Frac Treatment Revisions for Resumption of Hydraulic Fracturing Operations in the Bowland Basin

January 25, 2012

Frac Treatment

- Reduced job size compared to PH-1 well
- Proposed main fracs of approximately 4,700 bbl (747 m3)
- PH-1 stage 2 frac was 14,100 bbl (2,242 m3) which is 3 times the size of the proposed fracs
- The mini-fracs in front of the main fracs will be in the 100 bbl to 200 bbl range (16-32 m3) as compared to PH-1 mini-frac of 590 bbl (94 m3)

Frac Treatment

- Initial mini-frac will be observed overnight to monitor for unusual seismicity
- Initial main frac will be observed at least 24 hours to monitor for unusual seismicity
- Flowbacks will be performed between all stages to reduce seismic risk
- Barree and Associates compared the initial PH-1 frac to a model using the smaller job size

Frac Treatment

- Barree and Associates compared the initial PH-1 stage 2 frac to a model using the smaller job size
- PH-1 Stage 2 pressure match showed no fracture height growth out of the perforated interval
- Reducing proppant volume and pump rate reduced the created fracture half length with no change in fracture height

Frac Treatment

- Restricted fracture height growth with slickwater in shale reservoirs is commonly observed from diagnostic techniques including radioactive tracer, temperature surveys and production logs
- Microseismic events displaced large distances vertically are commonly observed during hydraulic fracturing – these events are caused by induced deformation but are not indicators of physical fracture height growth

Smaller Frac Schedule

Stage	Comments	Stage Clean Fluid bbl	Total Clean Fluid bbl	Prop Conc ppa	Slurry Rate bpm	Total Prop tonnes	ET min	Chem 1 FR-40 usg/1000
FR Pad		350	0		35.0		0	0.40
100 Mesh Chelford		50	350	0.50	35.0	-	10.0	0.40
FR Pad		200	400		35.0	0.5	11.5	0.40
100 Mesh Chelford		100	600	0.50	35.0	0.5	17.2	0.40
100 Mesh Chelford		200	700	1.00	35.0	1.4	20.1	0.40
FR Pad		200	900	0.00	35.0	5.2	26.1	0.40
100 Mesh Chelford		400	1,100	1.00	35.0	5.2	31.8	0.40
FR Pad		200	1,500	0.00	35.0	12.9	43.7	0.40
40/70 Chelford		300	1,700	0.50	35.0	12.9	49.4	0.40
40/70 Chelford		300	2,000	1.00	35.0	15.7	58.2	0.40
FR Pad		200	2,300	0.00	35.0	21.4	67.2	0.40
40/70 Chelford		500	2,500	1.00	35.0	21.4	72.9	0.40
FR Pad		200	3,000	0.00	35.0	31.0	87.8	0.40
40/70 Chelford		500	3,200	1.00	35.0	31.0	93.5	0.40
FR Pad		200	3,700	0.00	35.0	40.5	108.5	0.40
40/70 Chelford		500	3,900	1.00	35.0	40.5	114.2	0.40
FR Flush		280	4,400	0.00	35.0	50.0	129.1	0.40
Stop		0	4,680	0.00	0.0	50.0	137.1	0.00

On the Fly Additives	Name	Unit	Total	
Chem 1	FR-40	usg	78.62	

Total by Proppant	lbs	mt
100 Mesh Chelford	28,350	12.9
40/70 Chelford	81,900	37.1
	0	0.0
Total	**110,250**	**50.0**

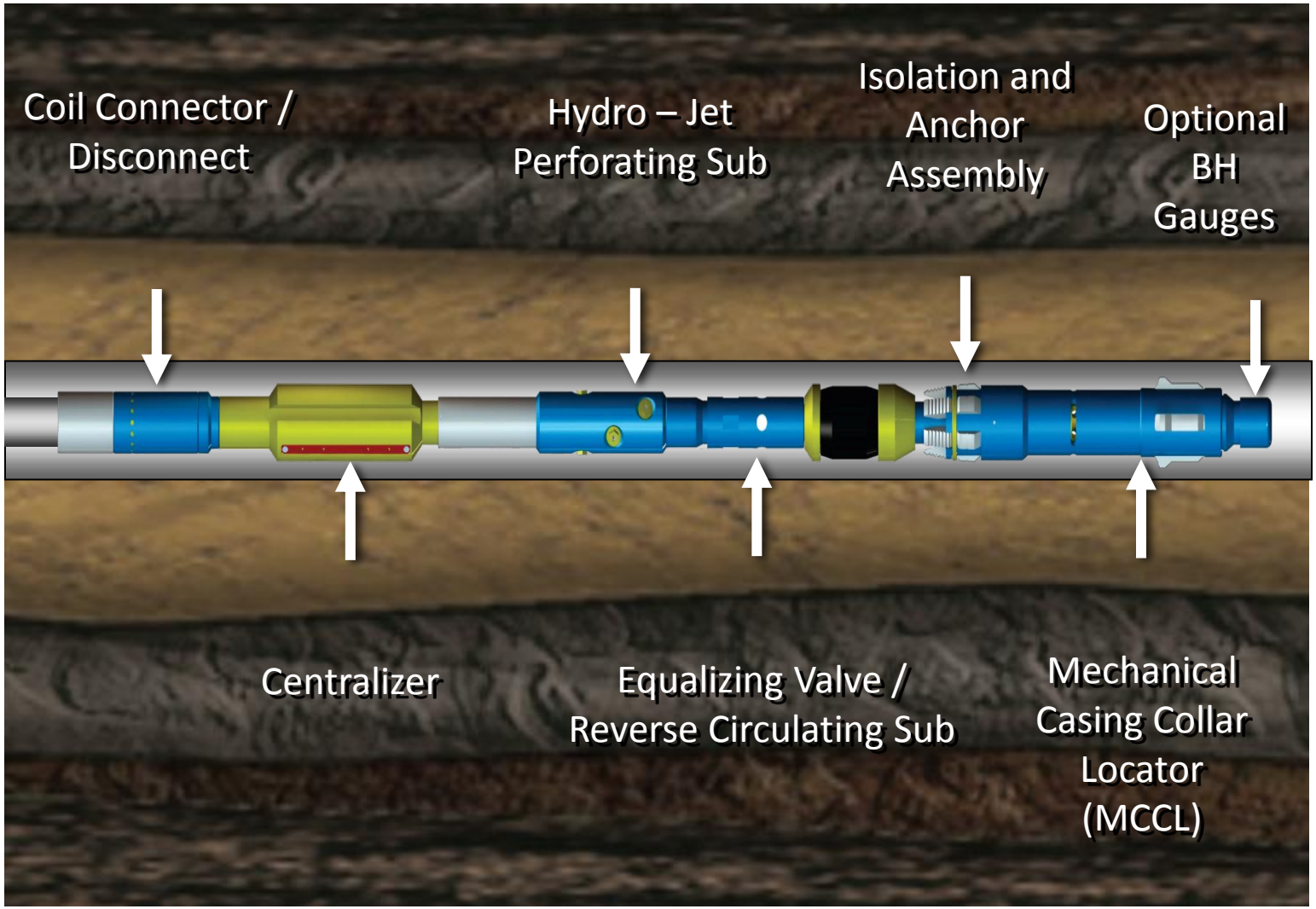
Mongoose Frac System

- Abrasive Jet Perforating – No explosives required
- Abrasive Jetting is performed down coil tubing with returns up the annulus
- Frac zonal isolation with multi-set packer on coil tubing– No bridge plugs
- Frac treatment is pumped down coil tubing/casing annulus
- Allows realtime monitoring of bottom hole pressure via dead string
- Memory gauges will be set below backer to monitor for downward frac growth

Multi-Stage Frac Completions Methods Comparison

Feature	Sand Plugs	Plug & Perf	Packers/Sleeves	Mongoose Frac ™
Reduced HorsePower	X	X	X	✓
No stage limits	✓	✓	X	✓
Positive Test Between Fracs	?	✓	✓	✓
Single Trip	✓	X	✓	✓
Ability to Reverse Sand-Out	✓	X	x	✓
AbilityTo Circulate Acid	✓	X	X	✓
Well Control During Operations	X	X	✓	✓
Control Of Frac Initiation	✓	?	X	✓
Bulb Perf Tunnel	✓	X	X	✓
Pressure Rating	?	12K	5-12K	10K
Dead Leg While Fracing	✓	X	X	✓
Clean out or Drill-Out Required	X	X	X	✓
Work-Over Ability	✓	?	X	✓

Mongoose Frac System



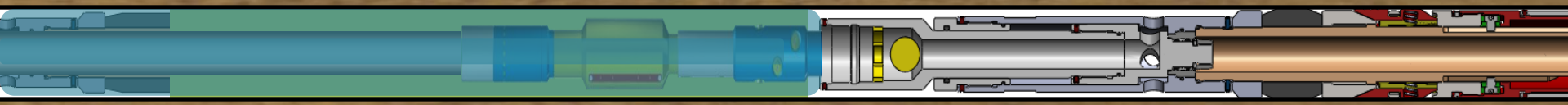
Mongoose Frac System

Run in hole, locate collars with Mechanical Casing Collar Locater (MCCL)

Position on depth, reciprocate BHA to set Packer

Establish circulation down the coil tubing at the calculated

perforating rates, prior to pumping sand laden fluid



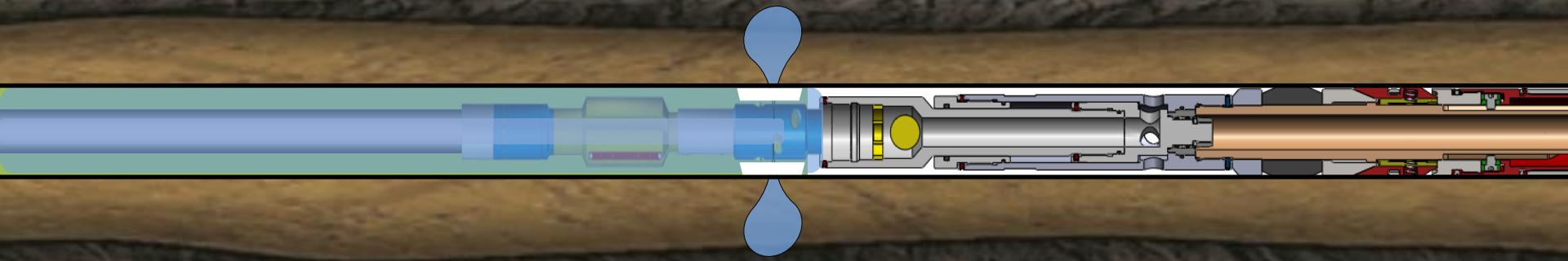
Mongoose Frac System

Circulate abrasive slurry to cut the casing

Pump sand laden fluid through jet sub to cut casing and formation

Approximately 10 minutes of cut time is required

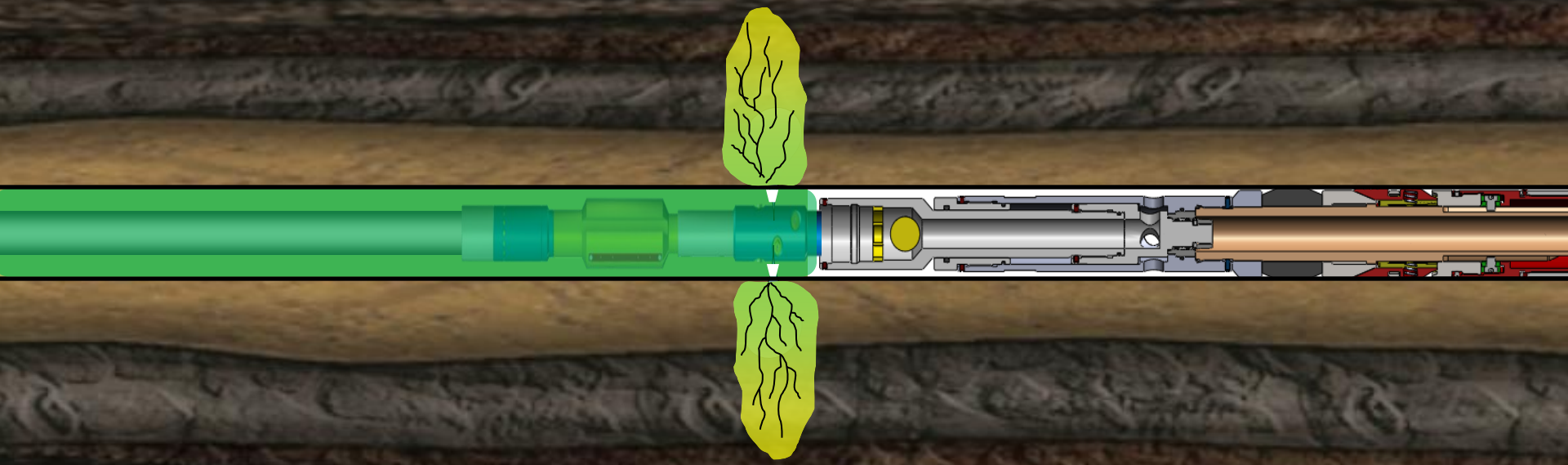
Displace the abrasive slurry up hole or out of well



Mongoose Frac System

Execute the fracture treatment while monitoring the tubing deadleg pressure, as per schedule or as the observed net pressure dictates

Real time Bottom Hole Pressure

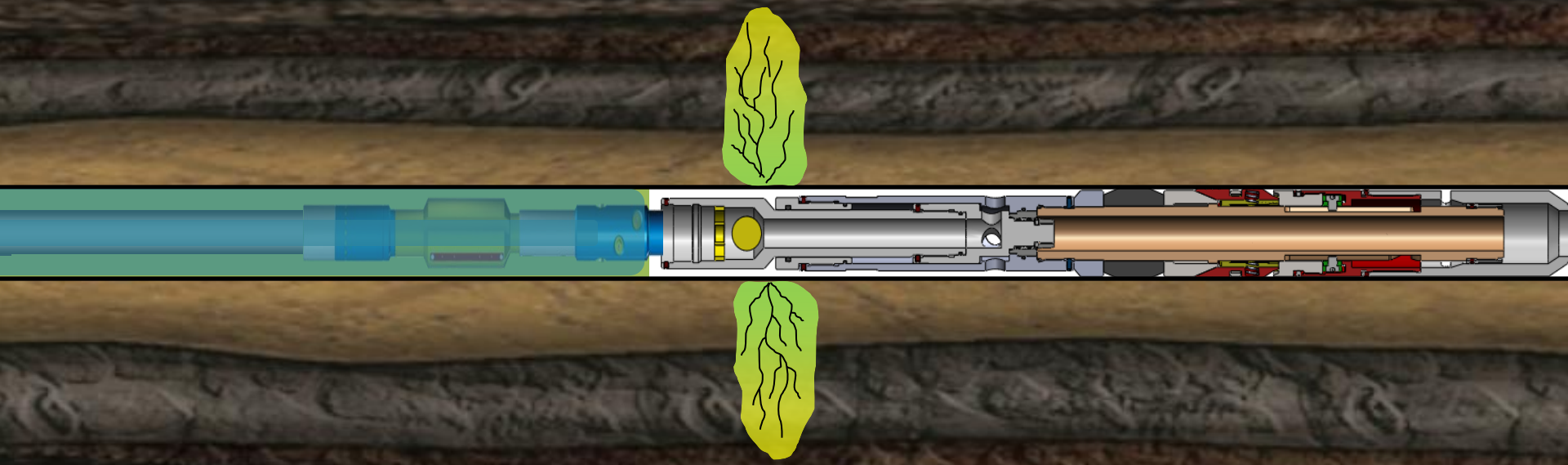


Mongoose Frac System

Straight pull on the tubing opens equalizing valve and unsets packer, Hoist the tools to the next interval to be treated

Reciprocate BHA to Cycle the Jay back into the setting position Set tools at next stage and pressure test BHA

Repeat the isolation, perforation and fracing process for the remaining intervals



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