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**Sent:** Friday, June 11, 2010 11:38 AM  
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**Subject:** CCE and Viscosity Data  
**Attach:** WTC-10-001812 BP CCE Visc Tables 061110.xls

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Yun,

The CCE and Viscosity Data at 243 F are attached. The only test remaining is the viscosity study at 100 F

Please let me know if you have any questions

Regards,

Edmond

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DW 0007085

TREX 010422.0001

TREX-010422.0001

## ATTACHMENT INFO

Name: WTC-10-001812 BP CCE Visc Tables  
061110.xls

Comments: THIS FILE WAS PRODUCED IN NATIVE  
FORMAT

## ATTACHMENT INFO

DW 0007086

TREX 010422.0002

TREX-010422.0002

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	
Solvent Gas	CO2	
Sampling Company:	.	
Name of Sampler:	.	
Sampling Date:	.	
Sampling Point:	BOTTOMHOLE	
Sampling Temperature:	243.0 F	390.4 K
Sampling Pressure:	13500.0 psia	93.08 MPa
Reservoir Temperature:	243.0 F	390.4 K
Reservoir Pressure:	13500.0 psia	93.08 MPa

**TABLE 1**  
**COMPOSITIONAL ANALYSIS OF RESERVOIR FLUID**

Component Name	Chemical Symbol	Mole Fraction	Mass Fraction	Calculated Properties	
Nitrogen	N <sub>2</sub>	0.0049	0.0026	Total Sample	
Carbon Dioxide	CO <sub>2</sub>	0.0092	0.0076	Molecular Weight	53.45
Hydrogen Sulphide	H <sub>2</sub> S	0.0000	0.0000		
Methane	C <sub>1</sub>	0.6485	0.1947		
Ethane	C <sub>2</sub>	0.0639	0.0360		
Propane	C <sub>3</sub>	0.0459	0.0379	C <sub>7+</sub> Fraction	
i-Butane	i-C <sub>4</sub>	0.0094	0.0102	Molecular Weight	213.92
n-Butane	n-C <sub>4</sub>	0.0215	0.0234		
i-Pentane	i-C <sub>5</sub>	0.0088	0.0119		
n-Pentane	n-C <sub>5</sub>	0.0110	0.0149		
Hexanes	C <sub>6</sub>	0.0195	0.0315	Molecular Weight	311.12
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		
Decanes	C <sub>10</sub>	0.0119	0.0316	Mole Fraction	0.0778
Undecanes	C <sub>11</sub>	0.0093	0.0256	Density (g/cc)	0.8921
Dodecanes	C <sub>12</sub>	0.0076	0.0229	C <sub>30+</sub> Fraction	
Tridecanes	C <sub>13</sub>	0.0075	0.0247	Molecular Weight	592.42
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		
Heptadecanes	C <sub>17</sub>	0.0042	0.0185	Mole Fraction	0.0156
Octadecanes	C <sub>18</sub>	0.0039	0.0183	Density (g/cc)	0.9708
Nonadecanes	C <sub>19</sub>	0.0035	0.0174	C <sub>36+</sub> Fraction	
Eicosanes	C <sub>20</sub>	0.0028	0.0145	Molecular Weight	662.30
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	0.0112	Mole Fraction	0.0105
Pentacosanes	C <sub>25</sub>	0.0017	0.0108	Density (g/cc)	0.9926
Hexacosanes	C <sub>26</sub>	0.0015	0.0099	C <sub>36+</sub> Fraction	
Heptacosanes	C <sub>27</sub>	0.0014	0.0098	Molecular Weight	662.30
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	Mole Fraction	0.0105
Dotriacontanes	C <sub>32</sub>	0.0009	0.0072	Density (g/cc)	0.9926
Tritriacontanes	C <sub>33</sub>	0.0008	0.0066	C <sub>36+</sub> Fraction	
Tetratriacontanes	C <sub>34</sub>	0.0008	0.0066	Molecular Weight	662.30
Pentatriacontanes	C <sub>35</sub>	0.0006	0.0059		
Hexatriacontanes plus	C <sub>36+</sub>	0.0105	0.1304		
		1.0000	1.0000		



TABLE 2  
AVERAGE FLUID COMPRESSIBILITIES @ 243.0 F (390.4 K) WITH MIXER

Pressure Range		Average Fluid Compressibility (psi <sup>-1</sup> )
From (psia)	To (psia)	
13500	12500	1.2284E-05
12500	11500	1.2789E-05
11500	10500	1.3753E-05
10500	9500	1.5323E-05
9500	8500	1.7331E-05
8500	7500	2.0654E-05
<b>7500</b>	<b>6438 Psat</b>	<b>2.6101E-05</b>

Pressure Range		Average Fluid Compressibility (MPa <sup>-1</sup> )
From (MPa)	To (MPa)	
93.08	86.18	1.7816E-03
86.18	79.29	1.8550E-03
79.29	72.39	1.9947E-03
72.39	65.50	2.2225E-03
65.50	58.61	2.5137E-03
58.61	51.71	2.9957E-03
<b>51.71</b>	<b>44.39 Psat</b>	<b>3.7857E-03</b>

Psat - Saturation Pressure

TABLE 3  
CONSTANT COMPOSITION EXPANSION @ 243.0 F (390.4 K) WITH MIXER

Pressure (psia)      (MPa)		Relative Volume [1]	Y-Function [2]	Liquid Volume (% of Vtot)	Fluid Density (g/cc)
13500	93.08	0.886046			0.6017
12500	86.18	0.897065			0.5943
11500	79.29	0.908687			0.5867
10500	72.39	0.921358			0.5787
9500	65.50	0.935696			0.5698
8500	58.61	0.952199			0.5599
7500	51.71	0.972281			0.5484
<b>6438 *</b>	<b>44.39</b>	<b>1.000000</b>		<b>100.00</b>	<b>0.5332</b>
6378	43.98	1.002437	3.8373	86.50	
6299	43.43	1.005779	3.8117	74.51	
6230	42.96	1.008803	3.7894	70.01	
6155	42.44	1.012208	3.7652	68.68	
6141	42.34	1.012860	3.7606	68.67	
5844	40.29	1.027735	3.6647	66.27	
5547	38.25	1.045009	3.5688	64.25	
5250	36.20	1.065157	3.4729	62.52	
4953 **	34.15	1.088782	3.3770	60.48	
4656 **	32.10	1.116648	3.2811	58.81	
4359 **	30.05	1.149738	3.1852	57.08	
4062 **	28.01	1.189343	3.0893	55.03	
3765 **	25.96	1.237177	2.9934	52.87	
3468 **	23.91	1.295569	2.8975	50.09	
3171 **	21.86	1.367750	2.8016	47.17	
2874 **	19.82	1.458330	2.7057	43.55	
2577 **	17.77	1.574099	2.6098	40.12	
2280 **	15.72	1.725457	2.5138	36.03	
1983 **	13.67	1.929138	2.4179	31.75	
[1] Volume at indicated pressure per volume at saturation pressure					
[2] Y Function = ((Psat-P)/P)/(Relative Volume - 1)					
* Saturation Pressure					
** Asphaltenes Precipitation					

**TABLE 4**  
**AVERAGE FLUID COMPRESSIBILITIES @ 243.0 F (390.4 K) WITHOUT MIXER**

Pressure Range		Average Fluid Compressibility
From (psia)	To (psia)	(psi <sup>-1</sup> )
13500	12500	1.3071E-05
12500	11500	1.3339E-05
11500	10500	1.4003E-05
10500	9500	1.5571E-05
9500	8500	1.8090E-05
8500	7500	2.2475E-05
<b>7500</b>	<b>6362 Psat</b>	<b>2.6983E-05</b>

Pressure Range		Average Fluid Compressibility
From (MPa)	To (MPa)	(MPa <sup>-1</sup> )
93.08	86.18	1.8958E-03
86.18	79.29	1.9346E-03
79.29	72.39	2.0309E-03
72.39	65.50	2.2584E-03
65.50	58.61	2.6238E-03
58.61	51.71	3.2597E-03
<b>51.71</b>	<b>43.86 Psat</b>	<b>3.9135E-03</b>

Psat - Saturation Pressure



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**TABLE 5**  
**CONSTANT COMPOSITION EXPANSION @ 243.0 F (390.4 K) WITHOUT MIXER**

Pressure		Relative Volume	Y-Function	Liquid Volume	Fluid Density
(psia)	(MPa)	[1]	[2]	(% of Vtot)	(g/cc)
13500	93.08	0.879364			0.6017
12500	86.18	0.891010			0.5943
11500	79.29	0.903056			0.5867
10500	72.39	0.915881			0.5787
9500	65.50	0.930368			0.5698
8500	58.61	0.947509			0.5599
7500	51.71	0.969293			0.5484
<b>6362 *</b>	<b>43.86</b>	<b>1.000000</b>		<b>100.00</b>	<b>0.5332</b>
6206	42.79	1.006580	3.8200	80.41	
6050	41.71	1.013719	3.7591	73.12	
5894	40.64	1.021470	3.6982	67.93	
5738	39.56	1.029898	3.6373	65.62	
5582	38.49	1.039071	3.5764	64.18	
5426	37.41	1.049069	3.5155	62.30	
5270	36.34	1.059981	3.4546	60.63	
5114	35.26	1.071908	3.3937	59.49	
4958	34.18	1.084966	3.3328	58.31	
4802	33.11	1.099288	3.2719	57.07	
4646	32.03	1.115026	3.2110	55.94	
4490	30.96	1.132352	3.1501	54.71	
4334	29.88	1.151471	3.0892	54.10	
4178	28.81	1.172616	3.0283	52.69	
4022	27.73	1.196062	2.9674	51.80	
[1] Volume at indicated pressure per volume at saturation pressure					
[2] Y Function = ((Psat-P)/P)/(Relative Volume - 1)					
* Saturation Pressure					



TABLE 6  
AVERAGE FLUID COMPRESSIBILITIES @ 100.0 F (310.9 K) WITH MIXER

Pressure Range		Average Fluid Compressibility (psi <sup>-1</sup> )
From (psia)	To (psia)	
13500	12500	1.1633E-05
12500	11500	1.1713E-05
11500	10500	1.1926E-05
10500	9500	1.2280E-05
9500	8500	1.3034E-05
8500	7500	1.5077E-05
<b>7500</b>	<b>6107 Psat</b>	<b>1.9269E-05</b>

Pressure Range		Average Fluid Compressibility (MPa <sup>-1</sup> )
From (MPa)	To (MPa)	
93.08	86.18	1.6872E-03
86.18	79.29	1.6988E-03
79.29	72.39	1.7297E-03
72.39	65.50	1.7810E-03
65.50	58.61	1.8905E-03
58.61	51.71	2.1867E-03
<b>51.71</b>	<b>42.11 Psat</b>	<b>2.7947E-03</b>

Psat - Saturation Pressure

**TABLE 7**  
**CONSTANT COMPOSITION EXPANSION @ 243.0 F (390.4 K) WITH MIXER**

Pressure		Relative Volume	Y-Function	Liquid Volume	Fluid Density
(psia)	(MPa)	[1]	[2]	(% of V <sub>tot</sub> )	(g/cc)
13500	93.08	0.901806			
12500	86.18	0.912420			
11500	79.29	0.923233			
10500	72.39	0.934376			
9500	65.50	0.945993			
8500	58.61	0.958486			
7500	51.71	0.973158			
<b>6107 *</b>	<b>42.11</b>	<b>1.000000</b>		<b>100.00</b>	
5835	40.23	1.006891	6.7647	71.16	
5563	38.36	1.014929	6.5504	67.26	
5291	36.48	1.024340	6.3361	65.33	
5019	34.60	1.035410	6.1218	63.60	
4747	32.73	1.048497	5.9075	61.85	
4475	30.85	1.064057	5.6932	60.54	
4203	28.98	1.082682	5.4790	58.87	
3931	27.10	1.105144	5.2647	57.13	
3659	25.23	1.132473	5.0504	55.37	
3387	23.35	1.166059	4.8361	53.15	
3115	21.48	1.207824	4.6218	51.07	
2843	19.60	1.260485	4.4075	48.43	
2571	17.73	1.327994	4.1932	46.08	
2299	15.85	1.416290	3.9789	42.76	
2027	13.98	1.534673	3.7646	39.28	
[1] Volume at indicated pressure per volume at saturation pressure					
[2] Y Function = ((P <sub>sat</sub> -P)/P)/(Relative Volume - 1)					
* Saturation Pressure					

TABLE 8  
DIFFERENTIAL LIBERATION FLUID VISCOSITY @ 243.0 F (390.4 K) WITH MIXER

Pressure		Oil Viscosity (cp=mPa.s)
(psia)	(MPa)	
14000	96.53	0.284
13000	89.63	0.273
11000	75.84	0.253
9000	62.05	0.230
8000	55.16	0.219
7000	48.26	0.209
<b>6438 Psat</b>	<b>44.39</b>	<b>0.202</b>
6000	41.37	0.240
5500	37.92	0.289
5000	34.47	0.334
4000	27.58	0.404
3000	20.68	0.487
2000	13.79	0.605
15	0.10	1.527
Psat - Saturation Pressure		