

WELL HISTORY
ENSIGN OPERATING COMPANY
SALLY SOUTHWEST PROSPECT
NO. 2-25 LIBERAL
S/2 S/2 NE SEC. 25, T34S, R34W
SEWARD COUNTY, KANSAS

BY
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STRIP LOG (WITH DRILL TIME, LITHOLOGY AND HOT WIRE MEASUREMENTS)	ATTACHED

SYNOPSIS

The Ensign Operating Co., No. 2-25 Liberal S/2 S/2 NE Sec. 25, T34S, R34W, Seward County, Kansas was a 6900 foot well to evaluate the Sally Southwest Prospect. The main objective of the well was to evaluate the Pennsylvanian Lower Morrow sandstones. The Chester limestones, the Lower Chester sandstones and the Mississippian Ste. Genevieve, St. Louis and Spergen were secondary objectives. Another objective was to evaluate any significant oil and gas shows encountered while drilling to total depth.

The Lower Morrow sandstones were present with subdued mud gas shows. There were no oil shows in the lithologic samples. A drill-stem test of these sandstones recovered 4.320 MMCF/D gas with a bottom hole shut-in pressure of 988 psi. These flow and pressure data indicate that the sandstones are not depleted by near by wells in the Salley Southwest field.

The upper part of the Chester limestones which had mud gas shows were included in the drill-stem test. Their contribution to the gas flow in the drill-stem test is not yet determined. Evaluation of bore hole geophysical log data suggests that the gas flow contribution from these limestones might be small. The Lower Chester limestones which were not included in the drill-stem test had questionable mud gas shows. It is possible that these shows are the result of recycled drill-stem test gas present in the mud.

Based on interpretative subsurface geology it was possible that the elusive Lower Chester sandstones would be present in this well. The Lower Chester sandstones which are present in a few wells in the area present a very narrow target for the bore hole to hit. The lower Chester sandstones were not present in this well.

The Mississippian limestones and dolomites of the Ste. Genevieve, St. Louis and Spergen formations contained some porosity developments but no significant oil or gas shows. The Spergen has good reservoir quality rocks but was not in a favorable oil or gas trapping position.

After an evaluation of the lithologic samples, drill-stem test data and bore hole geophysical logs, it was determined that the well was capable of gas production from the Pennsylvanian Lower Morrow sandstones. Pipe was set to further evaluate these sandstones for commercial gas production.

GENERAL WELL INFORMATION

Operator: Ensign Operating Co.

Well Name: No. 2-25 Liberal API No. 15-175-21591

Prospect: Sally Southwest Prospect

Location: S/2 S/2 NE Sec. 25, T34S, R34W, 1650' FNL, 1320' FEL

County: Seward

State: Kansas

Elevation: G.L. 2883' K.B. 2893'

Spudded: February 8, 1997 @ 10:45 P.M..

Completed Drilling: February 20, 1997 @ 3:00 P.M.

Total Depth: Driller 6900' Logger 6899'

Status: Set Production Casing To Produce Lower Morrow Sandstone.

Drill-Stem Tests: Drill-Stem Test No. 1 6138'-6220' Pennsylvanian Lower Morrow

Times: 30-60-45-135

I.O. Strong Blow, Bottom Of Bucket In 15 Seconds, Gas To Surface In Two Minutes.

F.O. Very Strong Blow.

Initial Open Gas Flow:

Time in Minutes	Orifice PSI	Orifice Size	Flow Rate CFD
2	NM	1.5"	GTS
10	38	1.5"	3,036,000
15	45	1.5"	3,454,000
20	47	1.5"	3,573,000
25	50	1.5"	3,752,000
30	50	1.5"	3,752,000

Final Open Gas Flow:

Time in Minutes	Orifice PSI	Orifice Size	Flow Rate CFD
5	38	1.5"	3,036,000
10	40	1.5"	3,155,000
15	55	1.5"	4,051,000
20	58	1.5"	4,230,000
25	58	1.5"	4,230,000
30	58	1.5"	4,230,000
35	58	1.5"	4,230,000
40	58	1.5"	4,230,000
45	58	1.5"	4,230,000

Recovery: 6114' Gas In Drill Pipe.

Sampler: 20.7 Cu Ft Gas @ 850 psi

Hydrostatic Pressures 2962-2841 psi
 Flow Pressures 525-665:665-988 psi
 Shut-in Pressures 994-988 psi
 Bottom Hole Temperature 139° F

Trilobite Testing L.L.C., Tom Horacek, Tester.

Logging Program: HRI/SP/GR 0' - 6900'
 SDL/DSN/GR/Cal 4000' - 6890'
 ML/GR/Cal 4000' - 6895'
 Sonic/GR/Cal 1598' - 6857'

Halliburton Energy Services, Piroutek, Engineer.

Sample Program: Ten foot samples from 4252' - 6900'. Samples were examined and described at the well site. Samples were caught on depth intervals by rig crews. Samples were lagged by geologist. All depths reported herein are lagged depths.

Mud Logging: Holmes Gas Detector Service, Unmanned Unit.

Mud Program: Cimmeron Mud Co. Jim Reed, Engineer.

Lost Circulation: None.

Contractor: Murfin Drilling Co., Inc., Rig No. 20, Rodney Farr, Toolpusher.

Bit Record:

No.	Size	Make	Type	Depth Out	Feet	Hours
1	12.25	Sec	S33S	1598'	1598'	18.25
2	7.875	HTC	GT18	5464'	3866'	122.50
3	7.875	HTC	S88F	6950'	1436'	79.50

Total Rotating Hours 220.25, Average 31.328 Ft/Hr

Deviation Record:

1/2°	@ 852'
1/2°	@ 1165'
3/4°	@ 1598'
1/2°	@ 2161'
1/2°	@ 2661'
1/2°	@ 3381'
1°	@ 4127'
1°	@ 4723'
1/2°	@ 5464'
1/2°	@ 6220'
1/2°	@ 6900'

DAILY DRILLING REPORT

Ensign Operating Co.
No. 2-25 Liberal
S/2 S/2 NE Sec. 25, T34S, R34W
Seward County, Kansas

7:00 A.M. Reports

1	Feb.	8	0' (0') Rig up rotary tools.
2	Sun	9	850' (850') Spud @ 10:45 P.M..
3	Mon	10	1598' (748') Set 8 5/8" @ 1598', Plug Down @ 12:30 A.M.
4	Tue	11	2120' (522') Drill Plug @ 1:30 P.M.
5	Wed	12	2980' (860')
6	Thur	13	3680' (700')
7	Fri	14	4310' (630')
8	Sat	15	4975' (665')
9	Sun	16	5464' (489') Bit Trip @ 5464'
10	Mon	17	5905' (441')
11	Tue	18	6220' (315') DST No. 1 6138'-6220' Lower Morrow Sandstone.
12	Wed	19	6400' (180')
13	Thur	20	6760' (360')
14	Fri	21	6900' (140') Logging
15	Sat	22	6900' (0') Set 4 1/2" Production Casing

FORMATION TOPS

Ensign Operating Company

No. 2-25 Liberal

S/2 S/2 NE/4 Sec. 25, T34S, R34W

Seward County, Kansas

EOC No. 1-31 Liberal

EOC No. 2-25 Liberal

EOC No. 2-25 Liberal

NW SW NE Sec. 31

S/2 S/2 NE Sec. 34,

S/2 S/2 NE Sec. 34,

T34S, R34W

T34S,R34 W

T34S,R34 W

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Borehole Geophysical Lo

Drill Time & Samples

Borehole Geophysical Logs

Tertiary

Permian

Guadalupian

White Horse

Leonardian

Nipewalla Grp.

Blaine

Cedar Hills

Salt Plain

Sumner Grp.

Stone Corral

Ninnescah

Wellington

Wolfcampian

Chase Grp.

Herington

Krider

Winfield

Towanda

Fort Riley

Wreford

Council Grove Gr

Admire Grp.

Depth	Subsea	Interval	Depth	Subsea	Interval	H/L	Depth	Subsea	Interval	H/L
Surface	2862	12	Surface	2883	10	21	Surface	2883	10	21
		689			655				654	
701	2173	215	665	2228	272	55	664	2229	266	56
916	1958	163	937	1956	165	-2	930	1963	170	5
1079	1795	141	1102	1791	138	-4	1100	1793	142	-2
1220	1654	340	1240	1653	335	-1	1242	1651	326	-3
1560	1314	66	1575	1318	69	4	1568	1325	74	11
1626	1248	501	1644	1249	500	1	1642	1251	508	3
2127	747	473	2144	749	473	2	2150	743	460	-4
2600	274	64	2617	276	66	2	2610	283	64	9
2664	210	56	2683	210	50	0	2674	219	52	9
2720	154	60	2733	160	60	6	2726	167	60	13
2780	94	58	2793	100	56	6	2786	107	60	13
2838	36	106	2849	44	100	8	2846	47	98	11
2944	-70	119	2949	-56	114	14	2944	-51	116	19
3063	-189	389	3063	-170	373	19	3060	-167	378	22
3452	-578	32	3436	-543	40	35	3438	-545	32	33

EOC No. 1-31 Liberal
NW SW NE Sec. 31
T34S, R34W
2874 KB

EOC No. 2-25 Liberal
S/2 S/2 NE Sec. 34,
T34S, R34 W
2893 KB

EOC No. 2-25 Liberal
S/2 S/2 NE Sec. 34,
T34S, R34 W
2893 KB

	Borehole Geophysical Lo			Drill Time & Samples				Borehole Geophysical Logs			
	Depth	Subsea	Interval	Depth	Subsea	Interval	H/L	Depth	Subsea	Interval	H/L
<i>Pennsylvanian</i>											
<i>Virgilian</i>											
Wabaunsee Grp.	3484	-610	832	3476	-583	854	27	3470	-577	862	33
Douglas Grp.											
Heebner	4316	-1442	18	4330	-1437	20	5	4332	-1439	18	3
Toronto	4334	-1460	80	4350	-1457	90	3	4350	-1457	70	3
<i>Missourian</i>											
Lansing Grp.	4414	-1540	346	4420	-1527	343	16	4420	-1527	340	13
Kansas City Grp	4760	-1886	418	4763	-1870	418	9	4760	-1867	416	19
<i>Desmoinesian</i>											
Marmaton Grp.	5178	-2304	172	5181	-2288	179	16	5176	-2283	182	21
Cherokee Grp.	5350	-2476	124	5360	-2467	115	9	5358	-2465	114	11
<i>Atokian</i>	5474	-2600	373	5475	-2582	396	18	5472	-2579	398	21
<i>Morrowian</i>	5847	-2973	249	5871	-2978	239	-5	5870	-2977	240	-4
Lower Morrow	6096	-3222	37	6110	-3217	29	5	6110	-3217	28	5
Top Pay Sand	6133	-3259	17	6139	-3246	29	13	6138	-3245	46	14
Base Pay Sand	6150	-3276	10	6186	-3293	47	-17	6184	-3291	18	-15
Chester	6160	-3286	326	6204	-3311	209	-25	6202	-3309	208	-23
Orange Marker	6374	-3500	112	6413	-3520	145	-20	6410	-3517	142	-17
<i>Mississippian</i>											
<i>Meramecian</i>											
Ste. Genevieve	6486	-3612	104	6558	-3665	37	-53	6552	-3659	44	-47
St. Louis	6590	-3716	222	6595	-3702	219	14	6596	-3703	216	13
Spergen	6812	-3938	129	6814	-3921	86	17	6812	-3919	87	19
<i>Total Depth</i>	6941	-4067		6900	-4007		41	6899	-4006		42

COMPARATIVE FORMATION TOPS

Ensign Operating Company

No. 2-25 Liberal

S/2 S/2 NE/4 Sec. 25, T34S, R34W

Seward County, Kansas

EOC No. 1-31 Liberal

OXY USA, Inc.

EOC No. 2-25 Liberal

NW SW NE Sec. 31

S/2 N/2 SW Sec. 30

S/2 S/2 NE Sec. 34,

T34S, R34W

T34S, R33W

T34S, R34 W

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Tertiary

Depth	Subsea	Interval	Depth	Subsea	Interval	H/L	Depth	Subsea	Interval	H/L
Surface	2862	12	Surface	2896	11	34	Surface	2883	10	21
		689							654	
701	2173	215	NL				664	2229	266	56
916	1958	163	NL				930	1963	170	5
1079	1795	141	NL				1100	1793	142	-2
1220	1654	340	NL				1242	1651	326	-3
1560	1314	66	NL				1568	1325	74	11
1626	1248	501					1642	1251	508	3
2127	747	473	2128	779	480	32	2150	743	460	-4
2600	274	64	2608	299	58	25	2610	283	64	9
2664	210	56	2666	241	62	31	2674	219	52	9
2720	154	60	2728	179	58	25	2726	167	60	13
2780	94	58	2786	121	54	27	2786	107	60	13
2838	36	106	2840	67	104	31	2846	47	98	11
2944	-70	119	2944	-37	114	33	2944	-51	116	19
3063	-189	389	3058	-151	388	38	3060	-167	378	22
3452	-578	32	3446	-539	32	39	3438	-545	32	33

Permian

Guadalupian

White Horse

Leonardian

Nipewalla Grp.

Blaine

Cedar Hills

Salt Plain

Sumner Grp.

Stone Corral

Ninnescah

Wellington

Wolfcampian

Chase Grp.

Herington

Krider

Winfield

Towanda

Fort Riley

Wreford

Council Grove Gr

Admire Grp.

LITHOLOGIC SAMPLE DESCRIPTIONS

Ensign Operating Co.
No. 2-25 Liberal
S/2 S/2 NE Sec. 25, T34S, R34W
Seward County, Kansas

Sample examination commenced at 4252 feet and continued to total depth at 6900 feet. Samples were caught by crews on depth intervals and lagged by geologist. All depths reported herein are lagged depths. A 10 foot sample interval was used from 4252 feet to 6900 feet.

- 4252 - 4290 Shale (50%), black, gray. Limestone (30%), gray, grayish tan, mudstone, wackestone. Dolomite (10%), tan, light grayish brown, fine crystalline. Mud Gas 37 Units, 4260'-4276.
- 4290 - 4300 Shale (70%), black, gray. Limestone (25%), gray, grayish tan, mudstone, wackestone. Dolomite (5%), tan, light grayish brown, fine crystalline.
- 4300 - 4312 Shale (75%), black, gray. Limestone (25%), gray, grayish tan, mudstone, wackestone. Dolomite (trace), tan, light grayish brown, fine crystalline.
- 4312 - 4322 Shale (85%), black, gray. Limestone (15%), gray, grayish tan, wackestone, some packstone. Mud Gas 55 Units, 4316'-4321'.
- 4322 - 4328 Limestone (75%), light gray, grayish tan, wackestone, mudstone. Shale (25%), black, gray.
- Heebner 4330' -1437' Log 4332' -1439'**
- 4328 - 4342 Shale (75%), black, very dark brown. Limestone (15%), gray, grayish brown, mudstone. Limestone (10%), light gray, grayish tan, buff, wackestone. Mud Gas 35 Units, 4333'-4343'.
- 4342 - 4348 Shale (70%), black, very dark brown. Limestone (30%), gray, grayish tan, wackestone, mudstone.
- Toronto 4350' -1457' Log 4350' -1457'**
- 4348 - 4354 Limestone (95%), buff, wackestone, packstone, some oolitic packstone with oomoldic porosity, some crystalline sparry calcite. Shale (5%), black, gray.
- 4354 - 4364 Limestone (95%), buff, wackestone, packstone, some oolitic packstone, some with oomoldic porosity, some vuggy porosity. Shale, (trace-5%), black, gray.
- 4364 - 4378 Limestone (100%), buff, wackestone, packstone, some oolitic packstone, some with oomoldic porosity, vuggy porosity. Shale (trace), black, gray.

- 4378 - 4384 Limestone (95%), grayish tan, gray, wackestone, some packstone. Shale (5%), gray, black.
- 4384 - 4391 Limestone (80%), tan, grayish tan, wackestone, some packstone, mudstone. Shale (20%), gray, black.
- 4391 - 4412 Limestone (75%), tan, grayish tan, packstone, wackestone, some vuggy porosity. Shale (25%), gray, black.
- 4412 - 4418 Limestone (100%), tan, grayish tan, packstone, wackestone, vuggy porosity. Shale (trace), gray, black.

Lansing 4420'-1527' Log 4420' -1527'

- 4418 - 4426 Limestone (100%), tan, grayish tan, packstone, wackestone, vuggy porosity. Shale (trace), gray, black.
- 4426 - 4442 Limestone (90%), gray, grayish tan, wackestone. Shale (10%), gray, black.
- 4442 - 4450 Limestone (95%), gray, grayish tan, wackestone, fossiliferous. Shale (5%), gray, black.
- 4450 - 4456 Limestone (95%), gray, grayish tan, wackestone, mudstone, fossiliferous. Shale (5%), gray, black.
- 4456 - 4466 Limestone (95%), gray, grayish tan, tan, wackestone, mudstone, fossiliferous. Shale (5%), gray, black.
- 4466 - 4480 Limestone (80%), tan, gray, grayish tan, wackestone, mudstone, some pelletoidal packstone with dark gray-black pellets. Dolomite (15%), tan, fine crystalline. Shale (5%), black, gray. Chert (trace), white, tan, gray.
- 4480 - 4490 Limestone (90%), gray, mudstone, some wackestone. Shale (10%), gray, black.
- 4490 - 4500 Limestone (90%), gray, light gray, mudstone, wackestone. Shale (10%), gray, black.
- 4500 - 4510 Limestone (90%), gray, light gray, mudstone, wackestone. Shale (10%), gray, black. Chert (trace), light gray, tan.
- 4510 - 4515 Limestone (90%), gray, light gray, mudstone, wackestone. Shale (10%), gray, black. Chert (trace), light gray, tan.
- 4515 - 4524 Dolomite (70%), gray, light gray, fine crystalline calcareous. Limestone (20%), gray, light gray, mudstone, some wackestone. Shale (10%), gray, black.
- 4524 - 4541 Dolomite (70%), gray, light gray, fine crystalline, calcareous. Limestone (20%), gray, light gray, mudstone, some wackestone. Shale (10%), gray, black. Questionable sample.

- 4541 - 4551 Dolomite (70%), gray, light gray, fine crystalline, calcareous. Limestone (20%), gray, light gray, mudstone, some wackestone. Shale (10%), gray, black. Questionable sample caught at 2:00 A.M..
- 4551 - 4561 Limestone (70%), gray, light gray, mudstone, some wackestone. Shale (15%), gray, black. Dolomite (15%), gray, light gray, fine crystalline, calcareous.
- 4561 - 4571 Limestone (60%), gray, light gray, mudstone, some wackestone. Shale (25%), gray, black. Dolomite (15%), gray, light gray, fine crystalline.
- 4571 - 4576 Shale (55%), black, gray. Limestone (40%), gray, grayish tan, mudstone, some wackestone, some dark brown lime mudstone. Dolomite (5%), gray, light gray, fine crystalline.
- 4576 - 4584 Shale (50%), black, gray. Limestone (50%), gray, grayish tan, mudstone, some wackestone. Chert (trace), dark brown.
- 4584 - 4590 Limestone (65%), gray, grayish tan, mudstone wackestone, trace vuggy porosity. Shale (35%), black, gray. Chert (trace), dark brown.
- 4590 - 4609 Limestone (80%), tan, grayish tan, wackestone, packstone, some mudstone, trace vuggy porosity. Shale (20%), gray, black.
- 4609 - 4622 Limestone (80%), tan, grayish tan, wackestone, some packstone, mudstone, trace vuggy porosity. Shale (20%), gray, black.
- 4622 - 4627 Limestone (95%), light grayish tan, mudstone, wackestone. Shale (5%), gray, black.
- 4627 - 4632 Limestone (100%), light gray, light grayish tan, wackestone, mudstone. Shale (trace), gray, black.
- 4632 - 4638 Limestone (100%), light gray, light grayish tan, wackestone, mudstone. Shale (trace), gray, black.
- 4638 - 4644 Limestone (95%), light gray, light grayish tan, wackestone, mudstone. Shale (5%), black, gray. Sample does match drill time.
- 4644 - 4664 Limestone (95%), light gray, light grayish tan, wackestone, mudstone. Shale (5%), black, gray. Questionable sample.
- 4664 - 4676 Limestone (100%), light gray, light grayish tan, wackestone, mudstone. Shale (trace), gray, black.
- 4676 - 4696 Limestone (95%), tan, light grayish tan, wackestone, packstone, some mudstone. Shale (5%), gray, black.
- 4696 - 4704 Limestone (90%), tan, grayish tan, gray, wackestone, mudstone. Shale (10%), gray, black. Chert (trace), gray, brown.
- 4704 - 4714 Limestone (75%), tan, grayish tan, gray, wackestone, mudstone. Shale (25%), gray, black. Chert (trace), gray, tan.

- 4714 - 4725 Limestone (55%), tan, grayish tan, packstone, wackestone, good vuggy porosity. Dolomite (40%), tan, fine crystalline, good vuggy porosity. Chert (trace-5%), gray, brown, tan, Shale (trace-5%), black, gray.
- 4725 - 4732 Limestone (90%), buff, tan, wackestone, packstone. Shale (10%), gray, black. Very small amount of cuttings in sample sack which consists mostly of lost circulation material. This is the first sample after a bore hole deviation survey and rig repairs. Questionable sample.
- 4732 - 4740 No Sample.
- 4740 - 4746 Limestone (95%), buff, tan, wackestone, some packstone, some vuggy porosity. Shale (5%), gray, black, green.
- 4746 - 4748 Limestone (85%), buff, tan, wackestone, some packstone, some vuggy porosity. Shale (15%), black, gray, green.
- 4748 - 4754 Limestone (80%), tan, grayish tan, wackestone, packstone, trace oolitic packstone with oomoldic porosity. Shale (20%), gray, black, green. Sample is 10% red shale cavings.

Kansas City 4763' -1870' Log 4760' -1867'

- 4754 - 4766 Limestone (95%), tan, grayish tan, oolitic packstone with oomoldic porosity, packstone, wackestone. Shale (5%), gray, black.
- 4766 - 4790 Limestone (90%), tan, grayish tan, wackestone, packstone, some oolitic packstone with oomoldic porosity. Shale (10%), gray, black.
- 4790 - 4798 Limestone (90%), buff, tan, wackestone, packstone, some oolitic packstone with oomoldic porosity, some vuggy porosity. Shale (10%), gray, black.
- 4798 - 4808 Limestone (95%), buff, tan, wackestone, packstone, some vuggy porosity. Shale (5%), gray, black.
- 4808 - 4820 Limestone (85%), tan, buff, light brown, wackestone, mudstone, some vuggy porosity. Shale (5%), gray, black. Dolomite (10%), tan, fine crystalline.
- 4820 - 4836 Limestone (80%), tan, buff, light grayish tan, wackestone, mudstone. Shale (5%), gray, black. Dolomite (15%), tan, gray, fine crystalline.
- 4836 - 4844 Limestone (95%), grayish tan, gray, tan, mudstone, wackestone. Shale (5%), gray, black.
- 4844 - 4851 Limestone (90%), grayish tan, gray, tan, mudstone, wackestone. Shale (10%), gray, black.
- 4851 - 4858 Limestone (90%), buff, tan, grayish tan, mudstone, wackestone. Shale (10%), gray, black.
- 4858 - 4864 Limestone (85%), buff, tan, grayish tan, mudstone, wackestone, some oolitic packstone. Shale (15%), gray, black, dark green. Chert (trace), gray.

- 4864 - 4872 Limestone (90%), buff, tan, grayish tan, wackestone, mudstone. Shale (10%), gray, black. Dolomite (trace), tan, fine crystalline.
- 4872 - 4880 Limestone (90%), buff, tan, wackestone, mudstone, some vuggy porosity. Shale (10%), gray, black. Dolomite (trace), tan, fine crystalline.
- 4880 - 4888 Limestone (100%), very light gray, wackestone, packstone, some vuggy and pin point porosity. Shale (trace), gray, black.
- 4888 - 4899 Limestone (100%), very light gray, wackestone, packstone, some vuggy and pin point porosity. Shale (trace), gray, black. Questionable 4:00 A.M. sample.
- 4899 - 4910 Limestone (100%), very light gray, wackestone, packstone, some vuggy and pin point porosity. Shale (trace), gray, black. Questionable sample.
- 4910 - 4926 Limestone (100%), very light gray, wackestone, trace oolitic packstone, some vuggy and oomoldic porosity. Shale (trace), gray.
- 4926 - 4942 Limestone (100%), very light gray, wackestone, mudstone. Shale (trace), gray, black.
- 4942 - 4951 Limestone (95%), light gray, grayish tan, mudstone, some wackestone. Shale (5%), black, gray.
- 4951 - 4957 Limestone (90%), gray, light gray, grayish tan, mudstone, some wackestone. Shale (10%), gray, black.
- 4957 - 4961 Limestone (90%), gray, light gray, grayish tan, mudstone, wackestone. Shale (10%), gray, black.
- 4961 - 4975 Limestone (100%), tan, grayish tan, wackestone, packstone, fair vuggy porosity. Shale (trace), gray, black.
- 4975 - 4985 Limestone (100%) light grayish tan, tan, light gray, wackestone, some packstone, trace vuggy porosity. Shale (trace), gray, black.
- 4985 - 4994 Limestone (100%), light grayish tan, tan, light gray, wackestone, some packstone, trace vuggy porosity. Shale (trace), gray, black.
- 4994 - 5004 Limestone (100%), light tan, grayish tan, wackestone, some packstone, mudstone, some vuggy porosity. Shale (trace), gray.
- 5004 - 5014 Limestone (100%), tan, light grayish tan, packstone, wackestone, oolitic packstone with oomoldic porosity. Shale (trace), gray.
- 5014 - 5026 Limestone (100%), tan, light grayish tan, packstone, wackestone, oolitic packstone with oomoldic porosity, trace brown lime mudstone. Shale (trace), gray.
- 5026 - 5036 Limestone (90%), grayish tan, light gray, wackestone, mudstone, trace oolitic packstone. Shale (10%), gray, black.

- 5036 - 5044 Limestone (100%), dark grayish tan, gray, mudstone, wackestone. Shale (trace), gray, black.
- 5044 - 5052 Limestone (100%), dark grayish tan, gray, brown, mudstone, some wackestone. Shale (trace), gray, black.
- 5052 - 5062 Limestone (95%), buff, light gray, wackestone, packstone, mudstone. Shale (5%), gray, black.
- 5062 - 5072 Limestone (100%), light gray, grayish tan, mudstone, wackestone. Shale (trace), gray, black.
- 5072 - 5084 Limestone (100%), light gray, grayish tan, mudstone, wackestone. Shale (trace), gray, black.
- 5084 - 5094 Limestone (90%), light gray, grayish tan, mudstone, wackestone. Shale (10%), gray, black.
- 5094 - 5106 Limestone (90%), light gray, grayish tan, mudstone, wackestone. Shale (10%), gray, black.
- 5106 - 5116 Limestone (80%), light gray, grayish tan, mudstone, wackestone. Shale (20%), gray, black.
- 5116 - 5128 Limestone (65%), gray, grayish tan, mudstone, wackestone. Shale (35%), gray, black.
- 5128 - 5138 Limestone (90%), gray, grayish tan, mudstone, wackestone. Shale (10%), black, gray.
- 5138 - 5148 Limestone (95%), gray, grayish tan, mudstone, wackestone. Shale (5%), gray, black.
- 5148 - 5160 Limestone (95%), gray, grayish tan, mudstone, wackestone. Shale (5%), black, gray.
- 5160 - 5167 Limestone (95%), gray, grayish tan, mudstone, wackestone. Shale (5%), black, gray.
- 5167 - 5176 Limestone (90%), gray, grayish tan, mudstone, wackestone. Shale (10%), gray, black.
- Marmaton 5181' -2288' Log 5176' -2283'**
- 5176 - 5186 Limestone (90%), gray, grayish tan, brown, mudstone, wackestone. Shale (10%), gray, black.

- 5186 - 5196 Limestone (90%), tan, gray, grayish tan, mudstone, wackestone. Shale (10%), gray, black.
- 5196 - 5204 Limestone (100%), light grayish tan, mudstone. Shale (trace), gray, black.
- 5204 - 5209 Limestone (100%), light gray, light grayish tan, mudstone, some wackestone. Shale (trace), black.
- 5209 - 5218 Limestone (100%), light grayish tan, wackestone, mudstone, fossiliferous, trace tan oolitic packstone with oomoldic porosity. Shale (trace), gray.
- 5218 - 5227 Limestone (70%), light gray, grayish tan, wackestone, mudstone, trace tan oolitic packstone with oomoldic porosity. Shale (30%), gray, black.
- 5227 - 5244 Limestone (80%), light gray, grayish tan, wackestone, mudstone, some tan oolitic packstone with oomoldic porosity. Shale (20%), black, gray.
- 5244 - 5256 Limestone (65%), light gray, grayish tan, wackestone, mudstone, trace tan oolitic packstone with oomoldic porosity. Shale (35%), black, gray, green. Chert (trace), white, tan, light gray. Red shale cavings make up 10% of sample.
- 5256 - 5268 Shale (60%), black, gray. Limestone (40%), gray, grayish tan, mudstone, some wackestone.
- 5268 - 5278 Shale (50%), black, gray. Limestone (50%), gray, grayish tan, mudstone, some wackestone. Poor sample quality.
- 5278 - 5286 Limestone (80%), light grayish tan, brown, tan, wackestone, mudstone. Shale (20%), black, gray. Chert (trace), white, tan.
- 5286 - 5298 Limestone (95%), light gray, light grayish tan, packstone, wackestone, vuggy porosity. Shale (5%), black, gray. Chert (trace), gray, white.
- 5298 - 5308 Limestone (90%), light gray, light grayish tan, mudstone, some wackestone, packstone. Shale (10%), black, gray. Chert (trace), gray.
- 5308 - 5318 Limestone (90%), light gray, grayish tan, mudstone, some wackestone. Shale (10%), gray, black. Chert (trace), gray, brown.
- 5318 - 5329 Limestone (90%), light gray, grayish tan, mudstone, some wackestones. Shale (10%), gray, black. Chert (trace), gray, brown.
- 5329 - 5339 Limestone (100%), light gray, light grayish tan, wackestone, coarse grained packstone. Shale (trace), black, gray.
- 5339 - 5348 Limestone (100%), light gray, light grayish tan, wackestone, medium grained packstone. Shale (trace), black.
- 5348 - 5354 Limestone (95%), light gray, light grayish tan, wackestone, mudstone, some packstone. Shale (5%), black.

Cherokee 5360' 2467' Log 5358' -2465'

- 5354 - 5362 Limestone (100%), light gray, light grayish tan, wackestone, mudstone. Shale (trace), black, gray. Chert (trace), gray.
- 5362 - 5376 Limestone (100%), light gray, light grayish tan, wackestone, mudstone. Shale (trace), black, gray. Mud Gas 9 Units, 5370'-5376'.
- 5376-5383 Limestone (95%), light gray, light grayish tan, wackestone, mudstone. Shale (5%), black, gray.
- 5383 - 5392 Limestone (95%), light gray, light grayish tan, wackestone, mudstone. Shale (5%), black, gray.
- 5392 - 5408 Limestone (90%), light gray, light grayish tan, wackestone, mudstone. Shale (10%), black, gray. Mud Gas 28 Units, 5403'-5406'.
- 5408 - 5422 Limestone (70%), light gray, light grayish tan, mudstone, wackestone. Shale (30%), black, gray.
- 5422 - 5438 Limestone (50%), brown, grayish brown, mudstone, some wackestone. Shale (50%), black, gray. Mud Gas 9 Units, 5428'-5430'.
- 5438 - 5448 Shale (60%), black, gray, greenish gray. Limestone (40%), grayish tan, tan, mudstone, wackestone.
- 5448 - 5458 Shale (80%), gray, greenish gray, black. Limestone (20%), tan, buff, light gray, wackestone, mudstone. Sample caught after bit trip.
- 5458 - 5466 Limestone (75%), grayish tan, gray, dark gray, mudstone, wackestone. Shale (25%), gray, black, green. Chert (trace), gray.
- Atoka 5475' -2582' Log 5472' -2579'**
- 5466 - 5476 Limestone (80%), tan, light gray, grayish tan, mudstone, wackestone, trace tan oolitic packstone. Shale (20%), gray, green, black. Mud Gas 25 Units, 5475'-5478'.
- 5476 - 5486 Limestone (90%), gray, grayish tan, mudstone, dolomitic. Shale (10%), gray, black. Mud Gas 7 Units, 5481'-5483'.
- 5486 - 5496 Limestone (100%), gray, grayish brown, dark brown, mudstone, dolomitic. Shale (trace), gray, black.
- 5496 - 5508 Limestone (70%), gray, grayish brown, mudstone, dolomitic. Shale (30%). gray, black.
- 5508 - 5517 Limestone (60%), gray, grayish brown, dark brown, mudstone, dolomitic. Shale (40%), gray, black.
- 5517 - 5527 Limestone (60%), gray, grayish brown, dark brown, dolomitic. Shale (40%), gray, black.

- 5527 - 5536 Limestone (85%), dark gray, dark brown, mudstone, dolomitic. Shale (15%), gray, black.
- 5536 - 5544 Limestone (75%), dark gray, dark brown, mudstone, dolomitic. Shale (25%), gray, black.
- 5544 - 5556 Limestone (80%), dark gray, dark brown, mudstone, dolomitic. Shale (20%), gray, black.
- 5556 - 5561 Shale (65%), gray, black. Limestone (35%), dark gray, dark brown, mudstone, dolomitic.
- 5561 - 5576 Limestone (50%), dark gray, dark brown, brown, some grayish tan, mudstone. Shale (50%), black, gray. Mud Gas 55 Units, 5568'-5580'.
- 5576 - 5586 Shale (65%), black, dark gray. Limestone (35%), dark gray, dark brown, brown, some grayish tan, mudstone.
- 5586 - 5596 Shale (75%), black, gray. Limestone (25%), dark gray, dark brown, mudstone. Mud Gas 23 Units, 5591'-5594'.
- 5596 - 5604 Limestone (50%), dark gray, dark brown, mudstone. Limestone (20%), tan, grayish tan, mudstone. Shale (30%), black, gray, green. Mud Gas 10 Units 5597'-5599'.
- 5604 - 5612 Shale (80%), black, gray, green, greenish gray. Limestone (20%), dark gray, dark brown, mudstone. Limestone (10%), tan, grayish tan, mudstone.
- 5612 - 5622 Shale (80%), black, gray, greenish gray. Limestone (15%), dark gray, dark brown, mudstone. Limestone (5%), tan, grayish tan, mudstone.
- 5622 - 5634 Shale (85%), black, gray. Limestone (15%), dark gray, dark brown, mudstone. Mud Gas 10 Units, 5630'-5632'.
- 5634 - 5644 Shale (60%), black, gray. Limestone (40%), dark brown, dark gray, mudstone.
- 5644 - 5656 Shale (85%), black, gray. Limestone (15%), dark brown, dark gray, mudstone.
- 5656 - 5666 Shale (75%), black, gray. Limestone (25%), dark brown, brown, dark gray, mudstone. Mud Gas 5 Units, 5656'-5658', 7 Units, 5660'-5662'.
- 5666 - 5674 Shale (70%), black, gray. Limestone (30%), dark brown, dark gray, mudstone.
- 5674 - 5684 Shale (65%), black, gray. Limestone (35%), dark brown, dark gray, mudstone.
- 5684 - 5694 Limestone (75%), brown, dark brown, dark gray, wackestone, mudstone. Shale (25%), black, gray. Mud Gas 21 Units, 5687'-5695'.
- 5694 - 5704 Limestone (50%), brown, dark brown, dark gray, wackestone, mudstone. Shale (50%), black, gray. Mud Gas 5 Units, 5696'-5698'.

- 5704 - 5711 Shale (80%), black, gray. Limestone (20%), brown, dark brown, dark gray, mudstone, some wackestone. Mud Gas 7 Units, 5708'-5712'.
- 5711 - 5718 Shale (90%), black, gray. Limestone(10%), dark brown, dark gray, brown, mudstone.
- 5718 - 5728 Limestone (65%), dark brown, brown, dark gray, mudstone. Shale (35%), black, gray. Mud Gas 50 Units, 5720'-5727'.
- 5728 - 5736 Shale (80%), black, gray. Limestone (20%), dark brown, brown, dark gray, mudstone.
- 5736 - 5748 Shale (95%), black, gray. Limestone (5%), dark brown, brown, dark gray, mudstone. Mud Gas 8 Units, 5743'-5746'.
- 5748 - 5758 Shale (50%), black, gray. Limestone (50%), dark brown, brown, dark gray, mudstone. Mud Gas 20 Units, 5753'-5763'.
- 5758 - 5768 Shale (60%), black, gray. Limestone (40%), dark brown, brown, dark gray, mudstone.
- 5768 - 5782 Limestone (70%), brown, dark brown, dark gray, mudstone, some wackestone. Shale (30%), black, gray. Mud Gas 22 Units, 5768'-5774', 45 Units, 5774'-5778', 16 Units, 5778'-5781'.
- 5782 - 5790 Limestone (65%), grayish tan, brown, dark brown, mudstone, some wackestone. Shale (35%), black, gray. Mud Gas 20 Units, 5783'-5785, 15 Units, 5786'-5788'.
- 5790 - 5796 Limestone (75%), dark brown, dark gray, some grayish tan, mudstone. Shale (25%), black, gray.
- 5796 - 5804 Shale (75%), black, gray. Limestone (25%), dark brown, dark gray, mudstone. Mud Gas 18 Units, 5798'-5801', 20 Units, 5802'-5805'.
- 5804 - 5818 Shale (70%), black, gray. Limestone (30%), dark brown, dark gray, mudstone. Mud Gas 22 Units, 5807'-5810', 28 Units, 5811'-5813', 65 Units, 5813'-5818'.
- 5818 - 5832 Shale (50%), black, gray. Limestone (50%), dark brown, dark gray, gray, mudstone, wackestone. Mud Gas 20 Units, 5820'-5823'.
- 5832 - 5842 Limestone (30%), light gray, mudstone, wackestone. Limestone (50%), dark brown, dark gray, mudstone. Shale (20%), black, gray.
- 5842 - 5852 Limestone (80%), gray, dark gray, dark brown, mudstone. Shale (20%), black gray.
- 5852 - 5863 Limestone (80%), gray, dark gray, dark brown, mudstone. Shale (20%), black, gray. Mud Gas 5 Units, 5858'-5860'.
- 5863 -5870 Limestone (90%), gray, dark gray, dark brown, mudstone. Dolomite (trace), light gray, fine crystalline. Shale (10%), black, gray. Mud Gas 30 Units, 5865'-5870'.

Morrow 5871' -2978' Log 5870' -2977'

- 5870 - 5877 Limestone (90%), gray, dark gray, dark brown, mudstone. Dolomite (trace), light gray, fine crystalline. Shale (10%), black, gray.
- 5877 - 5887 Limestone (70%), gray, dark gray, dark brown, mudstone, some wackestone. Dolomite (10%), light gray, fine crystalline. Shale (20%), black, gray, trace black shale with chlorite blebs. Mud Gas 31 Units, 5880'-5881', 10 Units, 5885'-5887'.
- 5887 - 5898 Shale (90%), black, gray, pyritic. Limestone (10%), gray, mudstone, wackestone.
- 5898 - 5908 Shale (95%), black, gray, pyritic. Limestone (5%), gray, mudstone, wackestone.
- 5908 - 5916 Shale (100%), black, gray, pyritic, trace light grayish tan bentonite. Limestone (trace), gray, mudstone.
- 5916 - 5926 Shale (100%), black, gray, pyritic. Limestone (trace), dark brown, gray, mudstone, wackestone.
- 5926 - 5940 Shale (100%), black, gray, pyritic. Limestone (trace), dark brown, gray, mudstone. Mud Gas 15 Units, 5936'-5940'.
- 5940 - 5954 Shale (100%), black, gray. Limestone (trace), dark brown, gray, mudstone.
- 5954 - 5962 Shale (100%), black, gray, pyritic. Limestone (trace), dark brown, mudstone.
- 5962 - 5972 Shale (100%), black, gray. Bentonite (trace), olive gray.
- 5972 - 5982 Shale (90%), black, gray, pyritic. Bentonite (10%), olive gray. Limestone (trace), dark brown, gray, mudstone. Mud Gas 15 Units, 5972'-5973'.
- 5982 - 5992 Shale (95%), black, gray, pyritic. Limestone (5%), gray, dark brown, wackestone, fossiliferous.
- 5992 - 6003 Shale (100%), black, gray, pyritic. Limestone (trace), gray, dark brown, wackestone, fossiliferous.
- 6003 - 6012 Shale (100%), black, gray, pyritic. Limestone (trace), gray, dark brown, wackestone, fossiliferous. Mud Gas 10 Units, 6006'-6008'.
- 6012 - 6020 Shale (100%), black, gray, pyritic. Limestone (trace), dark brown, wackestone, fossiliferous.
- 6020 - 6028 Shale (100%), black, gray, pyritic. Limestone (trace), dark brown, gray, wackestone, fossiliferous.
- 6028 - 6040 Shale (95%), black, gray, pyritic. Limestone (5%), dark brown, mudstone. Mud Gas 5 Units, 6032'-6035'.
- 6040 - 6056 Shale (100%), black, gray. Limestone (trace), dark gray, dark brown, mudstone.
- 6056 - 6068 Shale (100%), black, gray. Limestone (trace), dark gray, dark brown, mudstone.

- 6068 - 6078 Shale (100%), black, gray. Limestone (trace). dark gray, dark brown, mudstone.
- 6078 - 6084 Shale (100%), black, gray. Limestone (trace), dark brown, mudstone.
- 6084 - 6094 Shale (95%), black, gray. Limestone (5%), tan, brown, packstone, wackestone, mudstone.
- 6094 - 6108 Shale (75%), black, gray. Limestone (25%), tan, grayish brown, coarse grained packstone, trace sandy limestone, fossiliferous. Mud Gas 8 Units, 6097'-6099'.

Lower Morrow 6110' -3217' Log 6110' -3217'

- 6108 - 6118 Limestone (50%), tan, grayish tan, packstone, wackestone, fossiliferous, some glauconitic limestone. Shale (50%), black, gray. Sandstone (trace), white, light gray, fine-medium grained, chloritic, glauconitic. No oil show.
- 6118 - 6126 Limestone (35%), tan, grayish tan, packstone, wackestone, fossiliferous. Sandstone (15%), white, light gray, gray, fine-medium grained, chloritic, glauconitic. Shale (50%), black, gray.
- 6126 - 6134 Sandstone (30%), white, light gray, gray, fine grained, some medium grained, chloritic, glauconitic, some floating rounded quartz granules. No oil show. Limestone (20%), tan, grayish tan, packstone, wackestone, fossiliferous. Shale (50%), black, gray. Mud Gas 18 Units, 6127'-6130'.

Lower Morrow Gas Sand 6139' -3246' Log 6138' -3245'

- 6134 - 6142 Sandstone (80%), white, light gray, gray, fine-very fine grained, some rounded floating quartz granules, chloritic, glauconitic, some sandstone with intergranular porosity, dull yellow mineral fluorescence, no cut. Mud Gas 40 Units, 6138'-6142'. Shale (15%), black, gray. Limestone (5%), tan, grayish tan, packstone, wackestone, fossiliferous.
- 6142 - 6152 Sandstone (85%), white, light gray, gray, fine-very fine grained, some rounded floating quartz granules, chloritic, glauconitic, some sandstone with intergranular porosity, dull yellow mineral fluorescence, no cut. Mud Gas 50 Units, 6142'-6146', 38 Units, 6146'-6162'. Shale (15%), black, gray. Limestone (trace), tan, gray, grayish tan, packstone, wackestone, fossiliferous.
- 6152 - 6164 Sandstone (75%), white, light gray, gray, very fine-medium grained, with some floating rounded quartz granules, chloritic, glauconitic, some intergranular porosity, dull yellow mineral fluorescence, no cut. Mud Gas 38 Units, 6146'-6162'. Shale (25%), black, gray.
- 6164 - 6184 Sandstone (80%), white, light gray, very fine-medium grained with floating rounded quartz granules and limestone fossil fragments, chloritic, glauconitic, some intergranular porosity, dull yellow mineral fluorescence, no cut. Mud Gas 42 Units, 6162'-6166', 65 Units 6166'-6177', 75 Units, 6177'-6185'. Shale (20%), black, gray, trace light gray bentonite.

Base Lower Morrow Gas Sand 6186' -3293' Log 6184' -3291'

6184 - 6192 Limestone (80%), tan, grayish tan, coarse grained packstone, wackestone, sandy, fossiliferous. Shale (20%), gray, black. Sandstone (trace), white, light gray, fine-medium grained, glauconitic, chloritic. Mud Gas 75 Units, 6177'-6185'.

Chester 6204' -3311' Log 6202' -3309'

6192 - 6206 Limestone (80%), tan, brown, grayish tan, coarse grained packstone, wackestone, sandy, glauconitic, chloritic. Shale (15%), gray, black. Sandstone (5%), white, light gray, fine-medium grained, glauconitic, chloritic. Mud Gas 30 Units, 6192'-6194', 25 Units, 6195'-6197'.

6206 - 6214 Limestone (90%), tan, brown, grayish tan, coarse grained packstone, wackestone, glauconitic, fossiliferous. Shale (10%), black, gray. Sandstone (trace), white, light gray, fine grained glauconitic, chloritic. Mud Gas 35 Units, 6204'-6208', 20 Units, 6213'-6214'.

6214 - 6220 Limestone (95%), tan, brown, grayish tan, coarse grained packstone, wackestone, glauconitic, fossiliferous, some sandy limestone. Shale (5%), gray, black.

Drill-Stem Test No. 1 6138'-6220' Pennsylvanian Lower Morrow

Times: 30-60-45-135

I.O. Strong Blow, Bottom Of Bucket In 15 Seconds, Gas To Surface In 2 Minutes.

F.O. Very Strong Blow.

Initial Open Gas Flow:

Time in Minutes	Orifice PSI	Orifice Size	Flow Rate CFD
2	NM	1.5"	GTS
10	38	1.5"	3,036,000
15	45	1.5"	3,454,000
20	47	1.5"	3,573,000
25	50	1.5"	3,752,000
30	50	1.5"	3,752,000

Final Open Gas Flow:

Time in Minutes	Orifice PSI	Orifice Size	Flow Rate CFD
5	38	1.5"	3,036,000
10	40	1.5"	3,155,000
15	55	1.5"	4,051,000
20	58	1.5"	4,230,000
25	58	1.5"	4,230,000
30	58	1.5"	4,230,000
35	58	1.5"	4,230,000
40	58	1.5"	4,230,000
45	58	1.5"	4,230,000

Recovery: 6114' Gas In Drill Pipe.

Sampler: 20.7 Cu Ft Gas @ 850 psi

Hydrostatic Pressures 2962-2841 psi

Flow Pressures 525-665:665-988 psi

Shut-in Pressures 994-988 psi

Bottom Hole Temperature 139° F

- 6220 - 6225 Shale (70%) black, gray. Limestone (30%), tan, brown, grayish tan, coarse grained packstone, wackestone, fossiliferous. Trip sample.
- 6225 - 6237 Limestone (80%), tan, brown, grayish tan, coarse grained packstone, wackestone, fossiliferous, mineral fluorescence, no cut. Shale (20%) black, gray. Mud Gas 175 Units, 6230'-6243'. Note: The drilling mud was saturated with gas (600+ Units) after the DST. This gas show may be a recycle of the trip gas from the DST.
- 6237 - 6254 Limestone (70%), tan, brown, grayish tan, coarse grained packstone, wackestone, fossiliferous, mineral fluorescence, no cut. Dolomite (15%), tan, fine crystalline, sucrosic. Shale (15%), black, gray. Mud Gas 175 Units, 6230'-6243', 125 Units, 6243'-6252'. See note above.

- 6254 - 6272 Limestone (65%), tan, brown, grayish tan, coarse grained packstone, wackestone, fossiliferous. Shale (25%), black, gray. Dolomite (15%), tan, fine crystalline, sucrosic.
- 6272 - 6282 Limestone (90%) tan, brown, grayish tan, coarse grained packstone, wackestone, fossiliferous. Shale (10%), black, gray. Dolomite (trace), tan, fine crystalline, sucrosic.
- 6282 - 6290 Limestone (100%), tan, light grayish tan, coarse grained packstone, fossiliferous. Shale (trace), black, gray.
- 6290 - 6304 Limestone (80%), tan, light grayish tan, coarse grained packstone, fossiliferous. Shale (10%), black, gray. Limestone (10%), light gray, mudstone.
- 6304 - 6313 Limestone (80%), tan, light grayish tan, coarse grained packstone, fossiliferous. Shale (15%), black, gray. Limestone (5%), light gray, mudstone.
- 6313 - 6326 Shale (90%), gray, very calcareous, black, gray. Limestone (10%), tan, grayish tan, coarse grained packstone, fossiliferous.
- 6326 - 6332 Shale (80%), gray, very calcareous, some black plant residue, black, gray. Limestone (15%), tan, brown, grayish tan, coarse grained packstone, wackestone, fossiliferous. Limestone (5%), light gray, mudstone.
- 6332 - 6344 Shale (50%), gray, light gray, very calcareous. Shale (30%), black. Limestone (20%), tan, light gray, packstone, wackestone, fossiliferous.
- 6344 - 6352 Shale (65%), gray, light gray, very calcareous, pyritic. Shale (20%), black. Limestone (15%), tan, grayish tan, packstone, wackestone, fossiliferous.
- 6352 - 6364 Shale (60%), gray, light gray, very calcareous. Shale (30%), black. Limestone (10%), gray, tan, packstone, wackestone, fossiliferous.
- 6364 - 6374 Shale (80%), gray, light gray, very calcareous, pyritic. Shale (20%), black.
- 6374 - 6384 Shale (80%), gray, light gray, very calcareous, pyritic. Shale (15%), black. Limestone (5%), tan, grayish tan, wackestone, packstone, fossiliferous. Sandstone (trace), dark gray, fine grained, chloritic, glauconitic.
- 6384 - 6392 Shale (90%), gray, light gray, very calcareous, pyritic. Shale (10%), black.
- 6392 - 6398 Shale (95%), gray, light gray, calcareous, pyritic. Shale (5%), black.
- 6398 - 6408 Shale (70%) gray, light gray, calcareous, pyritic, trace shale with plant fragment impressions. Shale (25%), black. Limestone (5%), tan, grayish tan, packstone, wackestone, fossiliferous.

Orange Marker 6413' -3520' Log 6410' -3517'

- 6408 - 6420 Limestone (60%), buff, tan, mudstone. Dolomite (10%), light gray, fine crystalline. Shale (trace), black. Shale (30%), gray, light gray, calcareous.

- 6420 - 6432 Shale (90%), gray, light gray, calcareous. Limestone (5%), tan, grayish tan, mudstone. Shale (5%), black.
- 6432 - 6442 Shale (85%), gray, light gray, calcareous. Limestone (5%), tan, grayish tan, mudstone. Shale (15%), black.
- 6642 - 6452 Shale (80%), gray, light gray, calcareous, pyritic. Shale (20%), black.
- 6452 - 6462 Shale (90%), gray, light gray, calcareous, pyritic. Shale (10%), black.
- 6462 - 6472 Shale (80%), gray, light gray, calcareous, pyritic. Shale (20%), black.
- 6472 - 6482 Shale (45%), gray, light gray, calcareous. Limestone (50%), light gray, mudstone. Shale (5%), black.
- 6482 - 6490 Shale (50%), gray, light gray, calcareous. Limestone (40%), light gray, mudstone. Shale (10%), black.
- 6490 - 6502 Shale (30%), gray, light gray, calcareous. Limestone (30%), light gray, mudstone. Limestone (30%), gray, grayish tan, mudstone, wackestone. Shale (10%), black.
- 6502 - 6512 Shale (85%), gray, light gray, calcareous. Limestone (10%), light gray, mudstone. Shale (5%), black.
- 6512 - 6524 Shale (95%), gray, light gray, calcareous. Limestone (trace), light gray, mudstone. Shale (5%), black.
- 6524 - 6530 Shale (70%), gray, light gray, calcareous. Limestone (trace), light gray, mudstone. Shale (30%), black.
- 6530 - 6538 Shale (90%), gray, light gray, calcareous. Limestone (trace), light gray, mudstone. Shale (10%), black.
- 6538 - 6550 Shale (80%), gray, light gray, calcareous. Limestone (trace), light gray, mudstone. Shale (20%), black.

Ste. Genevieve 6558' -3665' Log 6552' -3659'

- 6550 - 6566 Limestone (35%), white, fine-very fine grained packstone. Shale (35%), gray, light gray, calcareous. Shale (30%), black.

- 6566 - 6576 Limestone (40%), white, buff, fine-very fine grained packstone. Shale (20%), light gray, calcareous. Shale (40%), black. Sample is 60% black, gray shale cavings.
- 6576 - 6583 Limestone (35%), white, buff, fine-very fine grained packstone. Shale (65%), black, gray. Sample is 65% black, gray shale cavings.
- 6583 - 6590 Limestone (20%), white, buff, fine -very fine grained packstone. Limestone (20%), buff, wackestone, packstone. Chert (5%), orange, white, light gray. Shale (55%), gray, black. Sample is 55% black, gray shale cavings.
- St. Louis 6595' -3702' Log 6596' -3703'**
- 6590 - 6596 Limestone (20%), buff, white, wackestone, packstone. Chert (trace), tan, white. Shale (80%), black. Sample is 80% black shale cavings.
- 6596 - 6605 Limestone (10%), buff, white, wackestone, packstone. Chert (trace), gray, white. Shale (90%), black, gray. Sample is 90% black, gray shale cavings.
- 6605 - 6618 Limestone (15%), buff, tan, wackestone, packstone, trace oolitic packstone. Chert (trace), light gray. Shale (85%), black, gray. Sample is 85% black, gray shale cavings.
- 6618 - 6632 Limestone (10%), buff, tan, wackestone, packstone, oolitic packstone. Chert (trace), light gray. Shale (90%), black, light gray. Sample is 90% black, light gray shale cavings.
- 6632 - 6640 Limestone (5%), buff, tan, wackestone, packstone. Shale (95%), black, gray. Sample is 95% black, gray shale cavings.
- 6640 - 6648 Limestone (10%), buff, tan, wackestone, packstone. Shale (90%), black, gray. Sample is 90% black, gray, shale cavings.
- 6648 - 6656 Limestone (5%), buff, tan, wackestone, packstone, oolitic packstone. Shale (95%), black, gray. Sample is 95% black, gray shale cavings.
- 6656 - 6666 Limestone (trace), buff, tan, wackestone, packstone, oolitic packstone. Shale (100%), black, gray. Sample is 100% black, gray shale cavings.
- 6666 - 6678 Limestone (15%), buff, tan, gray, packstone, oolitic packstone, wackestone. Shale (85%), black, gray. Sample is 85% black, gray shale cavings.

- 6678 - 6690 Limestone (20%), buff, tan, gray, wackestone, packstone. Shale (80%), black, gray. Sample is 80% black, gray shale cavings.
- 6690 - 6700 Limestone (20%), buff, tan, gray, wackestone, packstone, oolitic packstone. Shale (80%), black, gray. Sample is 80% black, gray shale cavings.
- 6700 - 6711 Limestone (30%), buff, tan, wackestone, packstone, some oolitic packstone. Shale (70%), black, gray. Sample is 70% black, gray shale cavings.
- 6711 - 6721 Limestone (20%), buff, tan, wackestone, packstone. Shale (80%), black, gray. Sample is 80% black, gray shale cavings.
- 6721 - 6730 Limestone (30%), buff, tan, wackestone, packstone some oolitic packstone. Shale (70%), black, gray. Sample is 70% black, gray shale cavings.
- 6730 - 6740 Limestone (40%), tan, buff, wackestone, packstone. Shale (60%), black, gray. Sample is 60% black, gray shale cavings.
- 6740 - 6750 Limestone (30%), tan, buff, wackestone, packstone. Shale (70%), black, gray. Sample is 70% black, gray shale cavings.
- 6750 - 6760 Limestone (65%), tan, buff, wackestone, packstone. Chert (5%), white, light gray, tan. Shale (30%), black, gray. Sample is 30% black, gray, shale cavings.
- 6760 - 6768 Limestone (45%), tan, buff, wackestone, packstone. Chert (5%), white, tan, light gray. Shale (50%), black, gray. Sample is 50% black, gray shale cavings.
- 6768 - 6780 Limestone (40%), tan, buff, wackestone, packstone. Chert (trace-5%), white, tan, light gray. Shale (60%), black, gray. Sample is 60% black, gray shale cavings.
- 6780 - 6792 Limestone (90%), tan, buff, wackestone, packstone. Chert (trace-5%), white, gray. Shale (5%), black, gray.
- 6792 - 6799 Limestone (70%), tan, buff, wackestone, packstone. Chert (trace), white, gray, tan. Shale (30%), black, gray. Sample is 30% black, gray shale cavings.
- 6799 - 6808 Limestone (70%), tan, grayish tan, wackestone, packstone. Shale (30%), black, gray. Sample is 30% black, gray shale cavings.

Spergen 6814' -3921' Log 6812' -3919'

- 6808 - 6818 Limestone (60%), tan, grayish tan, wackestone, packstone. Shale (40%), black, gray. Sample is 40% black, gray shale cavings. Mud Gas 10 Units, 6816'-6822'.
- 6818 - 6828 Limestone (60%), tan, grayish tan, wackestone, packstone. Dolomite (20%), tan, fine crystalline. Shale (20%), black, gray. Sample is 20% black, gray shale cavings. Mud Gas 10 Units, 6816'-6822'.
- 6828 - 6834 Limestone (40%), tan, grayish tan, wackestone, packstone. Dolomite (10%), tan, fine crystalline. Shale (50%), black, gray. Sample is 50% black, gray shale cavings.
- 6834 - 6844 Limestone (30%), tan, grayish tan, wackestone, packstone. Dolomite (20%), tan, fine crystalline. Chert (5%), gray, tan, white. Shale (45%), black, gray. Sample is 45% black, gray shale cavings. Mud Gas 7 Units, 6835'-6840'.
- 6844 - 6851 Limestone (35%), tan, grayish tan, wackestone, packstone. Dolomite (35%), tan, fine crystalline. Chert (10%), tan, gray, white. Shale (20%), black, gray. Sample is 20% black, gray shale cavings.
- 6851 - 6862 Limestone (30%), tan, grayish tan, wackestone, packstone. Dolomite (20%), tan, fine crystalline. Chert (trace), tan, white, light gray. Shale (50%), black, gray. Sample is 50% black, gray shale cavings. Mud Gas 10 Units, 6853'-6863'.
- 6862 - 6872 Limestone (10%), tan, grayish tan, wackestone, packstone. Dolomite (30%), tan, fine crystalline, sucrosic. Chert (trace), tan, gray, white. Shale (60%), black, gray. Sample is 60% black, gray shale cavings.
- 6872 - 6884 Dolomite (50%), tan, light brown, fine crystalline, sucrosic, vuggy porosity. Limestone (10%), tan, grayish tan, wackestone, packstone. Chert (trace), tan, white, gray. Shale (40%), black, gray. Sample is 40% black, gray, shale cavings.
- 6884 - 6900 Dolomite (50%), tan, light brown, fine crystalline, sucrosic, vuggy porosity. Limestone (15%), tan, wackestone, packstone, some oolitic packstone with oomoldic porosity, dolomitized. Chert (trace), white, tan. Shale (35%), black, gray. Sample is 35% black, gray shale cavings.

Total Depth Driller 6900' -4006'**Total Depth Logger 6899' -4007'**

SUMMARY

The Ensign Operating Co., No. 2-25 Liberal S/2 S/2 NE Sec. 25, T34S, R34W, Seward County, Kansas was a 6900 foot well to evaluate the Sally Southwest Prospect. The main objective of the well was to evaluate the Pennsylvanian Lower Morrow sandstones. The Chester limestones, the Lower Chester sandstones and the Mississippian Ste. Genevieve, St. Louis and Spergen were secondary objectives. Another objective was to evaluate any significant oil and gas shows encountered while drilling to total depth.

The Lower Morrow sandstones were present with subdued mud gas shows. There were no oil shows in the lithologic samples. A drill-stem test of these sandstones recovered 4.320 MMCF/D gas with a bottom hole shut-in pressure of 988 psi. These flow and pressure data indicate that the sandstones are not depleted by near by wells in the Salley Southwest field.

The quality of the lithologic samples was generally good for most of the interval of the well where samples were collected. There were several lapses by the sample catchers where no samples or bagged samples were recorded. The Morrow shale sloughed after being drilled. When the Mississippian limestones were drilled this sloughing resulted in samples that contained mostly black shale cavings. This problem is also present when the Lower Morrow and Chester are being drilled but not as easy to recognize due to the presence of similar looking black shales in these intervals. This problem is common in most wells drilled in this area.

After an evaluation of the lithologic samples, drill-stem test data and bore hole geophysical logs, it was determined that the well was capable of gas production from the Pennsylvanian Lower Morrow sandstones. Pipe was set to further evaluate these sandstones for commercial gas production.

PIPE TALLY

Ensign Operating Co.

No. 2-25 Liberal, S/2 S/2 NE Sec. 25 T34S, R34W, Seward Co., Kansas

	Total Feet	No. of Stands		Length Joint		Total Feet		No. of Stands		Length Joint		Total Feet		No. of Stands	
Kelly	38.42			-0.86	31.81	14	1818.88			31.49	2755.07			45	
Sub	1.85			31.55	30.23		1849.11		30	31.20	2786.27				
Sub	3.02			31.17	30.76	15	1879.87			30.45	2816.72			46	
Reamer				31.20	31.07		1910.94		31	31.60	2848.32				
Drill Collar	43.29			31.93	31.78	16	1942.72			31.72	2880.04			47	
29.78	73.07			31.32	31.09		1973.81		32	31.28	2911.32				
29.75	102.82	1		30.72	31.50	17	2005.31			31.32	2942.64			48	
1.84	104.66			31.29	31.60		2036.91		33	31.58	2974.22				
31.25	135.91	2		31.47	30.85	18	2067.76			31.92	3006.14			49	
31.15	167.06			31.37	31.17		2098.93		34	31.52	3037.66				
30.84	197.90	3		31.74	31.36	19	2130.29			31.09	3068.75			50	
31.16	229.06			31.45	31.51		2161.80		35	31.22	3099.97				
30.93	259.99	4		31.81	31.36	20	2193.16			31.36	3131.33			51	
31.24	291.23			30.75	-0.13		2193.03		36	31.62	3162.95				
30.83	322.06	5		31.38	30.49	21	2223.52			30.67	3193.62			52	
31.28	353.34			31.99	31.23		2254.75		37	31.73	3225.35				
31.25	384.59	6		30.87	31.56	22	2286.31			31.32	3256.67			53	
31.26	415.85			31.43	31.10		2317.41		38	31.81	3288.48				
31.24	447.09	7		30.73	31.57	23	2348.98			30.45	3318.93			54	
31.25	478.34			30.52	31.71		2380.69		39	31.76	3350.69				
31.22	509.56	8		29.77	31.70	24	2412.39			30.67	3381.36			55	
31.26	540.82			30.95	31.40		2443.79		40	31.25	3412.61				
30.12	570.94	9		30.99	30.94	25	2474.73			31.29	3443.90			56	
31.25	602.19			31.73	31.26		2505.99		41	31.18	3475.08				
31.23	633.42	10		31.54	31.18	26	2537.17			31.70	3506.78			57	
31.72	665.14			31.53	31.62		2568.79		42	31.42	3538.20				
31.40	696.54	11		31.61	30.76	27	2599.55			30.53	3568.73			58	
31.19	727.73			30.91	30.84		2630.39		43	31.53	3600.26				
31.37	759.10	12		30.90	31.37	28	2661.76			30.75	3631.01			59	
30.37	789.47			31.30	31.29		2693.05		44	31.97	3662.98				
31.39	820.86	13		30.29	30.53	29	2723.58								
31.58	852.44			-0.72	1787.07										

