

04/05/2019



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west virginia department of environmental protection

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

Austin Caperton, Cabinet Secretary  
[www.dep.wv.gov](http://www.dep.wv.gov)

Monday, April 1, 2019  
PERMIT MODIFICATION APPROVAL  
Horizontal 6A / New Drill

HG ENERGY II APPALACHIA, LLC  
5260 DUPONT ROAD  
PARKERSBURG, WV 26101

Re: Permit Modification Approval for NAYS 1209 N-5H  
47-033-05938-00-00

**Extend intermediate string, 17.5", by 150' through storage field.**

HG ENERGY II APPALACHIA, LLC

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

A blue ink signature of James A. Martin, written in a cursive style, is positioned above the printed name and title.

Operator's Well Number: NAYS 1209 N-5H  
Farm Name: HG ENERGY II APPALACHIA, LLC  
U.S. WELL NUMBER: 47-033-05938-00-00  
Horizontal 6A New Drill  
Date Modification Issued: 04/01/2019

Promoting a healthy environment.

WW-6B  
(04/15)

04/05/2019

API NO. 47- 033 - 05138  
OPERATOR WELL NO. Nays 1209 N-5H  
Well Pad Name: Nays 1209

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

1) Well Operator: HG Energy II Appalachia, L.P. 494519932 Harrison Union West Milford 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Nays 1209 N-5H Well Pad Name: Nays 1209

3) Farm Name/Surface Owner: Nays / HG Energy II Appalachia Public Road Access: Kincheloe Run Rd/SLS 35

4) Elevation, current ground: 1002' Elevation, proposed post-construction: 1007'

5) Well Type (a) Gas X Oil \_\_\_\_\_ Underground Storage \_\_\_\_\_  
Other \_\_\_\_\_

(b) If Gas Shallow X Deep \_\_\_\_\_  
Horizontal X

*SDW  
2/7/2019*

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):  
Marcellus at 6863'/6914' and 51' in thickness. Anticipated pressure at 4314#.

8) Proposed Total Vertical Depth: 6900'

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 23,179'

11) Proposed Horizontal Leg Length: 15520'

12) Approximate Fresh Water Strata Depths: 135', 500'

13) Method to Determine Fresh Water Depths: Nearest offset well data

14) Approximate Saltwater Depths: None noted in offsets

15) Approximate Coal Seam Depths: 660' to 665'

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

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

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

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WW-6B  
(04/15)

API NO. 47- \_\_\_\_\_  
OPERATOR WELL NO. Nays 1209 N-5H  
Well Pad Name: Nays 1209

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	30"	New	LS	157.5	100'	100'	Drilled In
Fresh Water	20"	NEW	J-55	94	600'	600'	40% excess yield = 1.20, CTS
Coal	13 3/8"	NEW	J-55	68	1735'	1735'	40% excess yield = 1.20, CTS
Intermediate	9 5/8"	NEW	J-55	40	2500'	2500'	40% excess yield Load/ 0% Excess Yield
Production	5 1/2"	NEW	P-110	23	23179'	23179'	20% excess yield = 1.19, tab yield = 1.19
Tubing							
Liners							

*SOW*  
*2/7/2019*

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"	30"	.500				CTS
Fresh Water	20"	24"	.438	2110	1200	Type 1, Class A	30% excess yield = 1.20, CTS
Coal	13 3/8"	17 1/2"	.480	3450		Type 1/Class A	40% excess yield = 1.20, CTS
Intermediate	9 5/8"	12 1/4"	.395	3950		Type 1/Class A	40% excess yield = 0% Excess Yield
Production	5 1/2"	8 1/2"	.415	14520	12500	Type 1/Class A	20% excess yield = 1.19, tab yield = 1.19
Tubing							
Liners							

**PACKERS**

Kind:				
Sizes:				
Depths Set:				

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04/05/2019

**Diane White**

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**From:** James H Moore Iii <James.H.Moore.Iii@dominionenergy.com>  
**Sent:** Wednesday, February 06, 2019 11:55 AM  
**To:** Diane White; Ronald L. Walden  
**Cc:** Josh Hinton  
**Subject:** RE: Revisions to the Nays 1209 N Lateral Permits for the Dominion Energy Natural Gas Storage Field

Diane,

DETI agrees/approves of HG Energy setting the 13-3/8" casing shoe 150' below the base of the Gantz Sand (Storage Zone) for the NAYS 1209 wells 1H,2H,3H,4H,5H,6H.

Thanks,

Jamie.

**Jamie Moore**  
Geologist II  
Gas Storage Department  
Dominion Energy Transmission, Inc.  
925 White Oaks Boulevard  
Bridgeport, WV 26330  
Office-681-842-3372  
Work Cell-304-859-1561  
Personal Cell 540-641-4044



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Environmental Protection

**From:** Diane White [mailto:dwhite@hgenergyllc.com]  
**Sent:** Tuesday, February 05, 2019 4:32 PM  
**To:** James H Moore Iii (GasInfrastructure - 2); Ronald L. Walden (GasInfrastructure - 2)  
**Cc:** Josh Hinton  
**Subject:** [External] Revisions to the Nays 1209 N Lateral Permits for the Dominion Energy Natural Gas Storage Field

Jamie and Ron,

Attached are the well schematics for the Nays 1209 N laterals. The revisions which will be requested are to allow for the 150 feet additional casing through the storage field as per your conversations with Josh Hinton.

If you can send back approval via email I'll include that with my request to the DEP for the permit revisions.

Thank You,

Diane



1209 N-5H  
Marcellus Shale Horizontal  
Harrison County, WV

		1209 N-5H SHL				237409.72N 1732371.49E			
Ground Elevation	1007'	1209 N-5H LP				238327.81N 1733745.33E			
Azm	341.493°	1209 N-5H BHL				253044.72N 1728819.04E			

WELLBORE DIAGRAM	HOLE	CASING	GEOLOGY	TOP	BASE	MUD	CEMENT	CENTRALIZERS	CONDITIONING	COMMENTS
	30"	30" 157.5# LS	Conductor	0	100	AIR	N/A, Casing to be drilled in w/ Dual Rotary Rig	N/A	Ensure the hole is clean at TD.	Conductor casing = 0.5" wall thickness
	24"	20" 94# J-55	Fresh Water	0	135	AIR	15.6 ppg PNE-1 + 3% bwoc CaCl 40% Excess Yield=1.20 / CTS	Centralized every 3 joints to surface	Once casing is at setting depth, circulate a minimum of one hole volume with Fresh Water prior to pumping cement.	Surface casing = 0.438" wall thickness Burst=2110 psi
			Fresh Water	0	600					
	17.5"	13-3/8" 68# J-55 BTC	Kittaning Coal	660	665	AIR / KCL Salt Polymer	Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS	Bow Spring on every joint <i>*will also be running ECP for isolating storage zone*</i>	Once casing is at setting depth, Circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement.	Intermediate casing = 0.480" wall thickness Burst=3450 psi
			Little/Big Lime	1126 / 1167	1151 / 1243					
			Injun / Gantz (Storage)	1243 / 1535	1349 / 1585					
	12.25"	9-5/8" 40# J-55 BTC	Fifty / Thirty Foot	1650 / 1730	1697 / 1742	AIR / KCL Salt Polymer	Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS	Bow Spring on first 2 joints then every third joint to 100' form surface	Once casing is at setting depth, Circulate and condition mud at TD. Circulate a minimum of one hole volume prior to pumping cement.	Intermediate casing = 0.395" wall thickness Burst=3950 psi
			Gordon Stray / Gordon	1785 / 1850	1850 / 1940					
			5th Sand	2035	2070					
			Bayard Sand	2125	2160					
	8.5" Vertical	5-1/2" 23# P-110 HC CDC HTQ	Speechley	2745	2763	9.0ppg SOBM	<b>Lead:</b> 14.5 ppg POZ:PNE-1 + 0.3% bwoc R3 + 1% bwoc EC1 + 0.75 gal/sk FP13L + 0.3% bwoc MPA170 <b>Tail:</b> 14.8 ppg PNE-1 + 0.35% bwoc R3 + 0.75 gal/sk FP13L + 50% bwoc ASCA1 + 0.5% bwoc MPA170 20% Excess Lead Yield=1.19 Tail Yield=1.94 CTS	Run 1 spiral centralizer every 5 joints from the top of the curve to surface.	Once on bottom/TD with casing, circulate at max allowable pump rate for at least 2x bottoms up, or until returns and pump pressures indicate the hole is clean. Circulate a minimum of one hole volume prior to pumping cement.	Production casing = 0.415" wall thickness Burst=14520 psi Note:Actual centralizer schedules may be changed due to hole conditions
			Balltown	2965	3005					
			Benson	4050	4083	11.5ppg-12.5ppg SOBM				
			West Falls	4620	5865					
			Rhinestreet	5865	6140					
Cashaqua			6140	6341						
Middlesex			6341	6421						
West River			6421	6514						
Burkett			6514	6540						
Tully Limestone			6540	6644						
Hamilton	6644	6863	11.5ppg-12.5ppg SOBM							
Marcellus	6863	6914								
8.5" Curve	5" Lateral	TMD / TVD (Production)	23179	6900						
		Onondaga	6914							

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04/05/2019

WW-6B  
(04/15)

Previous Permit

API NO. 47- \_\_\_\_\_  
OPERATOR WELL NO. Nays 1209 N-5H  
Well Pad Name: Nays 1209

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, OFFICE OF OIL AND GAS  
WELL WORK PERMIT APPLICATION

1) Well Operator: HG Energy II Appalachia, Inc. 494519932 Harrison Union West Milford 7.5'  
Operator ID County District Quadrangle

2) Operator's Well Number: Nays 1209 N-5H Well Pad Name: Nays 1209

3) Farm Name/Surface Owner: Nays / HG Energy II Appalachia Public Road Access: Kincheloe Run Rd/SLS 35

4) Elevation, current ground: 1002' Elevation, proposed post-construction: 1007'

5) Well Type (a) Gas  Oil  Underground Storage   
Other \_\_\_\_\_  
(b) If Gas Shallow  Deep   
Horizontal  SDW  
10/22/2018

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):  
Marcellus at 6863'/6914' and 51' in thickness. Anticipated pressure at 4314#.

8) Proposed Total Vertical Depth: 6900'

9) Formation at Total Vertical Depth: Marcellus

10) Proposed Total Measured Depth: 23,179'

11) Proposed Horizontal Leg Length: 15520'

12) Approximate Fresh Water Strata Depths: 135', 500'

13) Method to Determine Fresh Water Depths: Nearest offset well data

14) Approximate Saltwater Depths: None noted in offsets

15) Approximate Coal Seam Depths: 660' to 665'

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

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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4703305938  
04/05/2019

API NO. 47- \_\_\_\_\_  
OPERATOR WELL NO. Nays 1209 N-5H  
Well Pad Name: Nays 1209

18)

**CASING AND TUBING PROGRAM**

<b>TYPE</b>	<b>Size (in)</b>	<b>New or Used</b>	<b>Grade</b>	<b>Weight per ft. (lb/ft)</b>	<b>FOOTAGE: For Drilling (ft)</b>	<b>INTERVALS: Left in Well (ft)</b>	<b>CEMENT: Fill-up (Cu. Ft.)/CTS</b>
Conductor	30"	New	LS	157.5	100'	100'	Drilled In
Fresh Water	20"	NEW	J-55	94	600'	600'	40% excess yield = 1.20, CTS
Coal	13 3/8"	NEW	J-55	54.5	1635'	1635'	40% excess yield = 1.20, CTS
Intermediate	9 5/8"	NEW	J-55	40	2500'	2500'	40% excess yield = 1.20, CTS <i>CTS</i>
Production	5 1/2"	NEW	P-110	23	23179'	23179'	20% excess yield = 1.18, tail yield = 1.00
Tubing							
Liners							

*SDW  
10/22/2018*

<b>TYPE</b>	<b>Size (in)</b>	<b>Wellbore Diameter (in)</b>	<b>Wall Thickness (in)</b>	<b>Burst Pressure (psi)</b>	<b>Anticipated Max. Internal Pressure (psi)</b>	<b>Cement Type</b>	<b>Cement Yield (cu. ft./k)</b>
Conductor	30"	30"	.500				CTS
Fresh Water	20"	24"	.438	2110	1200	Type 1, Class A	30% excess yield = 1.20, CTS
Coal	13 3/8"	17 1/2"	.380	2730		Type 1/Class A	40% excess yield = 1.20, CTS
Intermediate	9 5/8"	12 1/4"	.395	3950		Type 1/Class A	40% excess yield = 0% Excess Lead
Production	5 1/2"	8 1/2"	.415	14520	12500	Type 1/Class A	20% excess yield = 1.18, tail yield = 1.00
Tubing							
Liners							

**PACKERS**

Kind:				
Sizes:				
Depths Set:				

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(10/14)

4703305938  
04/05/2019

API NO. 47- \_\_\_\_\_  
OPERATOR WELL NO. Nays 1209 N-5H  
Well Pad Name: Nays 1209

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

Drill the vertical depth to the Marcellus at an estimated total vertical depth of approximately 6900 feet. Drill horizontal leg to estimated 15520 TMD, stimulate and be capable of producing from the Marcellus Formation. Should we encounter an unanticipated void in the coal, we will install a minimum of 20' of casing below the void but not more than 100' below the void, set a basket and grout to surface.

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

The stimulation will be completed with multiple stages divided over the lateral length of the well. Stage spacing is dependent upon engineering design. Slickwater fracturing technique will be utilized on each stage using sand, water, and chemicals. See attached list. Maximum pressure not to exceed 12,500 psi.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 16.148 acres

22) Area to be disturbed for well pad only, less access road (acres): 10.834 acres

23) Describe centralizer placement for each casing string:

No centralizers will be used with conductor casing.  
Freshwater - centralized every 3 joints to surface.  
Coal - Blow Spring on every joint  
Intermediate - Blow Spring on first 2 joints then every third joint to 100' from surface.  
Production - Run 1 spiral centralizer every 3 joints from the top of the curve to surface. Run 1 spiral centralizer every 3 joints from the 1st 8.0' long joint to the top of the curve.

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

Conductor - W/A, Casing to be drilled in w/ Dual Rotary Rig.  
Fresh Water - 15.0 ppg PNE-1 + 3% bwoc CaCl<sub>2</sub>, 40% Excess / Yield = 1.20, CTS  
Coal - Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl<sub>2</sub>, 40% Excess / Tail: 15.0 ppg PNE-1 + 2.5% bwoc CaCl<sub>2</sub> 200% Excess, CTS  
Intermediate - Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl<sub>2</sub>, 40% Excess, Tail: 15.0 ppg PNE-1 + 2.5% bwoc CaCl<sub>2</sub> 200% Excess, CTS  
Production - Lead: 14.9 ppg POZ-PNE-1 + 0.3% bwoc RC + 1% bwoc EC1 + 0.75 gal/sk FP13L + 0.3% bwoc MPA110, Tail: 14.0 ppg PNE-1 + 0.35% bwoc RC + 0.75 gal/sk FP13L + 50% bwoc ASCA1 + 0.5% bwoc MPA17020% Excess/Lead Yield=1.10/Tail Yield=1.94, CTS

25) Proposed borehole conditioning procedures:

Conductor - Ensure the hole is clean at TD.  
Fresh Water - Once casing is at setting depth, circulate a minimum of one hole volume with Fresh Water prior to pumping cement.  
Coal - Once casing is at setting depth, circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement.  
Intermediate - Once casing is at setting depth, circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement.  
Production - Once on bottom/TD with casing, circulate at max allowable pump rate for at least 2x bottoms up, or until returns and pump pressures indicate the hole is clean. Circulate a minimum of one hole volume prior to pumping cement.

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\*Note: Attach additional sheets as needed.





**1209 N-5H  
Marcellus Shale Horizontal  
Harrison County, WV**

470305938

<b>Ground Elevation</b>	<b>1007'</b>	<b>1209 N-5H SHL</b>	<b>237409.72N 1732371.49E</b>
<b>Azm</b>	<b>341.493°</b>	<b>1209 N-5H LP</b>	<b>238327.81N 1733745.33E</b>
<b>WELLBORE DIAGRAM</b>		<b>1209 N-5H BHL</b>	<b>253044.72N 1728819.04E</b>

WELLBORE DIAGRAM	HOLE	CASING	GEOLOGY	TOP	BASE	MUD	CEMENT	CENTRALIZERS	CONDITIONING	COMMENTS
	30"	30" 157.5# LS	Conductor	0	100 ✓	AIR	N/A, Casing to be drilled in w/ Dual Rotary Rig	N/A	Ensure the hole is clean at TD.	Conductor casing = 0.5" wall thickness
	24"	20" 94# J-55	Fresh Water	0	135, 500	AIR	15.6 ppg PNE-1 + 3% bwoc CaCl 40% Excess Yield=1.20 / CTS	Centralized every 3 joints to surface	Once casing is at setting depth, circulate a minimum of one hole volume with Fresh Water prior to pumping cement.	Surface casing = 0.438" wall thickness Burst=2110 psi
			Fresh Water	0	600 ✓					
	17.5"	13-3/8" 68# J-55 BTC	Kittaning Coal	660	865	AIR / KCL Salt Polymer	Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS	Bow Spring on every joint	Once casing is at setting depth, Circulate and condition at TD. Circulate a minimum of one hole volume prior to pumping cement.	Intermediate casing = 0.480" wall thickness Burst=3450 psi
			Little/Big Lime	1126 / 1167	1151 / 1243					
			Injun / Gantz (Storage)	1243 / 1535	1349 / 1595					
			Intermediate 1 (Shoe 50' below storage)	0	1635 ✓					
	12.25"	9-5/8" 40# J-55 BTC	Fifty / Thirty Foot	1650 / 1730	1697 / 1742	AIR / KCL Salt Polymer	Lead: 15.4 ppg PNE-1 + 2.5% bwoc CaCl 40% Excess / Tail: 15.9 ppg PNE-1 + 2.5% bwoc CaCl zero% Excess. CTS	Bow Spring on first 2 joints then every third joint to 100' form surface	Once casing is at setting depth, Circulate and condition mud at TD. Circulate a minimum of one hole volume prior to pumping cement.	Intermediate casing = 0.395" wall thickness Burst=3950 psi
			Gordon Stray / Gordon	1785 / 1850	1850 / 1940					
			5th Sand	2035	2070					
			Bayard Sand	2125	2160					
			Intermediate 2	0	2500 ✓					
	8.5" Vertical	5-1/2" 23# P-110 HC CDC HTQ	Speechley	2745	2763	9.0ppg SOBM	Lead: 14.5 ppg POZ:PNE-1 + 0.3% bwoc R3 + 1% bwoc EC1 + 0.75 gal/sk FP13L + 0.3% bwoc MPA170 Tail: 14.8 ppg PNE-1 + 0.35% bwoc R3 + 0.75 gal/sk FP13L + 50% bwoc ASCA1 + 0.5% bwoc MPA170 20% Excess Lead Yield=1.19 Tail Yield=1.94 CTS	Run 1 spiral centralizer every 5 joints from the top of the curve to surface.	Once on bottom/TD with casing, circulate at max allowable pump rate for at least 2x bottoms up, or until returns and pump pressures indicate the hole is clean. Circulate a minimum of one hole volume prior to pumping cement.	Production casing = 0.415" wall thickness Burst=14520 psi Note:Actual centralizer schedules may be changed due to hole conditions
			Balltown	2965	3005					
			Benson	4050	4083					
West Falls			4620	5865						
Rhinestreet			5865	6140						
Cashaqua			6140	6341						
Middlesex			6341	6421						
West River			6421	6514						
Burkett			6514	6540						
Tully Limestone			6540	6644						
8.5" Curve	5-1/2" 23# P-110 HC CDC HTQ	Hamilton	6644	6863	11.5ppg-12.5ppg SOBM		Run 1 spiral centralizer every 3 joints from the 1st 5.5" long joint to the top of the curve.			
		Marcellus	8863	6914						
		TMD / TVD (Production)	23179	6900						
8.5" Lateral		Onondaga	6914		11.5ppg-12.5ppg SOBM					

LP @ 6900' TVD / 7659' MD

8.5" Hole - Cemented Long String  
5-1/2" 23# P-110 HC CDC HTQ

+/-15520' ft Lateral

TD @ +/-6900' TVD  
+/-23179' MD

Centralizers