

State of West Virginia
Department of Environmental Protection - Office of Oil and Gas
Well Operator's Report of Well Work

API 47- _____ - _____ County _____ District _____
Quad _____ Pad Name _____ Field/Pool Name _____
Farm name _____ Well Number _____
Operator (as registered with the OOG) _____
Address _____ City _____ State _____ Zip _____

As Drilled location NAD 83/UTM Attach an as-drilled plat, profile view, and deviation survey
Top hole Northing _____ Easting _____
Landing Point of Curve Northing _____ Easting _____
Bottom Hole Northing _____ Easting _____

Elevation (ft) _____ GL Type of Well New Existing Type of Report Interim Final
Permit Type Deviated Horizontal Horizontal 6A Vertical Depth Type Deep Shallow
Type of Operation Convert Deepen Drill Plug Back Redrilling Rework Stimulate
Well Type Brine Disposal CBM Gas Oil Secondary Recovery Solution Mining Storage Other _____
Type of Completion Single Multiple Fluids Produced Brine Gas NGL Oil Other _____
Drilled with Cable Rotary

Drilling Media Surface hole Air Mud Fresh Water Intermediate hole Air Mud Fresh Water Brine
Production hole Air Mud Fresh Water Brine
Mud Type(s) and Additive(s)

Date permit issued _____ Date drilling commenced _____ Date drilling ceased _____
Date completion activities began _____ Date completion activities ceased _____
Verbal plugging (Y/N) _____ Date permission granted _____ Granted by _____

Please note: Operator is required to submit a plugging application within 5 days of verbal permission to plug

Freshwater depth(s) ft _____ Open mine(s) (Y/N) depths _____
Salt water depth(s) ft _____ Void(s) encountered (Y/N) depths _____
Coal depth(s) ft _____ Cavern(s) encountered (Y/N) depths _____
Is coal being mined in area (Y/N) _____

Reviewed by:

API 47- _____ - _____ Farm name _____ Well number _____

CASING STRINGS	Hole Size	Casing Size	Depth	New or Used	Grade wt/ft	Basket Depth(s)	Did cement circulate (Y/ N) * Provide details below*
Conductor							
Surface							
Coal							
Intermediate 1							
Intermediate 2							
Intermediate 3							
Production							
Tubing							
Packer type and depth set							

Comment Details _____

CEMENT DATA	Class/Type of Cement	Number of Sacks	Slurry wt (ppg)	Yield (ft ³ /sks)	Volume (ft ³)	Cement Top (MD)	WOC (hrs)
Conductor							
Surface							
Coal							
Intermediate 1							
Intermediate 2							
Intermediate 3							
Production							
Tubing							

Drillers TD (ft) _____ Loggers TD (ft) _____
 Deepest formation penetrated _____ Plug back to (ft) _____
 Plug back procedure _____

Kick off depth (ft) _____

Check all wireline logs run
 caliper density deviated/directional induction
 neutron resistivity gamma ray temperature sonic

Well cored Yes No Conventional Sidewall Were cuttings collected Yes No

DESCRIBE THE CENTRALIZER PLACEMENT USED FOR EACH CASING STRING _____

WAS WELL COMPLETED AS SHOT HOLE Yes No DETAILS _____

WAS WELL COMPLETED OPEN HOLE? Yes No DETAILS _____

WERE TRACERS USED Yes No TYPE OF TRACER(S) USED _____

API 47- ___ - ___ Farm name _____ Well number _____

PERFORATION RECORD

Stage No.	Perforation date	Perforated from MD ft.	Perforated to MD ft.	Number of Perforations	Formation(s)
*PLEASE SEE ATTACHED EXHIBIT 1					

Please insert additional pages as applicable.

STIMULATION INFORMATION PER STAGE

Complete a separate record for each stimulation stage.

Stage No.	Stimulations Date	Ave Pump Rate (BPM)	Ave Treatment Pressure (PSI)	Max Breakdown Pressure (PSI)	ISIP (PSI)	Amount of Proppant (lbs)	Amount of Water (bbls)	Amount of Nitrogen/other (units)
*PLEASE SEE ATTACHED EXHIBIT 2								

Please insert additional pages as applicable.

API 47- _____ - _____ Farm name _____ Well number _____

<u>PRODUCING FORMATION(S)</u>	<u>DEPTHS</u>
_____	_____ TVD _____ MD
_____	_____
_____	_____
_____	_____

Please insert additional pages as applicable.

GAS TEST Build up Drawdown Open Flow OIL TEST Flow Pump
 SHUT-IN PRESSURE Surface _____ psi Bottom Hole _____ psi DURATION OF TEST _____ hrs
 OPEN FLOW Gas _____ mcfpd Oil _____ bpd NGL _____ bpd Water _____ bpd GAS MEASURED BY
 Estimated Orifice Pilot

LITHOLOGY/ FORMATION	TOP DEPTH IN FT NAME TVD	BOTTOM DEPTH IN FT TVD	TOP DEPTH IN FT MD	BOTTOM DEPTH IN FT MD	DESCRIBE ROCK TYPE AND RECORD QUANTITY AND TYPE OF FLUID (FRESHWATER, BRINE, OIL, GAS, H ₂ S, ETC)
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***PLEASE SEE ATTACHED EXHIBIT 3**

Please insert additional pages as applicable.

Drilling Contractor _____
 Address _____ City _____ State _____ Zip _____
 Logging Company _____
 Address _____ City _____ State _____ Zip _____
 Cementing Company _____
 Address _____ City _____ State _____ Zip _____
 Stimulating Company _____
 Address _____ City _____ State _____ Zip _____

Please insert additional pages as applicable.

Completed by _____ Telephone _____
 Signature _____ Title _____ Date _____

API 47-085-10377 Farm Name Michael Gail Underwood et al Well Number Hayhurst Unit 2H

EXHIBIT 1

Stage No.	Perforation Date	Perforated from MD ft.	Perforated to MD ft.	Number of Perforations	Formations
1	7/3/2019	16393		60	Marcellus
2	7/4/2019	16308.866	16140.196	60	Marcellus
3	7/5/2019	16104.062	15935.392	60	Marcellus
4	7/5/2019	15899.258	15730.588	60	Marcellus
5	7/5/2019	15694.454	15525.784	60	Marcellus
6	7/7/2019	15489.65	15320.98	60	Marcellus
7	7/7/2019	15284.846	15116.176	60	Marcellus
8	7/7/2019	15080.042	14911.372	60	Marcellus
9	7/9/2019	14875.238	14706.568	60	Marcellus
10	7/9/2019	14670.434	14501.764	60	Marcellus
11	7/9/2019	14465.63	14296.96	60	Marcellus
12	7/10/2019	14260.826	14092.156	60	Marcellus
13	7/10/2019	14056.022	13887.352	60	Marcellus
14	7/13/2019	13851.218	13682.548	60	Marcellus
15	7/14/2019	13646.414	13477.744	60	Marcellus
16	7/14/2019	13441.61	13272.94	60	Marcellus
17	7/15/2019	13236.806	13068.136	60	Marcellus
18	7/16/2019	13032.002	12863.332	60	Marcellus
19	7/16/2019	12827.198	12658.528	60	Marcellus
20	7/17/2019	12622.394	12453.724	60	Marcellus
21	7/18/2019	12417.59	12248.92	60	Marcellus
22	7/22/2019	12212.786	12044.116	60	Marcellus
23	7/22/2019	12007.982	11839.312	60	Marcellus
24	7/23/2019	11803.178	11634.508	60	Marcellus
25	7/23/2019	11598.374	11429.704	60	Marcellus
26	7/24/2019	11393.57	11224.9	60	Marcellus
27	7/24/2019	11188.766	11020.096	60	Marcellus
28	7/24/2019	10983.962	10815.292	60	Marcellus
29	7/25/2019	10779.158	10610.488	60	Marcellus
30	7/25/2019	10574.354	10405.684	60	Marcellus
31	7/25/2019	10369.55	10200.88	60	Marcellus
32	7/26/2019	10164.746	9996.076	60	Marcellus
33	7/26/2019	9959.942	9791.272	60	Marcellus
34	7/26/2019	9755.138	9586.468	60	Marcellus
35	7/27/2019	9550.334	9381.664	60	Marcellus
36	7/27/2019	9345.53	9176.86	60	Marcellus
37	7/28/2019	9140.726	8972.056	60	Marcellus
38	7/28/2019	8935.922	8767.252	60	Marcellus
39	7/28/2019	8731.118	8562.448	60	Marcellus
40	7/29/2019	8526.314	8357.644	60	Marcellus
41	7/29/2019	8321.51	8152.84	60	Marcellus
42	7/29/2019	8116.706	7948.036	60	Marcellus
43	7/29/2019	7911.902	7743.232	60	Marcellus
44	7/30/2019	7707.098	7538.428	60	Marcellus
45	7/30/2019	7502.294	7333.624	60	Marcellus
46	7/31/2019	7297.49	7128.82	60	Marcellus
47	7/31/2019	7092.686	6924.016	60	Marcellus
48	7/31/2019	6887.882	6719.212	60	Marcellus
49	8/1/2019	6683.078	6514.408	60	Marcellus

EXHIBIT 2

Stage No.	Stimulations Date	Avg Pump Rate	Avg Treatment Pressure (PSI)	Max Breakdown Pressure (PSI)	ISIP (PSI)	Amount of Proppant (lbs)	Amount of Water (bbls)	Amount of Nitrogen/ other (units)
1	7/3/2019	66.8818	7867.048	5954	5285	218600	6205.93	N/A
2	7/4/2019	76.81151	7541.192	5943	3668	507050	11011.42	N/A
3	7/5/2019	74.52445	7686.582	6312	3633	506870	12279.18	N/A
4	7/5/2019	77.32877	7562.516	6251	3716	462800	10744.55	N/A
5	7/5/2019	78.54783	7694.429	6410	3519	508900	10312.01	N/A
6	7/7/2019	74.2759	7603.498	6588	3850	510700	10582.7	N/A
7	7/7/2019	73.56972	7622.259	5827	3726	508650	10845.9	N/A
8	7/7/2019	67.69036	7814.162	5963	4360	464550	11958.86	N/A
9	7/9/2019	71.84105	7783.94	7453	4460	505450	10856.18	N/A
10	7/9/2019	76.92518	7572.136	5536	4297	507450	10400.17	N/A
11	7/9/2019	72.24457	7986.96	7074	5060	460400	9731.83	N/A
12	7/10/2019	74.56826	7348.826	5918	3846	505900	10436.91	N/A
13	7/10/2019	76.1607	7471.591	6594	3221	508250	10369.62	N/A
14	7/13/2019	76.96184	7289.01	6097	4123	506920	10236.56	N/A
15	7/14/2019	77.51562	7487.02	5436	4289	509150	10355.39	N/A
16	7/14/2019	77.78105	6998.718	5470	4358	508010	10572.23	N/A
17	7/15/2019	75.42834	7148.422	5402	4795	508250	11694.58	N/A
18	7/16/2019	76.57741	7051.514	5315	3559	505840	10189.23	N/A
19	7/16/2019	73.69634	6911.065	5758	3259	509250	10104.5	N/A
20	7/17/2019	67.33832	6990.252	6352	3210	505850	11907.82	N/A
21	7/18/2019	36.43575	7815.353	6531	4567	16810	5616.739	N/A
22	7/22/2019	70.66332	6692.621		3080	512700	10549.53	N/A
23	7/22/2019	76.87579	6993.127	5940	3618	501240	10188.88	N/A
24	7/23/2019	71.91057	6936.464	5472	3294	507500	11265.77	N/A
25	7/23/2019	75.98062	6756.816	5224	3254	508290	10175.65	N/A
26	7/24/2019	74.51883	6689.73	5480	3865	510700	10167.56	N/A
27	7/24/2019	76.18208	7110.228	6305	3581	507370	10194.17	N/A
28	7/24/2019	73.48103	6676.543	5565	3206	509300	10182.56	N/A
29	7/25/2019	76.21628	6635.349	5948	3032	506750	10124.21	N/A
30	7/25/2019	79.05065	6943.863	5923	3614	508350	10077.74	N/A
31	7/25/2019	74.7285	6854.546	5442	3661	509550	10114.53	N/A
32	7/26/2019	78.1728	6800.403	6343	3419	506450	10154.09	N/A
33	7/26/2019	69.21592	6960.741	6080	3986	507550	11926.34	N/A
34	7/26/2019	71.6723	6733.175	5953	2944	508250	10123.97	N/A
35	7/27/2019	78.61144	6863.27	6038	3292	509500	11272.91	N/A
36	7/27/2019	74.99915	6714.916	5857	3168	508800	10236.33	N/A
37	7/28/2019	71.4779	6648.24	5705	3303	508300	10078.95	N/A
38	7/28/2019	78.60087	6530.626	5434	3259	509300	10042.7	N/A
39	7/28/2019	75.33137	6315.957	6205	3474	507350	10096.38	N/A
40	7/29/2019	78.3723	6468.459	5960	3925	507800	10074.63	N/A
41	7/29/2019	77.97305	6615.098	5726	3919	507750	10027.42	N/A
42	7/29/2019	78.74989	6497.717	6156	3224	509900	9940.15	N/A
43	7/29/2019	77.40534	6342.617	7210	3101	508500	10123.75	N/A
44	7/30/2019	79.39258	6305.096	6675	2933	507750	10048.61	N/A
45	7/30/2019	86.29006	6540.952	6263	3002	507800	9972.08	N/A
46	7/31/2019	73.85108	6415.389	7286	3501	505150	10974.49	N/A
47	7/31/2019	78.58689	6285.506	6662	3771	510400	10137.24	N/A
48	7/31/2019	81.65228	6462.386	7325	3323	507830	9859.03	N/A
49	8/1/2019	80.78068	6600.013	6454	2834	504800	9941.51	N/A
	AVG	74.4	7,064	6,025	3,688	21,942,400	463,571	TOTAL

EXHIBIT 3

LITHOLOGY/ FORMATION	TOP DEPTH (TVD)	BOTTOM DEPTH (TVD)	TOP DEPTH (MD)	BOTTOM DEPTH (MD)
	From Surface	From Surface	From Surface	From Surface
Silty Sandstone	75	115	75	115
Sandy shale	115	295	115	295
Sandstone	295	355	295	355
Silty Sandstone tr shale	355	465	355	465
Sandy siltstone tr limestone	465	535	465	535
silty, limy shale	535	685	535	685
Sandy siltstone	685	935	685	935
sandy siltstone tr coal	935	1,075	935	1,075
Silty shale	1,075	1,255	1,075	1,255
Silty sandstone	1,255	1,435	1,255	1,435
silty shale tr coal	1,435	1,645	1,435	1,645
shaly sandstone tr coal	1,645	1,795	1,645	1,795
Shale w coal interbeds	1,795	1,868	1,795	1,883
Big Lime	1,883	2,941	1,858	2,942
Fifty Foot Sandstone	2,941	3,055	2,917	3,057
Gordon	3,055	3,210	3,032	3,213
Fifth Sandstone	3,210	3,472	3,188	3,481
Bayard	3,472	4,038	3,456	4,058
Speechley	4,038	4,255	4,033	4,280
Balltown	4,255	4,628	4,255	4,660
Bradford	4,628	4,906	4,635	4,945
Benson	4,906	5,185	4,920	5,229
Alexander	5,185	6,114	5,204	6,247
Sycamore	6,004	6,089	6,101	6,222
Middlesex	6,089	6,186	6,222	6,409
Burkett	6,186	6,207	6,409	6,467
Marcellus	6,207	NA	6,467	NA

*Please note Antero determines formation tops based on mud logs that are only run on one well on a multi-well pad. The measured depth (MD) data on subsequent wells may be slightly different due to the well's unique departure.

Hydraulic Fracturing Fluid Product Component Information Disclosure

Job Start Date:	7/3/2019
Job End Date:	8/1/2019
State:	West Virginia
County:	Ritchie
API Number:	47-085-10377-00-00
Operator Name:	Antero Resources Corporation
Well Name and Number:	Hayhurst Unit 2H
Latitude:	39.30951110
Longitude:	-81.02828300
Datum:	NAD83
Federal Well:	NO
Indian Well:	NO
True Vertical Depth:	6,299
Total Base Water Volume (gal):	21,785,295
Total Base Non Water Volume:	0



Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
Water	Supplied by Operator	Base Fluid					
			Water	7732-18-5	100.00000	87.97327	
CalGel 4000	CWS	Gel Slurry					
				Listed Below			

DWP-641	CWS	Friction Reducer					
				Listed Below			
DAP-103	CWS	Iron Control					
				Listed Below			
SaniFrac 8844	CWS	Biocide					
				Listed Below			
Sand (Proppant)	CWS	Propping Agent					
				Listed Below			
Hydrochloric Acid	CWS	Clean Perforations					
				Listed Below			
CI-9100G	CWS	Corrosion Inhibitor					
				Listed Below			
DAP-902	CWS	Scale Inhibitor					
				Listed Below			
Calbreak 5501	CWS	Breaker					
				Listed Below			
Other Chemical (s)	Listed Above	See Trade Name (s) List					

				Listed Below			
Items above are Trade Names with the exception of Base Water . Items below are the individual ingredients.							
			Crystalline silica (Quartz)	14808-60-7	100.00000	11.60392	
			Hydrochloric acid	7647-01-0	37.00000	0.08269	
			Calcite	471-34-1	1.00000	0.07736	
			Guar gum	9000-30-0	60.00000	0.05469	
			Distillates (petroleum), hydrotreated middle	64742-46-7	60.00000	0.05469	
			Illite	12173-60-3	1.00000	0.03864	
			Polymer	26100-47-0	45.00000	0.02662	
			Distillates (petroleum), hydrotreated light	64742-47-8	30.00000	0.01775	
			Goethite	1310-14-1	0.10000	0.01160	
			Biotite	1302-27-8	0.10000	0.01160	
			Apatite	64476-38-6	0.10000	0.01160	
			Polyethylene glycol mixture	25322-68-3	54.50000	0.00681	
			Ammonium chloride	12125-02-9	11.00000	0.00651	
			Quaternary ammonium compounds, bis (hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2	5.00000	0.00456	
			Ilmenite	98072-94-7	0.10000	0.00386	
			2,2-Dibromo-3-Nitrilopropionamide	10222-01-2	20.00000	0.00250	
			Sorbitan monooleate	1338-43-8	4.00000	0.00237	
			Polyethylene glycol monooleate	9004-96-0	3.00000	0.00177	
			Ammonium Persulfate	7727-54-0	100.00000	0.00160	
			Oxirane, 2-methyl-, polymer with oxirane, monodecyl ether	37251-67-5	1.50000	0.00137	
			Sorbitol tetraoleate	61723-83-9	2.00000	0.00118	
			Citric acid	77-92-9	60.00000	0.00079	

			Amines, tallow alkyl, ethoxylated	61791-26-2	1.00000	0.00059	
			Sodium bromide	7647-15-6	4.00000	0.00050	
			Dibromoacetonitrile	3252-43-5	3.00000	0.00037	
			Vinylidene chloride-methyl acrylate copolymer	25038-72-6	20.00000	0.00032	
			Alkyloxypolyethyleneoxy ethanol	84133-50-6	0.50000	0.00030	
			Acrylamide	79-06-1	0.10000	0.00006	
			Ethylene Glycol	107-21-1	40.00000	0.00005	
			Diethylene glycol, monomethyl ether	34590-94-8	20.00000	0.00002	
			Formic acid	64-18-6	10.00000	0.00001	
			Ethoxylated Alcohols	68131-39-5	10.00000	0.00001	
			Isopropyl alcohol	67-63-0	5.00000	0.00001	
			Cinnamaldehyde	104-55-2	10.00000	0.00001	
			Tar bases, quinolone derivs, benzyl chloride- quatenized	72480-70-7	10.00000	0.00001	
			Organic Acid Salts	9003-04-7			Proprietary Additive Concentration
			Glycol	57-55-6			Proprietary Additive Concentration

* Total Water Volume sources may include various types of water including fresh water, produced water, and recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

*** If you are calculating a percentage of total ingredients do not add the water volume below the green line to the water volume above the green line

Note: For Field Development Products (products that begin with FDP), MSDS level only information has been provided.

Ingredient information for chemicals subject to 29 CFR 1910.1200(i) and Appendix D are obtained from suppliers Material Safety Data Sheets (MSDS)