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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)

Wednesday, October 24, 2018  
PERMIT MODIFICATION APPROVAL  
Horizontal 6A / New Drill

HG ENERGY II APPALACHIA, LLC  
5260 DUPONT ROAD

PARKERSBURG, WV 26101

Re: Permit Modification Approval for MND 20 EU  
47-051-02045-00-00

**Modified Casing**

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

Operator's Well Number: MND 20 EU  
Farm Name: CONSOLIDATION COAL COMPANY/MURRAY EN  
U.S. WELL NUMBER: 47-051-02045-00-00  
Horizontal 6A New Drill  
Date Modification Issued: October 24, 2018

Promoting a healthy environment.

WW-6B  
(04/15)

API NO. 47-081-02045 **MOD**  
 OPERATOR WELL NO. MND20 EU  
 Well Pad Name: MND20

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#	60'	60'	NA
Fresh Water	20"	New	J-55	94#	950'	950'	CTS
Coal	13 3/8"	New	J-55	68#	2700'	2700'	CTS
Intermediate	9 5/8"	New	P-110	47#	9790'	9790'	CTS
Production	6 5/8"	New	Q-125	28.6#	9000'	9000'	20% excess, yield = 1.7669, CTS
Production	5 1/2"	New	P-110	23#	28545'	28545'	20% excess, yield = 1.7669, CTS

*JN 9/18/18*

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"	0.5"			Class A	CTS
Fresh Water	20"	26"	0.438"	2110 psi		Class A	40% Excess Yield = 1.1924, CTS
Coal	13 3/8"	17.5"	0.480"	3450 psi		Class A	30% Excess Yield = 1.18, CTS
Intermediate	9 5/8"	12.25"	0.472"	9440 psi		Stage 1, Class H, Stage 2	30% Excess Yield = 1.1744, CTS
Production	6 5/8"	8.5"	0.432"	15410 psi	11,500	Class H	20% Excess Yield = 1.7669, CTS
Production	5 1/2"	8.5"	0.415"	14520 psi	11.500	Class H	20% Excess Yield = 1.7669, CTS

**PACKERS**

Kind:				
Sizes:				
Depths Set:				

MOD  
47-051-02045



MND20EUHS  
Utica Shale Horizontal  
Marshall County, WV

Ground Elevation		1058'	MND20EUHS SHL	494976.91N 1634113.25E
Azm		144.906°	MND20EUHS LP	496900.44N 1637484.64E
WELLBORE DIAGRAM			MND20EUHS BHL	483549.57N 1646865.68E

HOLE	CASING	GEOLOGY	TOP	BASE	MUD	CEMENT	CENTRALIZERS	CONDITIONING	COMMENTS
30"	30" 157.5# LS	Conductor	0	60	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
26"	20" 94# J-55	Fresh Water		445, 708, 805	AIR	15.6 ppg Class A 40% Excess Yield = 1.1924 / 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
		Pittsburgh Coal	528	536					
		Surface Casing	0	550					
17.5"	13-3/8" 68# J-55 BTC	Eg Lime	1625	1741	AIR	Lead: 15.0 ppg / Class A / 30% Excess / Yield=1.2653 Tail: 15.6 ppg / Class A / 30% Excess / Yield=1.18 CTS	Bow Spring on first 2 joints then every third joint to 100' form surface	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
		Big Injun	1741	1854					
		1st Intermediate Casing	0	2700					
12.25"	9-5/8" 47# P-110 BTC	5th Sand	2599	3156	AIR / KCL Salt Polymer / 9.0ppg SOB	Stage 1: 15.2 ppg / 35.65 Class H / 30% Excess / Yield=1.1313 Stage 2: 14.5 ppg / 50:50 Class A / 30% Excess / Yield=1.1744 CTS	Bow Spring on first 8 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 = 0.472" wall thickness Burst=9440 psi
		Speechley	3156	3770					
		Warren	3770	4707					
		Java	4707	4802					
		Pipe Creek	4802	4889					
		Angola	4889	5471					
		Rhinestreet	5471	5792					
		Cashaqua	5792	5884					
		Middlesex	5864	5887					
		West River	5887	5948					
		Burkett	5948	5973					
		Tully LS	5973	5997					
		Hamilton	5997	6032					
		Marcellus	6032	6067					
		Onondaga	6067	6095					
		Hunnersville	6095	6309					
		Oriskany	6309	6421					
		Helderburg	6421	6681					
		Bass Island	6681	6760					
		Salina G	6760	6860					
Salina F	6860	7759							
Lockport	7759	8081							
Rochester	8081	8385							
Packer Shell	8385	8492							
Clinton	8492	8575							
Medina	8575	8874							
Queenston	8874	9431							
2nd Intermediate	0	9500 TVD 9790 MD							
8.5" Curve and 8.5" Lateral	6-5/8" 28.6# Q-125HP EAGLE SFH to 9,500' (CHANGEOVER) 5-1/2" 23# P-110HC CDC HTQ to TMD	Reedsville	9431	10049	10.5ppg SOB	Lead: 15.0 ppg / 35.65 Class H / 20% Excess / Yield=1.1475 Tail: 15.6 ppg / Class H - Acid Soluble / 20% Excess / Yield=1.7669 TOC @ 6,000'	Run 1 spiral centralizer every 5 joints from the top of the curve to surface. Run 1 spiral centralizer every 3 joints from the 1st 5.5" long joint to the top of the curve.	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.	(6-5/8") Production casing = 0.432" wall thickness Burst = 15410 psi (5-1/2") Production casing = 0.415" wall thickness Burst = 14520 psi Note: Actual centralizer schedules may be changed due to hole conditions
		Utica	10049	10662					
		Point Pleasant	10662	10782					
		Target	10700	10700					

LP @ 10700' TVD / 12228' MD  
8.5" Hole - Cemented Long String  
6-5/8" 28.6# Q-125HP EAGLE SFH to 9,500' (CHANGEOVER) 5-1/2" 23# P-110HC CDC HTQ to TMD  
7-16317" R Lateral  
TD @ +/-10700' TVD +/-28545' MD

JW 9/18/18