

**Retrograde Gas PVT Fluid Study**  
**for**

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July 17, 2008

Test Type: Retrograde Gas PVT Fluid Study

Dear Mr. :

The attached report contains results from a laboratory study performed on the recombined separator fluids from the subject well. The study determined the type and character of the reservoir fluid. The fluid study was performed using first-stage separator gas and oil samples obtained from the well on June 26, 2008 by FESCO, Ltd. FESCO then delivered the separator samples to its PVT laboratory in Alice, Texas. Extended compositional analyses were performed on the separator gas (C<sub>11+</sub>) and on the separator oil (C<sub>31+</sub>) samples. Tables 1-A through 1-C list the compositional analyses of the separator gas, separator oil and mathematically recombined wellstream fluid through C<sub>7+</sub>, C<sub>11+</sub> and C<sub>31+</sub>, respectively. The Appendix contains the ASTM D-86 distillation conducted on the stock tank oil. Table 2 reports the fluid properties measured as the separator oil was flashed from separator conditions to ambient laboratory conditions.

The separator gas and oil were physically recombined in a visual PVT cell at the reservoir temperature of 263 °F and at the reported gas-oil ratio of 3436 Scf/Sep Bbl (4320 Scf/STB). The recombined fluid was evaluated during a Constant Composition Expansion (CCE) process at pressures ranging from 11000 to 938 psig. The resulting CCE data is reported in Table 3. ***A retrograde dew point was observed at 5535 psig.*** The static reservoir pressure is higher than the observed retrograde dew point pressure. Therefore, the reservoir fluid exists as undersaturated (single-phase) gas at static reservoir conditions of 10440 psig and 263 °F. Figures 1 through 7

July 17, 2008

illustrate the data reported in Table 3.

A constant volume depletion (CVD) study was performed on the reservoir fluid to model wellstream production below the dew point. A CVD study consists of a series of expansions and constant pressure displacements terminating at the original saturated reservoir (dew point) volume. Table 4 provides the displaced wellstream volume and compositional analysis measured at each depletion pressure. The abandonment CVD residual oil composition is reported in the Appendix. Figures 8 and 10 illustrate the gas deviation factors (equilibrium gas and 2-phase) and cumulative produced wellstream volume, respectively, versus pressure as reported in Table 4. Figure 9 shows the corresponding P/Z (equilibrium gas and 2-phase) versus cumulative produced wellstream percent. Figure 11 presents the C<sub>3+</sub>, C<sub>4+</sub> and C<sub>5+</sub> GPM content of the wellstream gas at each depletion pressure.

The cumulative stock tank oil and sales gas recoveries using normal-temperature three-stage separation were calculated from the produced wellstream volumes and their corresponding compositions. The plant liquid products produced during the three-stage separation were also calculated. The total plant products in the wellstream were then determined. The results are shown in Table 5. All recoveries are based on one MMscf of original reservoir fluid at the retrograde dew point and 100 percent plant efficiency.

Table 6 contains the cumulative retrograde liquid volume that condensed during the CVD process at reservoir temperature (263 °F). The maximum observed volume of condensed retrograde liquid was 23.832 percent of the hydrocarbon pore space at 2500 psig. Figures 12 and 13 illustrate the condensed retrograde liquid volume reported in Table 6 versus pressure.

Thank you for this opportunity to serve . Please call me if you have any questions or concerns regarding this report.

Sincerely,

FESCO, Ltd.

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Armando Ramirez  
Natural Gas Engineer  
Alice, Texas

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Eddie Bickham, P. E.  
Vice - President  
Alice, Texas



## WELL SUMMARY

### WELL INFORMATION

### RESERVOIR INFORMATION

Reservoir Temperature:	263 °F
Static Reservoir Pressure:	10440 psig
Flowing Reservoir Pressure:	Unavailable

### SAMPLE INFORMATION

Sampling Date:	6/26/2008
Sampled By:	FESCO, Ltd. - Beaumont, TX
Sample Type:	1st-Stage Separator Gas and Oil
Flowing Tubing Pressure:	6895 psig
1st Stage Separator Pressure:	650 psig
1st Stage Separator Temperature:	94 °F
2nd Stage Separator Pressure:	76 psig
2nd Stage Separator Temperature:	80 °F
3rd Stage Separator Pressure:	30 psig
3rd Stage Separator Temperature:	120 °F

### PRODUCTION INFORMATION

Test Date:	6/26/2008
1st Stage Separator Gas Rate:	1901 Mcf/d
Stock Tank Oil Rate:	440.00 STB/d
Water Rate:	1.67 STB/d
Stock Tank Gas-Oil Ratio:	4320 Scf 1st Stage Gas / STB
Separator Gas-Oil Ratio:	3436 Scf 1st Stage Gas / Sep Bbl
Separator Oil Volume Factor:	1.25731 Sep Oil Vol / STO Vol



**RESULTS SUMMARY**

Type of Test:	Retrograde Gas PVT Fluid Study
Reservoir Fluid Type:	Undersaturated Gas
Saturation Conditions:	
Pressure (Retrograde Dew Point):	5535 psig
Temperature:	263 °F
Gas Deviation Factor (Z):	1.08234
Gas Expansion Factor:	1.39792 Mscf/Bbl
Reservoir Conditions:	
Pressure:	10440 psig
Temperature:	263 °F
Gas Deviation Factor (Z):	1.70691
Gas Expansion Factor:	1.67193 Mscf/Bbl
Report Date:	7/17/2008



SAMPLE SUMMARY			
Sample Date:	06/26/08		
<b>Separator Conditions</b>			
Pressure:	650 psig		
Temperature:	94 °F		
<b>Laboratory Quality Test</b>			
Separator Gas:	Pressure	Temperature	
Cylinder ID No. T-1930*	600 psig	77 °F	
Cylinder ID No. T-1923	600 psig	77 °F	
Separator Liquid:	BP Pressure	Temperature	
Cylinder ID No. W-209*	595 psig	77 °F	
Cylinder ID No. W-357	594 psig	77 °F	
Report Date:	7/17/2008		
* Samples used in fluid study			

## TABLE 1-A

### COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C<sub>7+</sub>

SEPARATOR GOR.....: 3436 Scf/Sep Bbl

SEPARATOR PRESSURE.....: 650 psig

SEPARATOR TEMPERATURE.....: 94 °F

Component	SEPARATOR GAS		SEPARATOR OIL		WELLSTREAM	
	Mole%	* GPM	Mole %	Liquid Volume %	Mole %	* GPM
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.000	0.000
Nitrogen	0.484	0.000	0.072	0.018	0.393	0.000
Carbon Dioxide	2.037	0.000	0.847	0.331	1.776	0.000
Methane	82.531	0.000	17.472	6.788	68.250	0.000
Ethane	7.266	1.933	6.165	3.779	7.024	1.868
Propane	5.155	1.411	11.852	7.476	6.625	1.813
Iso-butane	0.779	0.253	3.689	2.765	1.418	0.461
N-butane	1.047	0.328	6.843	4.942	2.319	0.727
2-2 Dimethylpropane	0.000	0.000	0.066	0.058	0.014	0.006
Iso-pentane	0.228	0.083	3.026	2.538	0.842	0.306
N-pentane	0.187	0.067	3.169	2.631	0.842	0.303
2-2 Dimethylbutane	0.004	0.002	0.087	0.083	0.022	0.009
Cyclopentane	0.022	0.006	0.000	0.000	0.017	0.005
2-3 Dimethylbutane	0.000	0.000	0.473	0.444	0.104	0.042
2 Methylpentane	0.037	0.015	1.125	1.070	0.276	0.114
3 Methylpentane	0.019	0.008	0.679	0.636	0.164	0.067
Other Hexanes	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.039	0.016	1.614	1.521	0.385	0.157
Heptanes Plus	0.165	0.067	42.822	64.919	9.529	6.235
<b>TOTAL</b>	<b>100.000</b>	<b>4.189</b>	<b>100.000</b>	<b>100.000</b>	<b>100.000</b>	<b>12.114</b>

HEPTANES PLUS (C <sub>7+</sub> ) FRACTION CHARACTERISTICS						
COMPONENT	Specific Gravity		Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value	
	°API	**			***	***
Gas	N/A	3.3606	97.333	24.613	5,007	
Oil	41.727	0.8168	170.519	15.203	130,716	
Wellstream	N/A	0.8163	169.530	15.282	N/A	

TOTAL SAMPLE CHARACTERISTICS						
COMPONENT	Specific Gravity		Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value	
	°API	**			Dry ***	Saturated ***
Gas	N/A	0.7050	20.353	238.696	1,183	1,163
Oil	68.622	0.7071	97.363	23.048	N/A	116,068
Wellstream	N/A	1.2864	37.257	41.733	N/A	N/A

\* GPM (gallons per Mscf) determined at 14.65 psia and 60 °F

\*\* Gas specific gravity and wellstream specific gravity determined relative to air (SG=1.000).  
Oil specific gravity determined relative to water (SG=1.000).

\*\*\* Gross Heating Value units for gas (real basis) and oil are BTU/Scf and BTU/Gal, respectively.



## TABLE 1-B

### COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C<sub>11+</sub>

SEPARATOR GOR.....: 3436 Scf/Sep Bbl  
SEPARATOR PRESSURE.....: 650 psig  
SEPARATOR TEMPERATURE.....: 94 °F

Component	SEPARATOR GAS		SEPARATOR OIL		WELLSTREAM	
	Mole%	* GPM	Mole %	Liquid Volume %	Mole %	* GPM
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.000	0.000
Nitrogen	0.484	0.000	0.072	0.018	0.393	0.000
Carbon Dioxide	2.037	0.000	0.847	0.331	1.776	0.000
Methane	82.531	0.000	17.472	6.788	68.250	0.000
Ethane	7.266	1.933	6.165	3.779	7.024	1.868
Propane	5.155	1.411	11.852	7.476	6.625	1.813
Iso-butane	0.779	0.253	3.689	2.765	1.418	0.461
N-butane	1.047	0.328	6.843	4.942	2.319	0.727
2-2 Dimethylpropane	0.000	0.000	0.066	0.058	0.014	0.006
Iso-pentane	0.228	0.083	3.026	2.538	0.842	0.306
N-pentane	0.187	0.067	3.169	2.631	0.842	0.303
2-2 Dimethylbutane	0.004	0.002	0.087	0.083	0.022	0.009
Cyclopentane	0.022	0.006	0.000	0.000	0.017	0.005
2-3 Dimethylbutane	0.000	0.000	0.473	0.444	0.104	0.042
2 Methylpentane	0.037	0.015	1.125	1.070	0.276	0.114
3 Methylpentane	0.019	0.008	0.679	0.636	0.164	0.067
Other Hexanes	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.039	0.016	1.614	1.521	0.385	0.157
Methylcyclopentane	0.025	0.009	1.252	1.015	0.294	0.104
Benzene	0.005	0.001	0.264	0.169	0.062	0.017
Cyclohexane	0.027	0.009	1.801	1.405	0.416	0.141
2-Methylhexane	0.008	0.004	0.477	0.508	0.111	0.051
3-Methylhexane	0.006	0.003	0.481	0.506	0.110	0.050
2,2,4 Trimethylpentane	0.000	0.000	0.000	0.000	0.000	0.000
Other Heptanes	0.014	0.006	1.256	1.253	0.287	0.124
n-Heptane	0.012	0.006	1.298	1.372	0.294	0.135
Methylcyclohexane	0.025	0.010	3.052	2.812	0.689	0.276
Toluene	0.007	0.002	1.035	0.794	0.233	0.077
Other C-8's	0.017	0.008	2.931	3.150	0.657	0.306
n-Octane	0.003	0.002	1.175	1.379	0.260	0.132
Ethylbenzene	0.001	0.000	0.145	0.128	0.033	0.013
M&P-Xylene	0.003	0.001	0.932	0.828	0.207	0.080
O-Xylene	0.001	0.000	0.190	0.166	0.042	0.016
Other C-9's	0.006	0.003	2.304	2.765	0.510	0.266
n-Nonane	0.001	0.001	0.854	1.102	0.188	0.105
Other C10's	0.003	0.002	2.622	3.458	0.578	0.331
n-Decane	0.001	0.001	0.724	1.020	0.160	0.098
Undecanes Plus	0.000	0.000	20.030	41.088	4.397	3.913
<b>TOTAL</b>	<b>100.000</b>	<b>4.189</b>	<b>100.000</b>	<b>100.000</b>	<b>100.000</b>	<b>12.114</b>

## TABLE 1-B

### COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C<sub>11+</sub>

SEPARATOR GOR.....: 3436 Scf/Sep Bbl  
SEPARATOR PRESSURE.....: 650 psig  
SEPARATOR TEMPERATURE.....: 94 °F

UNDECANES PLUS (C <sub>11+</sub> ) FRACTION CHARACTERISTICS						
COMPONENT	Specific Gravity		Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value	
	°API	**			***	
<b>Gas</b>	N/A	0.8250	156.000	16.784	8,400	
<b>Oil</b>	34.834	0.8507	240.300	11.235	132,613	
<b>Wellstream</b>	N/A	0.8507	240.300	11.235	N/A	

TOTAL SAMPLE CHARACTERISTICS						
COMPONENT	Specific Gravity		Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value	
	°API	**			Dry ***	Saturated ***
<b>Gas</b>	N/A	0.7050	20.353	238.696	1,183	1,163
<b>Oil</b>	68.622	0.7071	97.363	23.048	N/A	116,068
<b>Wellstream</b>	N/A	1.2864	37.257	41.733	N/A	N/A

\* GPM (gallons per Mscf) determined at 14.65 psia and 60 °F

\*\* Gas specific gravity and wellstream specific gravity determined relative to air (SG=1.000).  
Oil specific gravity determined relative to water (SG=1.000).

\*\*\* Gross Heating Value units for gas (real basis) and oil are BTU/Scf and BTU/Gal, respectively.

# TABLE 1-C

## COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C<sub>31+</sub>

SEPARATOR GOR.....: 3436 Scf/Sep Bbl  
SEPARATOR PRESSURE.....: 650 psig  
SEPARATOR TEMPERATURE.....: 94 °F

Component	SEPARATOR GAS		SEPARATOR OIL		WELLSTREAM	
	Mole%	* GPM	Mole %	Liquid Volume %	Mole %	* GPM
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.000	0.000
Nitrogen	0.484	0.000	0.072	0.018	0.393	0.000
Carbon Dioxide	2.037	0.000	0.847	0.331	1.776	0.000
Methane	82.531	0.000	17.472	6.788	68.250	0.000
Ethane	7.266	1.933	6.165	3.780	7.024	1.868
Propane	5.155	1.411	11.852	7.476	6.625	1.813
Iso-butane	0.779	0.253	3.689	2.765	1.418	0.461
N-butane	1.047	0.328	6.843	4.943	2.319	0.727
2-2 Dimethylpropane	0.000	0.000	0.066	0.058	0.014	0.006
Iso-pentane	0.228	0.083	3.026	2.538	0.842	0.306
N-pentane	0.187	0.067	3.169	2.631	0.842	0.303
2-2 Dimethylbutane	0.004	0.002	0.087	0.083	0.022	0.009
Cyclopentane	0.022	0.006	0.000	0.000	0.017	0.005
2-3 Dimethylbutane	0.000	0.000	0.473	0.444	0.104	0.042
2 Methylpentane	0.037	0.015	1.125	1.070	0.276	0.114
3 Methylpentane	0.019	0.008	0.679	0.636	0.164	0.067
Other Hexanes	0.000	0.000	0.000	0.000	0.000	0.000
n-Hexane	0.039	0.016	1.614	1.521	0.385	0.157
Methylcyclopentane	0.025	0.009	1.252	1.015	0.294	0.104
Benzene	0.005	0.001	0.264	0.169	0.062	0.017
Cyclohexane	0.027	0.009	1.801	1.405	0.416	0.141
2-Methylhexane	0.008	0.004	0.477	0.508	0.111	0.051
3-Methylhexane	0.006	0.003	0.481	0.506	0.110	0.050
2,2,4 Trimethylpentane	0.000	0.000	0.000	0.000	0.000	0.000
Other Heptanes	0.014	0.006	1.256	1.253	0.287	0.124
n-Heptane	0.012	0.006	1.298	1.372	0.294	0.135
Methylcyclohexane	0.025	0.010	3.052	2.812	0.689	0.276
Toluene	0.007	0.002	1.035	0.794	0.233	0.077
Other C-8's	0.017	0.008	2.931	3.150	0.657	0.306
n-Octane	0.003	0.002	1.175	1.379	0.260	0.132
Ethylbenzene	0.001	0.000	0.145	0.128	0.033	0.013
M&P-Xylene	0.003	0.001	0.932	0.829	0.207	0.080
O-Xylene	0.001	0.000	0.190	0.166	0.042	0.016
Other C-9's	0.006	0.003	2.304	2.765	0.510	0.266
n-Nonane	0.001	0.001	0.854	1.102	0.188	0.105
Other C10's	0.003	0.002	2.622	3.458	0.578	0.331
n-Decane	0.001	0.001	0.724	1.020	0.160	0.098
Undecanes	0.000	0.000	2.486	3.364	0.546	0.320
Dodecanes	0.000	0.000	2.075	3.033	0.455	0.289
Tridecanes	0.000	0.000	2.037	3.192	0.447	0.304

## TABLE 1-C

### COMPOSITIONAL ANALYSIS OF THE SEPARATOR GAS, OIL AND MATHEMATICALLY RECOMBINED WELLSTREAM THROUGH C<sub>31+</sub>

SEPARATOR GOR.....: 3436 Scf/Sep Bbl  
SEPARATOR PRESSURE.....: 650 psig  
SEPARATOR TEMPERATURE.....: 94 °F

Component	SEPARATOR GAS		SEPARATOR OIL		WELLSTREAM	
	Mole%	* GPM	Mole %	Liquid Volume %	Mole %	* GPM
Tetradecanes	0.000	0.000	1.805	3.030	0.396	0.289
Pentadecanes	0.000	0.000	1.884	3.387	0.413	0.323
Hexadecanes	0.000	0.000	1.318	2.533	0.289	0.241
Heptadecanes	0.000	0.000	0.998	2.027	0.219	0.193
Octadecanes	0.000	0.000	1.025	2.193	0.225	0.209
Nonadecanes	0.000	0.000	0.806	1.797	0.177	0.171
Eicosanes	0.000	0.000	0.669	1.551	0.147	0.148
Heneicosanes	0.000	0.000	0.595	1.451	0.131	0.138
Docosanes	0.000	0.000	0.518	1.317	0.114	0.125
Tricosanes	0.000	0.000	0.453	1.181	0.100	0.112
Tetracosanes	0.000	0.000	0.416	1.136	0.091	0.108
Pentacosanes	0.000	0.000	0.375	1.061	0.082	0.101
Hexacosanes	0.000	0.000	0.341	1.000	0.075	0.095
Heptacosanes	0.000	0.000	0.315	0.959	0.069	0.091
Octacosanes	0.000	0.000	0.290	0.911	0.064	0.087
Nonacosanes	0.000	0.000	0.272	0.884	0.060	0.084
Triacosanes	0.000	0.000	0.221	0.741	0.049	0.071
Hentriacontanes Plus	0.000	0.000	1.129	4.337	0.248	0.413
<b>TOTALS</b>	<b>100.000</b>	<b>4.189</b>	<b>100.000</b>	<b>100.000</b>	<b>100.000</b>	<b>12.113</b>

TOTAL SAMPLE CHARACTERISTICS						
COMPONENT	Specific Gravity		Molecular Weight lb/lb-mole	Vapor Volume Scf/Gal	Gross Heating Value	
	°API	**			Dry ***	Saturated ***
<b>Gas</b>	N/A	0.7050	20.353	238.696	1,183	1,163
<b>Oil</b>	68.622	0.7071	97.363	23.048	N/A	116,068
<b>Wellstream</b>	N/A	1.2864	37.257	41.733	N/A	N/A

\* GPM (gallons per Mscf) determined at 14.65 psia and 60 °F

\*\* Gas specific gravity and wellstream specific gravity determined relative to air (SG=1.000).  
Oil specific gravity determined relative to water (SG=1.000).

\*\*\* Gross Heating Value units for gas (real basis) and oil are BTU/Scf and BTU/Gal, respectively.



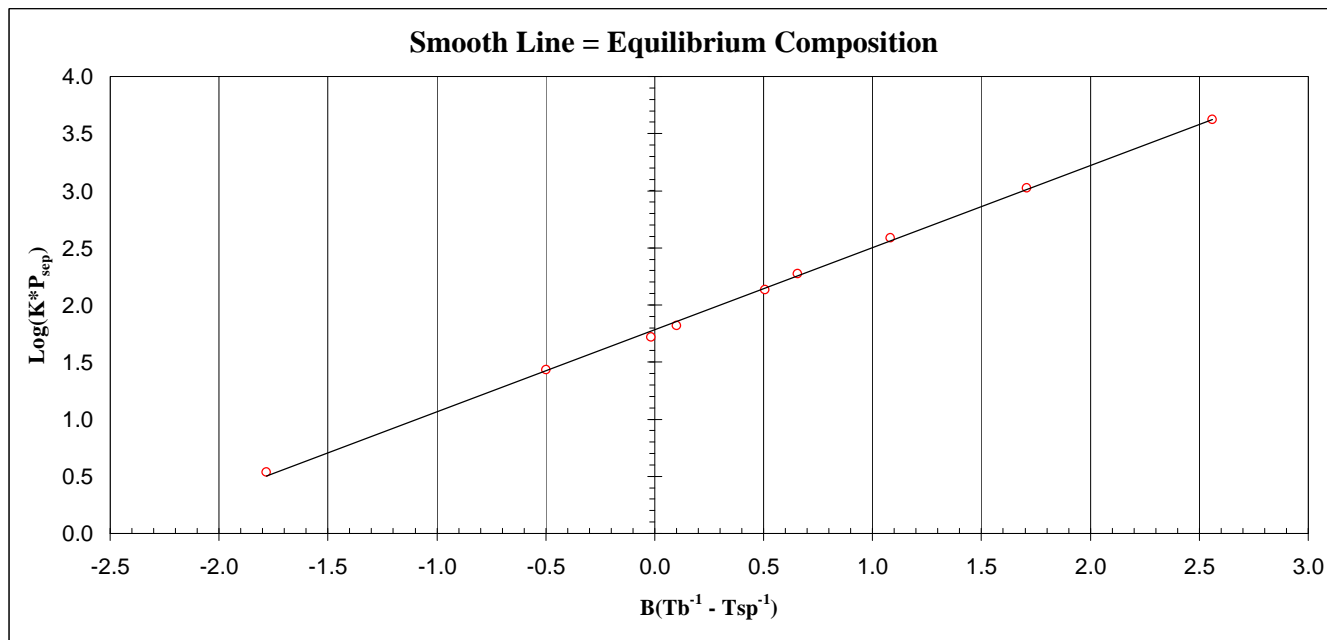
## HOFFMAN PLOT

### EQUILIBRIUM CHECK of SEPARATOR LIQUID and GAS COMPOSITIONAL ANALYSES

Separator Pressure = 650 psig  
 Separator Temperature = 94 °F

Components	Gas (X) Mole %	Oil (Y) Mole %	Equil. Ratio (K=Y/X)	K*Psep (psiA)	Normal BP (NBP) °R	$T_{NBP}^{-1} - T_{SEP}^{-1}$	Critical Pressure (Pc) psiA	Critical Temperature (Tc) °R	B-Factor	Graph Results	
										B(1/Tb-1/Tsp)	Log(K*Psep)
N2	0.484	0.072	6.758	4491.50	139	0.005373	493	227	551	2.958	3.652
CO2	2.037	0.847	2.404	1598.02	350	0.001048	1071	548	1811	1.898	3.204
C1	82.531	17.472	4.724	3139.57	201	0.003169	668	343	805	2.552	3.497
C2	7.266	6.165	1.179	783.39	332	0.001204	708	550	1413	1.701	2.894
C3	5.155	11.852	0.435	289.10	416	0.000598	616	666	1799	1.076	2.461
IC4	0.779	3.689	0.211	140.35	471	0.000319	529	735	2038	0.650	2.147
NC4	1.047	6.843	0.153	101.70	491	0.000231	551	765	2158	0.498	2.007
IC5	0.228	3.092	0.074	49.01	542	0.000040	490	829	2383	0.095	1.690
NC5	0.187	3.169	0.059	39.22	557	-0.000009	489	845	2483	-0.023	1.594
C6	0.121	3.978	0.030	20.22	615	-0.000181	437	913	2784	-0.504	1.306
C7+	0.165	42.822	0.004	2.56	763	-0.000496	332	1070	3607	-1.789	0.408
Total	100.000	100.000									

( Note: C7+ Critical Properties as C9. The C6 composition includes iso-hexanes. )





**TABLE 2**  
**FLASH LIBERATION OF 1st-STAGE SEPARATOR LIQUID**

SEPARATOR CONDITIONS and FLUID PROPERTIES						
Conditions	Pressure psia	Temperature °F	GOR (1)	Separator Oil Volume Factor (2)	Oil Density (3)	Gas Specific Gravity (4)
1st Stage Separator	665	94	N/A	1.2573	0.7071	0.705
2nd Stage Separator	91	80	263	N/A	N/A	0.926
3rd Stage Separator	45	120	47	N/A	N/A	1.264
Ambient Lab Condition	14.65	75	104	1.0079	0.7888	1.758
Stock Tank	14.65	60	0	1.0000	0.7961	1.758
<b>TOTALS</b>	-----	-----	414		-----	-----

Stock Tank Oil Gravity: 46.06 °API at 60 °F

- (1) Gas-Oil Ratio (GOR) is the cubic feet of gas at standard conditions per barrel of stock tank oil.
- (2) Barrels of oil at indicated separator conditions per barrel of stock tank oil.
- (3) Oil Density (g/cc) at indicated separator conditions.
- (4) Air = 1.000



**TABLE 3**  
**PRESSURE-VOLUME RELATION**  
**OF**  
**A 3436 Scf/Sep Bbl RESERVOIR FLUID AT 263 °F**  
**(Constant Composition Expansion)**

Pressure, (psig)	Relative Volume	Density, (g/cc)	Y-Function (1)	Retrograde Liquid Volume		Gas Deviation Factor, Z	Gas Expansion Factor, (4)
				% of HC Pore Volume (2)	Bbls / MMscf (3)		
11000	0.82736	0.47758	N/A	N/A	N/A	1.77731	1.69183
10440	0.83715	0.47199	N/A	N/A	N/A	1.70691	1.67193
10000	0.84486	0.46769	N/A	N/A	N/A	1.65013	1.65657
9000	0.86686	0.45581	N/A	N/A	N/A	1.52404	1.61426
8000	0.89274	0.44260	N/A	N/A	N/A	1.39542	1.56715
7000	0.92595	0.42673	N/A	N/A	N/A	1.26675	1.51055
6500	0.94639	0.41751	N/A	N/A	N/A	1.20243	1.47769
6000	0.97085	0.40699	N/A	N/A	N/A	1.13883	1.44019
5535	1.00000	0.39513	N/A	0.00%	0.000	1.08234	1.39792
5178	1.03101	N/A	2.21679	4.26%	30.252	N/A	N/A
4774	1.07253	N/A	2.19115	15.84%	112.422	N/A	N/A
4280	1.13887	N/A	2.10425	21.07%	149.544	N/A	N/A
3898	1.20738	N/A	2.01749	22.84%	162.094	N/A	N/A
3456	1.31271	N/A	1.91560	23.83%	169.096	N/A	N/A
3070	1.43810	N/A	1.82404	24.61%	174.671	N/A	N/A
2446	1.74876	N/A	1.67658	24.16%	171.474	N/A	N/A
1827	2.30634	N/A	1.54126	22.97%	163.019	N/A	N/A
1383	3.05722	N/A	1.44403	21.93%	155.621	N/A	N/A
938	4.56767	N/A	1.35256	20.78%	147.430	N/A	N/A

(1) Y - Function = Dimensionless Compressibility =  $(P_{sat} - P_i) * [P_i * (RV_i - 1)]^{-1}$

(2) Retrograde liquid volume at the indicated pressure and reservoir temperature as a percent of the hydrocarbon pore volume at the dew point pressure and reservoir temperature.

(3) Retrograde liquid volume at the indicated pressure and reservoir temperature (Bbls) per volume of gas (MMscf) at the dew point pressure and reservoir temperature.

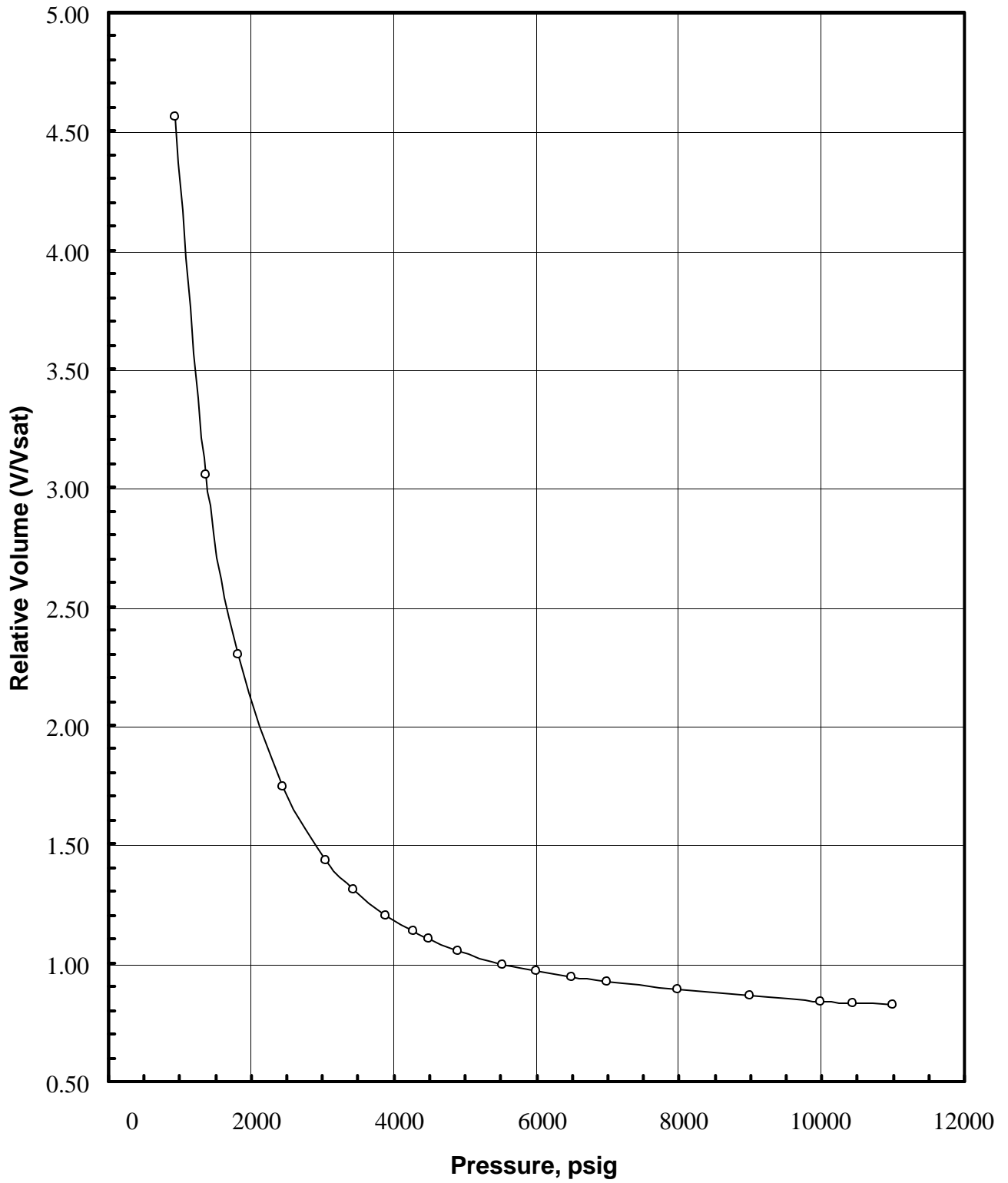
(4) Gas Expansion Factor = the volume of surface gas at standard conditions (Mscf) produced from one barrel of undersaturated gas at the indicated pressure and reservoir temperature.

Relative Volume = volume at indicated pressure per volume at the saturation pressure.

Psat = Saturation (Retrograde Dew Point) pressure at reservoir temperature.

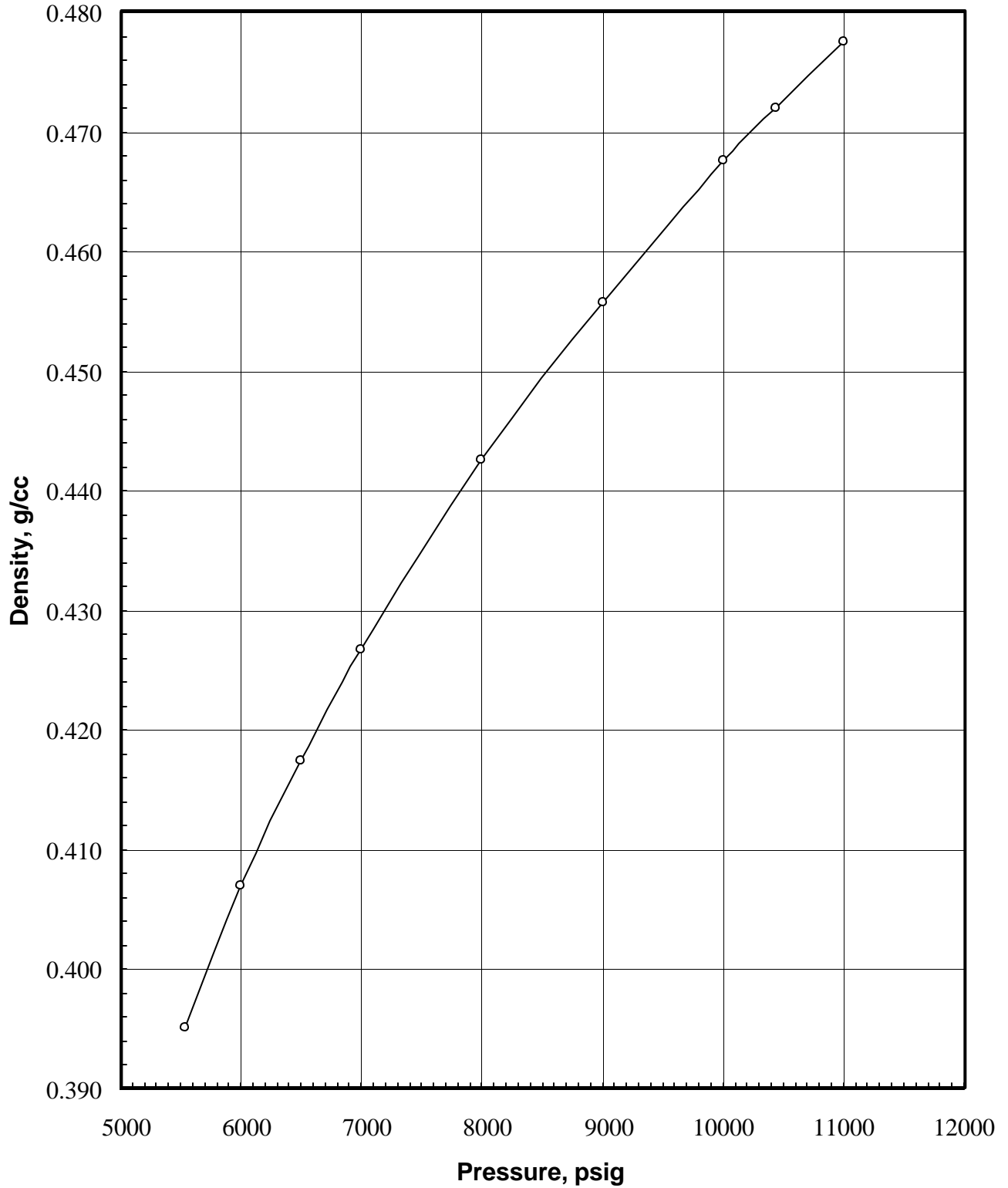
Pres = Current static reservoir pressure.

**FIGURE 1**  
**Relative Volume vs Pressure**

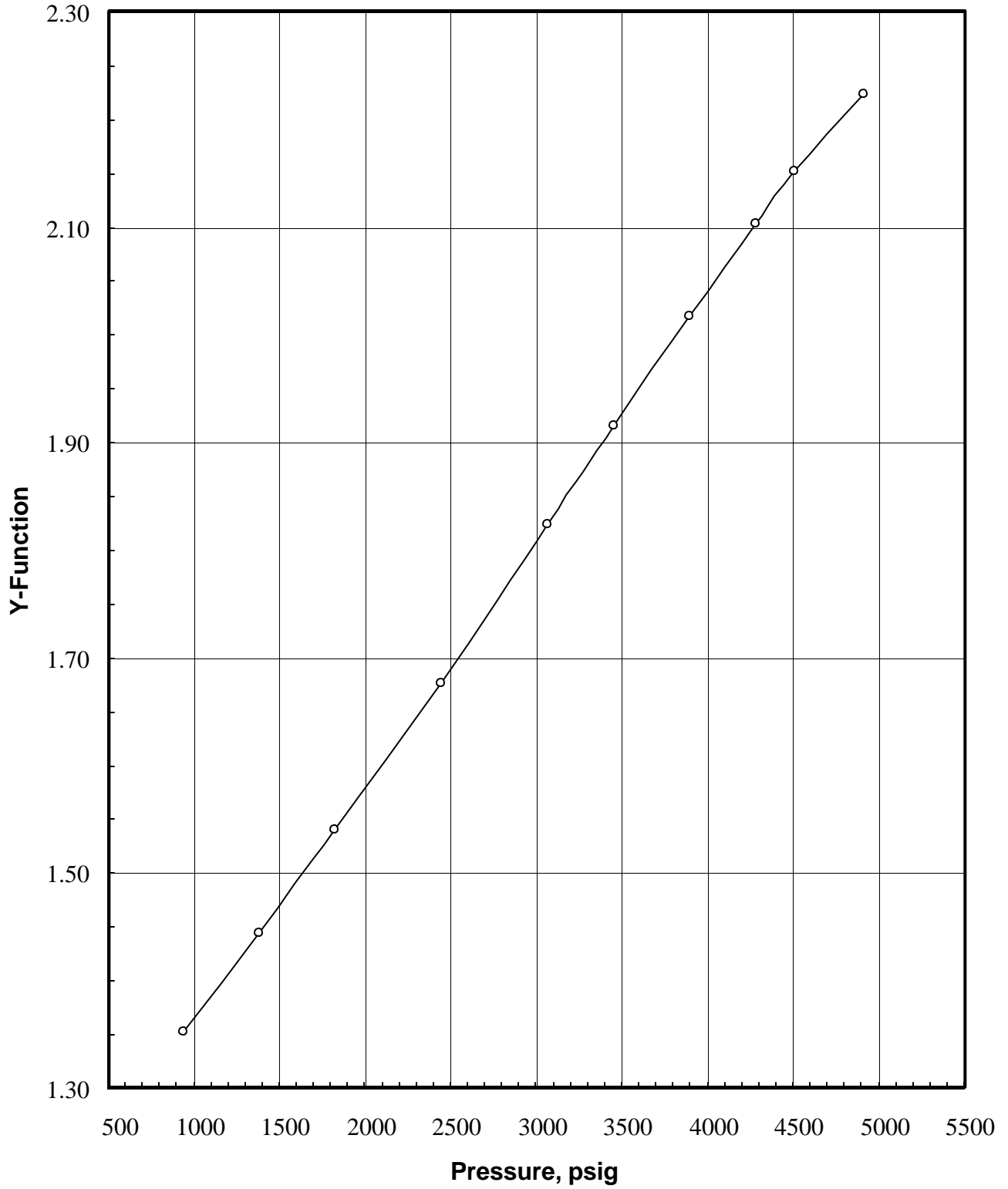




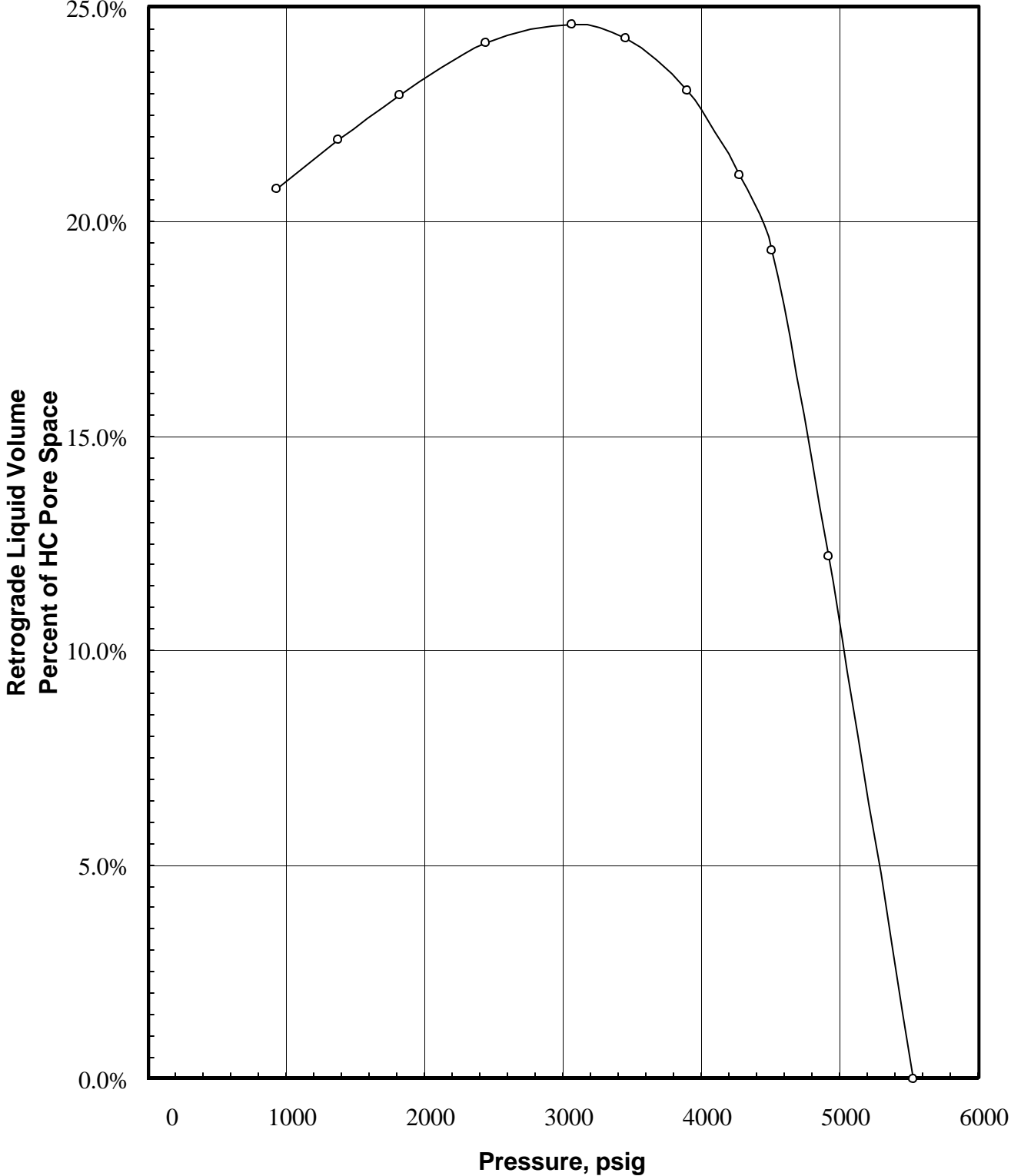
**FIGURE 2**  
**Density vs Pressure**



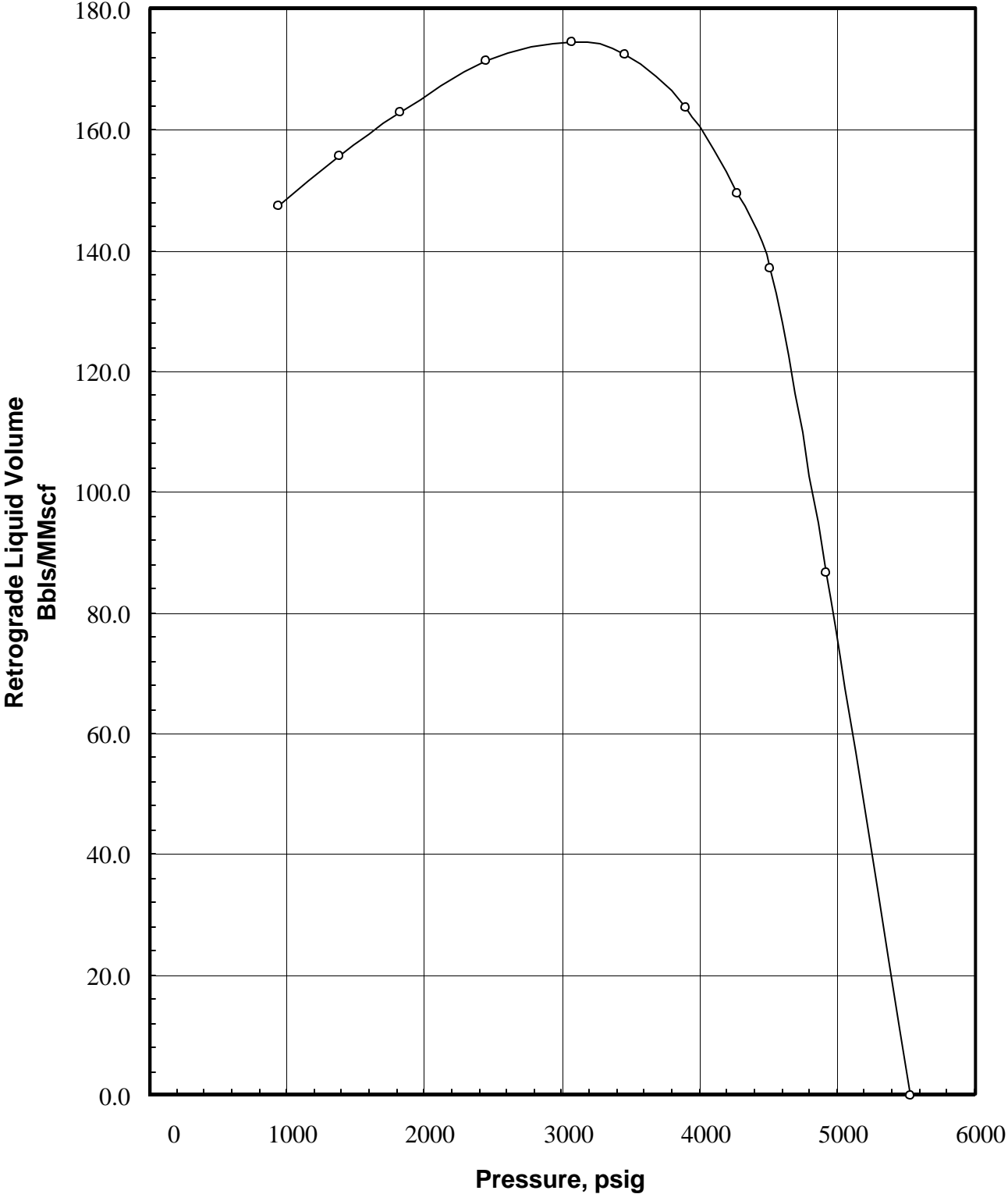
**FIGURE 3**  
**Y-Function vs Pressure**



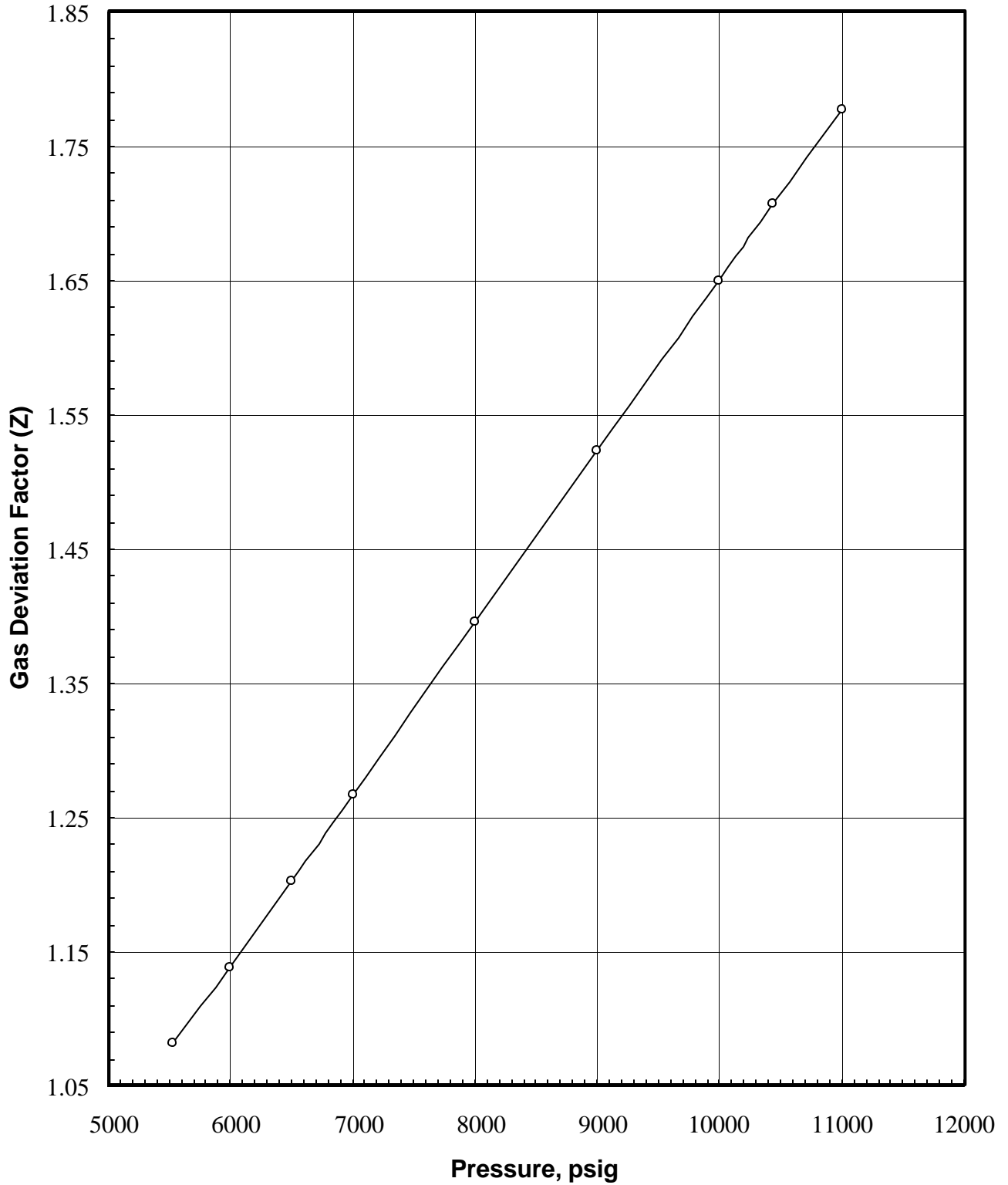
**FIGURE 4**  
**Retrograde Liquid Volume vs Pressure**



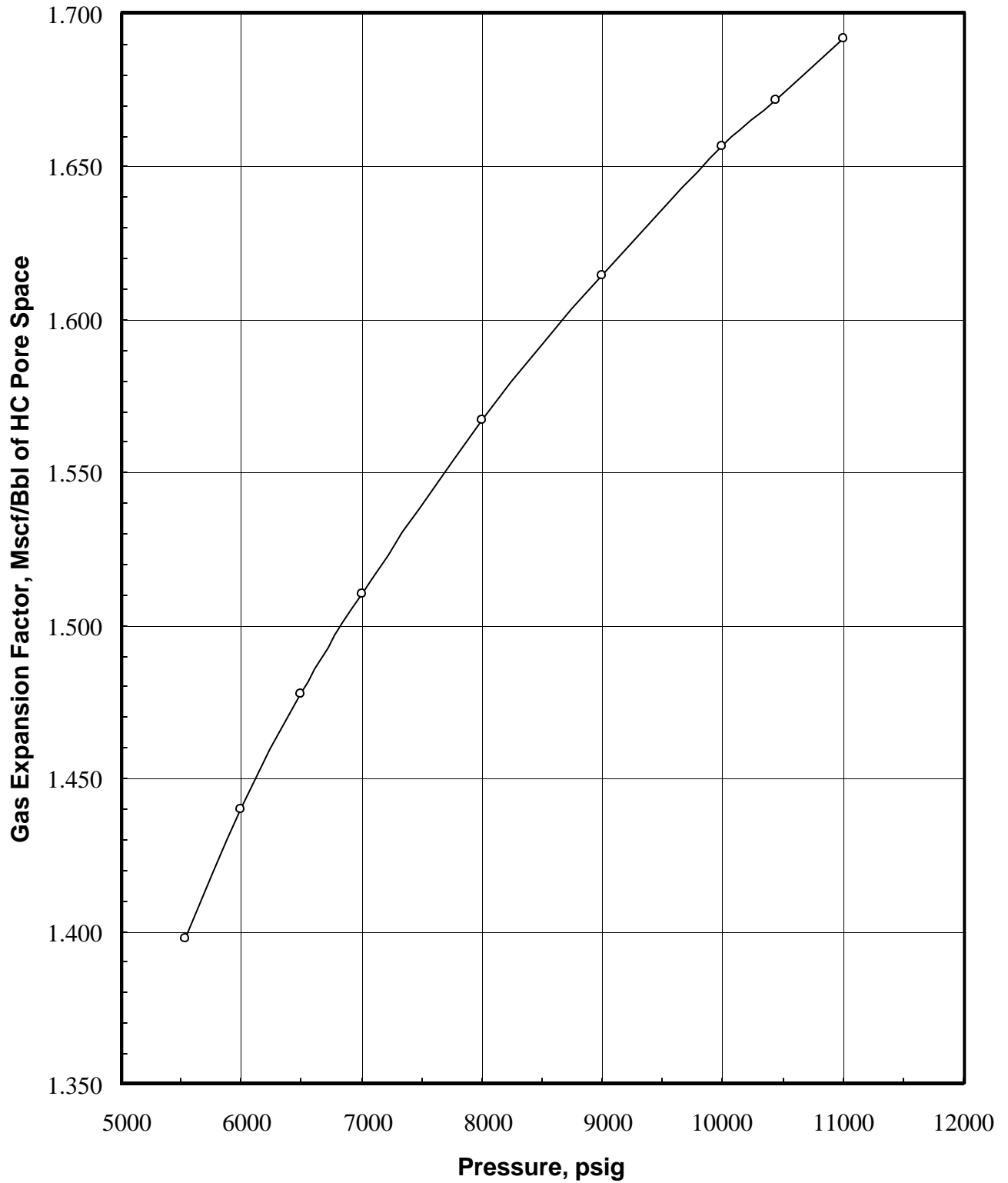
**FIGURE 5**  
**Retrograde Liquid Volume vs Pressure**



**FIGURE 6**  
**Gas Deviation Factor (Z) vs Pressure**



**FIGURE 7**  
**Gas Expansion Factor vs Pressure**





**TABLE 4**

**RESERVOIR GAS DEPLETION STUDY AT 263 °F**

Reservoir Pressure, psig	(D.P.) 5535	4500	3500	2500	1700	900	0
Wellstream Components	mole %	mole %	mole %	mole %	mole %	mole %	mole %
Hydrogen Sulfide	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitrogen	0.393	0.405	0.433	0.442	0.437	0.428	0.335
Carbon Dioxide	1.776	1.829	1.863	1.899	1.936	1.945	1.612
Methane	68.250	71.913	74.339	75.538	76.049	74.723	60.118
Ethane	7.024	7.178	7.244	7.464	7.621	7.691	7.178
Propane	6.625	6.501	6.501	6.501	6.501	7.112	8.091
Iso-butane	1.418	1.352	1.312	1.300	1.324	1.462	1.991
N-butane	2.319	2.178	2.113	2.113	2.113	2.360	3.243
Iso-pentane	0.857	0.800	0.766	0.724	0.690	0.815	1.213
N-pentane	0.842	0.787	0.757	0.716	0.681	0.762	1.151
Hexanes	0.968	0.857	0.771	0.701	0.647	0.701	1.268
Heptanes Plus	9.529	6.200	3.900	2.600	2.000	2.000	13.800
<b>TOTALS</b>	100.000	100.000	100.000	100.000	100.000	100.000	100.000

<b>HEPTANES PLUS (C<sub>7+</sub>) FRACTION CHARACTERISTICS</b>							
Molecular Weight	169.530	149.703	136.501	126.627	120.849	116.400	131.537
Specific Gravity	0.8163	0.8013	0.7897	0.7803	0.7746	0.7699	1.3869

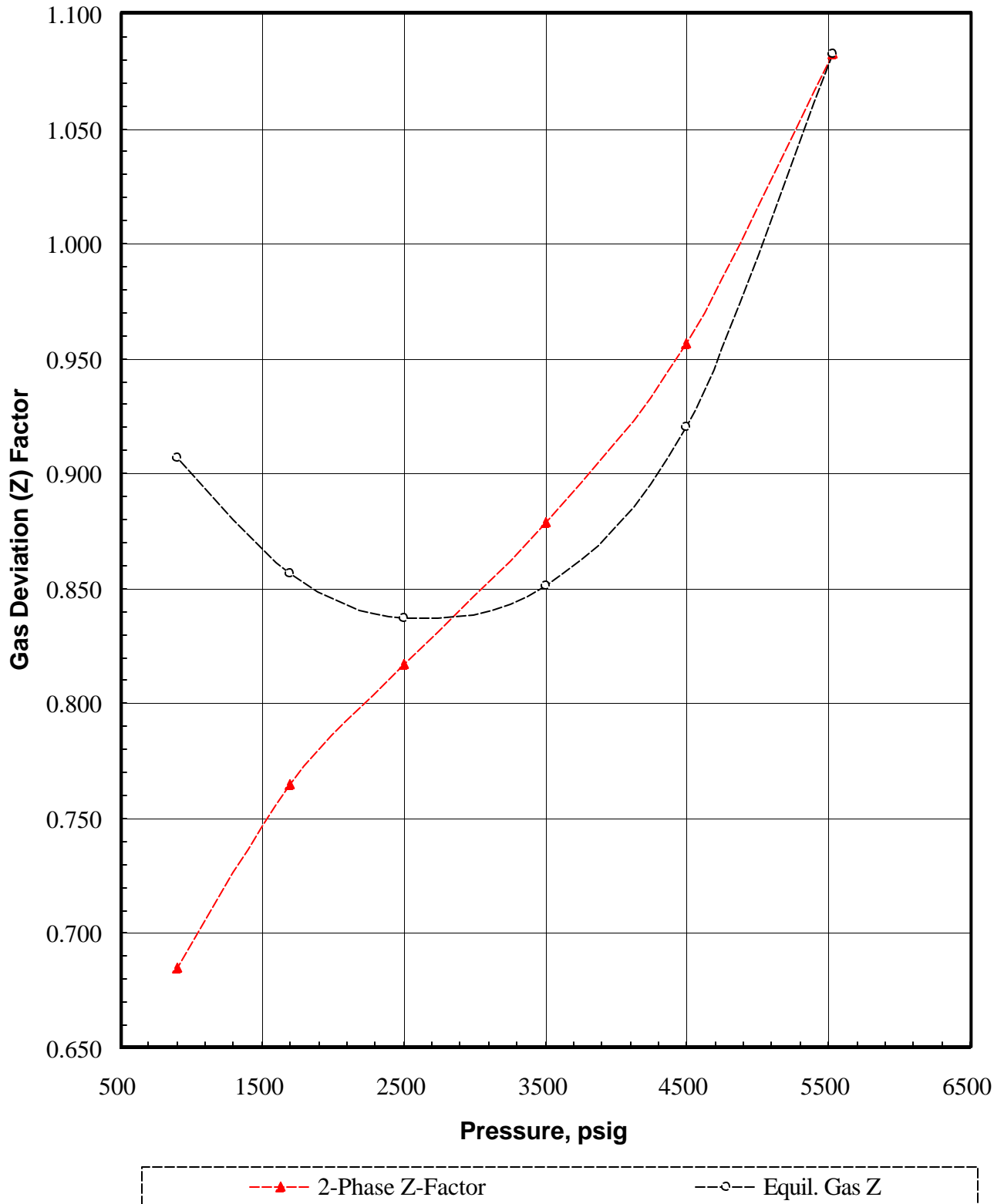
<b>CONDENSED RETROGRADE LIQUID VOLUME</b>							
HC Pore Volume %	0.000	17.000	22.842	23.832	22.309	19.063	14.967
Bbls/MMscf of DP Gas	0.000	120.639	162.094	169.122	158.316	135.277	106.213

<b>GAS DEVIATION FACTOR</b>							
Equilibrium Gas	1.0823	0.9202	0.8515	0.8369	0.8568	0.9069	N/A
Two-Phase	1.0823	0.9568	0.8786	0.8169	0.7645	0.6848	N/A

<b>CUMULATIVE PRODUCED WELLSTREAM VOLUME</b>							
Vol % of Initial DP Gas	0.000	7.976	21.980	39.965	56.259	73.951	93.845

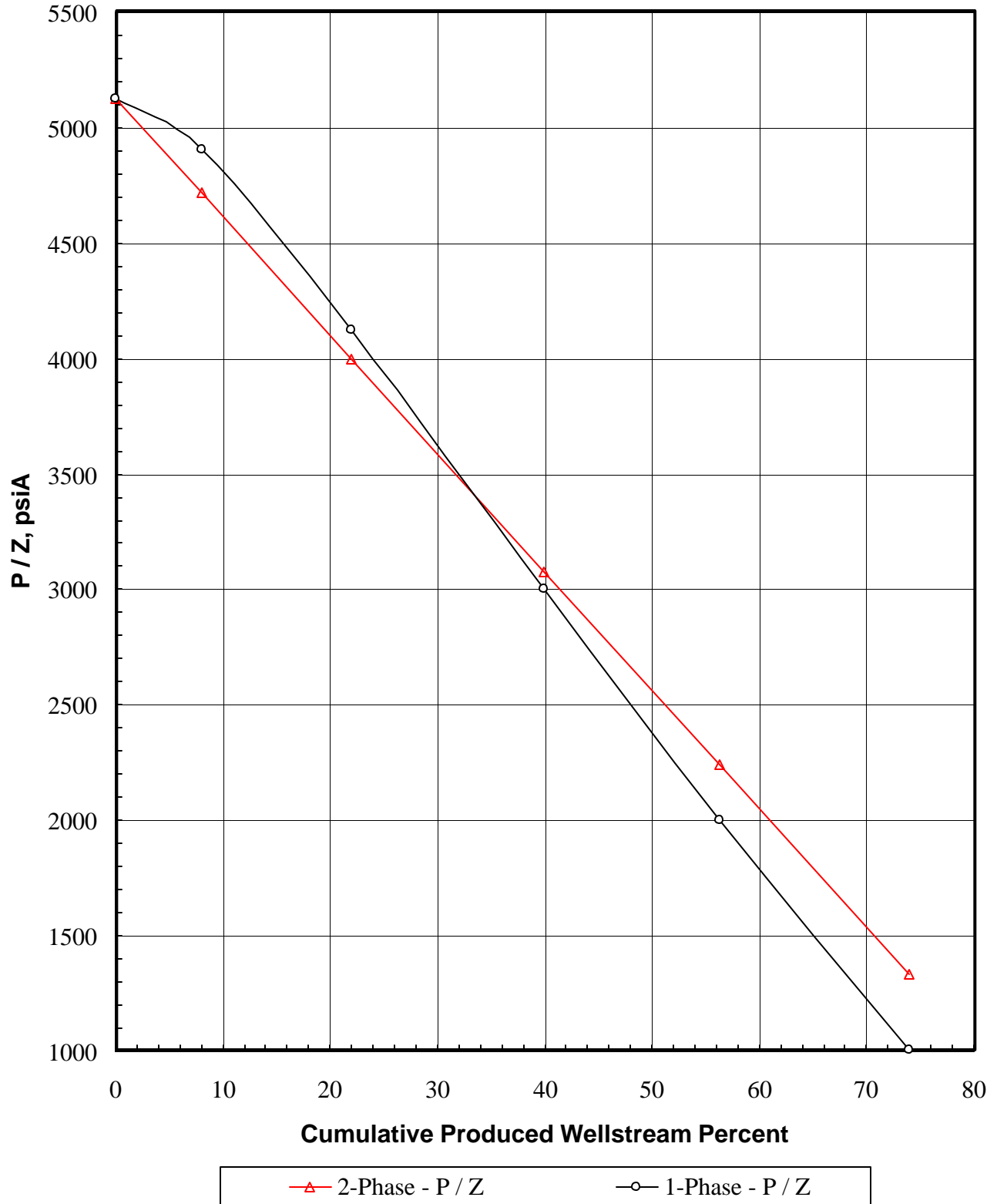
<b>GPM FROM CVD WELLSTREAM COMPOSITIONS</b>							
Propane plus (C <sub>3+</sub> )	10.246	7.476	5.859	5.002	4.617	4.972	12.546
Butanes plus (C <sub>4+</sub> )	8.432	5.697	4.080	3.223	2.837	3.026	10.332
Pentanes plus (C <sub>5+</sub> )	7.245	4.575	2.991	2.138	1.744	1.811	8.668

**FIGURE 8**  
**Equilibrium Gas Deviation (Z) Factor vs Pressure**

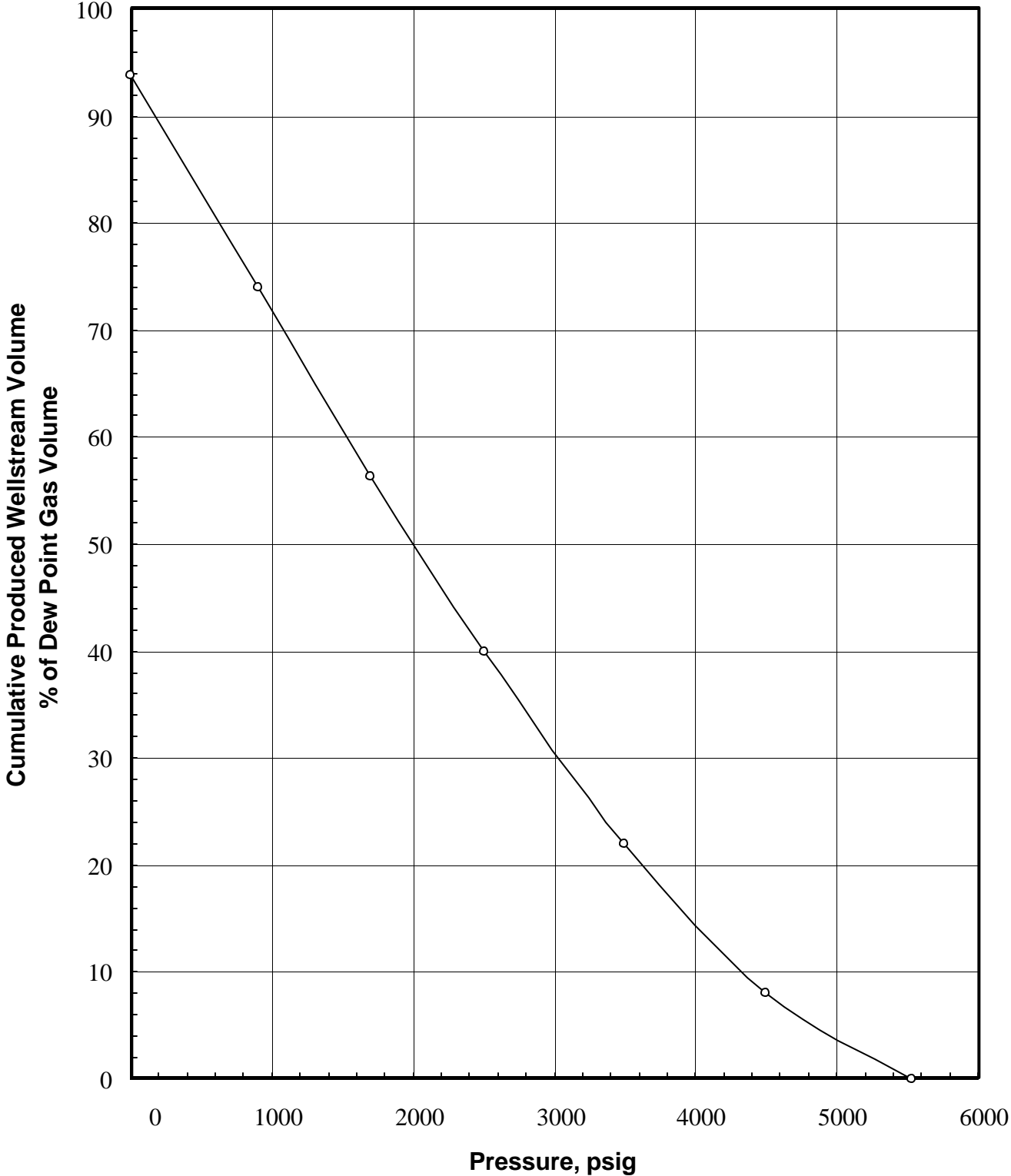




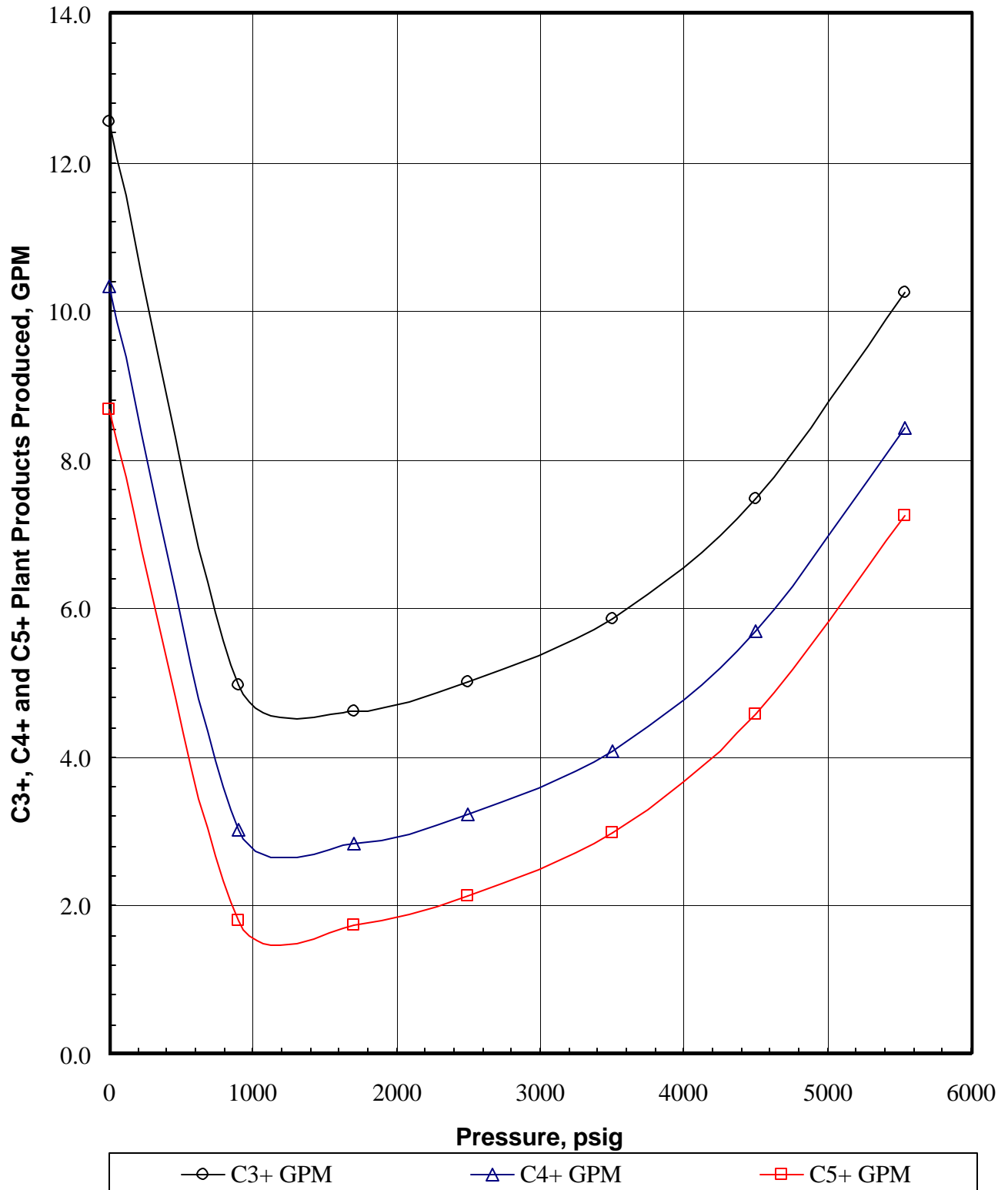
**FIGURE 9**  
**P / Z vs Cumulative Produced Wellstream %**



**FIGURE 10**  
**Cumulative Produced Wellstream Volume vs Pressure**



**FIGURE 11**  
**C3+, C4+ and C5+ GPM vs Pressure**





**TABLE 5**

**CALCULATED CUMULATIVE RECOVERY  
DURING DEPLETION AT 263 °F**

Cumulative Fluid Recovery per MMScf of Original Dew Point Gas	Initial Gas in Place	Reservoir Pressure - psig					
		(D.P.) 5535	4500	3500	2500	1700	900
<b>Well Stream (Mcf)</b>	1000.00	0.00	79.76	219.80	399.65	562.59	739.51
<b>* Normal Temperature Separation</b>							
Stock Tank Liquid (Bbls)	182.90	0.00	9.12	19.25	28.06	34.23	41.17
Primary Separator Gas (Mcf)	796.33	0.00	68.11	193.30	358.87	511.15	675.11
Second Stage Gas (Mcf)	47.91	0.00	2.89	6.92	11.01	14.18	18.18
Third Stage Gas (Mcf)	13.37	0.00	0.86	2.12	3.48	4.58	6.11
Stock Tank Gas (Mcf)	4.74	0.00	0.29	0.69	1.10	1.41	1.83
Cumulative Total GOR (Scf/STB)	4715	0	7914	10545	13346	15523	17032
Instantaneous Total GOR (Scf/STB)	4715	0	7914	12910	19473	25424	24472
<b>Total Gallons of Ethane Plus (C<sub>2+</sub>) Plant Products Produced in:</b>							
Well Stream	12113.96	0.00	748.61	1838.91	3095.65	4178.20	5419.86
Primary Separator Gas	3433.29	0.00	302.06	874.50	1663.21	2408.34	3251.54
Second Stage Gas	559.80	0.00	34.93	85.14	138.09	180.11	235.75
Third Stage Gas	323.14	0.00	21.50	53.70	89.54	118.86	160.95
Stock Tank Gas	129.18	0.00	8.07	19.31	30.96	40.08	52.18

\* Recovery Basis: 1st Stage Separation at 650 psig and 94 °F  
 2nd Stage Separation at 76 psig and 80 °F  
 3rd Stage Separation at 30 psig and 120 °F  
 Stock Tank Conditions at 14.65 psig and 60 °F  
 Standard Conditions at 14.65 psig and 60 °F



**TABLE 6**

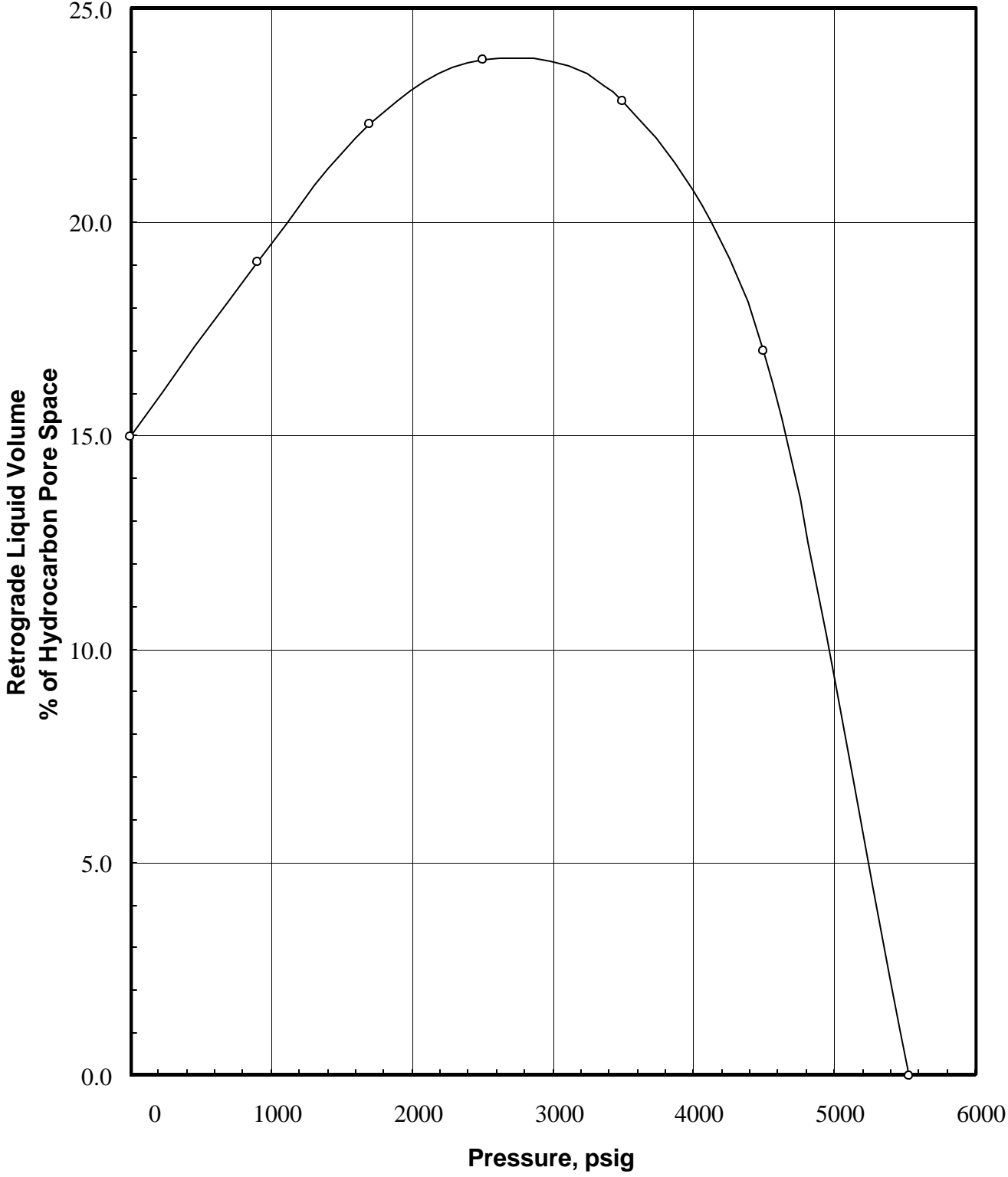
**RETROGRADE CONDENSATION DURING GAS DEPLETION  
AT 263 °F**

Pressure psig	Condensed Retrograde Liquid Volume	
	(1)	(2)
5535	0.000	0.00
4500	17.000	120.64
3500	22.842	162.09
2500	23.832	169.12
1700	22.309	158.32
900	19.063	135.28
0	14.967	106.21

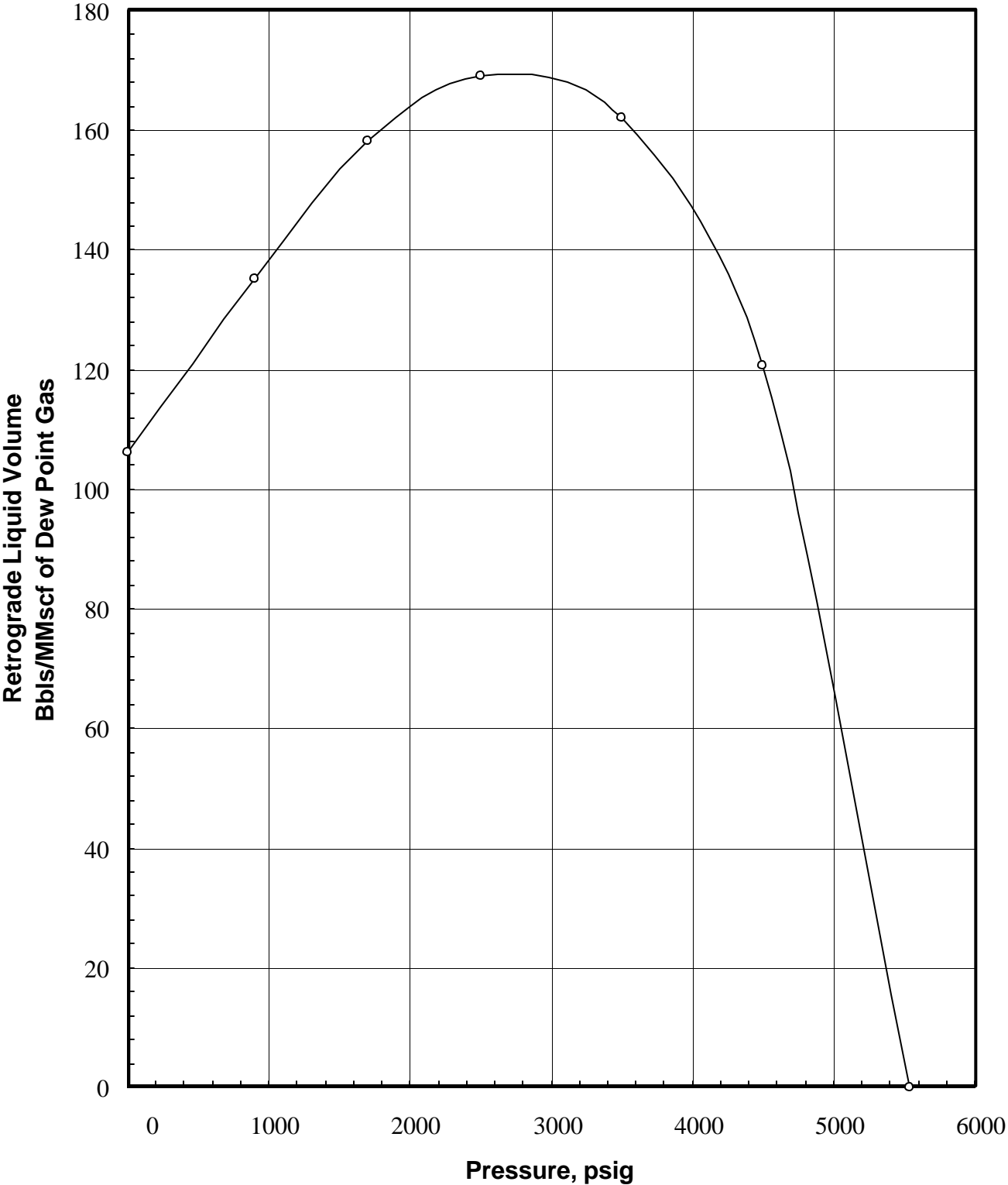
(1) Retrograde liquid volume condensed at the indicated pressure and reservoir temperature as a percent of the hydrocarbon pore volume at the dew point pressure and reservoir temperature.

(2) Retrograde liquid volume (Bbls) condensed at the indicated pressure and reservoir temperature per volume of gas (MMscf) at the dew point pressure and reservoir temperature.

**FIGURE 12**  
**Retrograde Liquid Volume vs Pressure**



**FIGURE 13**  
**Retrograde Liquid Volume vs Pressure**



# **APPENDIX**



**FESCO, Ltd.**  
**1100 FESCO Avenue - Alice, Texas 78332**

CVD Abandonment Oil  
 Spot Sample @ 0 PSIG & 70 ° F

Date Sampled: 6/26/2008

Job Number: 84131.005

**CHROMATOGRAPH EXTENDED ANALYSIS - SUMMATION REPORT**

COMPONENT	MOL %	LIQ VOL %	WT %
Nitrogen	0.000	0.000	0.000
Carbon Dioxide	0.000	0.000	0.000
Methane	0.002	0.001	0.000
Ethane	0.008	0.003	0.001
Propane	0.154	0.060	0.037
Isobutane	0.188	0.088	0.060
n-Butane	0.608	0.272	0.194
2,2 Dimethylpropane	0.004	0.002	0.002
Isopentane	0.835	0.434	0.330
n-Pentane	1.099	0.566	0.435
2,2 Dimethylbutane	0.055	0.033	0.026
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.356	0.208	0.168
2 Methylpentane	0.840	0.496	0.397
3 Methylpentane	0.560	0.325	0.265
n-Hexane	1.423	0.832	0.672
Heptanes Plus	93.867	96.681	97.412
Totals:	100.000	100.000	100.000

**Characteristics of Heptanes Plus:**

Specific Gravity ----- 0.8276 (Water=1)  
 °API Gravity ----- 39.48 @ 60°F  
 Molecular Weight ----- 189.3  
 Vapor Volume ----- 13.88 CF/Gal \_\_\_\_\_  
 Weight ----- 6.90 Lbs/Gal  
 Gross Heating Value-----~~130984~~ BTU/Gal

**Characteristics of Total Sample:**

Specific Gravity ----- 0.8214 (Water=1)  
 °API Gravity ----- 40.78 @ 60°F  
 Molecular Weight----- 182.4  
 Vapor Volume ----- 14.29 CF/Gal  
 Weight ----- 6.84 Lbs/Gal  
 Gross Heating Value-----~~130340~~ BTU/Gal

Base Conditions: 14.650 PSI & 60 °F

Certified: FESCO, Ltd. - Alice, Texas

Analyst: LAW  
 Processor: AR  
 Cylinder ID: Vial

\_\_\_\_\_  
 David Dannhaus 361-661-7015

## TOTAL EXTENDED REPORT

COMPONENT	Mol %	LiqVol %	Wt %
Nitrogen	0.000	0.000	0.000
Carbon Dioxide	0.000	0.000	0.000
Methane	0.002	0.001	0.000
Ethane	0.008	0.003	0.001
Propane	0.154	0.060	0.037
Isobutane	0.188	0.088	0.060
n-Butane	0.608	0.272	0.194
2,2 Dimethylpropane	0.004	0.002	0.002
Isopentane	0.835	0.434	0.330
n-Pentane	1.099	0.566	0.435
2,2 Dimethylbutane	0.055	0.033	0.026
Cyclopentane	0.000	0.000	0.000
2,3 Dimethylbutane	0.356	0.208	0.168
2 Methylpentane	0.840	0.496	0.397
3 Methylpentane	0.560	0.325	0.265
n-Hexane	1.423	0.832	0.672
Methylcyclopentane	1.296	0.652	0.598
Benzene	0.290	0.115	0.124
Cyclohexane	2.191	1.060	1.011
2-Methylhexane	0.565	0.373	0.310
3-Methylhexane	0.590	0.385	0.324
2,2,4 Trimethylpentane	0.000	0.000	0.000
Other C-7's	1.571	0.972	0.854
n-Heptane	1.705	1.118	0.937
Methylcyclohexane	4.580	2.617	2.466
Toluene	1.651	0.786	0.834
Other C-8's	4.868	3.244	2.942
n-Octane	2.052	1.494	1.285
E-Benzene	0.273	0.150	0.159
M & P Xylenes	2.081	1.148	1.212
O-Xylene	0.725	0.392	0.422
Other C-9's	4.058	3.020	2.809
n-Nonane	1.780	1.425	1.252
Other C-10's	5.904	4.829	4.574
n-decane	1.736	1.515	1.354
Undecanes(11)	6.105	5.123	4.921
Dodecanes(12)	5.443	4.934	4.806
Tridecanes(13)	5.589	5.432	5.364
Tetradecanes(14)	5.113	5.322	5.327
Pentadecanes(15)	5.355	5.971	6.048
Hexadecanes(16)	3.993	4.758	4.860
Heptadecanes(17)	2.991	3.770	3.887
Octadecanes(18)	3.048	4.045	4.196
Nonadecanes(19)	2.430	3.358	3.504
Eicosanes(20)	1.986	2.853	2.995
Heneicosanes(21)	1.798	2.718	2.869
Docosanes(22)	1.553	2.446	2.597
Tricosanes(23)	1.431	2.337	2.495
Tetracosanes(24)	1.225	2.074	2.224
Pentacosanes(25)	1.081	1.898	2.046
Hexacosanes(26)	1.015	1.846	1.999
Heptacosanes(27)	0.920	1.735	1.887
Octacosanes(28)	0.838	1.634	1.783
Nonacosanes(29)	0.797	1.605	1.757
Triacotanes(30)	0.620	1.288	1.414
Hentriacotanes Plus(31+)	<u>2.620</u>	<u>6.242</u>	<u>6.968</u>
Total	100.000	100.000	100.000



**FESCO, Ltd.**  
**1100 FESCO Ave. - Alice, Texas 78332**

### REPORT OF ASTM D-86 DISTILLATION

**Oil/Condensate Sample:**

**Field:**

**Date Sampled:** 6/26/2008

**API Gravity @ 60 °F:** 48.0°

**Color:** Amber

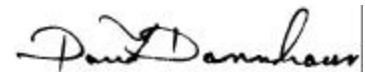
**Observed Initial Boiling Point:** 90 °F

Percent	Temperature Based on Percent	
	Recovered	Evaporated*
10	112	108
20	135	126
30	202	182
40	262	241
50	340	310
60	434	399
70	521	493
80	627	585
90	729	711
95	---	732
End Point	733	733
Recovery:	94.9 %	98.3 %
Residue:	1.7 %	1.7 %
Loss:	3.4 %	--- %
Totals:	100.0 %	100.0 %

\*The Arithmetical Procedure, As Described In ASTM D-86, Was Used To Correct the Temperature Readings For The 3.4 % Loss.

Certified: FESCO, Ltd. - Alice, Texas

David Dannhaus (361) 661-7015



Lab Job No.: 84131.003