



west virginia department of environmental protection

Office of Oil and Gas
601 57th Street, S.E.
Charleston, WV 25304
(304) 926-0450
fax: (304) 926-0452

Austin Caperton, Cabinet Secretary
www.dep.wv.gov

Friday, August 31, 2018
PERMIT MODIFICATION APPROVAL
Horizontal 6A / New Drill

ANTERO RESOURCES CORPORATION
1615 WYNKOOP STREET

DENVER, CO 80202

Re: Permit Modification Approval for SPOCK UNIT 2H
47-095-02427-00-00

Bottom hole adjustment

ANTERO RESOURCES CORPORATION

The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

If there are any questions, please feel free to contact me at (304) 926- 0450.

James A. Martin
Chief

Operator's Well Number: SPOCK UNIT 2H
Farm Name: TYRONE L. BEEM ET AL
U.S. WELL NUMBER: 47-095-02427-00-00
Horizontal 6A New Drill
Date Modification Issued: August 31, 2018

Promoting a healthy environment.

WW-6B
(04/15)

Permit Modification AP# 47-095-02427
API NO. 47-095 - 02427
OPERATOR WELL NO. Spock Unit 2H
Well Pad Name: Pyle Run Pad

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

1) Well Operator: Antero Resources Corporation 494507062 095 - Tyler Centerville Middlebourne 7.5'
Operator ID County District Quadrangle

2) Operator's Well Number: Spock Unit 2H Well Pad Name: Pyle Run Pad

3) Farm Name/Surface Owner: Tyrone L Beem et al Public Road Access: Bearsville-Mole Hole

4) Elevation, current ground: 1115' Elevation, proposed post-construction: _____

5) Well Type (a) Gas Oil _____ Underground Storage _____

Other _____

(b) If Gas Shallow Deep _____

Horizontal _____

6) Existing Pad: Yes or No Yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus Shale: 6800' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2800#

*Dmit
7-25-18
GEB
7/25/2018*

8) Proposed Total Vertical Depth: 6800' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 17200' MD

11) Proposed Horizontal Leg Length: 10172' ✓ w/Plat ✓

12) Approximate Fresh Water Strata Depths: 301', 332' ✓

13) Method to Determine Fresh Water Depths: Offset well records. Depths have been adjusted according to surface elevations.

14) Approximate Saltwater Depths: 674', 1584' ✓

15) Approximate Coal Seam Depths: 811' ✓

16) Approximate Depth to Possible Void (coal mine, karst, other): None Anticipated

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes _____ No

(a) If Yes, provide Mine Info: Name: _____

Depth: _____

Seam: _____

Owner: _____

Received

JUL 26 2018

WW-6B
(04/15)

Permit Modification API# 47-095-02427
 API NO. 47- 095 - 02427
 OPERATOR WELL NO. Spock Unit 2H
 Well Pad Name: Pyle Run Pad

18) CASING AND TUBING PROGRAM

TYPE	Size (in)	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling (ft)	INTERVALS: Left in Well (ft)	CEMENT: Fill-up (Cu. Ft.)/CTS
Conductor	20"	New	H-40	94#	80'	80' ✓	CTS, 77 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	385' *see #19	385' *see #19 ✓	CTS, 535 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2500'	2500' ✓	CTS, 1018 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	17200'	17200' ✓	4322 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

DMH 7-25-18 *Job 7/25/2015*

TYPE	Size (in)	Wellbore Diameter (in)	Wall Thickness (in)	Burst Pressure (psi)	Anticipated Max. Internal Pressure (psi)	Cement Type	Cement Yield (cu. ft./k)
Conductor	30"	24"	0.438"	1530	50	Class A	1.18
Fresh Water	13-3/8"	17-1/2"	0.38"/0.33"	2730/1730	1000	Class A	1.18
Coal	9-5/8"	12-1/4"	0.352"	3520	1500	Class A	1.18
Intermediate							
Production	5-1/2"	8-3/4" & 8-1/2"	0.361"	12,630	2500	Low H/POZ A Tyl-H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11,200 ✓			
Liners							

PACKERS

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

Received

JUL 26 2018

WW-6B
(10/14)

Permit Modification API# 47-095-02427
API NO. 47- 095 - 02427
OPERATOR WELL NO. Spock Unit 2H
Well Pad Name: Pylon Run Pad

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill, perforate, fracture a new horizontal shallow well and complete Marcellus Shale.

*Antero will be air drilling the fresh water string which makes it difficult to determine when freshwater is encountered, therefore we have built in a buffer for the casing setting depth which helps to ensure that all fresh water zones are covered.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Antero plans to pump Slickwater into the Marcellus Shale formation in order to ready the well for production. The fluid will be comprised of approximately 99 percent water and sand, with less than 1 percent special-purpose additives as shown in the attached "List of Anticipated Additives Used for Fracturing or Stimulating Well."

Anticipated Max Pressure - 9300 lbs ✓
Anticipated Max Rate - 80 bpm

DmH
7-25-18
JEB
7/25/2018

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 29.70 acres

22) Area to be disturbed for well pad only, less access road (acres): 10.67 acres

23) Describe centralizer placement for each casing string:

Conductor: no centralizers

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

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.

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

25) Proposed borehole conditioning procedures:

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

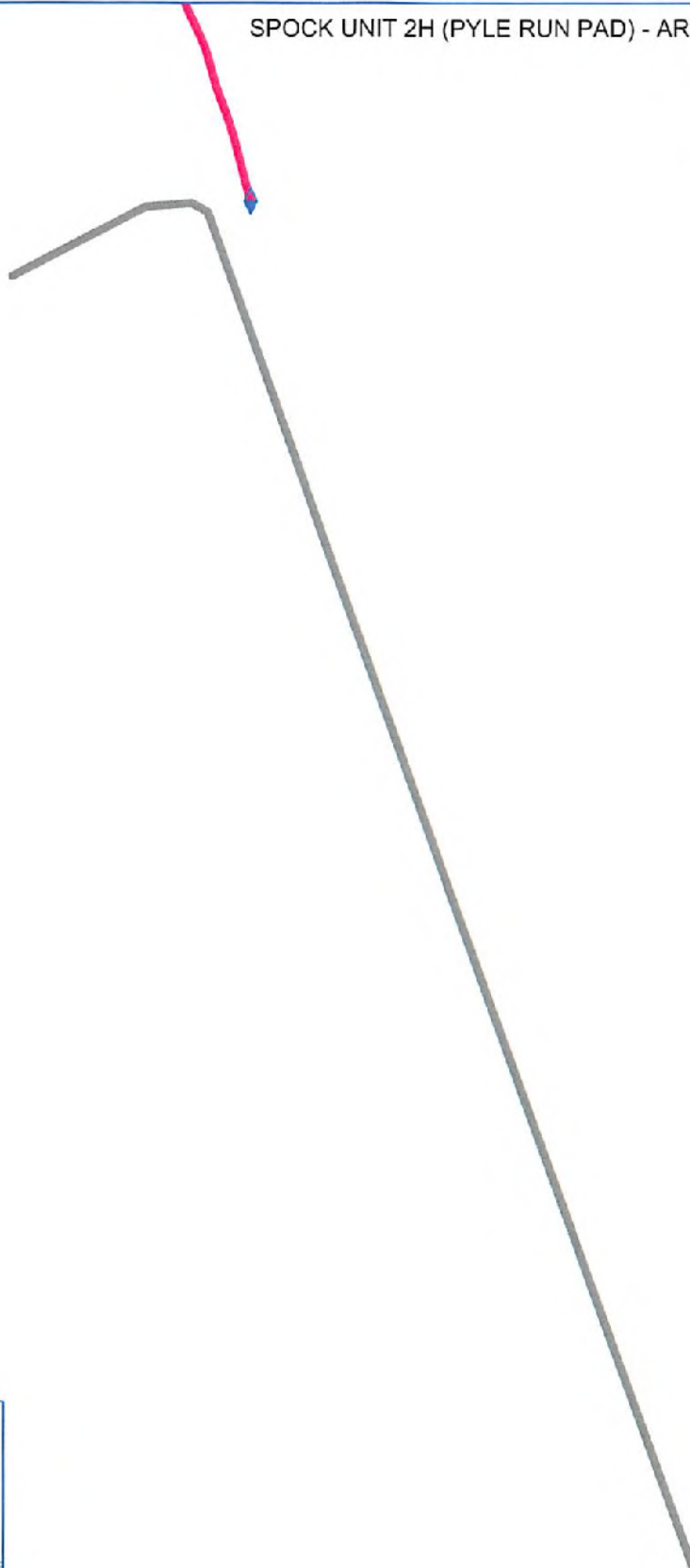
Surface: blowhole clean with air, trip to conductor shoe, trip to bottom, blowhole clean with air, trip out, run casing, circulate pipe capacity + 40 bbls fresh water followed by 25 bbls bentonite mud, 10 bbls fresh water spacer.

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.

Received
JUL 26 2018

*Note: Attach additional sheets as needed.



Antero Resources Corporation

Spock Unit 2H - AOR



WELL SYMBOLS
Waiting on Completion



4709502427

SPOCK UNIT 2H (PYLE RUN PAD) - AREA OF REVIEW 35-8-5.11 PAGE 1

Permit Modification API# 47-095-02427

LIW (API Num)	Well Name	Well Number	Operator	Historical Operator	TD	Perforated Interval (shallowest - deepest)	Perforated Formation(s)	Productible Formation(s) not perf'd
47095024000000	Ant Unit	1H	ANTERO RESOURCES CORPORATION	ANTERO RESOURCES CORPORATION	15869	N/A	Marcellus Fm	N/A

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Office of Oil and Gas

JUL 17 2018

WV Department of
Environmental Protection

LATITUDE 39°25'00"

8,174'

2H BOTTOM HOLE - 5,397' TO BOTTOM HOLE
LATITUDE 39°22'30"

93' TO BOTTOM HOLE
LONGITUDE 80°52'30"

5,993'

LONGITUDE 80°52'30"

Antero Resources Corporation
Well No. Spock Unit 2H
47-095-02427

LOREN BAGLEY LEASE
LOREN BAGLEY
W.B. 20 PG. 795
T.J.L. 11 PAR. 02
207.77 AC ±

GARY L. HALL LEASE
GARY HALL ET AL
D.B. 245 PG. 307
T.J.L. 7 PAR. 20
40 AC ±

JOSEPH MACRAY
D.B. 352 PG. 440
T.J.L. 12 PAR. 31
240.03 AC ±

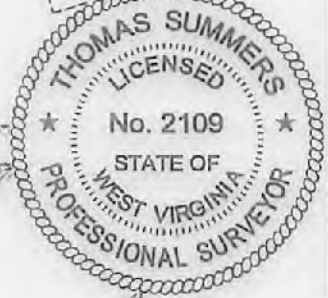
NOTES:
WELL 2H TOP HOLE INFORMATION:
N: 330,976ft E: 1,603,279ft
LAT: 39°24'00.77" LON: 80°54'14.13"
BOTTOM HOLE INFORMATION:
N: 321,627ft E: 1,607,913ft
LAT: 39°22'29.09" LON: 80°53'13.27"
WEST VIRGINIA COORDINATE SYSTEM OF 1927 NORTH ZONE.
ZONE WAS DERIVED FROM MEASUREMENTS TAKEN WITH TRIMBLE GEOXT SUBMETER MAPPING GRADE GPS UNIT. PLAT ORIENTATION, CORNER, AND WELL REFERENCE TIE LINES ARE BASED ON GRID NORTH.

(NAD) 83 (UTM) ZONE 17 COORDS:
WELL 2H TOP HOLE INFORMATION:
N: 4,361,203m E: 508,287m
BOTTOM HOLE INFORMATION:
N: 4,358,379m E: 509,746m

(NAD) 27 (UTM) ZONE 17 COORDS:
WELL 2H TOP HOLE INFORMATION:
N: 14,307,668ft E: 1,667,557ft
POINT OF ENTRY INFORMATION:
N: 14,307,971ft E: 1,668,908ft
BOTTOM HOLE INFORMATION:
N: 14,298,401ft E: 1,672,349ft



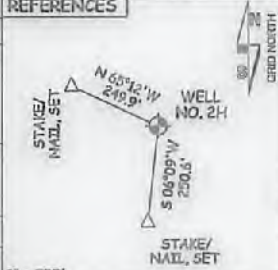
NOTE:
NO OCCUPIED BUILDINGS OR BUILDINGS TWO THOUSAND FIVE HUNDRED (2,500) SQUARE FEET OR LARGER USED TO HOUSE OR PROTECT DAILY CATTLE OR POULTRY RESIDING AND LOCATED WITHIN SIX HUNDRED TWENTY-FIVE (625) FEET OF THE CENTER OF THE WELL PAD.



JOB # 16-047WA
DRAWING # SPOCK2HR3
SCALE 1" = 1000'
MINIMUM DEGREE OF ACCURACY SUBMETER
PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS



LEGEND and OPERATOR'S WELL # SPOCK UNIT #2H



STATE OF WEST VIRGINIA, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
WILLOW LAND SURVEYING PLLC
220 MASONIC AVE. PENNSBORO WEST VIRGINIA 26415

WELL TYPE: OIL GAS X LIQUID INJECTION WASTE DISPOSAL
(IF "GAS") PRODUCTION X STORAGE DEEP SHALLOW X
LOCATION: ELEVATION 1,115' AS BUILT WATERSHED OUTLET MIDDLE ISLAND CREEK
QUADRANGLE THUNDERBOLTS SPENSBORO DISTRICT CENTERTVILLE COUNTY TYLER
SURFACE OWNER TYRONE L. BEEM ET AL ACREAGE 300 ACRES +/-
OIL & GAS ROYALTY OWNER E.C. BEEM; FRANK GRASS ET AL; CONRAD E. COSTILOW; LEASE ACREAGE 317 AC±; 43.78 AC±; 64.42 AC±;
ALF A. RIGGS; JOSEPH E. HESS ET AL; LINDA D. BURG-JETT;
19.4 AC±; 94.92 AC±; 178 AC±;
HAESSLY LAND & TIMBER, LLC; MARTHA E. GOODEN
28.76 AC±; 104.95 AC±
PROPOSED WORK: DRILL CONVERT DRILL DEEPER X REDRILL FRACTURE OR STIMULATE X
PLUG OFF OLD FORMATION PERFORATE NEW FORMATION X OTHER PHYSICAL CHANGE IN WELL
(SPECIFY) MOD-BHL PLUG & ABANDON PLUG & ABANDON CLEAN OUT & REPLUG
TARGET FORMATION MARCELLUS ESTIMATED DEPTH 6,800' TVD 17,200' MD
WELL OPERATOR ANTERO RESOURCES CORP. DESIGNATED AGENT DIANNA STAMPER-CT CORPORATION SYSTEM
ADDRESS 1615 WYNKOOP STREET ADDRESS 5400 D BIG TYLER ROAD
FORM WW-6 DENVER, CO 80202 CHARLESTON, WV 25313

THOMAS SUMMERS P.S. 2109
I THE UNDERSIGNED, HEREBY CERTIFY THAT THIS PLAT IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND SHOWS ALL THE INFORMATION REQUIRED BY LAW AND THE RULES ISSUED AND PERSCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION.

LATITUDE 39°25'00"

8,174'

2H BOTTOM HOLE - 3,397' TO BOTTOM HOLE
LATITUDE 39°22'30"

93' TO BOTTOM HOLE
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5,993'

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Antero Resources Corporation
Well No. Spock Unit 2H
47-095-02427

LOREN BAGLEY LEASE
LOREN BAGLEY
W.S. 33 PG. 756
T.M. 11 PAR. 05
207.77 AC. ±

GARY L. HALL LEASE
GARY HALL ET AL
D.B. 245 PG. 307
T.M. 7 PAR. 20
19 AC. ±

JOSEPH McGRAY
D.B. 352 PG. 440
T.M. 12 PAR. 31
240.81 AC. ±

E. C. BEEM LEASE
TYRONE L. BEEM ET AL
D.B. 343 PG. 60
T.M. 11 PAR. 04
300 AC. ±

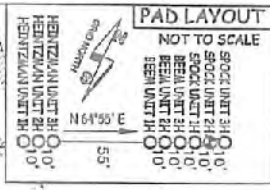
FRANK GRASS ET AL LEASE
FRANK GRASS ET AL
D.B. 279 PG. 225
T.M. 11 PAR. 05
43.70 AC. ±

CARL W. ASH ET UX LEASE
JOSEPH McGRAY
D.B. 352 PG. 440
T.M. 11 PAR. 31
240.81 AC. ±

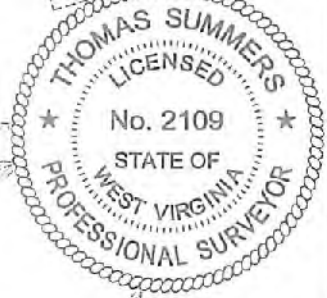
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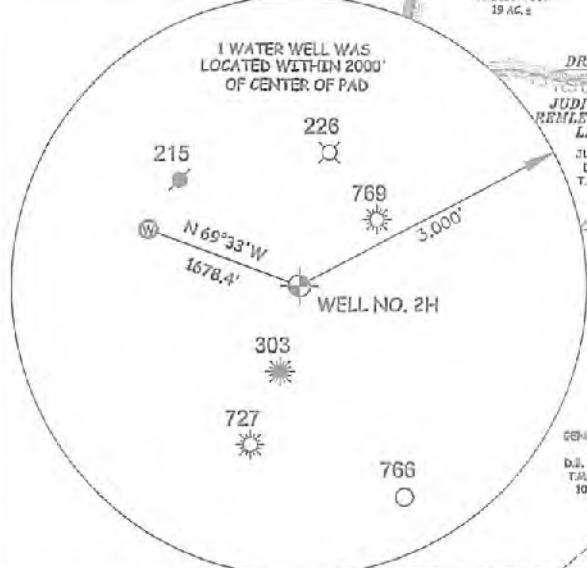
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JOB # 16-047WA
DRAWING # SPOCK2HR3
SCALE 1" = 1000'
MINIMUM DEGREE OF ACCURACY SUBMETER
PROVEN SOURCE OF ELEV. SUBMETER MAPPING GRADE GPS



LEGEND and REFERENCES table with symbols for surface owner boundary lines, interior surface tracts, existing fence, monument, and well location. Includes a small well location diagram.

REFERENCES table with well location diagram and scale 1" = 500'.



STATE OF WEST VIRGINIA, DIVISION OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
WILLOW LAND SURVEYING PLLC
220 MASONIC AVE. PENNSBORO WEST VIRGINIA 26415



WELL TYPE: OIL GAS X LIQUID INJECTION WASTE DISPOSAL
(IF "GAS") PRODUCTION X STORAGE DEEP SHALLOW X
LOCATION: ELEVATION 1,115-AS BUILT WATERSHED CUTLET MIDDLE ISLAND CREEK
QUADRANGLE TH MIDDLEBOURNE 7.5 R PENNSBORO 7.0 DISTRICT CENTERVILLE COUNTY TYLER
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COUNTY NAME PERMIT

RECEIVED
Office of Oil and Gas
JUL 17 2018
MN Department of
Environmental Protection

INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE
Chapter 22, Article 6A, Section 5(a)(5)
IN LIEU OF FILING LEASE(S) AND OTHER CONTINUING CONTRACT(S)

Under the oath required to make the verification on page 1 of this Notice and Application, I depose and say that I am the person who signed the Notice and Application for the Applicant, and that –

(1) the tract of land is the same tract described in this Application, partly or wholly depicted in the accompanying plat, and described in the Construction and Reclamation Plan;

(2) the parties and recordation data (if recorded) for lease(s) or other continuing contract(s) by which the Applicant claims the right to extract, produce or market the oil or gas are as follows:

Grantor, lessor, etc.	Grantee, lessee, etc.	Royalty	Book/Page
<u>E.G. Beem Lease</u> E.G. Beem Warren R. Haught Sancho Oil and Gas Corporation	Warren R. Haught Sancho Oil and Gas Corporation Antero Resources Corporation	1/8 Assignment Assignment	213/662 369/506 436/177
<u>Frank Grass et al Lease</u> Frank Grass et al Sancho Oil and Gas Corporation	Sancho Oil and Gas Corporation Antero Resources Corporation	1/8 Assignment	335/601 436/216
<u>Conrad E. Costilow Lease</u> Conrad E. Costilow	Antero Resources Corporation	1/8+	500/645
<u>Alf A. Riggs Lease</u> Alf A. Riggs Antero Resources Appalachian Corporation	Antero Resources Appalachian Corporation Antero Resources Corporation	1/8+ Name Change	408/615 EXHIBIT 1
<u>Joseph E. Hess et ux Lease</u> Joseph E. Hess aka Joseph Elden Hess and Judith C. Hess	Antero Resources Corporation	1/8+	447/625
<u>Linda D. Burg-Jett Lease</u> Linda D. Burg-Jett Antero Resources Appalachian Corporation	Antero Resources Appalachian Corporation Antero Resources Corporation	1/8+ Name Change	400/324 EXHIBIT 1
<u>Haessly Land and Timber, LLC Lease</u> Haessly Land and Timber, LLC	Antero Resources Corporation	1/8+	567/323

*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

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Office of Oil and Gas

JUL 17 2018

WV Department of
Environmental Protection

WW-6A1
(5/13)

Operator's Well No. Spock Unit 2H

**INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE
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Lease Name or Number	Grantor, Lessor, etc.	Grantee, Lessee, etc.	Royalty	Book/Page
<u>Martha E. Gooden Lease</u>	Martha E. Gooden	Chesapeake Appalachia LLC	1/8	369/622
	Chesapeake Appalachia LLC	SWN Production Company LLC	Assignment	465/463
	SWN Production Company LLC	Antero Resources Corporation	Assignment	544/242

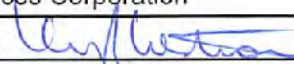
*Partial Assignments to Antero Resources Corporation include 100% rights to extract, produce and market the oil and gas from the Marcellus and any other formations completed with this well.

**Acknowledgement of Possible Permitting/Approval
In Addition to the Office of Oil and Gas**

The permit applicant for the proposed well work addressed in this application hereby acknowledges the possibility of the need for permits and/or approvals from local, state, or federal entities in addition to the DEP, Office of Oil and Gas, including but not limited to the following:

- WV Division of Water and Waste Management
- WV Division of Natural Resources WV Division of Highways
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- County Floodplain Coordinator

The applicant further acknowledges that any Office of Oil and Gas permit in no way overrides, replaces, or nullifies the need for other permits/approvals that may be necessary and further affirms that all needed permits/approvals should be acquired from the appropriate authority before the affected activity is initiated.

Well Operator: Antero Resources Corporation
 By: Kevin Kilstrom 
 Its: SR Vice President - Production

RECEIVED
Office of Oil and Gas

JUL 17 2018

WV Department of
Environmental Protection

**FORM WW-6A1
EXHIBIT 1**

FILED

JUN 10 2013

Natalie E. Tennant,
Secretary of State
1900 Kanawha Blvd E
Bldg 1, Suite 157-K
Charleston, WV 25305



Penney Barker, Manager
Corporations Division
Tel: (304)558-8000
Fax: (304)558-8381
Website: www.wvsos.com
E-mail: business@wvsos.com

**APPLICATION FOR
AMENDED CERTIFICATE
OF AUTHORITY**

Office Hours: Monday - Friday
8:30 a.m. - 5:00 p.m. ET

FILE ONE ORIGINAL
(Two if you want a filed
stamped copy returned to you)
FEE: \$25.00

**** In accordance with the provisions of the West Virginia Code, the undersigned corporation hereby ****
applies for an Amended Certificate of Authority and submits the following statement:

1. Name under which the corporation was authorized to transact business in WV: Antero Resources Appalachian Corporation
2. Date Certificate of Authority was issued in West Virginia: 6/25/2008
3. Corporate name has been changed to: Antero Resources Corporation
(Attach one Certified Copy of Name Change as filed in home State of Incorporation.)
4. Name the corporation elects to use in WV: Antero Resources Corporation
(due to home state name not being available)
5. Other amendments: _____
(attach additional pages if necessary)

6. Name and phone number of contact person. (This is optional; however, if there is a problem with the filing, listing a contact person and phone number may avoid having to return or reject the document.)

Alvyn A. Schopp (303) 367-7310
Contact Name Phone Number

7. Signature Information (See below **Important Legal Notice Regarding Signature**):

Print Name of Signer: Alvyn A. Schopp Title/Capacity: Authorized Person
Signature: *Alvyn A. Schopp* Date: June 10, 2013

**Important Legal Notice Regarding Signature:* For West Virginia Code §31D-1-12b. Penalty for signing false document. Any person who signs a document he or she knows is false in any material respect and knows that the document is to be delivered to the secretary of state for filing is guilty of a misdemeanor and, upon conviction thereof, shall be fined not more than one thousand dollars or confined in the county or regional jail not more than one year, or both.

WW-6B
(04/15)

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

1) Well Operator: Antero Resources Corporation 494507062 095 - Tyler Centerville Middlebourne 7.5'
Operator ID County District Quadrangle

2) Operator's Well Number: Spock Unit 2H Well Pad Name: Pyle Run Pad

3) Farm Name/Surface Owner: Tyrone L Beem et al Public Road Access: Bearsville-Mole Hole

4) Elevation, current ground: 1115' Elevation, proposed post-construction: _____

5) Well Type (a) Gas Oil _____ Underground Storage _____
Other _____

(b) If Gas Shallow Deep _____
Horizontal

6) Existing Pad: Yes or No Yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus Shale: 6800' TVD, Anticipated Thickness- 55 feet, Associated Pressure- 2800#

8) Proposed Total Vertical Depth: 6800' TVD

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 17200' MD

11) Proposed Horizontal Leg Length: 10172'

12) Approximate Fresh Water Strata Depths: 301', 332'

13) Method to Determine Fresh Water Depths: Offset well records. Depths have been adjusted according to surface elevations.

14) Approximate Saltwater Depths: 674', 1584'

15) Approximate Coal Seam Depths: 811'

16) Approximate Depth to Possible Void (coal mine, karst, other): None Anticipated

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes _____ No

(a) If Yes, provide Mine Info: Name: _____
Depth: _____
Seam: _____
Owner: _____

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WW-6B
(04/15)

Permit Modification API# 47-095-02427
 API NO. 47-095 - 02427
 OPERATOR WELL NO. Spock Unit 2H
 Well Pad Name: Pyle Run Pad

18)

CASING AND TUBING PROGRAM

TYPE	<u>Size (in)</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling (ft)</u>	<u>INTERVALS: Left in Well (ft)</u>	<u>CEMENT: Fill-up (Cu. Ft.)/CTS</u>
Conductor	20"	New	H-40	94#	80'	80'	CTS, 77 Cu. Ft.
Fresh Water	13-3/8"	New	J-55/H-40	54.5#/48#	385' *see #19	385' *see #19	CTS, 535 Cu. Ft.
Coal	9-5/8"	New	J-55	36#	2500'	2500'	CTS, 1018 Cu. Ft.
Intermediate							
Production	5-1/2"	New	P-110	20#	17200'	17200'	4322 Cu. Ft.
Tubing	2-3/8"	New	N-80	4.7#		7100'	
Liners							

TYPE	<u>Size (in)</u>	<u>Wellbore Diameter (in)</u>	<u>Wall Thickness (in)</u>	<u>Burst Pressure (psi)</u>	<u>Anticipated Max. Internal Pressure (psi)</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	30"	24"	0.438"	1530	50	Class A	1.18
Fresh Water	13-3/8"	17-1/2"	0.38"/0.33"	2730/1730	1000	Class A	1.18
Coal	9-5/8"	12-1/4"	0.352"	3520	1500	Class A	1.18
Intermediate							
Production	5-1/2"	8-3/4" & 8-1/2"	0.361"	12,630	2500	LeadH/POZ & Tail - H	H/POZ-1.44 & H-1.8
Tubing	2-3/8"	4.778"	0.19"	11,200			
Liners							

PACKERS

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

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WV Department of
Environmental Protection

WW-6B
(10/14)

Permit Modification API# 47-095-02427

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OPERATOR WELL NO. Spock Unit 2H

Well Pad Name: Pyle Run Pad

JUL 17 2018

WV Department of
Environmental Protection

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill, perforate, fracture a new horizontal shallow well and complete Marcellus Shale.

*Antero will be air drilling the fresh water string which makes it difficult to determine when freshwater is encountered, therefore we have built in a buffer for the casing setting depth which helps to ensure that all fresh water zones are covered.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Antero plans to pump Slickwater into the Marcellus Shale formation in order to ready the well for production. The fluid will be comprised of approximately 99 percent water and sand, with less than 1 percent special-purpose additives as shown in the attached "List of Anticipated Additives Used for Fracturing or Stimulating Well."

Anticipated Max Pressure - 9300 lbs

Anticipated Max Rate - 80 bpm

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 29.70 acres

22) Area to be disturbed for well pad only, less access road (acres): 10.67 acres

23) Describe centralizer placement for each casing string:

Conductor: no centralizers

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

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.

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

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.

*Note: Attach additional sheets as needed.