

## Methane Adsorption Isotherm Summary

**Well:** Shenandoah No. 1 Australia  
**Reservoir:** Lower Kyalla Shale  
**Sample Number:** 44569-2M  
**Sample Type:** shale  
**Drill Depth, feet:** 5,217.67-5,217.80  
**Temperature, °F:** 180.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
302.37	3.02	2.86
761.98	5.53	5.66
1,221.30	7.27	7.48
1,677.66	8.64	8.74
2,135.86	9.79	9.68
2,593.23	10.47	10.40

Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0627
Intercept:	86.7619
Regression Coefficient (squared):	0.9947
Intercept Variation, psia*ton/scf:	13.1567
Slope Variation, ton/scf:	0.0080
G <sub>sL</sub> Variation, scf/ton:	0.0022
P <sub>L</sub> Variation, psia:	130.2568
Langmuir Volume, scf/ton:	15.94
Langmuir Pressure, psia:	1,383.39
Langmuir Equation:	$G_s = (G_{sL} * p) / (P_L + p)$
Pressure (Midpoint), psia:	2,273.98
Storage Capacity, scf/ton:	9.91

*G<sub>s</sub>* Gas Storage Capacity

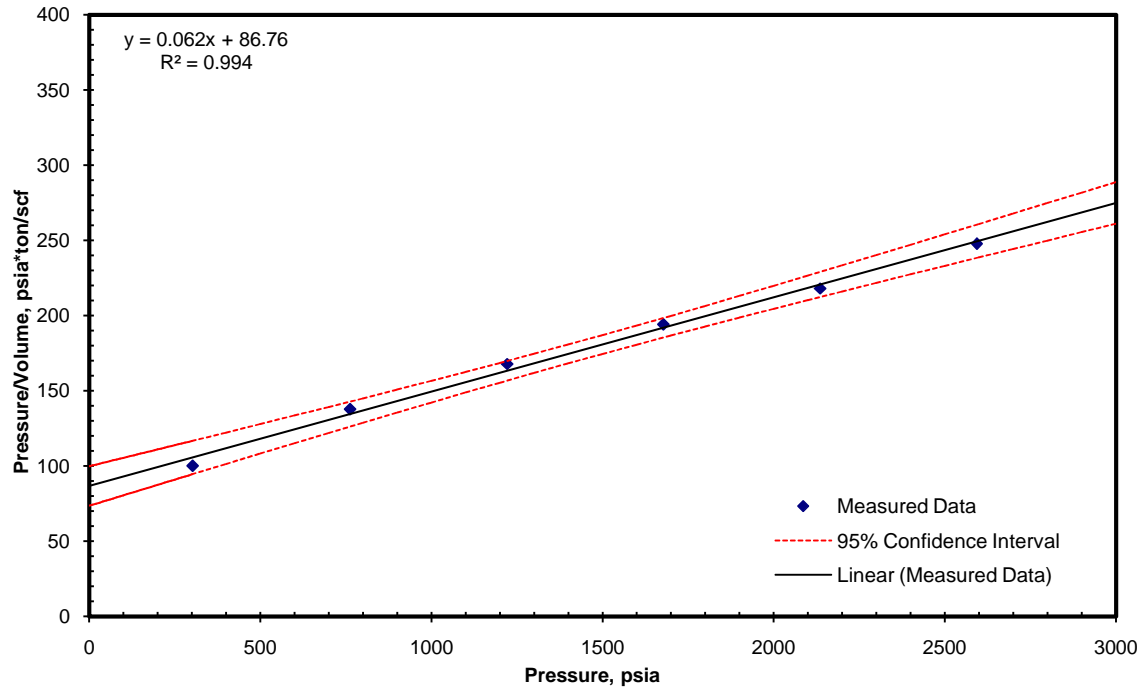
*G<sub>sL</sub>* Langmuir Gas Storage Capacity

*P<sub>L</sub>* Langmuir Pressure

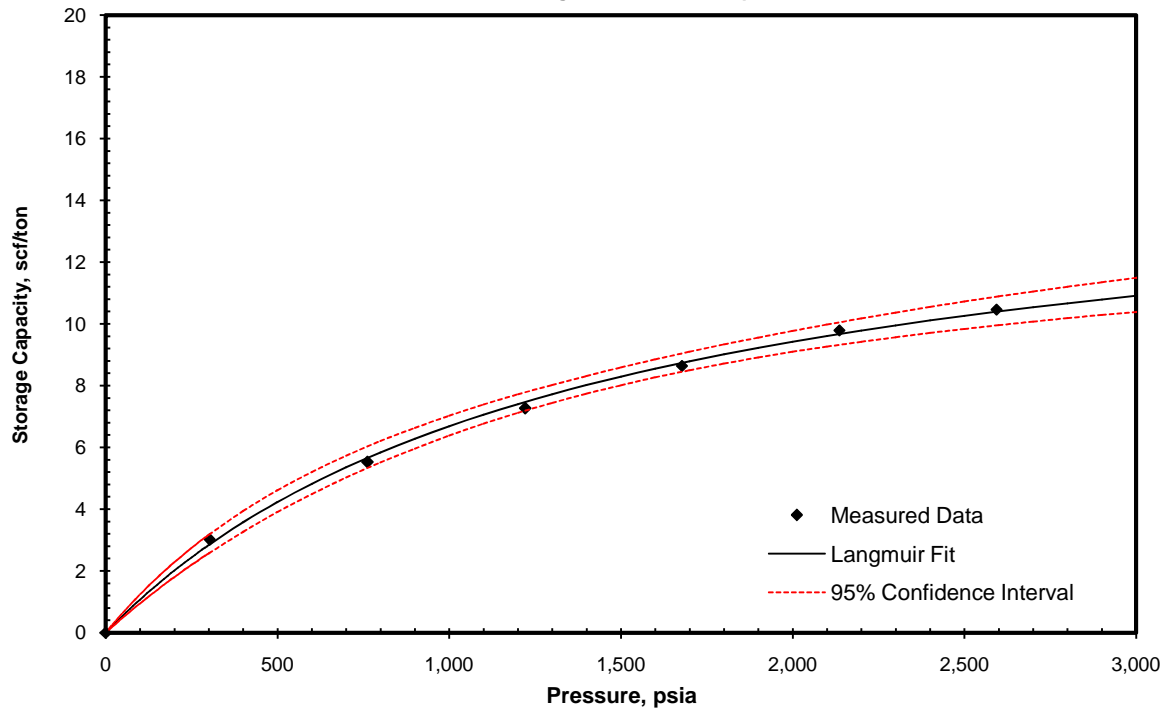
*p* Relevant Pressure (Reservoir Pressure)

## Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph



As-Received Langmuir Isotherm Graph



## Methane Adsorption Isotherm Summary

**Well:** Shenandoah No. 1 Australia  
**Reservoir:** Lower Kyalla Shale  
 Sample Number: 44569-2M  
 Sample Type: shale  
 Drill Depth, meters: 1590.35-1590.39  
 Temperature, °C: 82.22

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
2.08	0.09	0.09
5.25	0.17	0.18
8.42	0.23	0.23
11.57	0.27	0.27
14.73	0.31	0.30
17.88	0.33	0.32

Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	2.0093
Intercept:	19.1645
Regression Coefficient (squared):	0.9947
Intercept Variation, Mpa*gram/scc:	2.9061
Slope Variation, gram/scc:	0.2560
G <sub>sL</sub> Variation, scc/gram:	0.0001
P <sub>L</sub> Variation, MPa:	0.8981
Langmuir Volume, scc/gram:	0.50
Langmuir Pressure, MPa:	9.54
Langmuir Equation:	$V=0.5*P/(P+9.5)$
Pressure (Midpoint), MPa:	15.68
Storage Capacity, scc/gram:	0.31

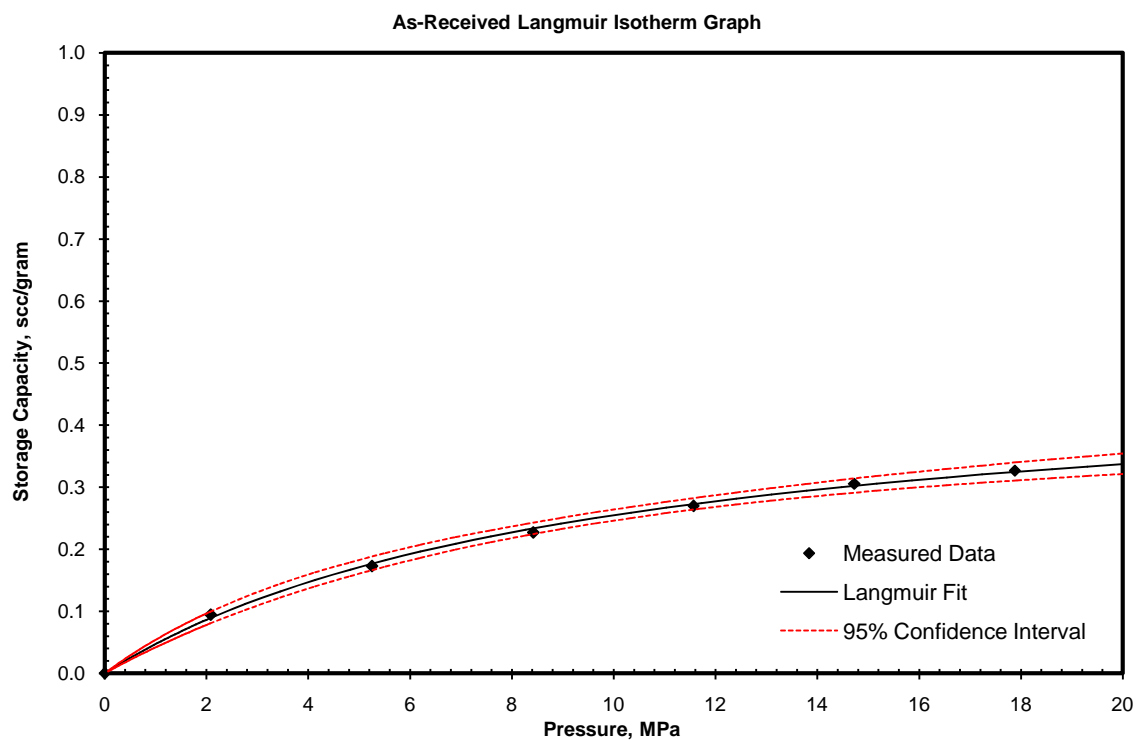
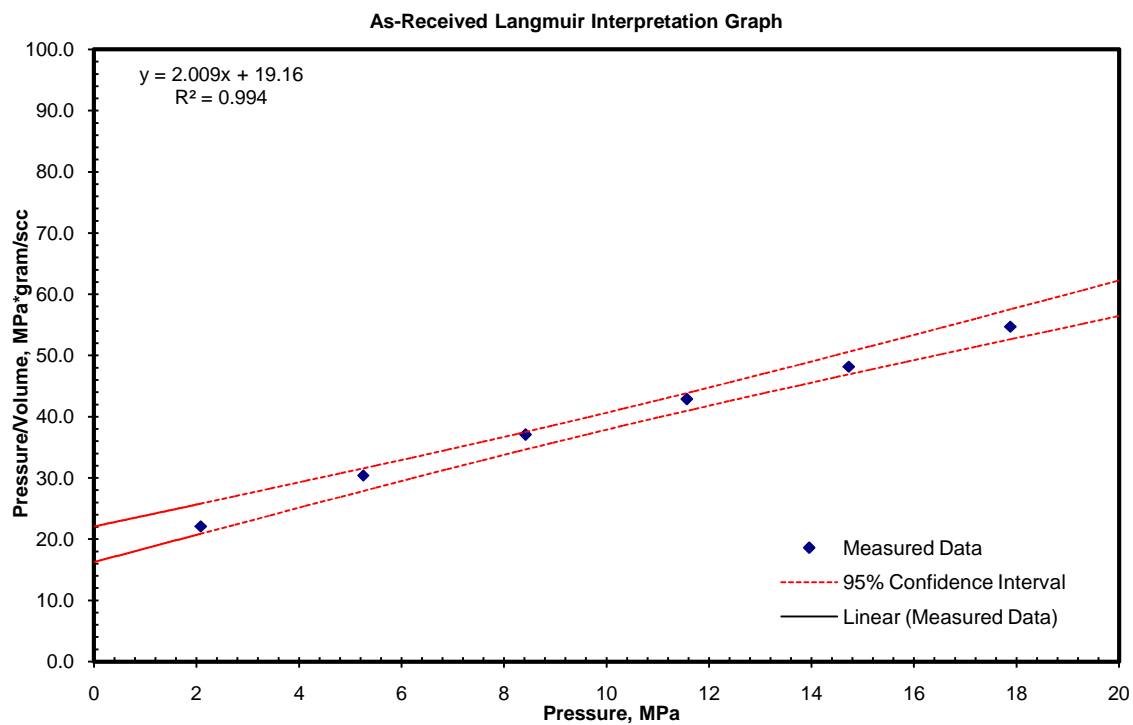
*G<sub>s</sub>* Gas Storage Capacity

*G<sub>sL</sub>* Langmuir Gas Storage Capacity

*P<sub>L</sub>* Langmuir Pressure

*p* Relevant Pressure (Reservoir Pressure)

## Methane Adsorption Isotherm Summary Graphs



## Methane Adsorption Isotherm Summary

**Well:** Shenandoah No. 1 Australia  
**Reservoir:** Lower Kyalla Shale  
**Sample Number:** 44569-3M  
**Sample Type:** shale  
**Drill Depth, feet:** 5,226.63-5,226.70  
**Temperature, °F:** 180.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
302.35	1.96	1.97
761.27	4.33	4.34
1,218.39	6.20	6.17
1,679.99	7.67	7.64
2,130.71	8.80	8.83
2,598.91	9.83	9.85

Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0481
Intercept:	138.9965
Regression Coefficient (squared):	0.9996
Intercept Variation, psia*ton/scf:	2.7332
Slope Variation, ton/scf:	0.0017
G <sub>sL</sub> Variation, scf/ton:	0.0008
P <sub>L</sub> Variation, psia:	35.2493
Langmuir Volume, scf/ton:	20.80
Langmuir Pressure, psia:	2,891.29
Langmuir Equation:	$G_s = (G_{sL} * p) / (P_L + p)$
Pressure (Midpoint), psia:	2,277.80
Storage Capacity, scf/ton:	9.17

*G<sub>s</sub>* Gas Storage Capacity

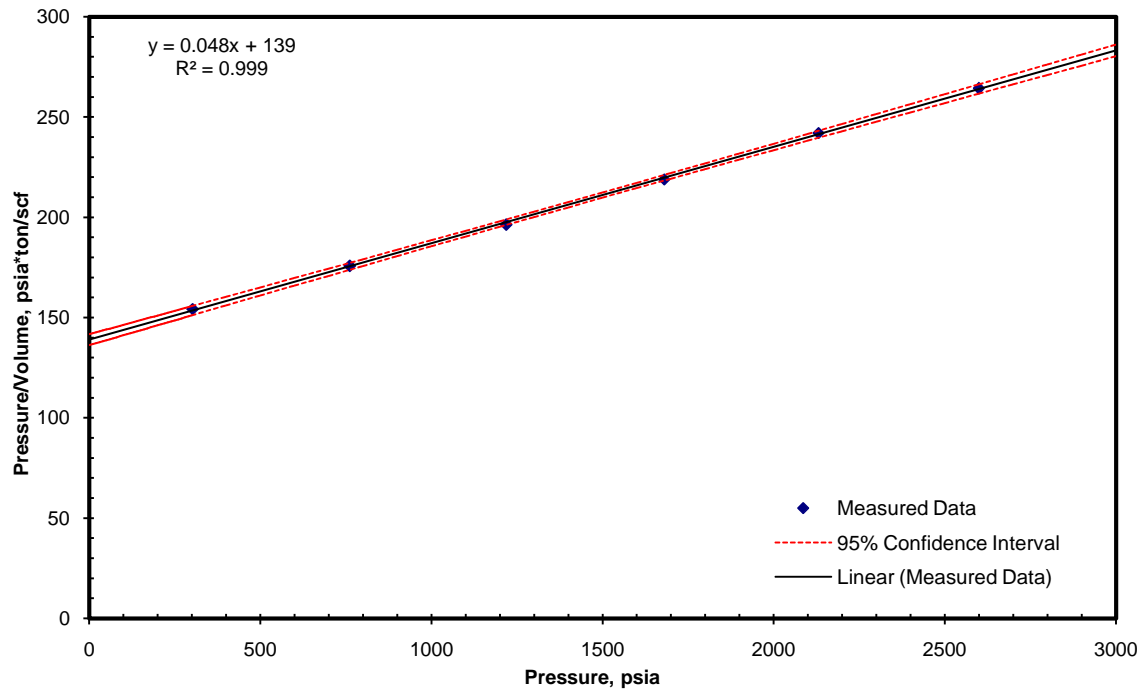
*G<sub>sL</sub>* Langmuir Gas Storage Capacity

*P<sub>L</sub>* Langmuir Pressure

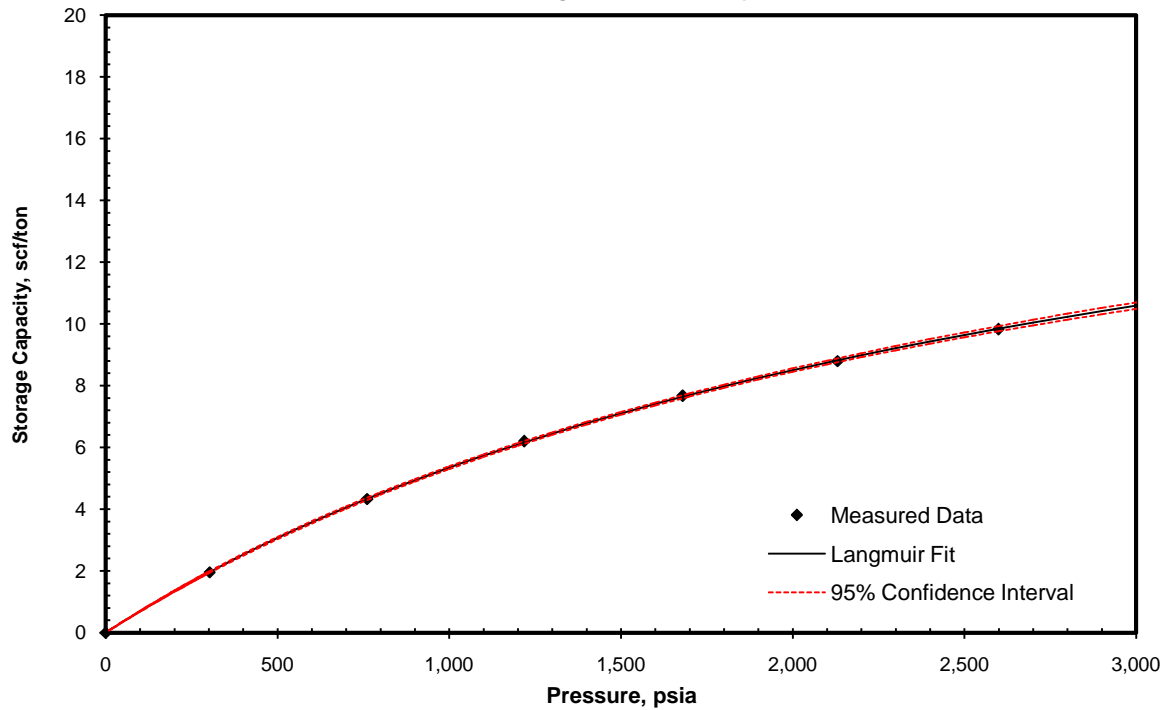
*p* Relevant Pressure (Reservoir Pressure)

## Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph



As-Received Langmuir Isotherm Graph



## Methane Adsorption Isotherm Summary

**Well:** Shenandoah No. 1 Australia  
**Reservoir:** Lower Kyalla Shale  
 Sample Number: 44569-3M  
 Sample Type: shale  
 Drill Depth, meters: 1593.08-1593.10  
 Temperature, °C: 82.22

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
2.08	0.06	0.06
5.25	0.14	0.14
8.40	0.19	0.19
11.58	0.24	0.24
14.69	0.27	0.28
17.92	0.31	0.31

Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	1.5402
Intercept:	30.7024
Regression Coefficient (squared):	0.9996
Intercept Variation, Mpa*gram/scc:	0.6037
Slope Variation, gram/scc:	0.0532
G <sub>sL</sub> Variation, scc/gram:	0.0000
P <sub>L</sub> Variation, MPa:	0.2430
Langmuir Volume, scc/gram:	0.65
Langmuir Pressure, MPa:	19.93
Langmuir Equation:	V=0.6*P/(P+19.9)
Pressure (Midpoint), MPa:	15.70
Storage Capacity, scc/gram:	0.29

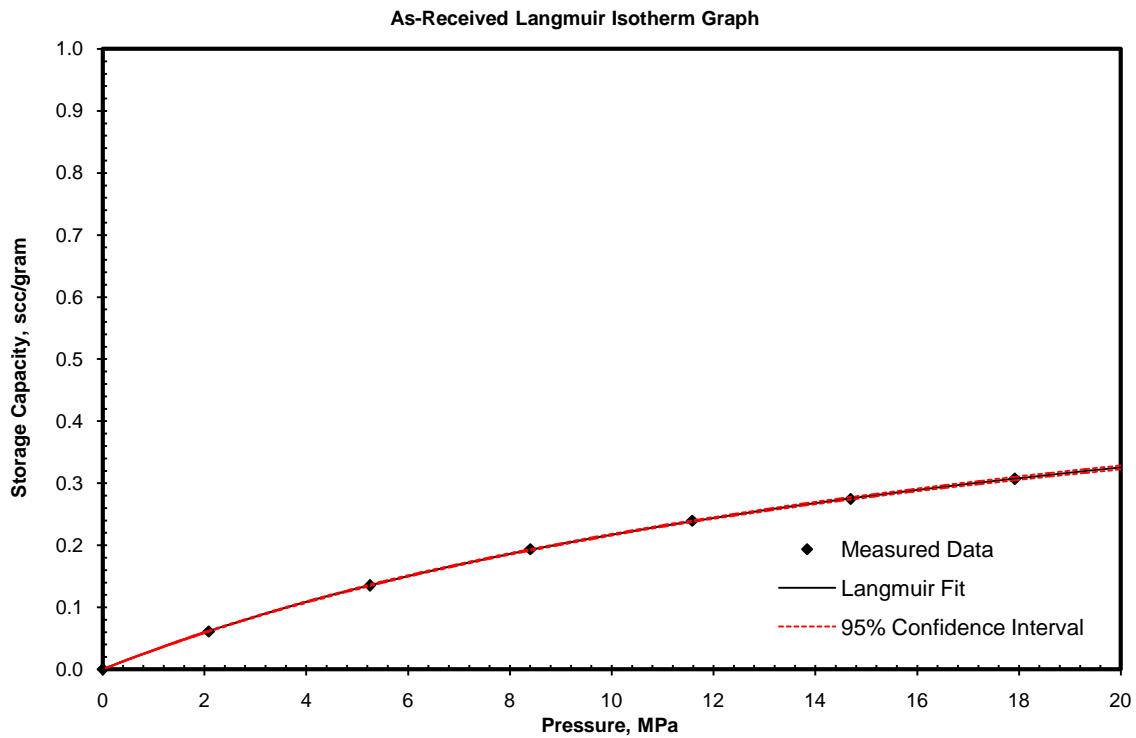
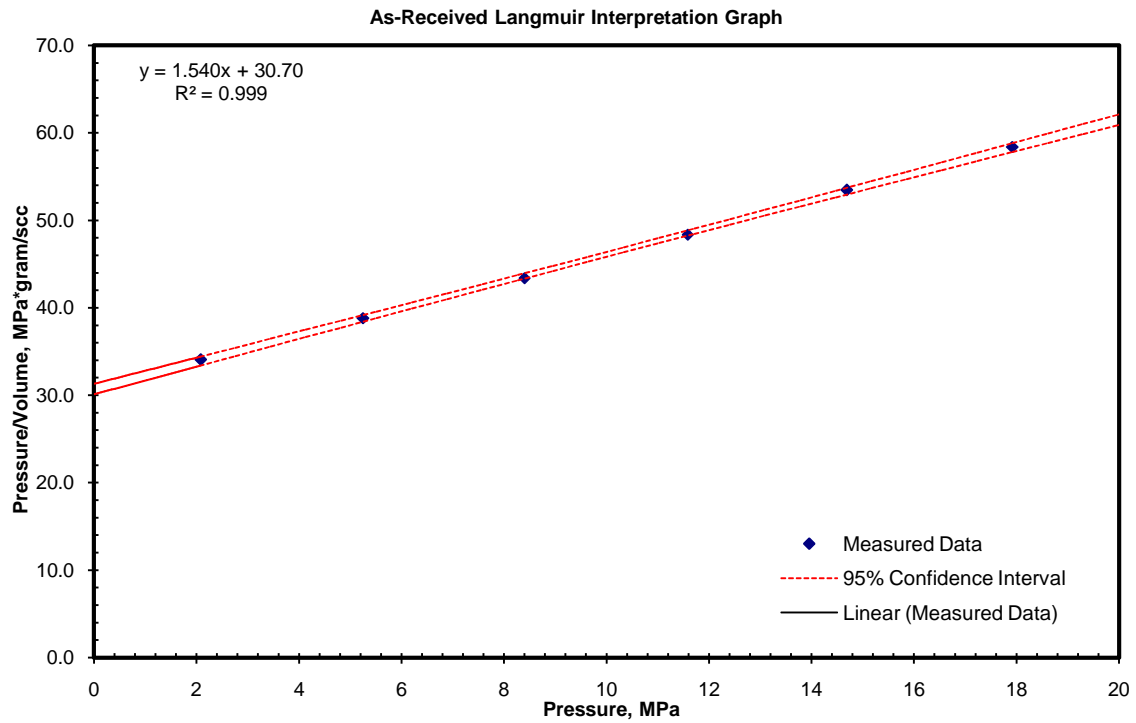
G<sub>s</sub> Gas Storage Capacity

G<sub>sL</sub> Langmuir Gas Storage Capacity

P<sub>L</sub> Langmuir Pressure

p Relevant Pressure (Reservoir Pressure)

## Methane Adsorption Isotherm Summary Graphs



## Methane Adsorption Isotherm Summary

Well: Shenandoah No. 1 Australia

Reservoir: Velkerri B Shale

Sample Number: 44569-4M

Sample Type: shale

Drill Depth, feet: 8,240.90-8,241.00

Temperature, °F: 220.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
488.18	15.77	15.36
924.61	24.13	24.22
1352.38	29.97	30.43
1791.23	34.28	35.21
2221.26	38.89	38.85
2659.52	42.40	41.82
3087.73	44.94	44.19
3527.31	46.44	46.22
3961.15	47.33	47.92

Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0147
Intercept:	24.6264
Regression Coefficient (squared):	0.9974
Intercept Variation, psia*ton/scf:	2.0037
Slope Variation, ton/scf:	0.0008
$G_{sL}$ Variation, scf/ton:	0.0569
$P_L$ Variation, psia:	78.9325
Langmuir Volume, scf/ton:	68.25
Langmuir Pressure, psia:	1,680.78
Langmuir Equation:	$V=68.3 \cdot P / (P+1,680.8)$
Pressure (Midpoint), psia:	3,583.03
Storage Capacity, scf/ton:	46.46

$G_s$  Gas Storage Capacity

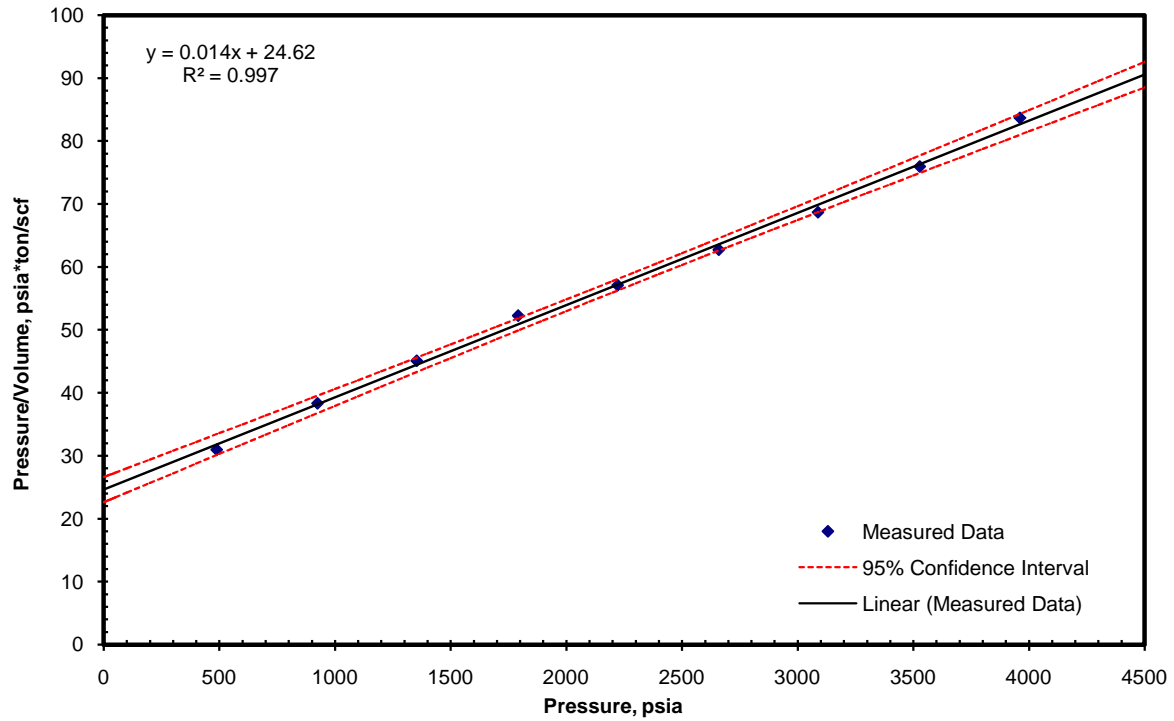
$G_{sL}$  Langmuir Gas Storage Capacity

$P_L$  Langmuir Pressure

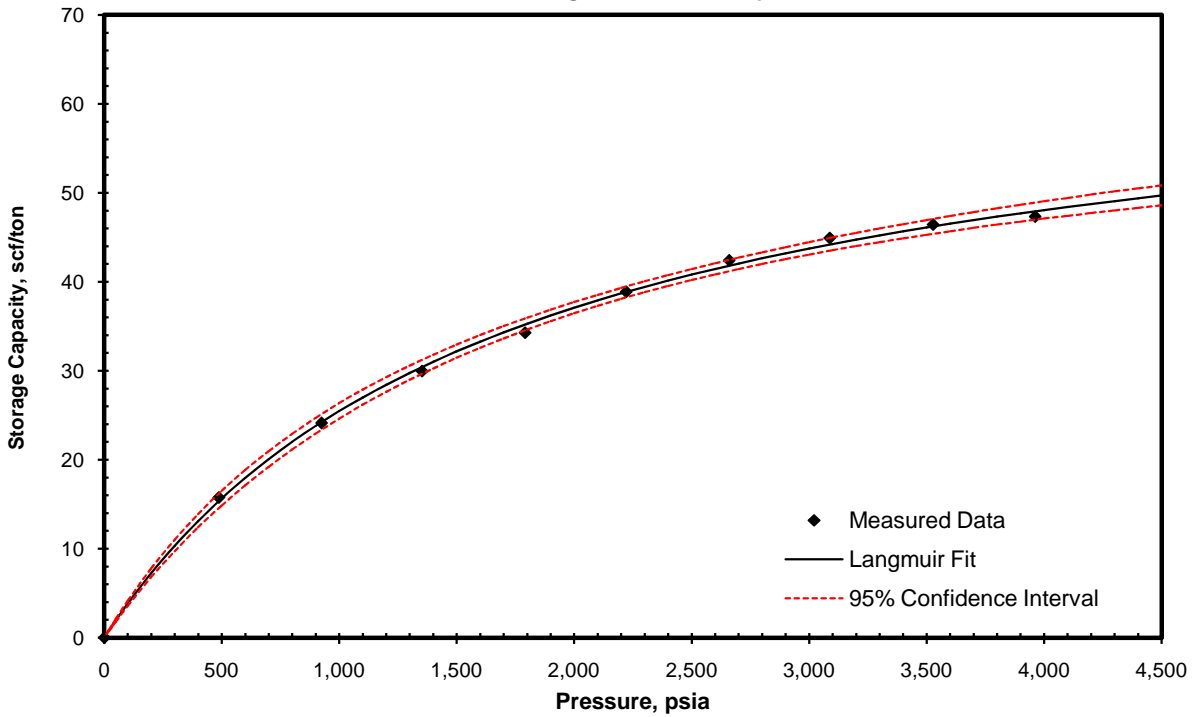
$p$  Relevant Pressure (Reservoir Pressure)

## Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph



As-Received Langmuir Isotherm Graph



## Methane Adsorption Isotherm Summary

Well: Shenandoah No. 1 Australia

Reservoir: Velkerri B Shale

Sample Number: 44569-4M

Sample Type: shale

Drill Depth, meters: 2511.83-2511.86

Temperature, °C: 104.44

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
3.37	0.49	0.48
6.37	0.75	0.76
9.32	0.94	0.95
12.35	1.07	1.10
15.32	1.21	1.21
18.34	1.32	1.31
21.29	1.40	1.38
24.32	1.45	1.44
27.31	1.48	1.50

Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	0.4694
Intercept:	5.4396
Regression Coefficient (squared):	0.9974
Intercept Variation, Mpa*gram/scc:	0.4426
Slope Variation, gram/scc:	0.0258
$G_{sL}$ Variation, scc/gram:	0.0018
$P_L$ Variation, MPa:	0.5442
Langmuir Volume, scc/gram:	2.13
Langmuir Pressure, MPa:	11.59
Langmuir Equation:	$V=2.1*P/(P+11.6)$
Pressure (Midpoint), MPa:	24.70
Storage Capacity, scc/gram:	1.45

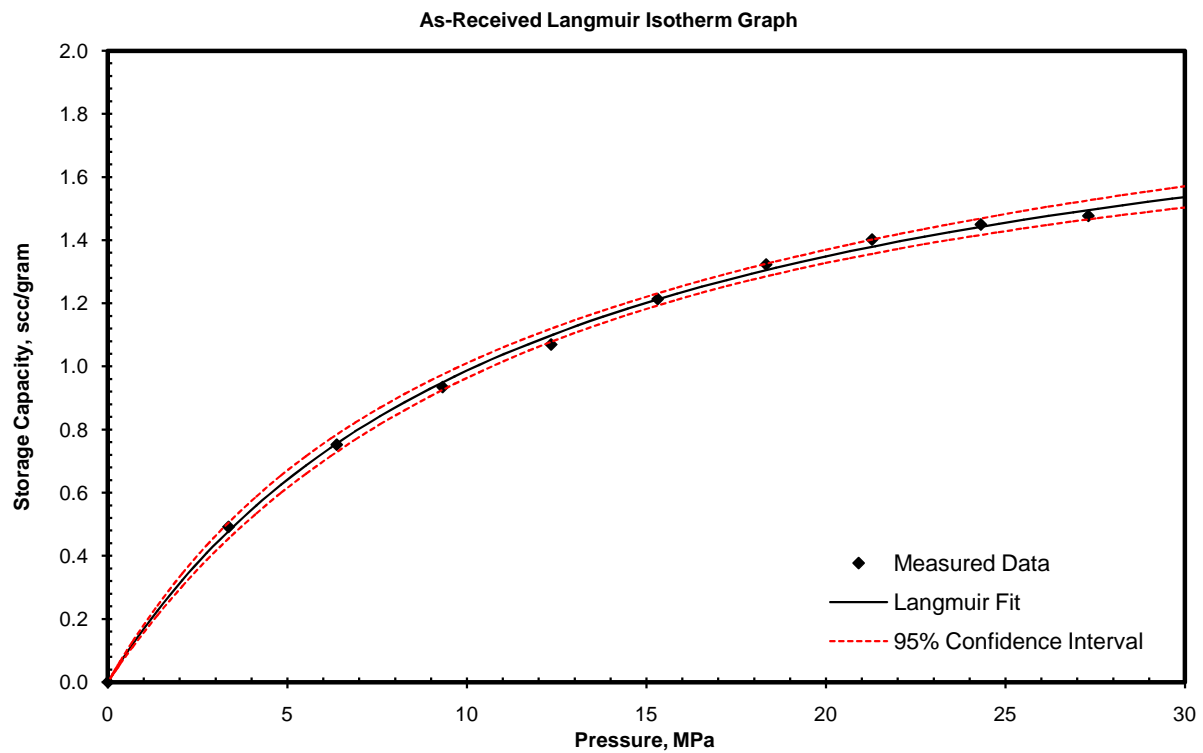
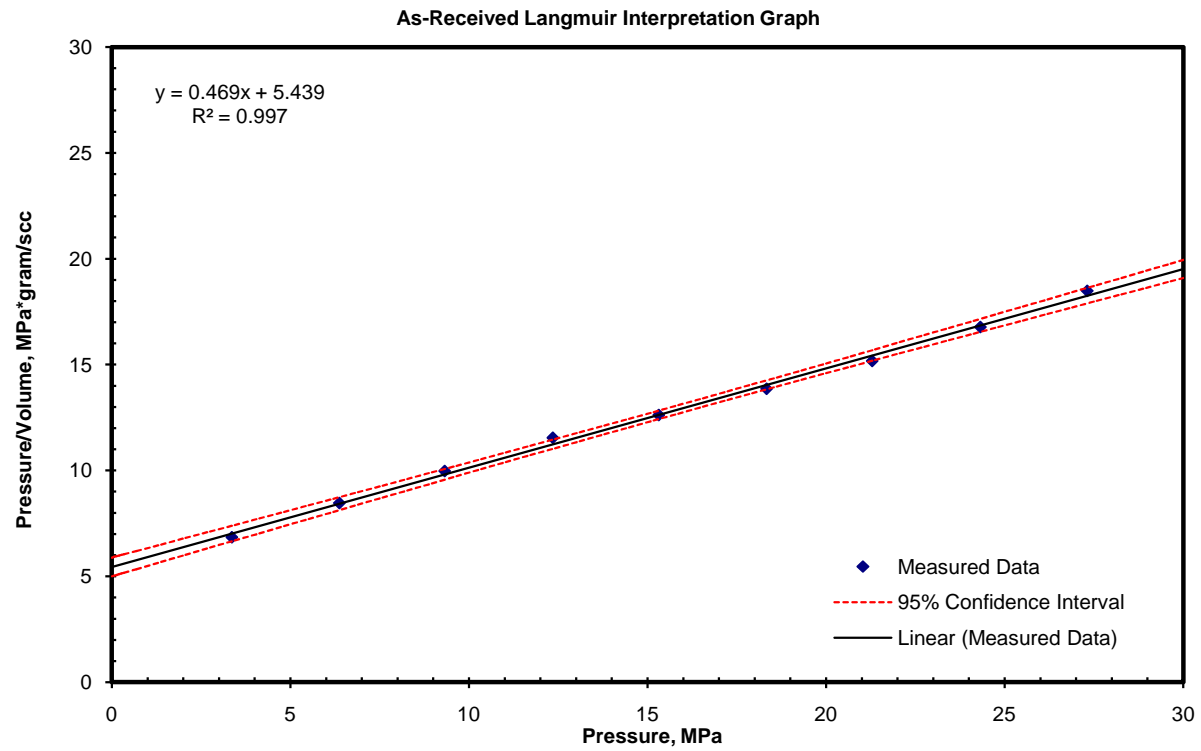
$G_s$  Gas Storage Capacity

$G_{sL}$  Langmuir Gas Storage Capacity

$P_L$  Langmuir Pressure

$p$  Relevant Pressure (Reservoir Pressure)

## Methane Adsorption Isotherm Summary Graphs



## Methane Adsorption Isotherm Summary

**Well:** Shenandoah No. 1 Australia  
**Reservoir:** Velkerri B Shale  
 Sample Number: 44569-5M  
 Sample Type: shale  
 Drill Depth, feet: 8,247.45-8,247.50  
 Temperature, °F: 220.00

Pressure	Methane Storage Capacity, scf/ton	
psia	As-Received	
	Measured	Calculated
0.00	0.00	0.00
487.50	23.36	22.75
924.65	35.91	36.43
1,359.57	45.86	46.38
1,800.77	54.04	54.07
2,240.52	59.60	60.10
2,680.02	65.72	64.97

Parameters	Methane Langmuir Parameters (U.S. Units)
	As-Received
Slope:	0.0090
Intercept:	17.0237
Regression Coefficient (squared):	0.9968
Intercept Variation, psia*ton/scf:	1.5693
Slope Variation, ton/scf:	0.0009
G <sub>sL</sub> Variation, scf/ton:	0.1732
P <sub>L</sub> Variation, psia:	91.9552
Langmuir Volume, scf/ton:	110.62
Langmuir Pressure, psia:	1,883.22
Langmuir Equation:	$G_s = (G_{sL} * p) / (P_L + p)$
Pressure (Midpoint), psia:	3,585.86
Storage Capacity, scf/ton:	72.53

*G<sub>s</sub>* Gas Storage Capacity

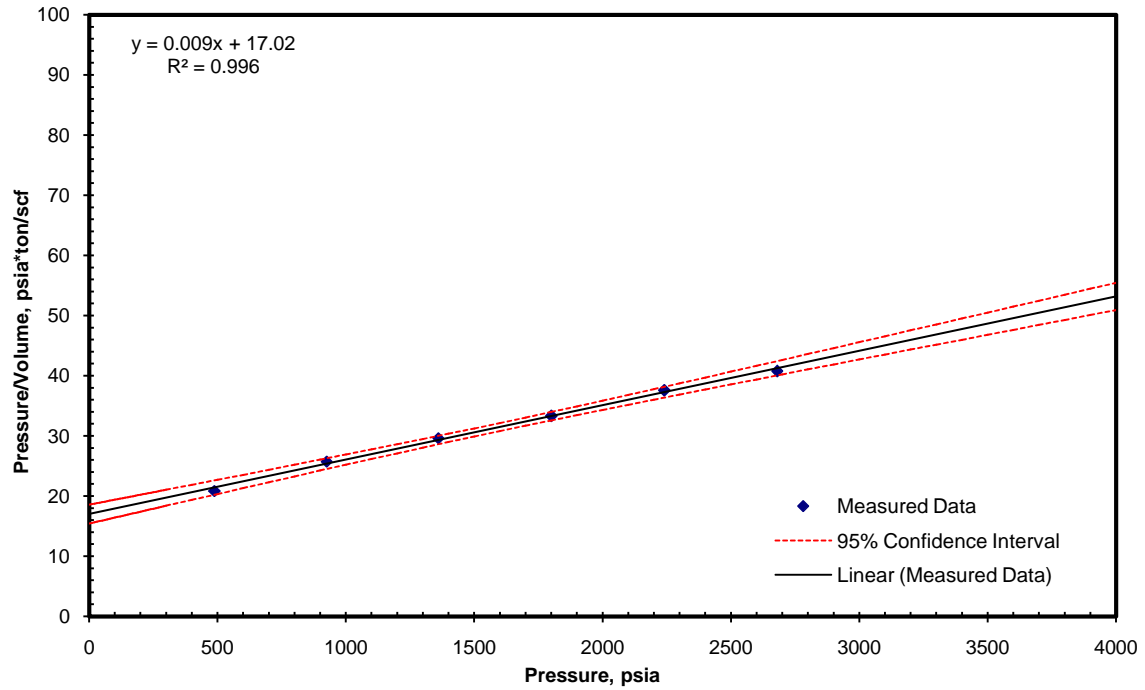
*G<sub>sL</sub>* Langmuir Gas Storage Capacity

*P<sub>L</sub>* Langmuir Pressure

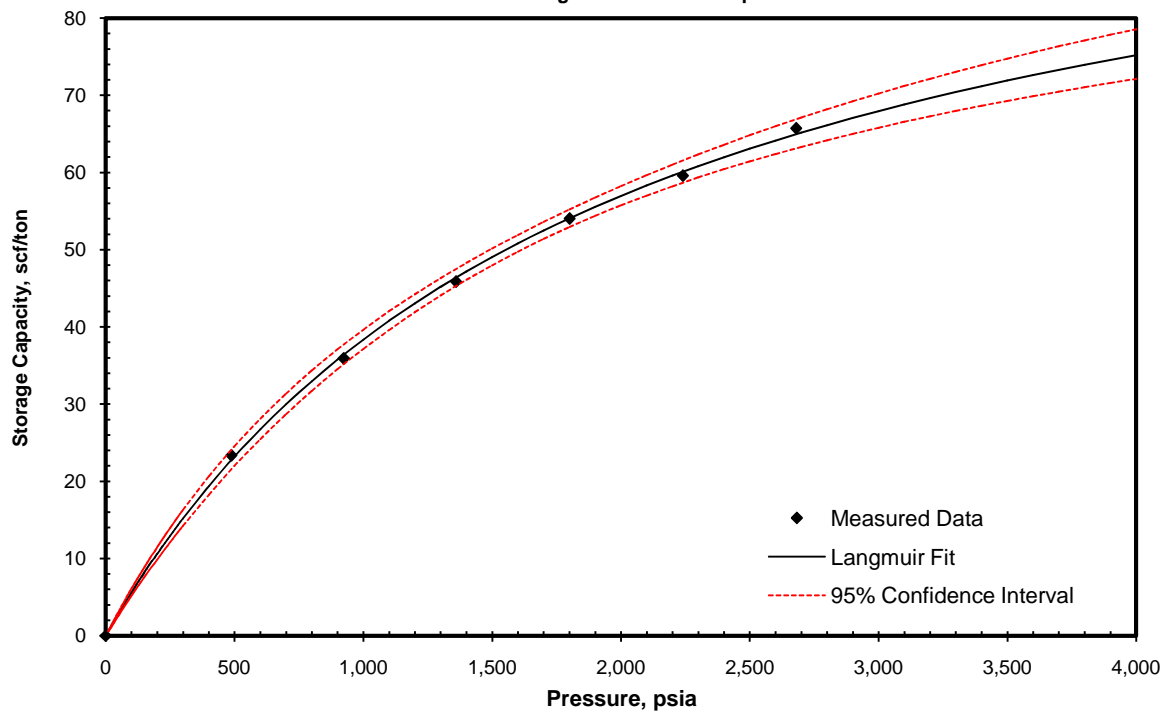
*p* Relevant Pressure (Reservoir Pressure)

## Methane Adsorption Isotherm Summary Graphs

As-Received Langmuir Interpretation Graph



As-Received Langmuir Isotherm Graph



## Methane Adsorption Isotherm Summary

**Well:** Shenandoah No. 1 Australia  
**Reservoir:** Velkerri B Shale  
 Sample Number: 44569-5M  
 Sample Type: shale  
 Drill Depth, meters: 2513.82-2513.84  
 Temperature, °C: 104.44

Pressure	Methane Storage Capacity, scc/gram	
MPa	As-Received	
	Measured	Calculated
0.00	0.00	0.00
3.36	0.73	0.71
6.38	1.12	1.14
9.37	1.43	1.45
12.42	1.69	1.69
15.45	1.86	1.88
18.48	2.05	2.03

Parameters	Methane Langmuir Parameters (S.I. Units)
	As-Received
Slope:	0.2896
Intercept:	3.7603
Regression Coefficient (squared):	0.9968
Intercept Variation, Mpa*gram/scc:	0.3466
Slope Variation, gram/scc:	0.0287
G <sub>sL</sub> Variation, scc/gram:	0.0054
P <sub>L</sub> Variation, MPa:	0.6340
Langmuir Volume, scc/gram:	3.45
Langmuir Pressure, MPa:	12.98
Langmuir Equation:	$V=3.5*P/(P+13.0)$
Pressure (Midpoint), MPa:	24.72
Storage Capacity, scc/gram:	2.26

*G<sub>s</sub>* Gas Storage Capacity

*G<sub>sL</sub>* Langmuir Gas Storage Capacity

*P<sub>L</sub>* Langmuir Pressure

*p* Relevant Pressure (Reservoir Pressure)

## Methane Adsorption Isotherm Summary Graphs

