sub>23</sub>  | 0.0112        | 0.0183        |                                 |
| Tetracosanes          | C <sub>24</sub>  | 0.0101        | 0.0171        | 0.00                            |
| Pentacosanes          | C <sub>25</sub>  | 0.0089        | 0.0158        |                                 |
| Hexacosanes           | C <sub>26</sub>  | 0.0082        | 0.0151        |                                 |
| Heptacosanes          | C <sub>27</sub>  | 0.0080        | 0.0154        | 0.00                            |
| Octacosanes           | C <sub>28</sub>  | 0.0070        | 0.0139        |                                 |
| Nonacosanes           | C <sub>29</sub>  | 0.0066        | 0.0136        |                                 |
| Tricontanes           | C <sub>30</sub>  | 0.0058        | 0.0123        | 0.00                            |
| Hentriacontanes       | C <sub>31</sub>  | 0.0052        | 0.0114        |                                 |
| Dotriacontanes        | C <sub>32</sub>  | 0.0047        | 0.0106        |                                 |
| Tritriacontanes       | C <sub>33</sub>  | 0.0044        | 0.0103        | 0.00                            |
| Tettratriacontanes    | C <sub>34</sub>  | 0.0038        | 0.0091        |                                 |
| Pentatriacontanes     | C <sub>35</sub>  | 0.0039        | 0.0096        |                                 |
| Hexatriacontanes plus | C <sub>36+</sub> | 0.0613        | 0.2070        | 0.00                            |
|                       |                  | <b>1.0000</b> | <b>1.0000</b> |                                 |



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*WTC-10-001812 - BP - - - - - BOTTOMHOLE FLUID*

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**APPENDIX A**

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**SAMPLE VALIDATION**

WTC-10-001812 - BP - . . . - BOTTOMHOLE FLUID

**TABLE A1  
COMPOSITIONAL ANALYSIS OF RESERVOIR FLUID**

| Component Name        | Chemical Symbol  | Mole Fraction | Mass Fraction | Calculated Properties           |        |
|-----------------------|------------------|---------------|---------------|---------------------------------|--------|
| Nitrogen              | N <sub>2</sub>   | 0.0049        | 0.0026        | <b>Total Sample</b>             |        |
| Carbon Dioxide        | CO <sub>2</sub>  | 0.0092        | 0.0076        |                                 |        |
| Hydrogen Sulphide     | H <sub>2</sub> S | 0.0000        | 0.0000        | Molecular Weight                | 53.45  |
| Methane               | C <sub>1</sub>   | 0.6485        | 0.1947        | Density (g/cc)                  | 0.4240 |
| Ethane                | C <sub>2</sub>   | 0.0639        | 0.0360        |                                 |        |
| Propane               | C <sub>3</sub>   | 0.0459        | 0.0379        | <b>C<sub>6+</sub> Fraction</b>  |        |
| i-Butane              | i-C <sub>4</sub> | 0.0094        | 0.0102        |                                 |        |
| n-Butane              | n-C <sub>4</sub> | 0.0215        | 0.0234        | Molecular Weight                | 199.81 |
| i-Pentane             | i-C <sub>5</sub> | 0.0088        | 0.0119        | Mole Fraction                   | 0.1768 |
| n-Pentane             | n-C <sub>5</sub> | 0.0110        | 0.0149        | Density (g/cc)                  | 0.8036 |
| Hexanes               | C <sub>6</sub>   | 0.0195        | 0.0315        |                                 |        |
| Heptanes              | C <sub>7</sub>   | 0.0173        | 0.0315        | <b>C<sub>7+</sub> Fraction</b>  |        |
| Octanes               | C <sub>8</sub>   | 0.0268        | 0.0539        |                                 |        |
| Nonanes               | C <sub>9</sub>   | 0.0142        | 0.0341        | Molecular Weight                | 213.92 |
| Decanes               | C <sub>10</sub>  | 0.0119        | 0.0316        | Mole Fraction                   | 0.1573 |
| Undecanes             | C <sub>11</sub>  | 0.0093        | 0.0256        | Density (g/cc)                  | 0.8183 |
| Dodecanes             | C <sub>12</sub>  | 0.0076        | 0.0229        |                                 |        |
| Tridecanes            | C <sub>13</sub>  | 0.0075        | 0.0247        | <b>C<sub>12+</sub> Fraction</b> |        |
| Tetradecanes          | C <sub>14</sub>  | 0.0066        | 0.0233        |                                 |        |
| Pentadecanes          | C <sub>15</sub>  | 0.0056        | 0.0214        | Molecular Weight                | 311.11 |
| Hexadecanes           | C <sub>16</sub>  | 0.0048        | 0.0199        | Mole Fraction                   | 0.0778 |
| Heptadecanes          | C <sub>17</sub>  | 0.0042        | 0.0185        | Density (g/cc)                  | 0.8672 |
| Octadecanes           | C <sub>18</sub>  | 0.0039        | 0.0183        |                                 |        |
| Nonadecanes           | C <sub>19</sub>  | 0.0035        | 0.0175        | <b>C<sub>30+</sub> Fraction</b> |        |
| Eicosanes             | C <sub>20</sub>  | 0.0028        | 0.0145        |                                 |        |
| Heneicosanes          | C <sub>21</sub>  | 0.0026        | 0.0140        | Molecular Weight                | 592.41 |
| Docosanes             | C <sub>22</sub>  | 0.0022        | 0.0127        | Mole Fraction                   | 0.0156 |
| Tricosanes            | C <sub>23</sub>  | 0.0020        | 0.0121        | Density (g/cc)                  | 0.9655 |
| Tetracosanes          | C <sub>24</sub>  | 0.0018        | 0.0113        |                                 |        |
| Pentacosanes          | C <sub>25</sub>  | 0.0017        | 0.0108        | <b>C<sub>36+</sub> Fraction</b> |        |
| Hexacosanes           | C <sub>26</sub>  | 0.0015        | 0.0099        |                                 |        |
| Heptacosanes          | C <sub>27</sub>  | 0.0014        | 0.0098        | Molecular Weight                | 662.30 |
| Octacosanes           | C <sub>28</sub>  | 0.0013        | 0.0097        | Mole Fraction                   | 0.0105 |
| Nonacosanes           | C <sub>29</sub>  | 0.0011        | 0.0086        | Density (g/cc)                  | 0.9926 |
| Tricontanes           | C <sub>30</sub>  | 0.0011        | 0.0083        |                                 |        |
| Hentriacontanes       | C <sub>31</sub>  | 0.0010        | 0.0077        |                                 |        |
| Dotriacontanes        | C <sub>32</sub>  | 0.0009        | 0.0072        | <b>Recombination Parameters</b> |        |
| Tritriacontanes       | C <sub>33</sub>  | 0.0008        | 0.0066        |                                 |        |
| Tetatriacontanes      | C <sub>34</sub>  | 0.0008        | 0.0067        | Gas-Oil Ratio (cc/cc)           | 504.18 |
| Pentatriacontanes     | C <sub>35</sub>  | 0.0006        | 0.0059        | Dead Oil Density (g/cc)         | 0.8467 |
| Hexatriacontanes plus | C <sub>36+</sub> | 0.0105        | 0.1304        | Dead Oil MW (g/mol)             | 211.73 |
|                       |                  | <b>1.0000</b> | <b>1.0000</b> |                                 |        |

Physical Properties calculated based on GPA 2145-00 physical constants

**TABLE A2  
COMPOSITIONAL ANALYSIS OF FLASHED OIL**

| Component Name        | Chemical Symbol  | Mole Fraction | Mass Fraction | Calculated Properties           |        |
|-----------------------|------------------|---------------|---------------|---------------------------------|--------|
| Nitrogen              | N <sub>2</sub>   | 0.0000        | 0.0000        | <b>Total Sample</b>             |        |
| Carbon Dioxide        | CO <sub>2</sub>  | 0.0000        | 0.0000        |                                 |        |
| Hydrogen Sulphide     | H <sub>2</sub> S | 0.0000        | 0.0000        | Molecular Weight                | 211.73 |
| Methane               | C <sub>1</sub>   | 0.0000        | 0.0000        | Density (g/cc)                  | 0.8022 |
| Ethane                | C <sub>2</sub>   | 0.0006        | 0.0001        |                                 |        |
| Propane               | C <sub>3</sub>   | 0.0034        | 0.0007        | <b>C<sub>6+</sub> Fraction</b>  |        |
| i-Butane              | i-C <sub>4</sub> | 0.0023        | 0.0006        |                                 |        |
| n-Butane              | n-C <sub>4</sub> | 0.0091        | 0.0025        | Molecular Weight                | 217.95 |
| i-Pentane             | i-C <sub>5</sub> | 0.0097        | 0.0033        | Mole Fraction                   | 0.9593 |
| n-Pentane             | n-C <sub>5</sub> | 0.0157        | 0.0053        | Density (g/cc)                  | 0.8109 |
| Hexanes               | C <sub>6</sub>   | 0.0434        | 0.0177        |                                 |        |
| Heptanes              | C <sub>7</sub>   | 0.0880        | 0.0411        | <b>C<sub>7+</sub> Fraction</b>  |        |
| Octanes               | C <sub>8</sub>   | 0.1140        | 0.0614        |                                 |        |
| Nonanes               | C <sub>9</sub>   | 0.0882        | 0.0534        | Molecular Weight                | 224.19 |
| Decanes               | C <sub>10</sub>  | 0.0750        | 0.0504        | Mole Fraction                   | 0.9159 |
| Undecanes             | C <sub>11</sub>  | 0.0590        | 0.0409        | Density (g/cc)                  | 0.8169 |
| Dodecanes             | C <sub>12</sub>  | 0.0482        | 0.0366        |                                 |        |
| Tridecanes            | C <sub>13</sub>  | 0.0477        | 0.0394        | <b>C<sub>12+</sub> Fraction</b> |        |
| Tetradecanes          | C <sub>14</sub>  | 0.0414        | 0.0372        |                                 |        |
| Pentadecanes          | C <sub>15</sub>  | 0.0352        | 0.0342        | Molecular Weight                | 311.11 |
| Hexadecanes           | C <sub>16</sub>  | 0.0302        | 0.0317        | Mole Fraction                   | 0.4917 |
| Heptadecanes          | C <sub>17</sub>  | 0.0264        | 0.0296        | Density (g/cc)                  | 0.8672 |
| Octadecanes           | C <sub>18</sub>  | 0.0247        | 0.0293        |                                 |        |
| Nonadecanes           | C <sub>19</sub>  | 0.0224        | 0.0279        | <b>C<sub>30+</sub> Fraction</b> |        |
| Eicosanes             | C <sub>20</sub>  | 0.0179        | 0.0232        |                                 |        |
| Heneicosanes          | C <sub>21</sub>  | 0.0162        | 0.0223        | Molecular Weight                | 592.41 |
| Docosanes             | C <sub>22</sub>  | 0.0141        | 0.0203        | Mole Fraction                   | 0.0985 |
| Tricosanes            | C <sub>23</sub>  | 0.0128        | 0.0193        | Density (g/cc)                  | 0.9655 |
| Tetracosanes          | C <sub>24</sub>  | 0.0115        | 0.0180        |                                 |        |
| Pentacosanes          | C <sub>25</sub>  | 0.0106        | 0.0173        | <b>C<sub>36+</sub> Fraction</b> |        |
| Hexacosanes           | C <sub>26</sub>  | 0.0093        | 0.0158        |                                 |        |
| Heptacosanes          | C <sub>27</sub>  | 0.0089        | 0.0157        | Molecular Weight                | 662.30 |
| Octacosanes           | C <sub>28</sub>  | 0.0084        | 0.0154        | Mole Fraction                   | 0.0665 |
| Nonacosanes           | C <sub>29</sub>  | 0.0072        | 0.0137        | Density (g/cc)                  | 0.9926 |
| Tricontanes           | C <sub>30+</sub> | 0.0068        | 0.0133        |                                 |        |
| Hentriacontanes       | C <sub>31</sub>  | 0.0060        | 0.0122        |                                 |        |
| Dotriacontanes        | C <sub>32</sub>  | 0.0055        | 0.0115        |                                 |        |
| Trtriacontanes        | C <sub>33</sub>  | 0.0049        | 0.0106        |                                 |        |
| Tetratriacontanes     | C <sub>34</sub>  | 0.0048        | 0.0106        |                                 |        |
| Pentatriacontanes     | C <sub>35</sub>  | 0.0041        | 0.0094        |                                 |        |
| Hexatriacontanes plus | C <sub>36+</sub> | 0.0665        | 0.2081        |                                 |        |
|                       |                  | <b>1.0000</b> | <b>1.0000</b> |                                 |        |

Physical Properties calculated based on GPA 2145-00 physical constants

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**TABLE A3  
COMPOSITIONAL ANALYSIS OF FLASHED GAS**

| Component Name    | Chemical Symbol  | Mole Fraction |               | Liquid Volume  |                |
|-------------------|------------------|---------------|---------------|----------------|----------------|
|                   |                  | As Analyzed   | Acid Gas Free | STB/MMscf      | mL/m3          |
| Nitrogen          | N <sub>2</sub>   | 0.0059        | 0.0059        |                |                |
| Carbon Dioxide    | CO <sub>2</sub>  | 0.0109        | 0.0000        |                |                |
| Hydrogen Sulphide | H <sub>2</sub> S | 0.0000        | 0.0000        |                |                |
| Methane           | C <sub>1</sub>   | 0.7703        | 0.7788        |                |                |
| Ethane            | C <sub>2</sub>   | 0.0759        | 0.0767        |                |                |
| Propane           | C <sub>3</sub>   | 0.0540        | 0.0545        | 35.231         | 197.805        |
| i-Butane          | i-C <sub>4</sub> | 0.0107        | 0.0108        | 8.319          | 46.709         |
| n-Butane          | n-C <sub>4</sub> | 0.0238        | 0.0241        | 17.829         | 100.099        |
| i-Pentane         | i-C <sub>5</sub> | 0.0087        | 0.0088        | 7.528          | 42.267         |
| n-Pentane         | n-C <sub>5</sub> | 0.0101        | 0.0102        | 8.707          | 48.886         |
| Hexanes           | C <sub>6</sub>   | 0.0150        | 0.0152        | 14.680         | 82.423         |
| Heptanes          | C <sub>7</sub>   | 0.0040        | 0.0040        | 4.336          | 24.344         |
| Octanes           | C <sub>8</sub>   | 0.0105        | 0.0106        | 12.723         | 71.436         |
| Nonanes           | C <sub>9</sub>   | 0.0003        | 0.0003        | 0.428          | 2.401          |
| Decanes           | C <sub>10</sub>  | 0.0000        | 0.0000        | 0.000          | 0.000          |
| Undecane          | C <sub>11</sub>  | 0.0000        | 0.0000        | 0.000          | 0.000          |
| Dodecanes Plus    | C <sub>12+</sub> | 0.0000        | 0.0000        | 0.000          | 0.000          |
| <b>Total</b>      |                  | <b>1.0000</b> | <b>1.0000</b> | <b>109.782</b> | <b>616.369</b> |
| Propanes Plus     | C <sub>3+</sub>  | 0.1371        | 0.1386        | 109.782        | 616.369        |
| Butanes Plus      | C <sub>4+</sub>  | 0.0831        | 0.0840        | 74.550         | 418.564        |
| Pentanes Plus     | C <sub>5+</sub>  | 0.0724        | 0.0732        | 48.402         | 271.756        |

| Calculated Gas Properties @ Standard Conditions |                  |                  | Calculated Pseudocritical Properties |            |          |
|---|------------------|------------------|--------------------------------------|------------|----------|
| Molecular Weight                                | 23.86 kg/kmol    | 23.86 lb/lb-mol  | Ppc                                  | 656.0 psia | 4.52 MPa |
| Specific Gravity                                | 0.8238 (Air = 1) | 0.8238 (Air = 1) | Tpc                                  | 419.7 R    | 233.2 K  |
| MW of C7+                                       | 1.54 kg/kmol     | 1.54 lb/lb-mol   | Ppc*                                 | 652.9 psia | 4.50 MPa |
| Density of C7+                                  | 0.7392 g/cc      | 739.2 kg/m3      | Tpc*                                 | 417.8 R    | 232.1 K  |

| Calculated Gross Heating Value @ Standard Conditions |                 |             | Calculated Net Heating Value @ Standard Conditions |                 |             |
|--|-----------------|-------------|--|-----------------|-------------|
| Dry  | 1,396.2 Btu/scf | 52.12 MJ/m3 | Dry  | 1,270.2 Btu/scf | 47.41 MJ/m3 |
| Wet  | 1,371.9 Btu/scf | 51.21 MJ/m3 | Wet  | 1,248.1 Btu/scf | 46.59 MJ/m3 |

Standard Conditions: 60 F (288.7 K) @ 14.696 psia (0.101325 MPa)



MULTI-STAGE SEPARATOR TEST



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**APPENDIX B**

MULTI-STAGE SEPARATOR TEST - MATERIAL BALANCE



*WTC-10-001812 - BP - - - - - BOTTOMHOLE FLUID*

**TABLE BI  
MULTI-STAGE SEPARATOR - MATERIAL BALANCE**

| Pressure         |              | Measured<br>Oil FVF<br>[1] | Calculated<br>Oil FVF<br>[1] | Absolute<br>Relative Error<br>(%) |
|------------------|--------------|----------------------------|------------------------------|-----------------------------------|
| (psia)           | (MPa)        |                            |                              |                                   |
| <b>6438 Psat</b> | <b>44.39</b> | <b>2.3875</b>              | <b>2.3723</b>                | <b>0.6405</b>                     |
| 1235             | 8.52         | 1.3073                     | 1.3006                       | 0.5153                            |
| 435              | 3.00         | 1.1439                     | 1.1414                       | 0.2109                            |
| 135              | 0.93         | 1.0748                     | 1.0727                       | 0.1945                            |
| 15               | 0.10         | 1.0035                     | 1.0057                       | 0.2157                            |

[1] (res bbl/STB) (res m3/m3)  
 Psat - Saturation Pressure  
 - Standard conditions: 60 F (288.7 K) @ 14.696 psia (0.101325 MPa)





MULTI-STAGE SEPARATOR TEST



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**APPENDIX C**

**MULTI-STAGE SEPARATOR - COMPOSITIONAL ANALYSES OF LIBERATED GAS**

WTC-10-001812 - BP - - - - - BOTTOMHOLE FLUID

**TABLE C1**  
**MSS GAS COMPOSITION @ 1,235 psia (8.52 MPa) AND 130.0 F (327.6 K)**

| Component Name    | Chemical Symbol  | Mole Fraction |               | Liquid Volume |                |
|-------------------|------------------|---------------|---------------|---------------|----------------|
|                   |                  | As Analyzed   | Acid Gas Free | STB/MMscf     | mL/m3          |
| Nitrogen          | N <sub>2</sub>   | 0.0063        | 0.0064        |               |                |
| Carbon Dioxide    | CO <sub>2</sub>  | 0.0105        | 0.0000        |               |                |
| Hydrogen Sulphide | H <sub>2</sub> S | 0.0000        | 0.0000        |               |                |
| Methane           | C <sub>1</sub>   | 0.8636        | 0.8727        |               |                |
| Ethane            | C <sub>2</sub>   | 0.0646        | 0.0653        |               |                |
| Propane           | C <sub>3</sub>   | 0.0335        | 0.0339        | 21.899        | 122.950        |
| i-Butane          | i-C <sub>4</sub> | 0.0051        | 0.0052        | 3.983         | 22.365         |
| n-Butane          | n-C <sub>4</sub> | 0.0096        | 0.0097        | 7.185         | 40.342         |
| i-Pentane         | i-C <sub>5</sub> | 0.0016        | 0.0016        | 1.368         | 7.682          |
| n-Pentane         | n-C <sub>5</sub> | 0.0007        | 0.0007        | 0.569         | 3.193          |
| Hexanes           | C <sub>6</sub>   | 0.0021        | 0.0022        | 2.084         | 11.702         |
| Heptanes          | C <sub>7</sub>   | 0.0021        | 0.0021        | 2.261         | 12.695         |
| Octanes           | C <sub>8</sub>   | 0.0003        | 0.0003        | 0.353         | 1.984          |
| Nonanes           | C <sub>9</sub>   | 0.0000        | 0.0000        | 0.054         | 0.301          |
| Decanes           | C <sub>10</sub>  | 0.0000        | 0.0000        | 0.015         | 0.082          |
| Undecane          | C <sub>11</sub>  | 0.0000        | 0.0000        | 0.000         | 0.000          |
| Dodecanes Plus    | C <sub>12+</sub> | 0.0000        | 0.0000        | 0.000         | 0.000          |
| <b>Total</b>      |                  | <b>1.0000</b> | <b>1.0000</b> | <b>39.771</b> | <b>223.296</b> |
| Propanes Plus     | C <sub>3+</sub>  | 0.0550        | 0.0556        | 39.771        | 223.296        |
| Butanes Plus      | C <sub>4+</sub>  | 0.0215        | 0.0217        | 17.873        | 100.346        |
| Pentanes Plus     | C <sub>5+</sub>  | 0.0164        | 0.0166        | 6.704         | 37.639         |

| Calculated Gas Properties @ Standard Conditions |                  |                  | Calculated Pseudocritical Properties |            |          |
|---|------------------|------------------|--------------------------------------|------------|----------|
| Molecular Weight                                | 19.35 kg/kmol    | 19.35 lb/lb-mol  | Ppc                                  | 668.4 psia | 4.61 MPa |
| Specific Gravity                                | 0.6681 (Air = 1) | 0.6681 (Air = 1) | Tpc                                  | 378.5 R    | 210.3 K  |
| MW of C7+                                       | 97.90 kg/kmol    | 97.90 lb/lb-mol  | Ppc*                                 | 665.0 psia | 4.59 MPa |
| Density of C7+                                  | 0.7257 g/cc      | 725.7 kg/m3      | Tpc*                                 | 376.6 R    | 209.2 K  |

| Calculated Gross Heating Value @ Standard Conditions |                 |             | Calculated Net Heating Value @ Standard Conditions |                 |             |
|--|-----------------|-------------|--|-----------------|-------------|
| Dry  | 1,151.4 Btu/scf | 42.98 MJ/m3 | Dry  | 1,041.8 Btu/scf | 38.89 MJ/m3 |
| Wet  | 1,131.3 Btu/scf | 42.23 MJ/m3 | Wet  | 1,023.7 Btu/scf | 38.21 MJ/m3 |

Standard Conditions: 60 F (288.7 K) @ 14.696 psia (0.101325 MPa)

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**TABLE C2**  
**MSS GAS COMPOSITION @ 435 psia (3.00 MPa) AND 120.0 F (322.0 K)**

| Component Name    | Chemical Symbol  | Mole Fraction |               | Liquid Volume |                |
|-------------------|------------------|---------------|---------------|---------------|----------------|
|                   |                  | As Analyzed   | Acid Gas Free | STB/MMscf     | mL/m3          |
| Nitrogen          | N <sub>2</sub>   | 0.0333        | 0.0338        |               |                |
| Carbon Dioxide    | CO <sub>2</sub>  | 0.0146        | 0.0000        |               |                |
| Hydrogen Sulphide | H <sub>2</sub> S | 0.0000        | 0.0000        |               |                |
| Methane           | C <sub>1</sub>   | 0.7872        | 0.7989        |               |                |
| Ethane            | C <sub>2</sub>   | 0.0933        | 0.0947        |               |                |
| Propane           | C <sub>3</sub>   | 0.0467        | 0.0473        | 30.470        | 171.075        |
| i-Butane          | i-C <sub>4</sub> | 0.0064        | 0.0065        | 4.944         | 27.758         |
| n-Butane          | n-C <sub>4</sub> | 0.0114        | 0.0116        | 8.546         | 47.981         |
| i-Pentane         | i-C <sub>5</sub> | 0.0025        | 0.0025        | 2.183         | 12.257         |
| n-Pentane         | n-C <sub>5</sub> | 0.0024        | 0.0024        | 2.067         | 11.605         |
| Hexanes           | C <sub>6</sub>   | 0.0017        | 0.0018        | 1.704         | 9.565          |
| Heptanes          | C <sub>7</sub>   | 0.0005        | 0.0005        | 0.510         | 2.861          |
| Octanes           | C <sub>8</sub>   | 0.0000        | 0.0000        | 0.024         | 0.132          |
| Nonanes           | C <sub>9</sub>   | 0.0000        | 0.0000        | 0.000         | 0.000          |
| Decanes           | C <sub>10</sub>  | 0.0000        | 0.0000        | 0.000         | 0.000          |
| Undecane          | C <sub>11</sub>  | 0.0000        | 0.0000        | 0.000         | 0.000          |
| Dodecanes Plus    | C <sub>12+</sub> | 0.0000        | 0.0000        | 0.000         | 0.000          |
| <b>Total</b>      |                  | <b>1.0000</b> | <b>1.0000</b> | <b>50.447</b> | <b>283.235</b> |
| Propanes Plus     | C <sub>3+</sub>  | 0.0716        | 0.0727        | 50.447        | 283.235        |
| Butanes Plus      | C <sub>4+</sub>  | 0.0249        | 0.0253        | 19.977        | 112.159        |
| Pentanes Plus     | C <sub>5+</sub>  | 0.0186        | 0.0188        | 6.487         | 36.421         |

| Calculated Gas Properties @ Standard Conditions |                  |                  | Calculated Pseudocritical Properties |            |          |
|---|------------------|------------------|--------------------------------------|------------|----------|
| Molecular Weight                                | 20.65 kg/kmol    | 20.65 lb/lb-mol  | Ppc                                  | 665.5 psia | 4.59 MPa |
| Specific Gravity                                | 0.7130 (Air = 1) | 0.7130 (Air = 1) | Tpc                                  | 387.6 R    | 215.3 K  |
| MW of C7+                                       | 96.44 kg/kmol    | 96.44 lb/lb-mol  | Ppc*                                 | 661.2 psia | 4.56 MPa |
| Density of C7+                                  | 0.7229 g/cc      | 722.9 kg/m3      | Tpc*                                 | 385.0 R    | 213.9 K  |

| Calculated Gross Heating Value @ Standard Conditions |                 |             | Calculated Net Heating Value @ Standard Conditions |                 |             |
|--|-----------------|-------------|--|-----------------|-------------|
| Dry  | 1,166.2 Btu/scf | 43.53 MJ/m3 | Dry  | 1,056.6 Btu/scf | 39.44 MJ/m3 |
| Wet  | 1,145.9 Btu/scf | 42.77 MJ/m3 | Wet  | 1,038.3 Btu/scf | 38.76 MJ/m3 |

Standard Conditions: 60 F (288.7 K) @ 14.696 psia (0.101325 MPa)

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**TABLE C3  
MULTI-STAGE SEPARATOR GAS COMPOSITION @ 135 psia (0.93 MPa) AND 120.0 F (322.0 K)**

| Component Name    | Chemical Symbol  | Mole Fraction |               | Liquid Volume  |                |
|-------------------|------------------|---------------|---------------|----------------|----------------|
|                   |                  | As Analyzed   | Acid Gas Free | STB/MMscf      | mL/m3          |
| Nitrogen          | N <sub>2</sub>   | 0.0351        | 0.0357        |                |                |
| Carbon Dioxide    | CO <sub>2</sub>  | 0.0172        | 0.0000        |                |                |
| Hydrogen Sulphide | H <sub>2</sub> S | 0.0000        | 0.0000        |                |                |
| Methane           | C <sub>1</sub>   | 0.6218        | 0.6327        |                |                |
| Ethane            | C <sub>2</sub>   | 0.1681        | 0.1711        |                |                |
| Propane           | C <sub>3</sub>   | 0.1027        | 0.1045        | 67.059         | 376.505        |
| i-Butane          | i-C <sub>4</sub> | 0.0145        | 0.0147        | 11.222         | 63.006         |
| n-Butane          | n-C <sub>4</sub> | 0.0258        | 0.0262        | 19.296         | 108.335        |
| i-Pentane         | i-C <sub>5</sub> | 0.0054        | 0.0055        | 4.660          | 26.165         |
| n-Pentane         | n-C <sub>5</sub> | 0.0051        | 0.0052        | 4.392          | 24.659         |
| Hexanes           | C <sub>6</sub>   | 0.0035        | 0.0035        | 3.375          | 18.951         |
| Heptanes          | C <sub>7</sub>   | 0.0009        | 0.0009        | 0.984          | 5.522          |
| Octanes           | C <sub>8</sub>   | 0.0000        | 0.0000        | 0.059          | 0.330          |
| Nonanes           | C <sub>9</sub>   | 0.0000        | 0.0000        | 0.000          | 0.000          |
| Decanes           | C <sub>10</sub>  | 0.0000        | 0.0000        | 0.000          | 0.000          |
| Undecane          | C <sub>11</sub>  | 0.0000        | 0.0000        | 0.000          | 0.000          |
| Dodecanes Plus    | C <sub>12+</sub> | 0.0000        | 0.0000        | 0.000          | 0.000          |
| <b>Total</b>      |                  | <b>1.0000</b> | <b>1.0000</b> | <b>111.047</b> | <b>623.473</b> |
| Propanes Plus     | C <sub>3+</sub>  | 0.1578        | 0.1606        | 111.047        | 623.473        |
| Butanes Plus      | C <sub>4+</sub>  | 0.0551        | 0.0561        | 43.987         | 246.968        |
| Pentanes Plus     | C <sub>5+</sub>  | 0.0407        | 0.0414        | 13.470         | 75.628         |

| Calculated Gas Properties @ Standard Conditions |                  |                  | Calculated Pseudocritical Properties |            |          |
|---|------------------|------------------|--------------------------------------|------------|----------|
| Molecular Weight                                | 24.78 kg/kmol    | 24.78 lb/lb-mol  | Ppc                                  | 662.1 psia | 4.56 MPa |
| Specific Gravity                                | 0.8556 (Air = 1) | 0.8556 (Air = 1) | Tpc                                  | 434.7 R    | 241.5 K  |
| MW of C7+                                       | 96.56 kg/kmol    | 96.56 lb/lbmol   | Ppc*                                 | 657.6 psia | 4.53 MPa |
| Density of C7+                                  | 0.7232 g/cc      | 723.2 kg/m3      | Tpc*                                 | 431.8 R    | 239.9 K  |

| Calculated Gross Heating Value @ Standard Conditions |                 |             | Calculated Net Heating Value @ Standard Conditions |                 |             |
|--|-----------------|-------------|--|-----------------|-------------|
| Dry  | 1,378.7 Btu/scf | 51.46 MJ/m3 | Dry  | 1,255.1 Btu/scf | 46.85 MJ/m3 |
| Wet  | 1,354.7 Btu/scf | 50.57 MJ/m3 | Wet  | 1,233.3 Btu/scf | 46.03 MJ/m3 |

Standard Conditions: 60 F (288.7 K) @ 14.696 psia (0.101325 MPa)

WTC-10-001812 - BP - - - - - BOTTOMHOLE FLUID

**TABLE C4**  
**MULTI-STAGE SEPARATOR GAS COMPOSITION @ 15 psia (0.10 MPa) AND 66.0 F (292.0 K)**

| Component Name    | Chemical Symbol  | Mole Fraction |               | Liquid Volume  |                 |
|-------------------|------------------|---------------|---------------|----------------|-----------------|
|                   |                  | As Analyzed   | Acid Gas Free | STB/MMscf      | mL/m3           |
| Nitrogen          | N <sub>2</sub>   | 0.0359        | 0.0363        |                |                 |
| Carbon Dioxide    | CO <sub>2</sub>  | 0.0107        | 0.0000        |                |                 |
| Hydrogen Sulphide | H <sub>2</sub> S | 0.0000        | 0.0000        |                |                 |
| Methane           | C <sub>1</sub>   | 0.1944        | 0.1965        |                |                 |
| Ethane            | C <sub>2</sub>   | 0.2267        | 0.2291        |                |                 |
| Propane           | C <sub>3</sub>   | 0.2900        | 0.2931        | 189.375        | 1063.247        |
| i-Butane          | i-C <sub>4</sub> | 0.0567        | 0.0573        | 44.017         | 247.131         |
| n-Butane          | n-C <sub>4</sub> | 0.1124        | 0.1137        | 84.122         | 472.302         |
| i-Pentane         | i-C <sub>5</sub> | 0.0265        | 0.0268        | 23.048         | 129.406         |
| n-Pentane         | n-C <sub>5</sub> | 0.0257        | 0.0260        | 22.082         | 123.977         |
| Hexanes           | C <sub>6</sub>   | 0.0177        | 0.0179        | 17.237         | 96.779          |
| Heptanes          | C <sub>7</sub>   | 0.0028        | 0.0029        | 3.108          | 17.448          |
| Octanes           | C <sub>8</sub>   | 0.0005        | 0.0005        | 0.577          | 3.239           |
| Nonanes           | C <sub>9</sub>   | 0.0000        | 0.0000        | 0.000          | 0.000           |
| Decanes           | C <sub>10</sub>  | 0.0000        | 0.0000        | 0.000          | 0.000           |
| Undecane          | C <sub>11</sub>  | 0.0000        | 0.0000        | 0.000          | 0.000           |
| Dodecanes Plus    | C <sub>12+</sub> | 0.0000        | 0.0000        | 0.000          | 0.000           |
| <b>Total</b>      |                  | <b>1.0000</b> | <b>1.0000</b> | <b>383.565</b> | <b>2153.529</b> |
| Propanes Plus     | C <sub>3+</sub>  | 0.5323        | 0.5381        | 383.565        | 2153.529        |
| Butanes Plus      | C <sub>4+</sub>  | 0.2423        | 0.2450        | 194.190        | 1090.282        |
| Pentanes Plus     | C <sub>5+</sub>  | 0.1856        | 0.1876        | 66.052         | 370.848         |

| Calculated Gas Properties @ Standard Conditions |                  |                  | Calculated Pseudocritical Properties |            |          |
|---|------------------|------------------|--------------------------------------|------------|----------|
| Molecular Weight                                | 39.64 kg/kmol    | 39.64 lb/lb-mol  | Ppc                                  | 624.6 psia | 4.31 MPa |
| Specific Gravity                                | 1.3687 (Air = 1) | 1.3687 (Air = 1) | Tpc                                  | 589.2 R    | 327.3 K  |
| MW of C7+                                       | 97.58 kg/kmol    | 97.58 lb/lb-mol  | Ppc*                                 | 622.6 psia | 4.29 MPa |
| Density of C7+                                  | 0.7253 g/cc      | 725.3 kg/m3      | Tpc*                                 | 587.2 R    | 326.2 K  |

| Calculated Gross Heating Value @ Standard Conditions |                 |             | Calculated Net Heating Value @ Standard Conditions |                 |             |
|--|-----------------|-------------|--|-----------------|-------------|
| Dry  | 2,190.3 Btu/scf | 81.76 MJ/m3 | Dry  | 2,012.2 Btu/scf | 75.11 MJ/m3 |
| Wet  | 2,152.2 Btu/scf | 80.33 MJ/m3 | Wet  | 1,977.2 Btu/scf | 73.80 MJ/m3 |

Standard Conditions: 60 F (288.7 K) @ 14.696 psia (0.101325 MPa)