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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)

February 9, 2018  
PERMIT MODIFICATION APPROVAL  
Horizontal 6A / New Drill

SWN PRODUCTION COMPANY, LLC  
POST OFFICE BOX 12359

SPRING, TX 773914954


Re: Permit Modification Approval for COLUMBIA GAS TRANSMISSION  
47-051-01942-00-00

**Modified Cement on 9 5/8" to Type H with Bonding Agent**

SWN PRODUCTION COMPANY, 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: COLUMBIA GAS TRANSMISSION UD MSH 9H  
Farm Name: COLUMBIA GAS TRANSMISSION, LLC  
U.S. WELL NUMBER: 47-051-01942-00-00  
Horizontal 6A / New Drill  
Date Issued: February 9, 2018

Promoting a healthy environment.

02/09/2018

WW-6B  
(10/14)

API NO. 47- 51  
OPERATOR WELL NO. Columbia Gas Transmission LLC PFE  
Well Pad Name: Columbia Gas Transmission PAD

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

1) Well Operator: SWN Production Co., LLC 49447757 51-Marshall 681-Will 009-Meade  
Operator ID County District Quadrangle

2) Operator's Well Number: Columbia Gas Transmission UD MSH 9H Well Pad Name: Columbia Gas Transmission PAD

3) Farm Name/Surface Owner: Columbia Gas Transmission, LLC Public Road Access: Fish Creek Road

4) Elevation, current ground: 784' Elevation, proposed post-construction: 784'

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

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

6) Existing Pad: Yes or No yes

*JU 2/7/18*

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Associated Pressure(s):  
Target Formation- Burket Shale, Target Top TVD- 6519', Target Base TVD- 6544', Anticipated Thickness- 25', Associated Pressure- 4245

8) Proposed Total Vertical Depth: 6530'

9) Formation at Total Vertical Depth: Burket Shale

10) Proposed Total Measured Depth: 13004'

11) Proposed Horizontal Leg Length: 6211.72'

12) Approximate Fresh Water Strata Depths: 228'

13) Method to Determine Fresh Water Depths: Nearby water wells are less than 300' TVD. Minimum casing depth to protect fresh water.

14) Approximate Saltwater Depths: 642'

15) Approximate Coal Seam Depths: 509'

16) Approximate Depth to Possible Void (coal mine, karst, other): None that we are aware of.

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  
(10/14)

API NO. 47- 51  
OPERATOR WELL NO. Columbia Gas Transmission UG 611  
Well Pad Name: Columbia Gas Transmission 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#	100'	100'	CTS
Fresh Water	13 3/8"	New	H-40	48#	340'	340'	340 sx/CTS
Coal	9 5/8"	New	J-55	36#	2015'	2015'	786 sx/CTS
Intermediate	7"	New	J-55	20#	If Needed	If Needed	If Needed/As Needed
Production	5 1/2"	New	HCP-110	20#	13004'	13004'	Lead 766x23 1457x1007 1140x1007 1140x1007
Tubing	2 3/8"	New	HCP-110	4.7#	Approx. 6382'	Approx. 6382'	
Liners							

*JW*  
2/7/18

TYPE	Size (in)	Wellbore Diameter (in)	Wall Thickness (in)	Burst Pressure (psi)	Max. Associated Surface Pressure (psi)	Cement Type	Cement Yield (cu. ft./k)
Conductor	20"	30"	0.25	2120	81	Class A	1.19/50% Excess
Fresh Water	13 3/8"	17.5"	0.380	2740	633	Class A	1.19/50% Excess
Coal	9 5/8"	12 1/4"	0.395	3950	1768	Class H	1.08/50% Excess
Intermediate	7"	8 3/4"	0.317	4360	3250	Class A	1.20/15% Excess
Production	5 1/2"	8 3/4"	0.361	12360	9500	Class A	1.20/15% Excess
Tubing	2 3/8"	4.778"	0.190				
Liners							

PACKERS

Kind:	10K Arrowset AS1-X			
Sizes:	5 1/2"			
Depths Set:				

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Environmental Protection  
Page 2 of 3

02/09/2018

WW-6B  
(10/14)

API NO. 47- 51 -  
OPERATOR WELL NO. Columbia Gas Transmission Corp 9 H  
Well Pad Name: Columbia Gas Transmission PAD

*JW*  
2/7/18

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

Drill and stimulate any potential zones between and including the Benson to Burket Shale. \*\*If we should encounter a void place basket above and below void area- balance cement to bottom of void and grout from basket to surface. Run casing not less than 20' below void nor more than 50' below void. (\*if freshwater is encountered deeper than anticipated it must be protected, set casing 50' below and cts.)

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

Well will be perforated within the target formation and stimulated with a slurry of water, sand, and chemical additives at a high rate. This will be performed in stages with the plug and perf method along the wellbore until the entire lateral has been stimulated within the target formation. All stage plugs are then drilled out and the well is flowed back to surface. The well is produced through surface facilities consisting of high pressure production unites, vertical separation units, water and oil storage tanks. Max press and anticipated max rate- 9000 lbs @ 80 barrels a minute.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 11.4

22) Area to be disturbed for well pad only, less access road (acres): 1.8

23) Describe centralizer placement for each casing string:

All casing strings will be ran with a centralizer at a minimum of 1 per every 3 joints of casing.

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

See Attachment \*\*\*

25) Proposed borehole conditioning procedures:

All boreholes will be conditioned with circulation and rotation for a minimum of one bottoms up and continuing until operator is satisfied with borehole conditions.

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\*Note: Attach additional sheets as needed.



4705101942  
*med*

Columbia Gas Transmission UD MSH 9H

*Columbia Gas Transmission, PH*  
*JL 2/1/18*

Product Name	Product Use	Chemical Name	CAS Number
BA-10A	Bonding Agent	Polyvinyl Alcohol	Proprietary

Schlumberger Cement Additives

	Product Name	Product Use	Chemical Name	CAS Number
Intermediate Surface	S001	accelerator	calcium chloride	10043-52-4
	S001	accelerator	calcium chloride	10043-52-4
Kick Off Plug	D080	dispersant	sodium polynaphthalene sulfonate	9008-63-3
	D801	retarder	aromatic polymer derivative	proprietary
	D047	antifoam	polypropylene glycol	25322-69-4
Production-Lead	D167	fluid loss	aliphatic amide polymer	proprietary
	D154	extender	non-crystalline silica	7631-86-9
	D400	gas migration	boric acid	10043-35-3
	D046	antifoam	polypropylene glycol	25322-69-4
			fullers earth (attapulgate)	8031-18-3
	D201	retarder	chrystalline silica	14808-60-7
			metal oxide	proprietary
	D202	dispersant	sulphonated synthetic polymer	proprietary
formaldehyde (impurity)			proprietary	
Production-Tail	D046	antifoam	polypropylene glycol	25322-69-4
			fullers earth (attapulgate)	8031-18-3
	D167	fluid loss	aliphatic amide polymer	proprietary
	D065	dispersant	sodium polynaphthalene sulfonate	9008-63-3
			sodium sulfate	7757-82-6
	D201	retarder	chrystalline silica	14808-60-7
			metal oxide	proprietary
D153	anti-settling	chrystalline silica	14808-60-7	

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 02/09/2018

WW-6AW  
(1-12)

API NO. 47- 51  
OPERATOR WELL NO. Columbia Gas Transmission LP  
Well Pad Name: Columbia Gas Transmission PAD

**STATE OF WEST VIRGINIA**  
**DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS**  
**VOLUNTARY STATEMENT OF NO OBJECTION**

**Instructions to Persons Named on Page WW-6A**

The well operator named on page WW-6A is applying for a permit from the State of West Virginia to conduct oil or gas well work. Well work permits are valid for twenty-four (24) months. Please contact the listed well operator and the Office of Oil and Gas if you do not own any interest in the listed surface tract.

**Comment and Waiver Provisions**

Pursuant to West Virginia Code § 22-6A-11(a), all persons described in subsection (b), section ten of this article may file written comments with the secretary as to the location or construction of the applicant's proposed well work within thirty days after the application is filed with the secretary.

Pursuant to West Virginia Code § 22-6A-8(b) No permit may be issued less than thirty days after the filing date of the application for any well work except plugging or replugging; and no permit for plugging or replugging may be issued less than five days after the filing date of the application except a permit for plugging or replugging a dry hole: *Provided*, That if the applicant certifies that all persons entitled to notice of the application under the provisions of subsection (b), section ten of this article have been served in person or by certified mail, return receipt requested, with a copy of the well work application, including the erosion and sediment control plan, if required, and the well plat, and further files written statements of no objection by all such persons, the secretary may issue the well work permit at any time.

**VOLUNTARY STATEMENT OF NO OBJECTION**

I, Cosy V. Saunders, hereby state that I have read the Instructions to Persons Named on Page WW-6A and the associated provisions listed above, and that I have received copies of a Notice of Application, an Application for a Well Work Permit on Form WW-6A and attachments consisting of pages one (1) through \_\_\_\_\_, including the erosion and sediment control plan, if required, and the well plat, all for proposed well work on the tract of land as follows:

State: <u>WV</u>	UTM NAD 83 Easting: <u>632883.15</u>
County: <u>61-Marshall</u>	Northring: <u>4400580.88</u>
District: <u>Liberty</u>	Public Road Access: <u>Fish Creek Road</u>
Quadrangle: <u>Cameron</u>	Generally used farm name: <u>Columbia Gas Transmission</u>
Watershed: <u>Upper Ohio South</u>	

I further state that I have no objection to the planned work described in these materials, and I have no objection to a permit being issued on those materials.

<p>*Please check the box that applies</p> <p><input type="checkbox"/> SURFACE OWNER</p> <p><input type="checkbox"/> SURFACE OWNER (Road and/or Other Disturbance)</p> <p><input type="checkbox"/> SURFACE OWNER (Impoundments/Pits)</p> <p><input checked="" type="checkbox"/> COAL OWNER OR LESSEE</p> <p><input type="checkbox"/> COAL OPERATOR</p> <p><input type="checkbox"/> WATER PURVEYOR</p> <p><input type="checkbox"/> OPERATOR OF ANY NATURAL GAS STORAGE FIELD</p>	<p align="center"><b>FOR EXECUTION BY A NATURAL PERSON</b></p> <p>Signature: _____</p> <p>Print Name: _____</p> <p>Date: _____</p>
	<p align="center"><b>FOR EXECUTION BY A CORPORATION, ETC.</b></p> <p>Company: <u>CONSOL ENERGY</u></p> <p>By: <u>Cosy Saunders</u></p> <p>Its: <u>Marshall Coal - Gas Coordination</u></p> <p>Signature: <u>Cosy V. Saunders</u></p> <p>Date: <u>02/06/18</u></p>

**Oil and Gas Privacy Notice:**

The Office of Oil and Gas processes your personal information, such as name, address and telephone number, as part of our regulatory duties. Your personal information may be disclosed to other State agencies or third parties in the normal course of business or as needed to comply with statutory or regulatory requirements, including Freedom of Information Act requests. Our office will appropriately secure your personal information. If you have any questions about our use of your personal information, please contact DEP's Chief Privacy Officer at [depprivacyofficer@wv.gov](mailto:depprivacyofficer@wv.gov).

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WW-6AW  
(1-12)

API NO. 47-51  
OPERATOR WELL NO. Columbia Gas Transmission LP  
Well Pad Name: Columbia Gas Transmission PAD

STATE OF WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
**VOLUNTARY STATEMENT OF NO OBJECTION**

**Instructions to Persons Named on Page WW-6A**

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**VOLUNTARY STATEMENT OF NO OBJECTION**

I, James Amos, hereby state that I have read the Instructions to Persons Named on Page WW-6A and the associated provisions listed above, and that I have received copies of a Notice of Application, an Application for a Well Work Permit on Form WW-6A and attachments consisting of pages one (1) through \_\_\_\_\_, including the erosion and sediment control plan, if required, and the well plat, all for proposed well work on the tract of land as follows:

State:	<u>wv</u>	UTM NAD 83	Easting:	<u>692993.15</u>
County:	<u>51-Marshall</u>		Northing:	<u>4400560.96</u>
District:	<u>Liberty</u>	Public Road Access:	<u>Fish Creek Road</u>	
Quadrangle:	<u>Cameron</u>	Generally used farm name:	<u>Columbia Gas Transmission</u>	
Watershed:	<u>Upper Ohio South</u>			

I further state that I have no objection to the planned work described in these materials, and I have no objection to a permit being issued on those materials.

<p>*Please check the box that applies</p> <p><input type="checkbox"/> SURFACE OWNER</p> <p><input type="checkbox"/> SURFACE OWNER (Road and/or Other Disturbance)</p> <p><input type="checkbox"/> SURFACE OWNER (Impoundments/Pits)</p> <p><input type="checkbox"/> COAL OWNER OR LESSEE</p> <p><input type="checkbox"/> COAL OPERATOR</p> <p><input type="checkbox"/> WATER PURVEYOR</p> <p><input checked="" type="checkbox"/> OPERATOR OF ANY NATURAL GAS STORAGE FIELD</p>	<p><b>FOR EXECUTION BY A NATURAL PERSON</b></p> <p>Signature: _____</p> <p>Print Name: _____</p> <p>Date: _____</p>
	<p><b>FOR EXECUTION BY A CORPORATION, ETC.</b></p> <p>Company: <u>Columbia Gas Transmission</u></p> <p>By: <u>James Amos</u></p> <p>Its: <u>SR ENGINEER</u></p> <p>Signature: <u>[Signature]</u></p> <p>Date: <u>2/8/18</u></p>

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The Office of Oil and Gas processes your personal information, such as name, address and telephone number, as part of our regulatory duties. Your personal information may be disclosed to other State agencies or third parties in the normal course of business or as needed to comply with statutory or regulatory requirements, including Freedom of Information Act requests. Our office will appropriately secure your personal information. If you have any questions about our use or your personal information, please contact DEP's Chief Privacy Officer at [depprivacyofficer@wv.gov](mailto:depprivacyofficer@wv.gov).

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Central-East Geomarket Cement Lab Report

Client/Well Information:					
Operator:		BHST:	85°F	Client Contact:	
Well Name:		BHCT:	80°F	BHI Representative:	
API #:		MD:	2,387 FT	Slurry Description:	
County:		TVD:	2,387 FT	Slurry Type:	
State:		Casing Size:	9-5/8"	Test Number:	1709181-1
Job Type:		Hole Size:	12-3/8"	Test Date:	9/20/2017
District:		Water Type:	Field Water	Notes	

Slurry Design:							
Lafarge Class H + 1%bwoc A-7P + 0.4%bwoc BA-10A							
Base Material	Conc.	Additive	Conc.	UoM	Additive	Conc.	UoM
Lafarge Class H	100%	A-7P	1.000	%bwoc	BA-10A	0.400	%bwoc

Slurry Properties:										
Density	16.4	ppg	Yield	1.08	ft <sup>3</sup> /sk	Mix Water	4.35	gal/sk	Mix Water	38.6%

Rheology	300	200	100	60	30	6	3	
Ambient	160	126	85	68	52	33	25	
80°F	210	167	121	100	82	52	37	Conditioning Time: 65 Minutes

Free Fluid	0	%
Fluid Loss	7	cc/30min

Channeling	No	Settling	No
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API Static Gel Strength:			
100 lb/100 ft <sup>2</sup>	500 lb/100 ft <sup>2</sup>	Transition Time	Condition Time
0:13	0:26	11 Minutes	75 Minutes

Thickening Time Results:					
50 Bc	2:24	70 Bc	3:03	100 Bc	3:30

Compressive Strength Results:											
Temp	1,284 psi	2,204 psi					50psi	350psi	500psi	3000psi	Algorithm
85°F	8:00	12:00	24:00	48:00	72:00		3:29	4:28	4:59	16:26	C

Compressive Strength Results:											
Temp	1,695 psi	2,726 psi					50psi	350psi	500psi	3000psi	Algorithm
90°F	8:00	12:00	24:00	48:00	72:00		1:42	3:07	3:34	13:19	C

Comments:

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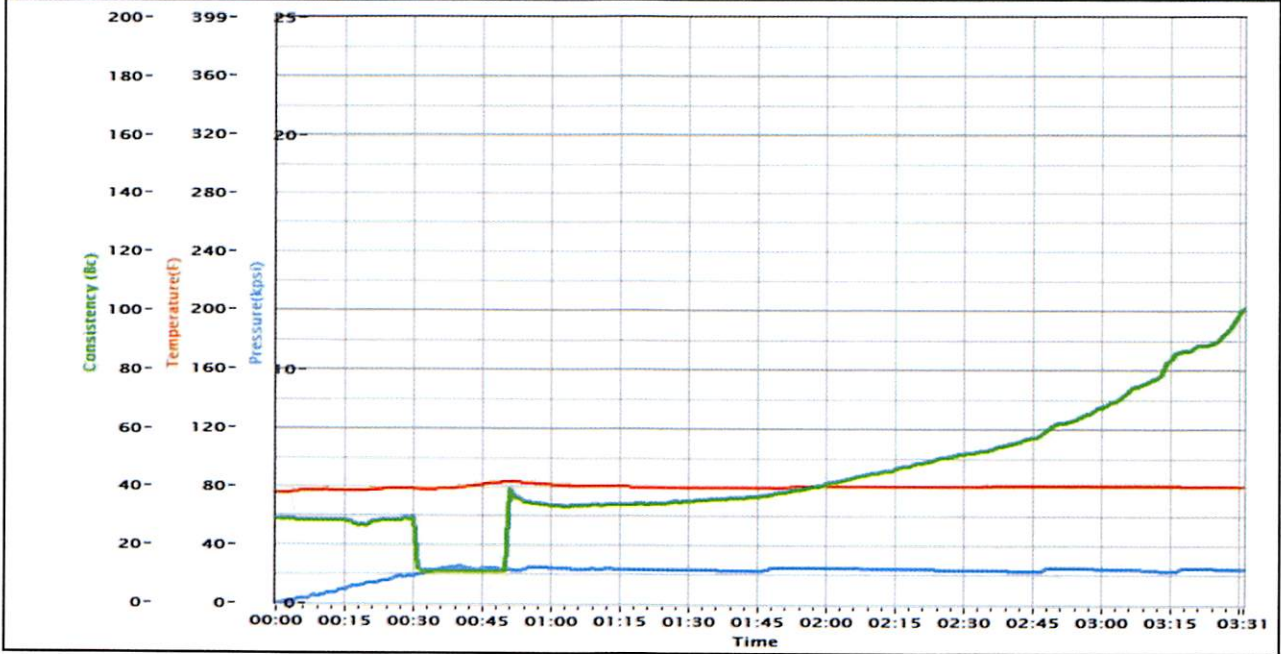
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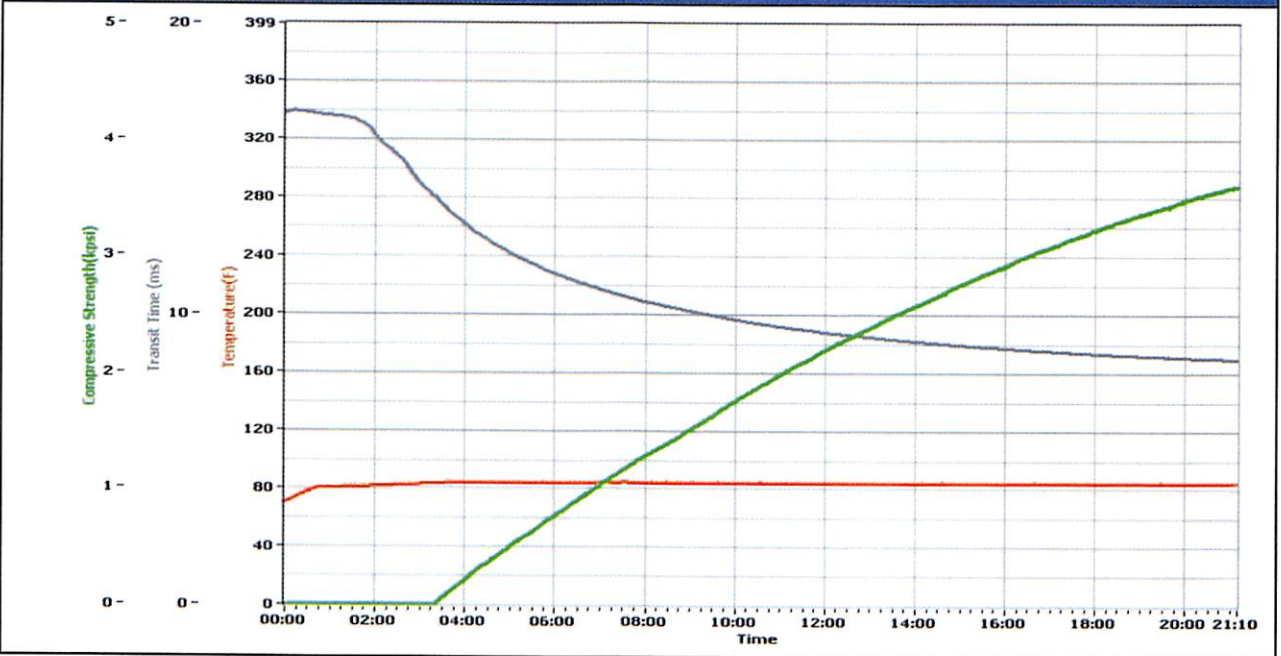
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Thickening Time Results:



Compressive Strength Results:

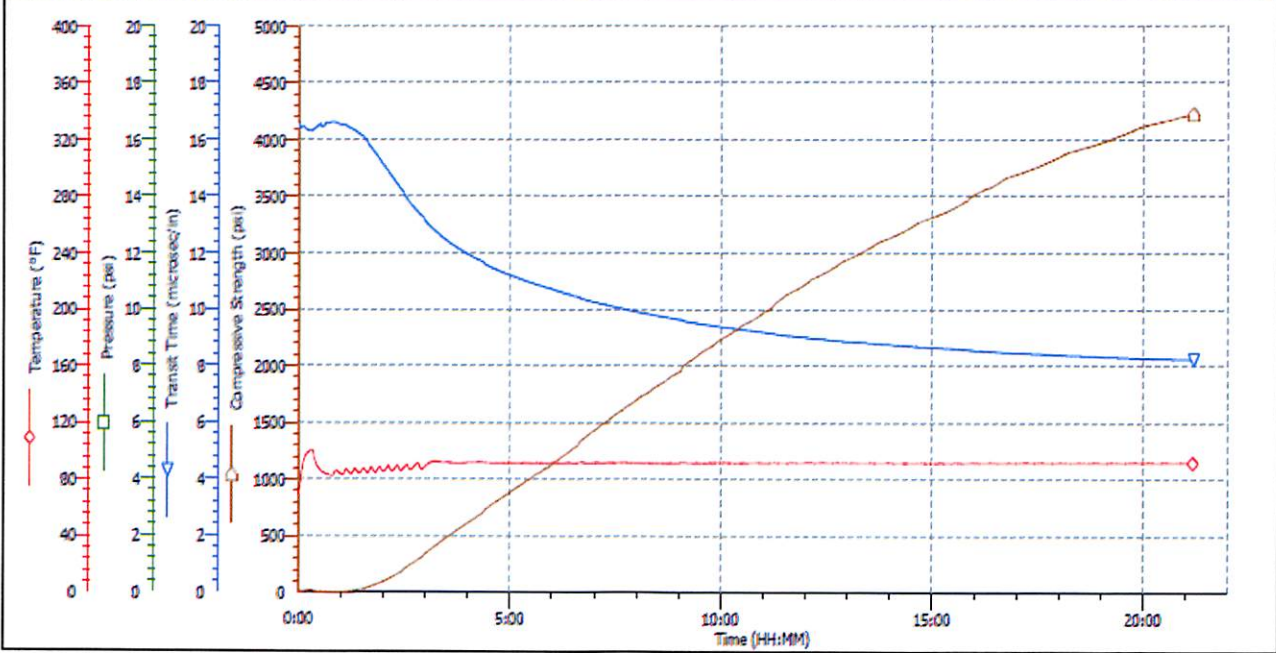


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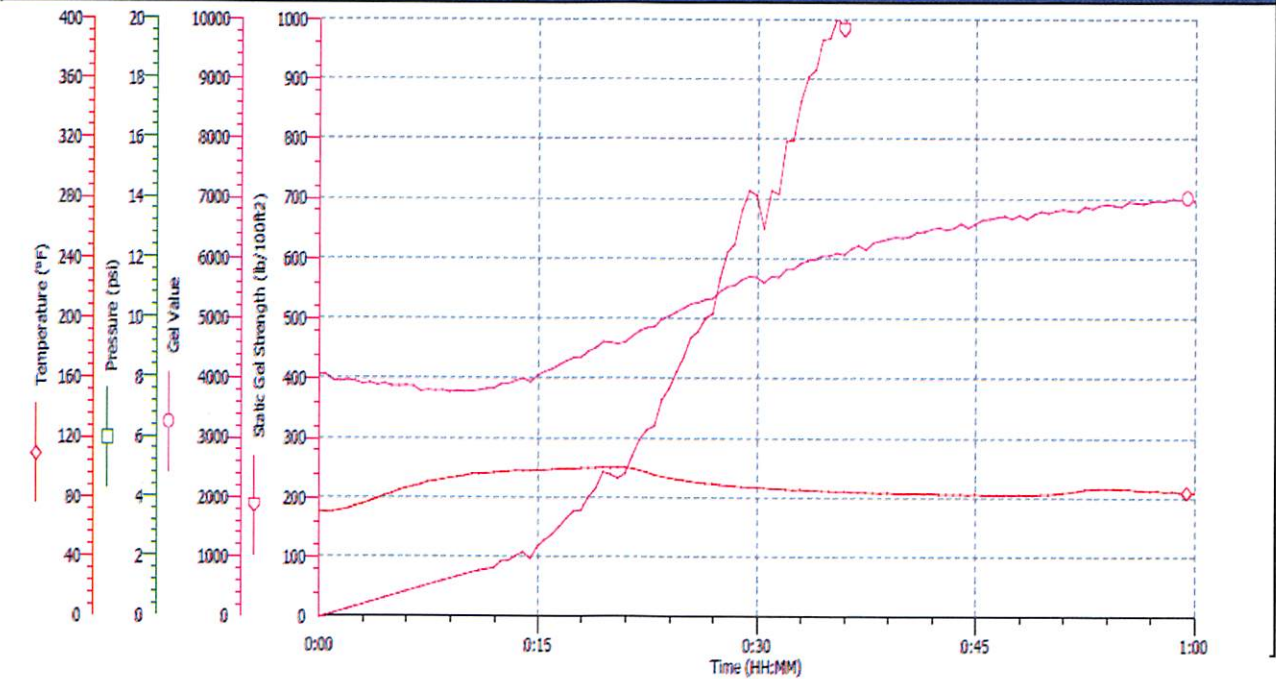
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Compressive Strength Results:



Static Gel Strength Results:



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Central-East Geomarket Cement Lab Report

**Client/Well Information:**

Operator:		BHST:	90°F	Client Contact:	
Well Name:		BHCT:	80°F	BHI Representative:	Andrew Morris
API #:		MD:	1,995 ft	Slurry Description:	Single
County:		TVD:	1,995 ft	Slurry Type:	Field-Short
State:		Casing Size:	9.625"	Test Number:	82273-001
Job Type:		Hole Size:	13.375"	Test Date:	5/4/2017
District:		Water:	Rig	Notes	

**Slurry Design:**

Class A + 0.5% A-7P + 0.4% BA-10A

Base	Vendor	Conc.	Additive	Conc.	UoM	Additive	Conc.	UoM
Class A	Joppa	100%	A-7P	0.5	%BWOB	BA-10A	0.4	%BWOB

**Slurry Properties:**

Density	15.6	ppg	Yield	1.19	ft <sup>3</sup> /sk	Mix Water	5.21	gal/sk	Mix Water	58.810%
---------	------	-----	-------	------	---------------------	-----------	------	--------	-----------	---------

Rheology	300	200	100	60	30	6	3
Ambient	97	77	55	45	36	25	22
80°F	118	96	69	58	48	36	29

Free Fluid	0.5	mL @ 90°
Fluid Loss	20	cc/30min

Channeling	No	Settling	No
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**SGSA:**  
 100 lbs/sec<sup>2</sup>: 0:21  
 200 lbs/sec<sup>2</sup>: 0:30  
 300 lbs/sec<sup>2</sup>: 0:35  
 400 lbs/sec<sup>2</sup>: 0:39  
 500 lbs/sec<sup>2</sup>: 0:42  
 Zero Gel Time: 0:21  
 TT: 0.:21

Gel Strength	10 sec	10 min
	29 lb/100 ft <sup>2</sup>	31 lb/100 ft <sup>2</sup>

**Thickening Time Results:**

50 Bc	4:37	70 Bc	4:38	100 Bc	4:38
-------	------	-------	------	--------	------

**Compressive Strength Results:**

Temp	50 psi	350 psi	500psi	1200psi	1004psi	1615psi	Alg.			
90°F	2:25	4:21	5:13	9:18	8:00	12:00	B			

**Comments:**

Preconditioned for 80 minutes prior to UCA testing.

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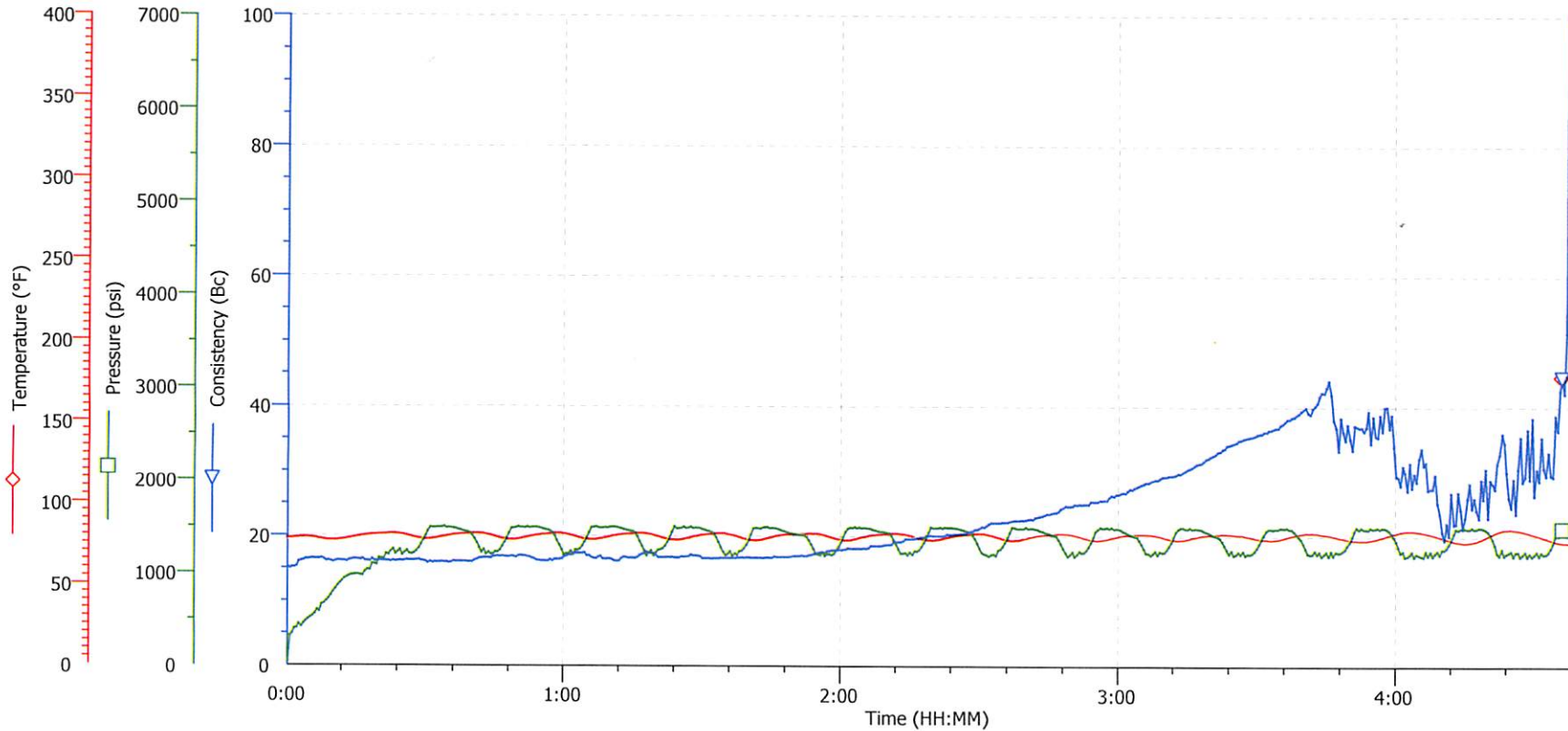
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Environment  
02/09/2018



Instrument: 3 7222-386 7222-386  
Test Start Time and Date: 9:14:03 AM 5/2/2017  
Test Length: 4:38:45  
Test Name:

# Rice

50Bc: 4:37:00  
70Bc: 4:37:30  
100Bc: N/A



BJ Services District Lab  
Clarksburg, WV

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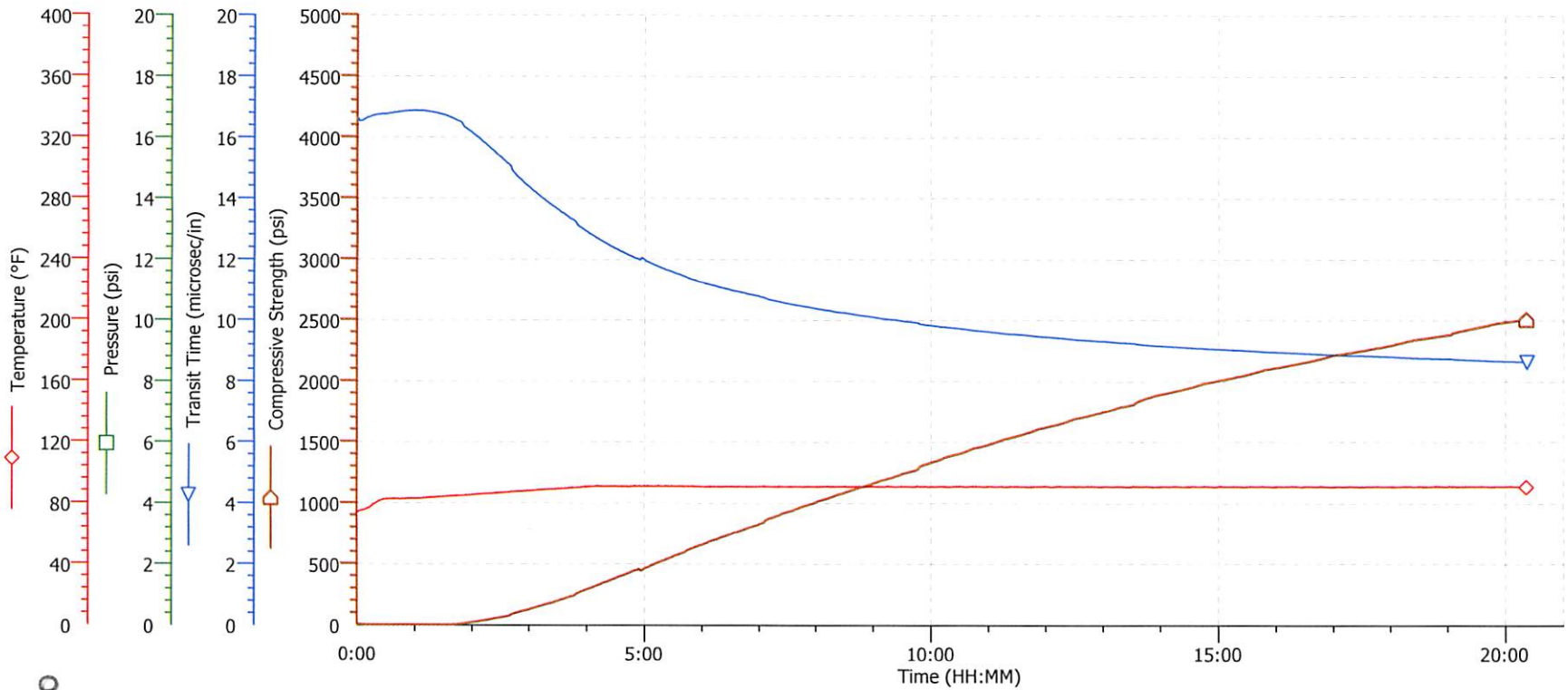
4705101942  
msd



Instrument: SGSA 1 1137  
Algorithm: Compressive strength type B (more than 14 lb/gal)  
Comments: Tap Water

Test Start: 5/3/2017 11:31:53 AM  
Algorithm: Static gel strength

Test Stop: 5/4/2017 7:53:53 AM



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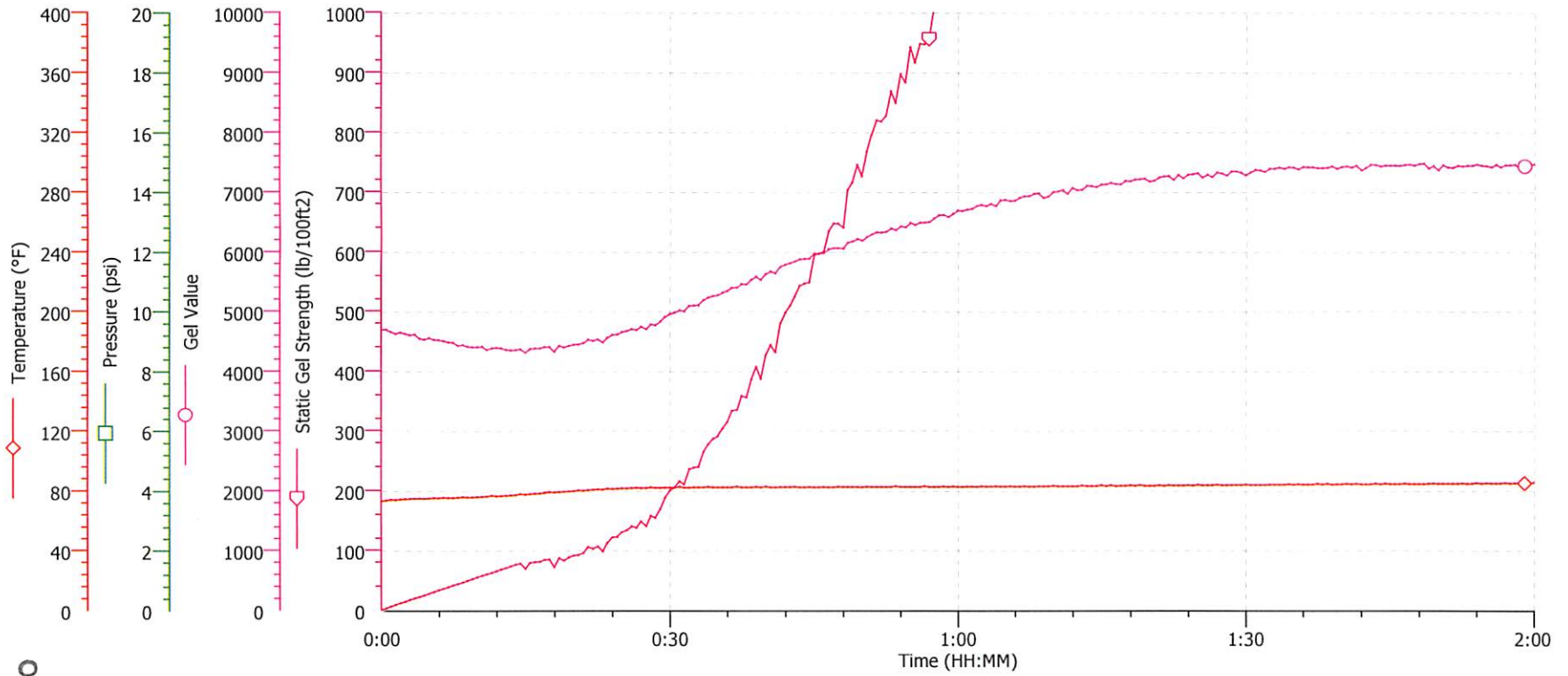
4705101942  
mjs



Instrument: SGSA 1 1137  
Algorithm: Compressive strength type B (more than 14 lb/gal)  
Comments: Tap Water

Test Start: 5/3/2017 11:31:53 AM  
Algorithm: Static gel strength

Test Stop: 5/4/2017 7:53:53 AM



Printed: 1/24/2018 10:56:09 AM

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