

Reviewed
Jul 15
5/9/18

11/09/2018

Page 1 of 4

WR-35
Rev. 8/23/13

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

API 47 - 017 - 06778 County Doddridge District Central
Quad West Union 7.5' Pad Name Long Run Pad Field/Pool Name -----
Farm name Richard F. McCullough, et al Well Number Mossor Unit 2H
Operator (as registered with the OOG) Antero Resources Corporation
Address 1615 Wynkoop Street City Denver State CO Zip 80202

As Drilled location NAD 83/UTM Attach an as-drilled plat, profile view, and deviation survey
Top hole Northing 4350122m Easting 511743m
Landing Point of Curve Northing 4350444.26m Easting 512283.13m
Bottom Hole Northing 4352633m Easting 511579m

Elevation (ft) 1021' 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)
Air - Foam & 4% KCL
Mud - Polymer

Date permit issued 10/25/2016 Date drilling commenced 12/16/2016 Date drilling ceased 4/15/2017
Date completion activities began 6/17/2017 Date completion activities ceased 11/11/2017
Verbal plugging (Y/N) N/A Date permission granted N/A Granted by N/A

RECEIVED
Office of Oil and Gas

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

APR 30 2018

Freshwater depth(s) ft 53' Open mine(s) (Y/N) depths No
Salt water depth(s) ft 884' Void(s) encountered (Y/N) depths No
Coal depth(s) ft N/A Cavern(s) encountered (Y/N) depths No
Is coal being mined in area (Y/N) No

WV Department of
Environmental Protection

Reviewed by:

WR-35
Rev. 8/23/13

API 47-017 - 06778 Farm name Richard F. McCullough, et al Well number Mossor Unit 2H

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	24"	20"	65'	New	94#, H-40	N/A	Y
Surface	17-1/2"	13-3/8"	525'	New	48#, H-40	N/A	Y
Coal							
Intermediate 1	12-1/4"	9-5/8"	2615'	New	36#, J-55	N/A	Y
Intermediate 2							
Intermediate 3							
Production	8-3/4"/8-1/2"	5-1/2"	14773'	New	23#, P-110	N/A	Y
Tubing		2-3/8"	6577'		4.7#, N-80		
Packer type and depth set		N/A					

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	Class A	102 sx	15.6	1.18	120	0'	8 Hrs.
Surface	Class A	620 sx	15.6	1.19	738	0'	8 Hrs.
Coal							
Intermediate 1	Class A	1015 sx	15.6	1.18	1198	0'	8 Hrs.
Intermediate 2							
Intermediate 3							
Production	Class H	763 sx (Lead) 1143 sx (Tail)	13.50 (Lead), 15.20 (Tail)	1.56 (Lead), 1.83 (Tail)	3282	-500' into Intermediate Casing	8 Hrs.
Tubing							

Drillers TD (ft) 14773' MD, 6471' TVD (BHL), 6490' (Deepest Point Drilled) Loggers TD (ft) 14773' MD
 Deepest formation penetrated Marcellus Plug back to (ft) N/A
 Plug back procedure N/A

Kick off depth (ft) 6291'

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 _____

Conductor - 0
 Surface - 1 above guide shoe, 1 above insert float, 1 every 4th joint to surface
 Intermediate - 1 above float joint, 1 above float collar, 1 every 4th joint to surface
 Production - 1 above float joint, 1 below float collar, 1 every 3rd joint to top of cement

WAS WELL COMPLETED AS SHOT HOLE Yes No DETAILS _____

RECEIVED
Office of Oil and Gas

WAS WELL COMPLETED OPEN HOLE? Yes No DETAILS _____

APR 30 2018

WERE TRACERS USED Yes No TYPE OF TRACER(S) USED N/A

WV Department of
Environmental Protection

API 47-017 - 06778 Farm name Richard F. McCullough, et al Well number Mossor Unit 2H

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								

RECEIVED
Office of Oil and Gas
APR 30 2018

Please insert additional pages as applicable.

WR-35
Rev. 8/23/13

API 47- 017 - 06778 Farm name Richard F. McCullough, et al Well number Mossor Unit 2H

<u>PRODUCING FORMATION(S)</u>	<u>DEPTHS</u>		
Marcellus	6446' (TOP)	TVD	7022' (TOP) MD
_____	_____	_____	_____
_____	_____	_____	_____

Please insert additional pages as applicable.

GAS TEST Build up Drawdown Open Flow OIL TEST Flow Pump

SHUT-IN PRESSURE Surface 3100 psi Bottom Hole --- psi DURATION OF TEST --- hrs

OPEN FLOW Gas 11120 mcfpd Oil 54 bpd NGL --- bpd Water 14 bpd GAS MEASURED BY Estimated Orifice Pilot

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

***PLEASE SEE ATTACHED EXHIBIT 3**

Please insert additional pages as applicable.

Drilling Contractor Frontier Drilling LLC
Address 562 Spring Run Road City Pennsboro State WV Zip 26415

Logging Company Pro Oil & Gas Services LLC
Address 3035 Lynnwood Drive City Hermitage State PA Zip 16148

Cementing Company C&J Energy Services
Address 1650 Hackers Creek City Jane Lew State WV Zip 26378

Stimulating Company Baker Hughes
Address 837 Philippi Pike City Clarksburg State WV Zip 26301

Please insert additional pages as applicable.

RECEIVED
Office of Oil and Gas

Completed by Mallory Stanton Telephone 303-357-7182 APR 30 2018
Signature _____ Title Permitting Supervisor Date 4/27/2018

API 47-017-06778 Farm Name Richard F. McCullough et al Well Number Mossor Unit 2H					
EXHIBIT 1					
Stage No.	Perforation Date	Perforated from MD ft.	Perforated to MD ft.	Number of Perforations	Formations
1	9/28/2017	14501	14671	60	Marcellus
2	9/28/2017	14299	14469	60	Marcellus
3	9/29/2017	14098	14268	60	Marcellus
4	9/29/2017	13896	14066	60	Marcellus
5	9/29/2017	13694	13864	60	Marcellus
6	9/30/2017	13493	13663	60	Marcellus
7	10/1/2017	13291	13461	60	Marcellus
8	10/1/2017	13090	13260	60	Marcellus
9	10/2/2017	12888	13058	60	Marcellus
10	10/2/2017	12686	12856	60	Marcellus
11	10/3/2017	12485	12655	60	Marcellus
12	10/3/2017	12283	12453	60	Marcellus
13	10/4/2017	12082	12252	60	Marcellus
14	10/4/2017	11880	12050	60	Marcellus
15	10/5/2017	11678	11848	60	Marcellus
16	10/5/2017	11477	11647	60	Marcellus
17	10/6/2017	11275	11445	60	Marcellus
18	10/6/2017	11074	11244	60	Marcellus
19	10/7/2017	10872	11042	60	Marcellus
20	10/7/2017	10670	10840	60	Marcellus
21	10/8/2017	10469	10639	60	Marcellus
22	10/9/2017	10267	10437	60	Marcellus
23	10/9/2017	10066	10236	60	Marcellus
24	10/10/2017	9864	10034	60	Marcellus
25	10/11/2017	9662	9832	60	Marcellus
26	10/12/2017	9461	9631	60	Marcellus
27	10/12/2017	9259	9429	60	Marcellus
28	10/13/2017	9058	9228	60	Marcellus
29	10/13/2017	8856	9026	60	Marcellus
30	10/14/2017	8654	8824	60	Marcellus
31	10/14/2017	8453	8623	60	Marcellus
32	10/15/2017	8251	8421	60	Marcellus
33	10/15/2017	8050	8220	60	Marcellus
34	10/16/2017	7848	8018	60	Marcellus
35	10/16/2017	7646	7816	60	Marcellus
36	10/16/2017	7445	7615	60	Marcellus
37	10/17/2017	7243	7413	60	Marcellus
38	10/17/2017	7042	7212	60	Marcellus

RECEIVED
Office of Oil and Gas

APR 30 2018

WV Department of
Environmental Protection

API 47-017-06778 Farm Name Richard F. McCullough et al Well Number Mossor Unit 2H								
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	9/28/2017	76.3	7307	7378	3121	413000	9003	N/A
2	9/28/2017	30.5	8524	5913	6220	7200	9043	N/A
3	9/29/2017	74.8	7127	5955	3685	414650	9109	N/A
4	9/29/2017	76.9	7211	5810	3556	412200	8595	N/A
5	9/29/2017	71.9	6710	5743	3298	416950	8794	N/A
6	9/30/2017	70.6	6976	5272	3179	412750	8631	N/A
7	10/1/2017	73.6	6879	5708	3268	413600	8749	N/A
8	10/1/2017	72.1	7060	5991	3405	416160	8612	N/A
9	10/2/2017	74.8	6954	5779	3369	414450	8693	N/A
10	10/2/2017	76.6	6835	5629	3233	415650	8621	N/A
11	10/3/2017	72.9	7138	5726	3770	418400	10257	N/A
12	10/3/2017	74.2	7150	5531	3381	416100	10025	N/A
13	10/4/2017	73.1	7101	5514	3399	418200	8599	N/A
14	10/4/2017	73.9	7108	5437	4518	416100	12021	N/A
15	10/5/2017	74.2	6962	5523	5092	416350	8931	N/A
16	10/5/2017	70.1	6691	5458	5206	416150	10453	N/A
17	10/6/2017	72.3	6971	5117	3900	416550	10281	N/A
18	10/6/2017	70.7	6845	5416	4182	416700	11076	N/A
19	10/7/2017	75.4	6933	5290	4840	411850	8733	N/A
20	10/7/2017	78.6	7267	5434	5021	416750	10044	N/A
21	10/8/2017	73.7	6640	5425	3680	416850	9612	N/A
22	10/9/2017	71.9	6821	5327	3680	416050	9209	N/A
23	10/9/2017	73.2	7012	5381	3929	415850	10208	N/A
24	10/10/2017	68.1	7709	5723	9018	339000	11107	N/A
25	10/11/2017	73.1	7079	5926	5220	416500	8842	N/A
26	10/12/2017	77.2	6647	5689	5360	417400	8360	N/A
27	10/12/2017	77	6371	5270	4886	417150	8417	N/A
28	10/13/2017	75.9	6646	6182	4937	417700	8699	N/A
29	10/13/2017	78.4	6411	5376	4801	416950	8455	N/A
30	10/14/2017	78.8	6369	5922	4988	417950	8381	N/A
31	10/14/2017	78	6375	5149	4960	416700	8412	N/A
32	10/15/2017	77.3	6480	5527	4937	410550	8161	N/A
33	10/15/2017	76.4	6398	5450	4920	417250	8406	N/A
34	10/16/2017	78.9	6302	5809	5066	417950	8329	N/A
35	10/16/2017	76.4	6481	5547	4728	416150	8412	N/A
36	10/16/2017	79.6	6308	5579	5053	418150	8305	N/A
37	10/17/2017	76.3	6174	6000	4942	417250	8394	N/A
38	10/17/2017	80.2	6087	5751	5001	FALSE	8204	N/A
	AVG=	73.0	6,947	5,641	4,376	12,818,410	296,133	TOTAL

RECEIVED
Office of Oil and Gas

APR 30 2018

WV Department of
Environmental Protection

API 47-017-06778 Farm Name <u>Richard F. McCullough et al</u> Well Number <u>Mossor Unit 2H</u>				
EXHIBIT 3				
LITHOLOGY/ FORMATION	TOP DEPTH (TVD) From Surface	BOTTOM DEPTH (TVD) From Surface	TOP DEPTH (MD) From Surface	BOTTOM DEPTH (MD) From Surface
Fresh Water	53'	N/A	N/A	N/A
Sandy siltstone	0	80	0	80
Silty sandstone	80	120	80	120
Sandy siltstone	120	400	120	400
Silty sandstone (tr coal)	400	600	400	600
Sandy shale	600	640	600	640
Silty limestone	640	720	640	720
Silty shale	720	800	720	800
Siltstone	800	880	800	880
Sandstone	880	960	880	960
Shaly sandstone	960	1,080	960	1,080
Silty sandstone (tr coal)	1,080	1,280	1,080	1,280
Silty shale	1,280	1,520	1,280	1,520
Sandy shale (tr coal)	1,520	1,690	1,520	1,690
Shaly sandstone	1,690	1,740	1,690	1,740
Silty shale	1,740	1,862	1,740	1,883
Big Lime	1,862	2,561	1,883	2,605
Fifty Foot Sandstone	2,561	2,659	2,605	2,706
Gordon	2,659	3,161	2,706	3,245
Fifth Sandstone	3,161	3,217	3,245	3,307
Bayard	3,217	3,688	3,307	3,819
Speechley	3,688	3,975	3,819	4,135
Baltown	3,975	4,488	4,135	4,694
Bradford	4,488	4,890	4,694	5,137
Benson	4,890	5,157	5,137	5,426
Alexander	5,157	5,791	5,426	6,117
Rhinestreet	5,791	6,100	6,117	6,452
Sycamore	6,100	6,263	6,452	6,652
Middlesex	6,263	6,385	6,652	6,856
Burkett	6,385	6,413	6,856	6,923
Tully	6,413	6,446	6,923	7,022
Marcellus	6,446	NA	7,022	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.

RECEIVED
Office of Oil and Gas

APR 30 2018

WV Department of
Environmental Protection

Hydraulic Fracturing Fluid Product Component Information Disclosure

Job Start Date:	9/28/2017
Job End Date:	10/17/2017
State:	West Virginia
County:	Doddridge
API Number:	47-017-06778-00-00
Operator Name:	Antero Resources Corporation
Well Name and Number:	Mossor Unit 2H
Latitude:	39.30040000
Longitude:	-80.86380800
Datum:	NAD83
Federal Well:	NO
Indian Well:	NO
True Vertical Depth:	6,472
Total Base Water Volume (gal):	14,635,619
Total Base Non Water Volume:	0

RECEIVED
Office of Oil and Gas

APR 30 2018

WV Department of
Environmental Protection



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	70.00000	88.46298	
Hydrochloric Acid	CWS	Clean Perforations					
				Listed Below			

Sand (Proppant)	CWS	Propping Agent					
				Listed Below			
CI-9100G	CWS	Corrosion Inhibitor					
				Listed Below			
DAP-902	CWS	Scale Inhibitor					
				Listed Below			
DWP-111	CWS	Gel Slurry					
				Listed Below			
DAP-103	CWS	Iron Control					
				Listed Below			
SANIFRAC 8844	CWS	Biocide					
				Listed Below			
DWP-641	CWS	Friction Reducer					
				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	11.11026	
			Calcite	471-34-1	1.00000	0.08534	
			Guar gum	9000-30-0	60.00000	0.05844	
			Distillates (petroleum), hydrotreated middle	64742-46-7	60.00000	0.05844	
			Hydrochloric acid	7647-01-0	37.00000	0.05648	
			Polymer	26100-47-0	45.00000	0.03196	
			Illite	12173-60-3	1.00000	0.02571	
			Distillates (petroleum), hydrotreated light	64742-47-8	30.00000	0.02131	
			Ammonium Persulfate	64742-47-8	100.00000	0.01117	
			Goethite	1310-14-1	0.10000	0.01111	
			Apatite	64476-38-6	0.10000	0.01111	
			Biotite	1302-27-8	0.10000	0.01111	
			Ammonium chloride	12125-02-9	11.00000	0.00781	
			Polyethylene glycol mixture	25322-68-3	54.50000	0.00642	
			2-Propenoic acid, homopolymer, sodium salt	9003-04-7	40.00000	0.00634	
			Quaternary ammonium compounds, bis (hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2	5.00000	0.00487	
			Sorbitan monooleate	1338-43-8	4.00000	0.00284	
			Ilmenite	98072-94-7	0.10000	0.00257	
			2,2-Dibromo-3-Nitrilopropionamide	10222-01-2	20.00000	0.00236	
			Vinylidene chloride-methyl acrylate copolymer	69418-26-4	20.00000	0.00223	
			Polyethylene glycol monooleate	9004-96-0	3.00000	0.00213	

			1,2-Propanediol	57-55-6	10.00000	0.00158	
			Oxirane, 2-methyl-, polymer with oxirane, monodecyl ether	37251-67-5	1.50000	0.00146	
			Sorbitol tetraoleate	61723-83-9	2.00000	0.00142	
			Amines, tallow alkyl, ethoxylated	61791-26-2	1.00000	0.00071	
			Citric acid	77-92-9	60.00000	0.00051	
			Sodium bromide	7647-15-6	4.00000	0.00047	
			Alkyloxypolyethyleneoxy ethanol	84133-50-6	0.50000	0.00036	
			Dibromoacetonitrile	3252-43-5	3.00000	0.00035	
			Acrylamide	79-06-1	0.10000	0.00007	
			Ethylene glycol	107-21-1	40.00000	0.00003	
			Diethylene glycol (mono) methyl ether	34590-94-8	20.00000	0.00002	
			Diethylene glycol	111-46-6	1.00000	0.00001	
			Tar bases, quinolone derivs	68513-87-1	1.00000	0.00001	
			Ethoxylated alcohols	Proprietary	10.00000	0.00001	Proprietary CAS
			Formic Acid	64-18-6	10.00000	0.00001	
			Tar bases, quinolone derivs, benzyl chloride- quatenized	72480-70-7	10.00000	0.00001	
			Cinnamaldehyde	104-55-2	10.00000	0.00001	
			Isopropanol	67-63-0	5.00000	0.00001	

* 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(l) and Appendix D are obtained from suppliers Material Safety Data Sheets (MSDS)