End of Well Coring Report

NORTHEAST NATURAL ENERGY

MIP 3H PILOT HOLE

MONONGALIA CO, WEST VIRGINIA

16 SEPTEMBER 2015

ALS Corpro

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Table of Contents

1. Introduction 1
2. Objective 1
3. Well Overview 1
4. Corpro 250P - 120' BHA 2
5. Core Head Details 3
6. Bit Performance 4
   6.1 Bit ROP Performance 4
7. Bit Dull Grade 4
8. Well Summary 5
9. Core Run Overview 5
   9.1 Core Run Review 5
      9.1.1 Core Run 1 6
10. Key Observations 6
11. Conclusion 6
12. Addendum 8

1. Introduction

The purpose of this report is to provide an overview of the Coring Program that was carried out by ALS Corpro personnel, on the Northeast Natural Energy MIP 3H Pilot Hole well in Monongalia County, West Virginia.

2. Objective

The primary objective for Corpro was to utilise the CC102 conventional coring system to collect core in the Marcellus and Onondoga formation. Operational procedures and coring parameters were tailored to maximise coring performance in this formation.

3. Well Overview

Customer:	Northeast Natural Energy
County	Monongalia Co, West Virginia
Coring Technicians:	Vic White / Dane Hately
Job Duration:	August 25 – September 1, 2015
Drilling Contractor:	Patterson #254
Well Name:	MIP 3H Pilot Hole
Core Point(s):	7445.0’
Coring System:	Corpro 250P
Core BBL Assembly:	6-3/4” x 4” x 120’
Inner BBL:	4” Fluted Aluminum
Amount Cored:	111.0’
Total Depth:	7556.0’
Core Head Size	8-3/4” x 4”
Core Bit Type:	DC 613 (6 x 12/32 nozzles = 0.66in² TFA)
Core Bit Serial Number:	1317

4. Corpro 250P - 120' BHA

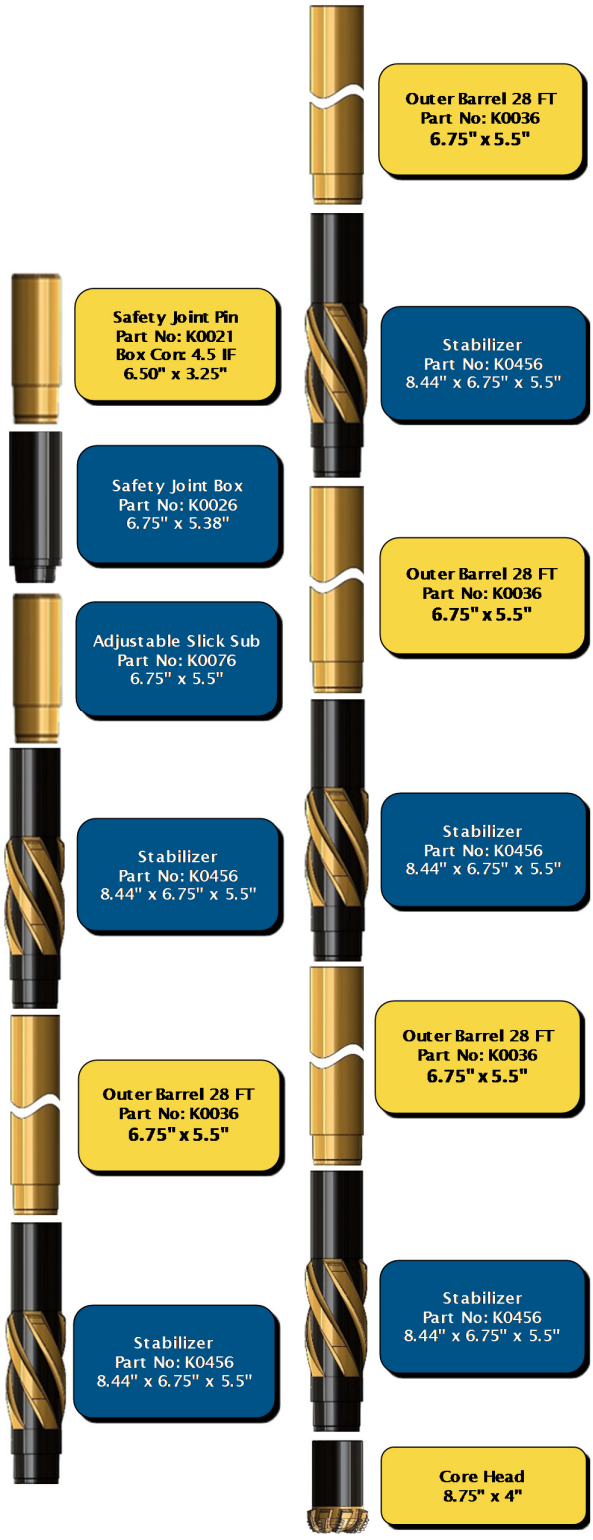
Well Information	
Operator:	Northeast Natural Energy
Country:	USA
Well Name:	MIP 3H Pilot Hole
Hole Size:	8.75"
Core Size:	4

Core Barrel Information	
OD x ID:	6.75" x 5.5"
Stabiliser:	8 7/16"
Fish Neck:	18"
Top Connection:	4.5 IF
Overpull:	400,000 lbs
Make-up Torque:	9,600 ft-lbs
Maximum Torque:	14,800 ft-lbs

Core Head Information	
Type:	DC 613
OD x ID:	8.75" x 4"
SN:	1317
TFA:	1.33 in^2

Inner Barrel Information	
Tube Type:	4" Fluted Aluminum
OD x ID:	4.750" x 4.125"

6.75" 250P - 120 Ft (6.75" x 5.5" x 4")		
Recommended Coring BHA		
Item	Description	Length (FT)
1	Core Head	1
2	Stabilizer	2
3	Outer Barrel	28
4	Stabilizer	2
5	Outer Barrel	28
6	Stabilizer	2
7	Outer Barrel	28
8	Stabilizer	2
9	Outer Barrel	28
10	Stabilizer	2
11	Adjustable Slick Sub	1.25
12	Safety Joint Box	1.2
13	Safety Joint Pin	1
14		
15		
	TOTAL (ft)	126.45



5. Core Head Details

The DC 613 is designed for use with soft to medium formations with low to medium compressive strengths, low to medium cementation and abrasiveness. Applications include carbonate formations, coal, sandstone and shale.

DC 613
8-3/4" x 4" [222mm x 102mm]

TECHNICAL SPECIFICATIONS:

Cutter Type		PDC	
Primary Cutter Size		1/2 in.	*13mm*
Cutters	1/2 in.	40	*13mm*
	3/8 in.	2	*10mm*
Body Type		Steel	
Profile		Double Cone	
Number of Blades		6	
Face Discharge Ports		6	
IADC Code		S433	
Gauge Length	OD	2.34	in.
	ID	1.07	in.
TFA	Ports	1.33	sq. in.
	Inner Gauge	-	sq. in.
	Junk Slot Area	12.4	sq. in.
Connection: CSX58			CC102

Part Number: CH1107

Operating Range

Flow (GPM)	200	400
Rotation (RPM)	30	120
WOB (KLBS)	3	20

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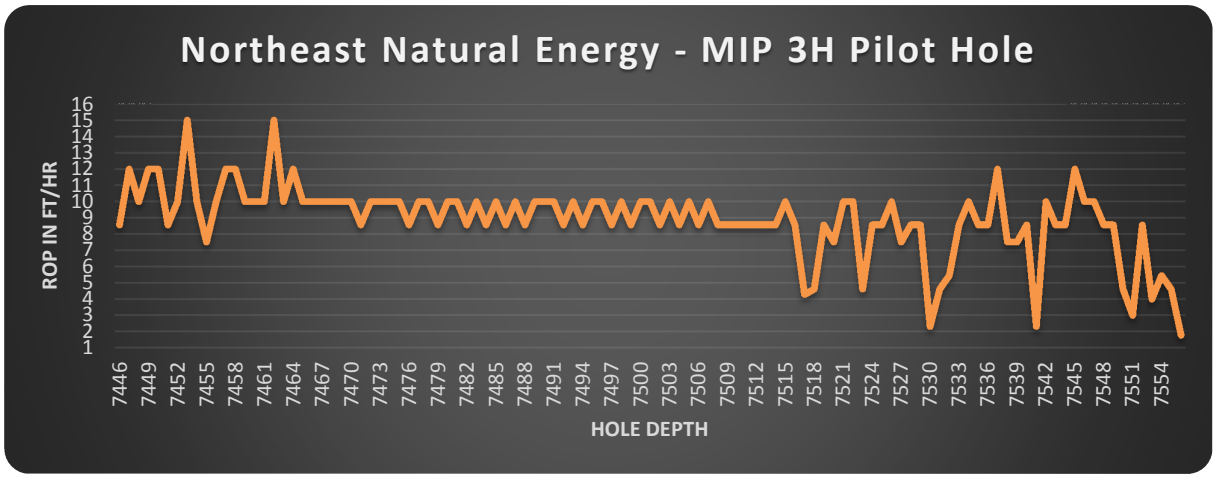
6. Bit Performance

Coring Parameters						
Bit Type	Serial No.	ROP (ft/hr)	Cored (ft)	Recovered (ft)	RPM	Flow (GPM)
DC 613	1317	7.9	111.00	112.15	43	282

6.1 Bit ROP Performance



7. Bit Dull Grade

Core Bit: DC 613 (Serial Number: 1258)							
Inner	Outer	Dull Char	Location	Bearings	Gauge	Other Char	Pulled
0	0	NO	A	X	I	NR	TD

8. Well Summary

CORING SUMMARY

Customer	Northeast Natural Energy	Job Number	70148
Well Name and Legals	MIP 3H	Date	31/08/2015
Drilling Contractor	Patterson 254	Company Man	Brad Chadwick
State	West Virginia	County	Monongalia
Barrel Number	DCB 634-001	Barrel Size	6 3/4"x4"x120'
Jar Number	JSM 031	Jar Type	Hyd/Mech
Hole Size	8 3/4"	Hole Angle	Verticle w/Nudge
Date Start	30/08/2015	Time Start	21:38
Date Finish	31/08/2015	Time Finish	11:44
Coring Technicians	Vic White Dane Hately		

Bit Type	Bit Size	Bit Serial Number	Damage	Total Feet
DC613	8 3/4"x4"	1317	No Visible Damage	112

Core #	Bit #	Depth In	Depth Out	Feet Cored	Feet Rec'd	Time (mins)	Formation	Description
1	1317	7445.00	7556.00	111.00	112.15	846	Marcellus/Onondoga	Shale, LS
Totals				111.00	112.15	846		

Total % Recovery	101.04%	Coring ROP (feet/hr)	7.87

9. Core Run Overview

Corpro succeeded in coring 111.0 feet with 100% recovery. The formations cored were the Marcellus and Onondoga. On the MIP 3H Pilot Hole well, Corpro's 250P conventional system completed the coring target in a single run.

Corpro's DC 613 core head, achieved an average Coring Rate of Penetration (CROP) of 7.87 ft/hr (bit serial #1317), and sustained no visible damage. This core head proved to be an excellent selection for this application.

9.1 Core Run Review

The following is a brief summary of the core run on the MIP 3H Pilot Hole well. The Core Log has been added to the end of this report as an addendum.

All core run lengths were determined by Northeast Natural Energy Geology and carried out as per their instruction.

9.1.1 Core Run 1

Cut – 111.00 ft Recovered – 39.50 ft Time – 5.6 hrs

The core run began at 7,445.0', with 43 RPM, 4Klbs WOB and a flow rate of 282 GPM. The off bottom standpipe pressure was 500psi, increasing to 650psi as coring began and holding steady between 590 – 605psi for the duration of the run.

At approximately 7556', the rig discovered that there was a blockage in the liner washer on the mud pump. As this can quickly damage and burn out liners, coring was stopped so the pump could be idled down and stopped to allow the rig to switch to the alternate pump.

Once the pumps had been switched, the alternate pump was engaged and the flowrate brought back to coring parameters. As the Core Technician established rotary and applied weight to the core head, he found that he was no longer achieving the torque noted prior to the pump shutting down.

It is not uncommon for core runs to jam when sitting immobile for a period of time. As the coefficient of static friction is greater than kinetic friction, the force required to initiate the core moving up the inner barrel again can be more than the core in the lower section/shoe of the inner barrel can withstand. The type of core and amount of core already in the inner barrel are key variables in this equation.

Upon recovering the core, it was noted the core in the shoe was highly fractured and the location of the jam.

10. Key Observations

The following list details the main points observed during the carrying out of this coring program:

- The well was completed with no Lost Time HSE incidents and all operations were completed in accordance with Corpro's JSA's and procedures in accordance with the systems of Northeast Natural Energy.
- The mud system was well conditioned prior to running in the hole with coring tools.
- The rig staff was very accommodating and helpful.
- The stoppage of coring to change pumps is the probable cause for the core jamming.

11. Conclusion

MIP 3H Pilot Hole concluded in an overall of 100% recovery and provided excellent core recovery and quality in a safe and efficient manner.

The planning invested in this project led to outstanding execution. Unfortunately a malfunction of standard rig equipment led to the early termination of the core run. These types of events are rare and difficult to foresee.

If there are any questions regarding this report, please contact Chad Beck – Operations Manager at +1 281 776 5300.

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12. Addendum

Coring Log & Parameters

Job # 70148

CORE #	1	Well Name & #	MIP 3H	Operator	Northeast Natural Energy	Run Date	30 August 2015
Core Barrel Size	6 3/4x4	CH Type	DC 613	Mud Type	Water Base	Start Coring	21:38
Length	120 ft	Size	8 3/4 x 4	Weight	12.40 ppg	Stop Coring	11:44
		Serial #	1317			Interval	14.10 hrs

Formation Name	Marcellus	Anandoga	Lithology	Shale	Limestone

ft Depth	# Cored	Minutes	ft/hr	ROP LOG (ft/hr)	Kft-lb Torque Min	Kft-lb Torque Max	TORQUE LOG Off Bottom – Maxi	Head RPM	klbs WOB	gpm Flow	psi SPP	Lithology or Remark
7445.0	Starting Depth			Graph Zoom: 20.0			Graph Zoom: 6.0	43	4	282	500	
7446.0	1.0	7.0	8.6					43	6	282	605	
7447.0	2.0	5.0	12.0					43	5	282	605	
7448.0	3.0	6.0	10.0					43	5	282	605	
7449.0	4.0	5.0	12.0					43	5	282	605	
7450.0	5.0	5.0	12.0					43	6	282	605	
7451.0	6.0	7.0	8.6					43	6	282	605	
7452.0	7.0	6.0	10.0					43	6	282	605	
7453.0	8.0	4.0	15.0					43	6	282	605	
7454.0	9.0	6.0	10.0					43	6	282	605	
7455.0	10.0	8.0	7.5					43	6	282	605	
7456.0	11.0	6.0	10.0					43	6	282	605	
7457.0	12.0	5.0	12.0					43	6	282	605	
7458.0	13.0	5.0	12.0					43	6	282	605	
7459.0	14.0	6.0	10.0					43	6	282	605	
7460.0	15.0	6.0	10.0					43	6	282	605	
7461.0	16.0	6.0	10.0					43	6	282	605	
7462.0	17.0	4.0	15.0					43	6	282	605	
7463.0	18.0	6.0	10.0					43	6	282	605	
7464.0	19.0	5.0	12.0					43	6	282	605	
7465.0	20.0	6.0	10.0					43	6	282	605	
7466.0	21.0	6.0	10.0					43	6	282	605	
7467.0	22.0	6.0	10.0					43	6	282	605	
7468.0	23.0	6.0	10.0					43	6	282	605	
7469.0	24.0	6.0	10.0					43	6	282	605	
7470.0	25.0	6.0	10.0					43	6	282	605	
7471.0	26.0	7.0	8.6					43	6	282	605	
7472.0	27.0	6.0	10.0					43	6	282	605	
7473.0	28.0	6.0	10.0					43	6	282	605	
7474.0	29.0	6.0	10.0					43	6	282	605	
7475.0	30.0	6.0	10.0					43	6	282	605	
7476.0	31.0	7.0	8.6					43	6	282	605	
7477.0	32.0	6.0	10.0					43	6	282	605	
7478.0	33.0	6.0	10.0					43	6	282	605	
7479.0	34.0	7.0	8.6					43	6	282	605	
7480.0	35.0	6.0	10.0					43	6	282	605	
7481.0	36.0	6.0	10.0					43	6	282	605	
7482.0	37.0	7.0	8.6					43	6	282	605	
7483.0	38.0	6.0	10.0					43	6	282	605	
7484.0	39.0	7.0	8.6					43	6	282	605	

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Coring Log & Parameters

Job # 70148

CORE # 1	Well Name & # MIP 3H			Operator Northeast Natural Energy		Run Date 30 August 2015
Core Barrel Size	6 3/4x4	CH Type	DC 613	Mud Type	Water Base	Start Coring 21:38
Length	120 ft	Size	8 3/4 x 4	Weight	12.40 ppg	Stop Coring 11:44
		Serial #	1317			Interval 14.10 hrs

Formation Name	Marcellus	Anandoga	Lithology	Shale	Limestone

ft Depth	# Cored	Minutes	ft/hr	ROP LOG (ft/hr)	Kft-lb Torque Min	Kft-lb Torque Max	TORQUE LOG Off Bottom / Maxi	Head RPM	klbs WOB	gpm Flow	psi SPP	Lithology or Remark
7445.0	Starting Depth			Graph Zoom: 20.0			Graph Zoom: 6.0	43	4	282	500	
7485.0	40.0	6.0	10.0					43	6	282	605	
7486.0	41.0	7.0	8.6					43	6	282	605	
7487.0	42.0	6.0	10.0					43	6	282	605	
7488.0	43.0	7.0	8.6					43	6	282	605	
7489.0	44.0	6.0	10.0					43	6	282	605	
7490.0	45.0	6.0	10.0					43	6	282	605	
7491.0	46.0	6.0	10.0					43	6	282	605	
7492.0	47.0	7.0	8.6					43	6	282	605	
7493.0	48.0	6.0	10.0					43	6	282	605	
7494.0	49.0	7.0	8.6					43	6	282	605	
7495.0	50.0	6.0	10.0					43	6	282	605	
7496.0	51.0	6.0	10.0					43	6	282	605	
7497.0	52.0	7.0	8.6					43	6	282	605	
7498.0	53.0	6.0	10.0					43	6	282	605	
7499.0	54.0	7.0	8.6					43	6	282	605	
7500.0	55.0	6.0	10.0					43	6	282	605	
7501.0	56.0	6.0	10.0					43	6	282	605	
7502.0	57.0	7.0	8.6					43	6	282	605	
7503.0	58.0	6.0	10.0					43	6	282	605	
7504.0	59.0	7.0	8.6					43	6	282	605	
7505.0	60.0	6.0	10.0					43	6	282	605	
7506.0	61.0	7.0	8.6					43	6	282	590	
7507.0	62.0	6.0	10.0					43	6	282	590	
7508.0	63.0	7.0	8.6					43	6	282	590	
7509.0	64.0	7.0	8.6					43	6	282	590	
7510.0	65.0	7.0	8.6					43	6	282	590	
7511.0	66.0	7.0	8.6					43	6	282	590	
7512.0	67.0	7.0	8.6					43	6	282	590	
7513.0	68.0	7.0	8.6					43	6	282	590	
7514.0	69.0	7.0	8.6					43	6	282	590	
7515.0	70.0	6.0	10.0					43	6	282	590	
7516.0	71.0	7.0	8.6					43	6	282	590	
7517.0	72.0	14.0	4.3					43	6	282	590	
7518.0	73.0	13.0	4.6					43	6	282	590	
7519.0	74.0	7.0	8.6					43	6	282	590	
7520.0	75.0	8.0	7.5					43	6	282	590	
7521.0	76.0	6.0	10.0					43	6	282	590	
7522.0	77.0	6.0	10.0					43	6	282	590	
7523.0	78.0	13.0	4.6					43	6	282	590	

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Coring Log & Parameters

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7445.0	Starting Depth			Graph Zoom: 20.0			Graph Zoom: 6.0	43	4	282	500	
7524.0	79.0	7.0	8.6					43	6	282	590	
7525.0	80.0	7.0	8.6					43	6	282	590	
7526.0	81.0	6.0	10.0					43	6	282	590	
7527.0	82.0	8.0	7.5					43	6	282	590	
7528.0	83.0	7.0	8.6					43	6	282	590	
7529.0	84.0	7.0	8.6					43	6	282	590	
7530.0	85.0	26.0	2.3					43	6	289	600	
7531.0	86.0	13.0	4.6					43	6	289	600	
7532.0	87.0	11.0	5.5					43	6	289	600	
7533.0	88.0	7.0	8.6					43	6	289	600	
7534.0	89.0	6.0	10.0					43	6	289	600	
7535.0	90.0	7.0	8.6					43	6	289	600	
7536.0	91.0	7.0	8.6					43	6	289	600	
7537.0	92.0	5.0	12.0					43	6	289	600	
7538.0	93.0	8.0	7.5					43	6	289	600	
7539.0	94.0	8.0	7.5					43	6	289	600	
7540.0	95.0	7.0	8.6					43	7	289	600	
7541.0	96.0	26.0	2.3					43	7	289	600	
7542.0	97.0	6.0	10.0					43	7	289	600	
7543.0	98.0	7.0	8.6					43	7	289	600	
7544.0	99.0	7.0	8.6					43	7	289	600	
7545.0	100.0	5.0	12.0					43	6	289	600	
7546.0	101.0	6.0	10.0					43	6	289	600	
7547.0	102.0	6.0	10.0					43	6	289	600	
7548.0	103.0	7.0	8.6					43	6	289	600	
7549.0	104.0	7.0	8.6					43	6	289	600	
7550.0	105.0	13.0	4.6					43	6	289	600	
7551.0	106.0	20.0	3.0					43	6	289	600	
7552.0	107.0	7.0	8.6					43	6	289	600	
7553.0	108.0	15.0	4.0					43	6	289	600	
7554.0	109.0	11.0	5.5					43	6	289	600	
7555.0	110.0	13.0	4.6					43	6	289	600	
7556.0	111.0	34.0	1.8					43	6	289	600	

From	To	Cored	Hrs On Bttm	ROP ft/hr	Recovery Lgth	Recovery %	Remarks	Run End Reason
7445.0	7556.0	111.0	14.1	7.9	112.5	101	Changed pumps f/ liner washer lost all torque and ROP (No Break)	Jamming

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