

COMMISSION

OIL CONSERVATION

CASE NUMBER

Clear

EXHIBIT

19

Equations by Starling-Carnahan (Dake book, pp19-20). Wichert-Aziz correction for sour gases applied (accurate for 150-7000 psia, CO2<54.4% and H2S<73.8%. See O&G Journal 10/18/93 pg. 52. Do not use initial pressures < 1500 psia. Required Input: Standard conditions, initial reservoir temp and pressure, and gas gravity OR gas composition (mole %). Mole percentage of C1 to C5+ also required for any Heating Value calculation. Current version of this worksheet does not allow for metric units.

Field:	Well:		
Input Data		Input Data	Computed Data
Gas grav, Gg (air=1) =	0.718	%C1 = 80.613	ghc (air=1) = 0.7107
Cond? (Yes=1,No=0)	0	%C2 = 10.249	ghc, degR = 392.6692
Metric? (Yes=1,No=0)	0	%C3 = 4.611	Ppch,psia = 668.7188
Reservoir Temperature =	186	%iC4 = 0.642	Tpc,degR = 392.2080
Reservoir Pressure =	6300	%nC4 = 1.325	Ppc, psia = 669.7349
Standard Pressure =	14.7	%C5+ = 1.057	CWA = 1.2272
Standard Temperature =	60	% N2 = 0.876	Tpc*, degR = 390.9808
		% CO2 = 0.635	Ppc*,psia = 667.6393
Computed Data		% H2S = 0.000	Init. Ppr = 9.4362
Res Temp, deg. F	186.0	Total %	100.008
Res Pr, psia	6300.0	Calc'd Gg	0.7224
			Tpr = 1.6523
			t=1/Tpr = 0.6052

WARNING: Z factor accurate for 0.2<Ppr<24.0 & 1.15<Tpr<3.0
Gas viscosity accurate for 100-8000 psi, 100-340 degF, 0.9<CO2 mole %<3.2.

Pr, psia	Ppr	Y	df/dY	Yk+1	Init. Y	Z	Eg SCF/cu.ft.	Gas Den. gm/cc	Gas Visc cp.	Cr=CgPpc	Cg	Bg (cu.ft./SCF)	Bg (bbls/SCF)
6300	9.4362	0.00E+00	2.34090	0.26458	0.26458	1.09661	314.6	0.273467	0.031946	0.049881	7.471E-05	0.003179	0.000566
6100	9.1367	0.00E+00	2.24128	0.26056	0.26056	1.07819	309.8	0.269311	0.031358	0.052935	7.929E-05	0.003228	0.000575
5900	8.8371	0.00E+00	2.14268	0.25636	0.25636	1.05993	304.8	0.264967	0.030759	0.056317	8.435E-05	0.003281	0.000584
5700	8.5375	0.00E+00	2.04523	0.25196	0.25196	1.04188	299.6	0.260419	0.030148	0.060076	8.998E-05	0.003338	0.000595
5500	8.2380	-1.25E-16	1.94907	0.24734	0.24734	1.02408	294.1	0.255651	0.029524	0.064268	9.626E-05	0.003400	0.000606
5300	7.9384	2.50E-16	1.85435	0.24250	0.24250	1.00655	288.3	0.250644	0.028887	0.068961	0.0001033	0.003468	0.000618
5100	7.6389	0.00E+00	1.76127	0.23740	0.23740	0.98936	282.3	0.245376	0.028236	0.074235	0.0001112	0.003543	0.000631
4900	7.3393	0.00E+00	1.67004	0.23203	0.23203	0.97257	275.9	0.239825	0.027571	0.080184	0.0001201	0.003625	0.000646
4700	7.0397	-1.11E-16	1.58091	0.22636	0.22636	0.95623	269.1	0.233966	0.026892	0.086921	0.0001302	0.003715	0.000662
4500	6.7402	0.00E+00	1.49417	0.22037	0.22037	0.94044	262.0	0.227772	0.026198	0.094577	0.0001417	0.003816	0.000680
4300	6.4406	8.33E-17	1.41014	0.21402	0.21402	0.92529	254.5	0.221213	0.025491	0.103307	0.0001547	0.003930	0.000700
4100	6.1410	0.00E+00	1.32922	0.20730	0.20730	0.91088	246.5	0.214259	0.024769	0.113291	0.0001697	0.004057	0.000723
3900	5.8415	-2.01E-16	1.25183	0.20015	0.20015	0.89736	238.0	0.206878	0.024033	0.124736	0.0001868	0.004202	0.000748
3700	5.5419	-5.55E-17	1.17846	0.19257	0.19257	0.88488	229.0	0.199038	0.023286	0.137876	0.0002065	0.004367	0.000778
3500	5.2424	0.00E+00	1.10964	0.18451	0.18451	0.87359	219.4	0.190711	0.022528	0.152970	0.0002291	0.004558	0.000812
3300	4.9428	9.71E-17	1.04598	0.17596	0.17596	0.86371	209.2	0.181872	0.021763	0.168643	0.0002526	0.004780	0.000851
3200	4.7930	0.00E+00	1.01627	0.17149	0.17149	0.85935	203.9	0.177255	0.021379	0.178119	0.0002668	0.004904	0.000874
3100	4.6432	0.00E+00	0.98809	0.16690	0.16690	0.85542	198.4	0.172504	0.020994	0.188264	0.000282	0.005039	0.000898
3000	4.4934	0.00E+00	0.96151	0.16217	0.16217	0.85195	192.8	0.167620	0.020609	0.199116	0.0002982	0.005186	0.000924
2900	4.3437	-1.04E-16	0.93661	0.15732	0.15732	0.84896	187.1	0.162603	0.020226	0.210715	0.0003156	0.005346	0.000952
2800	4.1939	0.00E+00	0.91346	0.15234	0.15234	0.84648	181.1	0.157456	0.019844	0.223103	0.0003342	0.005521	0.000983
2700	4.0441	8.67E-17	0.89213	0.14724	0.14724	0.84453	175.1	0.152183	0.019464	0.236323	0.000354	0.005712	0.001017
2600	3.8943	0.00E+00	0.87270	0.14202	0.14202	0.84315	168.9	0.146787	0.019088	0.250419	0.0003751	0.005922	0.001055
2500	3.7445	0.00E+00	0.85520	0.13668	0.13668	0.84235	162.5	0.141276	0.018716	0.265443	0.0003976	0.006153	0.001096
2400	3.5948	-4.86E-17	0.83970	0.13125	0.13125	0.84214	156.1	0.135658	0.018350	0.281452	0.0004216	0.006408	0.001141
2300	3.4450	5.64E-17	0.82622	0.12572	0.12572	0.84255	149.5	0.129942	0.017989	0.298516	0.0004471	0.006690	0.001192
2200	3.2952	-1.99E-17	0.81478	0.12010	0.12010	0.84359	142.8	0.124139	0.017636	0.316719	0.0004744	0.007003	0.001247
2100	3.1454	-4.51E-17	0.80541	0.11442	0.11442	0.84527	136.0	0.118261	0.017292	0.336171	0.0005035	0.007351	0.001309
2000	2.9956	0.00E+00	0.79809	0.10867	0.10867	0.84758	129.2	0.112323	0.016956	0.357010	0.0005347	0.007739	0.001378
1900	2.8458	-4.47E-17	0.79280	0.10288	0.10288	0.85052	122.3	0.106337	0.016631	0.379417	0.0005683	0.008175	0.001456
1800	2.6961	4.34E-18	0.78953	0.09706	0.09706	0.85409	115.4	0.100320	0.016316	0.403624	0.0006046	0.008665	0.001543
1700	2.5463	3.64E-17	0.78822	0.09122	0.09122	0.85828	108.5	0.094284	0.016013	0.429936	0.000644	0.009220	0.001642
1600	2.3965	-3.04E-18	0.78883	0.08538	0.08538	0.86306	101.5	0.088246	0.015722	0.458747	0.0006871	0.009851	0.001755
1500	2.2467	0.00E+00	0.79130	0.07955	0.07955	0.86842	94.6	0.082220	0.015444	0.490577	0.0007348	0.010573	0.001883
1400	2.0969	3.40E-17	0.79555	0.07374	0.07374	0.87434	87.7	0.076220	0.015178	0.526103	0.000788	0.011405	0.002031
1300	1.9472	3.14E-18	0.80151	0.06797	0.06797	0.88078	80.8	0.070257	0.014926	0.566231	0.0008481	0.012373	0.002204
1200	1.7974	-8.67E-19	0.80911	0.06225	0.06225	0.88773	74.0	0.064346	0.014687	0.612174	0.0009169	0.013510	0.002406
1100	1.6476	-2.61E-17	0.81826	0.05659	0.05659	0.89515	67.3	0.058494	0.014462	0.665600	0.0009969	0.014861	0.002647
1000	1.4978	1.34E-17	0.82888	0.05100	0.05100	0.90302	60.6	0.052714	0.014250	0.728846	0.0010917	0.016491	0.002937
900	1.3480	4.04E-18	0.84090	0.04548	0.04548	0.91129	54.1	0.047011	0.014052	0.805294	0.0012062	0.018491	0.003294
800	1.1983	2.62E-18	0.85424	0.04005	0.04005	0.91996	47.6	0.041394	0.013868	0.900014	0.0013481	0.021000	0.003741
700	1.0485	-2.05E-18	0.86882	0.03470	0.03470	0.92898	41.3	0.035868	0.013697	1.020967	0.0015292	0.024236	0.004317
600	0.8987	-9.26E-18	0.88456	0.02945	0.02945	0.93833	35.0	0.030438	0.013540	1.181418	0.0017695	0.028559	0.005087
500	0.7489	-3.18E-19	0.90140	0.02429	0.02429	0.94798	28.9	0.025107	0.013397	1.404759	0.0021041	0.034624	0.006167
450	0.6740	7.54E-19	0.91022	0.02175	0.02175	0.95291	25.9	0.022479	0.013331	1.553700	0.0023272	0.038671	0.006888
400	0.5991	-1.06E-18	0.91928	0.01923	0.01923	0.95791	22.9	0.019877	0.013268	1.739681	0.0026057	0.043733	0.007790
350	0.5242	-1.19E-18	0.92859	0.01674	0.01674	0.96298	19.9	0.017301	0.013209	1.978601	0.0029636	0.050245	0.008950
300	0.4493	1.28E-19	0.93813	0.01427	0.01427	0.96810	17.0	0.014751	0.013154	2.296957	0.0034404	0.058931	0.010497
250	0.3745	-2.62E-18	0.94791	0.01183	0.01183	0.97329	14.1	0.012227	0.013103	2.742440	0.0041077	0.071096	0.012664
200	0.2996	-1.75E-19	0.95790	0.00941	0.00941	0.97853	11.2	0.009729	0.013056	3.410429	0.0051082	0.089349	0.015915
150	0.2247	-1.44E-19	0.96811	0.00702	0.00702	0.98382	8.3	0.007258	0.013014	4.523472	0.0067753	0.119776	0.021334
100	0.1498	3.11E-19	0.97854	0.00466	0.00466	0.98916	5.5	0.004812	0.012977	6.748917	0.0101086	0.180640	0.032175
95	0.1423	-5.80E-20	0.97959	0.00442	0.00442	0.98970	5.3	0.004569	0.012973	7.100333	0.010635	0.190251	0.033887
90	0.1348	2.07E-19	0.98065	0.00419	0.00419	0.99024	5.0	0.004326	0.012970	7.490792	0.0112198	0.200930	0.035789
85	0.1273	2.98E-20	0.98171	0.00395	0.00395	0.99078	4.7	0.004084	0.012967	7.927184	0.0118735	0.212865	0.037915
80	0.1198	-7.31E-20	0.98277	0.00372	0.00372	0.99132	4.4	0.003841	0.012964	8.418122	0.0126088	0.226292	0.040307
75	0.1123	-1.33E-19	0.98383	0.00348	0.00348	0.99185	4.1	0.003599	0.012961	8.974514	0.0134422	0.241509	0.043017
70	0.1048	7.81E-20	0.98489	0.00325	0.00325	0.99239	3.9	0.003358	0.012958	9.610386	0.0143946	0.258900	0.046115
65	0.0974	-2.85E-20	0.98596	0.00301	0.00301	0.99293	3.6	0.003116	0.012955	10.344081	0.0154935	0.278968	0.049689
60	0.0899	1.93E-19	0.98703	0.00278	0.00278	0.99348	3.3	0.002875	0.012952	11.200054	0.0167756	0.302379	0.053860
55	0.0824	1.78E-19	0.98810	0.00255	0.00255	0.99402	3.0	0.002634	0.012949	12.211875	0.0182911	0.330048	0.058788
15	0.0225	5.74E-21	0.99673	0.00069	0.00069	0.99836	0.8	0.000715	0.012931	0.000000	0	1.215468	0.216498

Note: Last pressure included so that Cr and Cg values are not zero. It is not plotted.

