

#### west virginia department of environmental protection

Office of Oil and Gas 601 57th Street SE Charleston, WV 25304 (304) 926-0450 (304) 926-0452 fax Earl Ray Tomblin, Governor Randy C. Huffman, Cabinet Secretary www.dep.wv.gov

February 27, 2015

## WELL WORK PERMIT Horizontal 6A Well

This permit, API Well Number: 47-8510187, issued to ANTERO RESOURCES CORPORATION, is evidence of permission granted to perform the specified well work at the location described on the attached pages and located on the attached plat, subject to the provisions of Chapter 22 of the West Virginia Code of 1931, as amended, and all rules and regulations promulgated thereunder, and to all conditions and provisions outlined in the pages attached hereto. Notification shall be given by the operator to the Oil and Gas Inspector at least 24 hours prior to the construction of roads, locations, and/or pits for any permitted work. In addition, the well operator shall notify the same inspector 24 hours before any actual well work is commenced and prior to running and cementing casing. Spills or emergency discharges must be promptly reported by the operator to 1-800-642-3074 and to the Oil and Gas inspector.

Please be advised that form WR-35, Well Operators Report of Well Work is to be submitted to this office within 90 days completion of permitted well work, as should form WR-34 Discharge Monitoring Report within 30 days of discharge of pits, if applicable. Failure to abide by all statutory and regulatory provisions governing all duties and operations hereunder may result in suspension or revocation of this permit and, in addition, may result in civil and/or criminal penalties being imposed upon the operators.

In addition to the applicable requirements of this permit, and the statutes and rules governing oil and gas activity in WV, this permit may contain specific conditions which must be followed. Permit conditions are attached to this cover letter.

Per 35CSR-4-5.2.g this permit will expire in two (2) years from the issue date unless permitted well work is commenced. If there are any questions, please feel free to contact me at (304) 926-0499 ext. 1654.

James Martin

hief

Operator's Well No: BROADWATER UNIT 2H

Farm Name: OSBOURNE, MARVIN W.

API Well Number: 47-8510187

Permit Type: Horizontal 6A Well

Date Issued: 02/27/2015

Promoting a healthy environment.

# **PERMIT CONDITIONS**

West Virginia Code § 22-6A-8(d) allows the Office of Oil and Gas to place specific conditions upon this permit. Permit conditions have the same effect as law. <u>Failure to adhere to the specified permit</u> conditions may result in enforcement action.

#### **CONDITIONS**

- Operator shall take additional measures with this permitted activity to avoid communication with offset wells. Such additional measures are described in the attached addendum. This addendum is part of the terms of the well work permit, and includes a description of depth and completed formations of offset wells. Also included is a description of monitoring activities that will take place during fracturing operations of the permitted well work.
- 1. This proposed activity may require permit coverage from the United States Army Corps of Engineers (USACOE). Through this permit, you are hereby being advised to consult with USACOE regarding this proposed activity.
- 2. If the operator encounters an unanticipated void, or an anticipated void at an unanticipated depth, the operator shall notify the inspector within 24 hours. Modifications to the casing program may be necessary to comply with W. Va. Code § 22-6A-5a (12), which requires drilling to a minimum depth of thirty feet below the bottom of the void, and installing a minimum of twenty (20) feet of casing. Under no circumstance should the operator drill more than fifty (50) feet below the bottom of the void or install less than twenty (20) feet of casing below the bottom of the void.
- 3. When compacting fills, each lift before compaction shall not be more than 12 inches in height, and the moisture content of the fill material shall be within limits as determined by the Standard Proctor Density test of the actual soils used in specific engineered fill, ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort, to achieve 95 % compaction of the optimum density. Each lift shall be tested for compaction, with a minimum of two tests per lift per acre of fill. All test results shall be maintained on site and available for review.
- 4. Operator shall install signage per § 22-6A-8g (6) (B) at all source water locations included in their approved water management plan within 24 hours of water management plan activation.
- 5. Oil and gas water supply wells will be registered with the Office of Oil and Gas and all such wells will be constructed and plugged in accordance with the standards of the Bureau for Public Health set forth in its Legislative rule entitled *Water Well Regulations*, 64 C.S.R. 19. Operator is to contact the Bureau of Public Health regarding permit requirements. In lieu of plugging, the operator may transfer the well to the surface owner upon agreement of the parties. All drinking water wells within fifteen hundred feet of the water supply well shall be flow tested by the operator upon request of the drinking well owner prior to operating the water supply well.

# PERMIT CONDITIONS

- 6. Pursuant to the requirements pertaining to the sampling of domestic water supply wells/springs the operator shall, no later than thirty (30) days after receipt of analytical data provide a written copy to the Chief and any of the users who may have requested such analyses.
- 7. If any explosion or other accident causing loss of life or serious personal injury occurs in or about a well or well work on a well, the well operator or its contractor shall give notice, stating the particulars of the explosion or accident, to the oil and gas inspector and the Chief, within 24 hours of said accident.
- 8. During the casing and cementing process, in the event cement does not return to the surface, the oil and gas inspector shall be notified within 24 hours.
- Operator shall provide the Office of Oil & Gas notification of the date that drilling commenced on this well. Such notice shall be provided by sending an email to <u>DEPOOGNotify@wv.gov</u> within 30 days of commencement of drilling.



#### Addendum for Antero pads in Ritchie County, WV

Broadwater Unit 1H	(API# 47-085-10186)	Osborne Pad
Broadwater Unit 2H	(API# 47-085-10187)	Osborne Pad
Broadwater Unit 3H	(API# 47-085-10188)	Osborne Pad
Broadwater Unit 4H	(API# 47-085-10189)	Osborne Pad

The following outlines the process to be undertaken by Antero Resources prior to and during completion process of wells in Ritchie County.

- •Investigate all wells within 1320' of new wells for all identified Marcellus vertical wells and any existing well(s) with an interval that is <u>less than</u> 1500 feet from the deepest formation drilled (including, but not specific to the Alexander formation) to the top of Marcellus:
  - Contact operator of all wells
  - Confirm well status, producing horizon, well completion/stimulation information
  - Discuss plans to stimulate the horizontal Marcellus wells and the plans for monitoring potential impact on shallow wells
  - Make sure all vertical wells (with an interval that is less than 1500 feet from the deepest formation drilled to the top of Marcellus) have adequate wellhead equipment, Including pressure gauges
  - Provide shallow well operator with frac dates and develop plan for monitoring during stimulation
  - If well waters out during frac, shut it in until after stimulation, and install adequate well
    control equipment prior to swabbing in the impacted shallow well
- Control fracturing parameters during job to limit fracture height growth
  - Limit rate and limit pressures for each segment of fracturing stages

Received

FEB 2 6 2015

Office of Oil and Gas
WV Dept. of Environmental Protection

# STATE OF WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS WELL WORK PERMIT APPLICATION

1) Well Operator: Antero Res	ources Corporation	494488557	085-Ritchie	Union	Pullman 7.5'
		Operator ID	County	District	Quadrangle
2) Operator's Well Number: B	roadwater Unit 2H	Well Pad	Name: Osbor	ne Pad	
3) Farm Name/Surface Owner:	Osborne, Marvin	W. Public Road	d Access: Harri	sville-Pullma	n Oxford Road (CR 9)
4) Elevation, current ground:	~934' Ele	evation, proposed p	ost-constructio	on: 923'	
5) Well Type (a) Gas	■ Oil	Unde	rground Storag	e	
Other					
(b)If Gas Sh	allow	Deep			
He	orizontal _				1/
6) Existing Pad: Yes or No No	)				1
7) Proposed Target Formation(					18015
Marcellus Shale: 6,700' TVD, A	inticipated Thickness-	50 feet, Associated	Pressure- 3000#		7.25
8) Proposed Total Vertical Dep	oth: 6,700' TVD				
9) Formation at Total Vertical	Depth: Marcellus S	Shale			
10) Proposed Total Measured I	Depth: 13,300' MD				
11) Proposed Horizontal Leg L	ength: 6123'				·
12) Approximate Fresh Water	Strata Depths:	9', 17', 51', 143'			
13) Method to Determine Fresh	Water Depths:	offset well records. Dep	oths have been adj	usted accord	ing to surface elevations.
14) Approximate Saltwater De	pths: 1,077', 1,438	', 1,866'			
15) Approximate Coal Seam D	epths: No Data Ava	ilable			
16) Approximate Depth to Pos	sible Void (coal mi	ne, karst, other): 1	None anticipated		
17) Does Proposed well location directly overlying or adjacent t		Yes	No	<b>V</b>	
(a) If Yes, provide Mine Info	: Name:				
	Depth:	1			
	Seam:				
	Owner:				

WW-6B (9/13)

#### 18)

# CASING AND TUBING PROGRAM

TYPE	Size	New	Grade	Weight per ft.	FOOTAGE: For	INTERVALS:	CEMENT:
		or Used		(lb/ft)	Drilling	Left in Well	Fill-up (Cu. Ft.)
Conductor	20"	New	H-40	94#	105'	105'	CTS, 101 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	300'	300'	CTS, 417 Cu. Ft
Coal	9-5/8"	New	J-55	36#	2400'	2400'	CTS, 977 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	13,300'	13,300'	3,280 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7,100'	
Liners							



TYPE	Size	Wellbore Diameter	Wall Thickness	Burst Pressure	Cement Type	Cement Yield (cu. ft./k)
Conductor	20"	24"	0.438"	1530	Class A	1.18
Fresh Water	13-3/8"	17-1/2"	0.38"/0.33"	2730/1730	Class A	1.18
Coal	9-5/8"	12-1/4"	0.352"	3520	Class A	1.18
Intermediate						
Production	5-1/2"	8-3/4" & 8-1/2"	0.361"	12630	Lead-H/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11200		
Liners						

## **PACKERS**

Kind:	N/A		
Sizes:	N/A		
Depths Set:	N/A		

19) Describe proposed well work, including the drilling and plugging back of any	pilot noie:
Drill, perforate, fracture a new horizontal shallow well and complete Marcellus Shale.	
20) Describe fracturing/stimulating methods in detail, including anticipated max antero plans to pump Slickwater into the Marcellus Shale formation in order to ready the value comprised of approximately 99 percent water and sand, with less than 1 percent specific the attached "List of Anticipated Additives Used for Fracturing or Stimulating Well."	well for production. The fluid will
21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres):	34.95 acres
22) Area to be disturbed for well pad only, less access road (acres): 6.25 acres	
23) Describe centralizer placement for each casing string:	12-1
Conductor: no centralizers	

#### 24) Describe all cement additives associated with each cement type:

Conductor: no additives, Class A cement.

Surface: Class A cement with 2-3% calcium chloride and 1/4 lb of flake Intermediate: Class A cement with 1/4 lb of flake, 5 gallons of clay treat

Production: Lead cement- 50/50 Class H/Poz + 1.5% salt + 1% C-45 + 0.5% C-16a + 0.2% C-12 + 0.45% C-20 + 0.05% C-51 Production: Tail cement- Class H + 45 PPS Calcium Carbonate + 1.0% FL-160 + 0.2% ACGB-47 + 0.05% ACSA-51 + 0.2% ACR-20

Surface Casing: one centralizer 10' above the float shoe, one on the insert float collar and one every 4th joint spaced up the hole

Intermediate Casing: one centralizer above float joint, one centralizer 5' above float collar and one every 4th collar to surface.

Production Casing: one centralizer at shoe joint and one every 3 joints to top of cement in intermediate casing.

#### 25) Proposed borehole conditioning procedures:

Conductor: blowhole clean with air, run casing, 10 bbls fresh water.

Surface: blowhole clean with air, trip to conductor shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate pipe capacity + 40 bbls fresh water followed by 25 bbls bentonite mud, 10 bbls fresh water spacer.

Intermediate: blowhole clean with air, trip to surface casing shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate 40 bbls brine water followed by 10 bbls fresh water and 25 bbls bentonite mud, pump 10 bbls fresh water.

Production: circulate with 14 lb/gal NaCl mud, trip to middle of lateral, circulate, pump high viscosity sweep, trip to base of curve, pump high viscosity sweep, trip to top of curve, trip to bottom, circulate, pump high viscosity sweep, trip out, run casing, circulate 10 bbls fresh water, pump 48 bbls barite pill, pump 10 bbls fresh water followed by 48 bbls mud flush and 10 bbls water.

<sup>\*</sup>Note: Attach additional sheets as needed.

WW-9 (9/13)

API Number 47 -	085	a
Operator's	Well No.	Broadwater Unit 2H

# STATE OF WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION OFFICE OF OIL AND GAS

#### FLUIDS/ CUTTINGS DISPOSAL & RECLAMATION PLAN

Operator Name Antero Resources Corporation OP Code 494488557
Watershed (HUC 10) Tributary of South Fork Hughes River Quadrangle Pullman 7.5'
Elevation 923' County Ritchie District Union
Do you anticipate using more than 5,000 bbls of water to complete the proposed well work? Yes No
If so, please describe anticipated pit waste:  No pit will be used at this site (Drilling and Flowtrack Fluids will be stored in tanks. Cutlings will be tanked and hauded offsite).
Will a synthetic liner be used in the pit? Yes No If so, what ml.? N/A
Proposed Disposal Method For Treated Pit Wastes:
Land Application Underground Injection (UIC Permit Number  Reuse (at API Number Future permitted well locations when applicable. API# will be provided on Form WR-34  Off Site Disposal (Supply form WW-9 for disposal location) (Meadowfill Landfill Permit #SWF-1032-98)  Other (Explain
Will closed loop system be used? If so, describe: Yes
Drilling medium anticipated for this well (vertical and horizontal)? Air, freshwater, oil based, etc. Dud/Suff ream, Production - Water Based Mood
-If oil based, what type? Synthetic, petroleum, etc. N/A
Additives to be used in drilling medium? Please See Attachment
Drill cuttings disposal method? Leave in pit, landfill, removed offsite, etc. Stored in tanks, removed offsite and taken to landfill.
-If left in pit and plan to solidify what medium will be used? (cement, lime, sawdust)_N/A
-Landfill or offsite name/permit number? Meadowfill Landfill (Permit #SWF-1032-98)
I certify that I understand and agree to the terms and conditions of the GENERAL WATER POLLUTION PERMIT issued on August 1, 2005, by the Office of Oil and Gas of the West Virginia Department of Environmental Protection. I understand that the provisions of the permit are enforceable by law. Violations of any term or condition of the general permit and/or other applicable law or regulation can lead to enforcement action.  I certify under penalty of law that I have personally examined and am familiar with the information submitted on this application form and all attachments thereto and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.
Company Official Signature  Company Official (Typed Name) Cole Kilstrom  STANDACKENBUSH  Company Official Title Environmental Representative
Company Official (Typed Name) Cole Kilstrom
Company Official (Typed Name) Cole Kilstrom  Company Official Title Environmental Representative  MY COMMISSION EXPLANATION  Company Official Title Environmental Representative
Company Official (Typed Name) Cole Risilotti  Company Official Title Environmental Representative  My COMMISSION EXPINES JULY 21, 2018  Subscribed and sworn before me this 24 day of NOVEMBER JULY 21, 2018  Notary Public
My commission expires JUN 21, 2018 Received Office of Oil & Gas  DFC 1 2 2014
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DFC 1 2 2014 02/27/2015

Lime 2-4 Tons/acre or to correct to pH 6.5  Fertilizer type Hav or straw or Wood Fiber (will be used where needed)  Fertilizer amount 500 Ibs/acre  Mulch 2-3 Tons/acre  Drill Pad (6.25) + Access Road (20.87) + Storage Pad (4.28) + Top Seil Pile 1 (2.35) + Top Seil Pile 2 (0.52) + Material Spoil Pile 1 (0.68) = .34.95 Acres  Temporary Permanent  Seed Type Ibs/acre Seed Type Ibs/acre  Tall Fescue 45  Perennial Rye Grass 20 Perennial Rye Grass 20 *or type of grass seed requested by surface owner  Attach: Drawing(s) of road, location, pit and proposed area for land application (unless engineered plans including this info have bee provided)  Photocopied section of involved 7.5' topographic sheet.	Fertilizer type Hay or straw or Wood Fiber (will be used where needed)  Fertilizer amount 500   lbs/acre    Mulch 2-3   Tons/acre  Drill Pad (6.25) + Access Road (20.87) + Storage Pad (4.28) + Top Soil Pile 1 (2.35) + Top Soil Pile 2 (0.52) + Material Spoil Pile 1  Temporary   Perma    Seed Type   lbs/acre   Seed Type    Tall Fescue   45   Tall Fescue    Perennial Rye Grass   20   Perennial Rye Grass    *or type of grass seed requested by surface owner   *or type of grass seed requested    Attach: Drawing(s) of road, location, pit and proposed area for land application (unless engineered plans in provided)  Photocopied section of involved 7.5' topographic sheet.  Plan Approved by: Danf when    Comments: Present Y with all all and area    Comments: Present Y with all area    Comments: Present Y with a lbs. Area    Comments    Comments Y with a lbs. Area    Comments    Comments    Comments    Com		ion pH
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#### Form WW-9 Additives Attachment

#### **SURFACE INTERVAL**

- 1. Fresh Water
- 2. Soap -Foamer AC
- 3. Air

#### **INTERMEDIATE INTERVAL**

#### STIFF FOAM RECIPE:

- 1) 1 ppb Soda Ash / Sodium Carbonate-Alkalinity Control Agent
- 2) 1 ppb Conqor 404 (11.76 ppg) / Corrosion Inhibitor
- 3) 4 ppb KLA-Gard (9.17 ppg) / Amine Acid Complex-Shale Stabilizer
- 4) 1ppb Mil Pac R / Sodium Carboxymethylcellulose-Filtration Control Agent
- 5) 12 ppb KCL / Potassium Chloride-inorganic Salt
- 6) Fresh Water 80 bbls
- 7) Air

#### PRODUCTION INTERVAL

1. Alpha 1655

Salt Inhibitor

2. Mil-Carb

Calcium Carbonate

3. Cottonseed Hulls

Cellulose-Cottonseed Pellets – LCM

4. Mil-Seal

Vegetable, Cotton & Cellulose-Based Fiber Blend - LCM

5. Clay-Trol

Amine Acid Complex – Shale Stabilizer

6. Xan-Plex

Viscosifier For Water Based Muds

7. Mil-Pac (All Grades)

Sodium Carboxymethylcellulose – Filtration Control Agente of Cil and Gas

8. New Drill

Anionic Polyacrylamide Copolymer Emulsion – Shale Stabilizer 5 2014

9. Caustic Soda

Sodium Hydroxide – Alkalinity Control

10. Mil-Lime

Calcium Hydroxide - Lime

11. LD-9

Polyether Polyol – Drilling Fluid Defoamer

12. Mil Mica

Hydro-Biotite Mica – LCM

13. Escaid 110

Drilling Fluild Solvent - Aliphatic Hydrocarbon

14. Ligco

Highly Oxidized Leonardite - Filteration Control Agent

15. Super Sweep

Polypropylene – Hole Cleaning Agent

16. Sulfatrol K

Drilling Fluid Additive - Sulfonated Asphalt Residuum

17. Sodium Chloride, Anhydrous

Inorganic Salt

18. D-D

Drilling Detergent – Surfactant

19. Terra-Rate

Organic Surfactant Blend

20. W.O. Defoam

Alcohol-Based Defoamer

21. Perma-Lose HT

Fluid Loss Reducer For Water-Based Muds

22. Xan-Plex D

Polysaccharide Polymer - Drilling Fluid Viscosifier

23. Walnut Shells

Ground Cellulosic Material - Ground Walnut Shells - LCM

24. Mil-Graphite

Natural Graphite - LCM

25. Mil Bar

Barite - Weighting Agent

26. X-Cide 102

Biocide

27. Soda Ash

Sodium Carbonate – Alkalinity Control Agent

28. Clay Trol

Amine Acid complex – Shale Stabilizer

29. Sulfatrol

Sulfonated Asphalt – Shale Control Additive

30. Xanvis

Viscosifier For Water-Based Muds

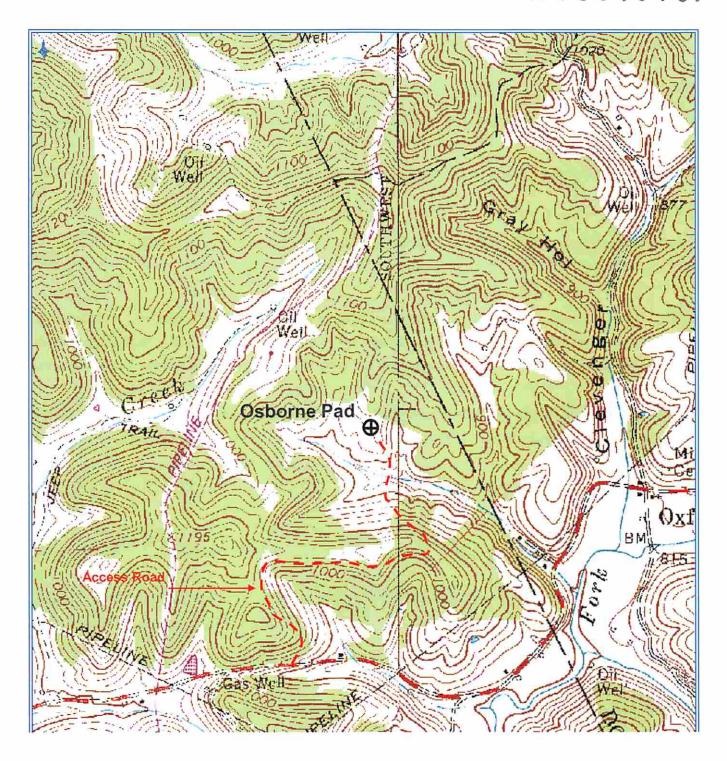
31. Milstarch

Starch - Fluid Loss Reducer For Water Based Muds

32. Mil-Lube

**Drilling Fluid Lubricant** 





# **Antero Resources Corporation**

Appalachian Basin Broadwater Unit 2H Ritchie County

Quadrangle: Pullman

Watershed: South Fork Hughes River

District: Union Date: 11-12-14

