

**ELLGEN 11-10-1**  
Fractured Niobrara Oil Well  
Surface: 759' FNL & 719' FWL, NW/4 Sec. 10, T6N, R91W  
BHL: 759' FNL & 719' FWL, Sec. 10, T6N, R91W  
Moffat Co. Colorado

**EIGHT POINT DRILLING PLAN**

**1. ESTIMATED FORMATION TOPS: (based on a surface elev. of 6351.5')**

Lewis Shale	Surface
Isles SS	1,845' TVD
Niobrara Shale	6,475' TVD
Lower Niobrara Marker	7,327' TVD
Carlile Shale	7,797' TVD
Frontier SS	8,056' TVD
TD	8,300' TVD

**2. ESTIMATED DEPTHS OF TOP AND BOTTOM OF WATER, OIL, GAS, OR OTHER MINERAL BEARING FORMATIONS AND PLAN FOR PROTECTION:**

**Possible Aquifers: Less than 625'**

**Oil Shale: None expected**

**Oil: Niobrara**

**Gas: None Expected**

**Protection of oil, gas, water, or other mineral bearing formations:**

Protection shall be accomplished by cementing surface casing back to the surface and cementing intermediate casing with sufficient cement volume to bring cement 500' above the Mancos formation. Well will be completed as an open hole producer in the Niobrara.

**3. PRESSURE CONTROL EQUIPMENT:**

**For drilling 12 1/4" surface hole to 625':**

No BOP equipment required. Rotating head will be utilized if a Surface Hole Drilling rig equipped to drill with air/air mist is used to preset surface casing

**For drilling through 9 5/8" surface casing to TD:**

Maximum anticipated surface pressure is <3000 psi

A 3000# 9 5/8" x 7" screw type casing head will be used off surface casing. 11 3/4" 8rd 3000# flange will be screwed on to surface head for BOP stack.

BOP stack will consist of either 2 single gate or a double gate and annular preventer. The gate preventers will be equipped with pipe rams on bottom and blind rams on top. The choke and kill lines will be connected to outlets between the bottom and top rams, utilizing either the ram body outlet or a drilling spool with side outlets. The BOP stack will be 11" or 13.625" bore, 3000 psi working pressure or greater.

**4. SUPPLEMENTAL DRILLING EQUIPMENT AND CASING INFORMATION:** Casing Information: All casing will be new pipe and tested to 1500 psi

Casing	Weight	Grade	Conn.	Stage	Centralizers
9 5/8"	36.0 #/ft	J-55	LTC	No	*
7"	23.0 #/ft	J-55	LTC	No	As Needed

\*Centralizers will be placed 10' above shoe, on 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup> and last collars

**Casing Design Information (9 5/8" casing @ 625'):**

Collapse value for new pipe	2,020 psi	Actual Load	257 psi	S F	7.8
Burst value for new pipe	3,520 psi	Actual Load	2,348 psi	S F	1.5
Tension value for new pipe	453,000 #	Actual Load	19,800 #	S F	22.9

**Casing Design Information (7" intermediate casing @ 6,425') 50' Above Niobrara Formation.**

Collapse value for new pipe	3,270 psi	Actual Load	1,582 psi	S F	2.1
Burst value for new pipe	4,360 psi	Actual Load	1,939 psi*	S F	2.2
Tension value for new pipe	313,000 #	Actual Load	146,740#	S F	2.1

**Cement Information:**

**Casing Cement**

- 9 5/8"** Oilfield type cement circulated in place 381 sx of Premium Plus –Type II 02% Calcium Chloride + 02% Versaset mixed to 14.5 ppg, yield = 1.41 cf/sx. Sufficient cement volume will be pumped to fill to surface. Calcs include 100% excess based upon gauge hole. Will pump a 20 bbl. water spacer ahead.
- 7"** 243sx lead slurry 11 ppg, and a yield of 3.94 cuft/sx for 4900' of fill. 294 cuft (233 sx) tail slurry of 50/50 Poz Premium AG + 02%Bentonite Total + 02% Micro bond + 06% Halad(R)-322 + 5%bwow salt + 02%Cuper CBL + 0.125 LBM/SX Poly-E-Flake mixed to 14.35 ppg, yield of 1.26 cf/sx for 1500' of fill. Calcs include 30% excess based upon gauge hole. Sufficient cement volume will be pumped to bring cement to 500' above the Morapos. Will pump a 20 bbl mud flush III spacer with 10 bbl water ahead and behind)

**Drilling Equipment:**

**Surface Hole (0'-625')**

Drilling of the surface hole will be with a Surface Hole drilling rig equipped to drill with air/air mist if the rig is available. Hole size will be in the 12 1/4".

Variance to Onshore Oil and Gas Order No. 2 III–E Special Drilling Operations which addresses additional drilling equipment required for drilling with air/gas is requested for the Surface Hole drilling rig which may be used to preset surface casing. To our knowledge, shallow gas (625') has never been encountered on any well in this area. Consequently, the

majority of the equipment specified in the Special Drilling Operations is not necessary to drill surface holes (625') in this area. Auxiliary Equipment to be used is outlined in Section 8.

If the Surface Hole drilling rig is not available to preset the surface casing, a conventional rotary drilling rig will be used to drill the surface hole. A 12 1/4" hole will be drilled utilizing fresh water mud.

#### **Intermediate Hole (625'-6,425')**

Drilling below surface casing will be with conventional rotary equipment utilizing fresh water mud. Hole size will be 8 3/4".

#### **Production Hole (6,425'-8,300')**

A 6 1/8" production hole will be drilled to TD using a separation package and mineral oil mud.

### **5. CIRCULATING MEDIUM, MUD TYPE, MINIMUM QUANTITIES OF WEIGHT MATERIAL, AND MONITORING EQUIPMENT:**

#### **Surface hole (0'-625')**

Surface hole will be drilled with air/air mist if a Surface Hole drilling rig is utilized to preset surface casing prior to moving in and rigging up a conventional rotary drilling rig.

Mud circulating equipment and materials as specified in Onshore Order #2, III – E will not be kept on location due to the fact that the Surface Hole drilling rig equipped to drill with air/air mist is not equipped to circulate mud.

If a Surface Hole drilling rig is not utilized to preset the surface casing, a conventional rotary rig will be used to drill the surface hole. Water based drilling fluids consisting primarily of fresh water, bentonite, lignite, caustic, lime, soda ash, and polymers will be used. It is not intended to use oil in the mud; however, in the event it is used, oil concentration will be less than 4% by volume. Maximum anticipated mud weight is  $\pm 9.0$  ppg.

A minimum quantity of weighting material will be kept on location.

#### **Intermediate Hole (625'-6,425')**

Drilling below surface casing will be with water-based drilling fluids consisting primarily of fresh water, bentonite, lignite, caustic, lime, soda ash, and polymers. No chromates will be used. It is not intended to use oil in the mud, however, in the event it is used, oil concentration will be less than 4% by volume. Maximum anticipated mud weight is  $\pm 9.0$  ppg.

A minimum quantity of weighting material will be kept on location.

PVT/Flow Show will be on location and operable base of surface casing to TD.

#### **Production Hole (6,425'-8,300')**

Drilling below intermediate casing will be with mineral oil-based mud utilizing polymer viscosifiers for rheology control and oil wetting agents to aide in hole cleaning. Maximum anticipated mud weight is 7.0 ppg, and the maximum anticipated pore pressure is 6.7 ppg. See *attached bulletin AMD9*.

**6. ANTICIPATED TYPE AND AMOUNT OF TESTING, LOGGING, AND CORING:**

**Logging:**

Mud Logging	From surface casing to TD
Electric Logging	A complete suite of open hole logs will be run.

**Coring:**

None planned but are possible.

**Testing:**

None planned but are possible.

**7. EXPECTED BOTTOM HOLE PRESSURE AND ANY ANTICIPATED ABNORMAL PRESSURE, TEMPERATURES, OR OTHER HAZARDS (H<sub>2</sub>S, STEAM, ETC.) AND ASSOCIATED CONTINGENCY PLANS:**

Subnormal pressure gradient to TD

MASP and casing design parameters determined using 0.35 psi/ft

Maximum expected BHP @ bottom of Niobrara ~2,530 psi

Maximum expected BHT @ 8,300'TVD ~205°F

**8. OTHER:**

**Auxiliary Equipment**

Conventional Rotary Drilling Rig

Geolograph

PVT-Flowmeter

Desilter

Desander

Full Opening Safety Valve

Upper Kelly Valve

Lower Kelly Valve

Surface Hole Rig Equipped to Drill with Air/Air Mist

Rotating Head

100' Bloopie Discharge Line

**Completion**

Well will be completed open-hole and put on rod pump. No stimulation is planned.

## Amodrill® 1500 synthetic olefin

Amodrill 1500 synthetic olefin is a low-viscosity fluid with excellent environmental properties such as biodegradation.

This product is a base component in formulations designed to improve the performance and wellbore stability expected from conventional mineral oil-based muds. Similar to other Amodrill olefins used in drilling on land, Amodrill 1500 synthetic olefin is expected to have low toxicity and fast biodegradation in soil, making it ideal for landfarming of cuttings. Environmental tests are in progress to confirm these properties.

Low pour point makes this product well suited for cold climates. BP alpha olefins are clear, colorless, water-white, mobile liquids, which are 99% olefinic.

**Table 1: Physical Properties\***

Property	Typical Value	Test Method
Kinematic Viscosity, cSt		ASTM D445
0°C	2.55	
40°C	1.46	
100°C	0.74	
Pour Point, °C	-30	ASTM D97
Flash Point, °C	91	ASTM D92
Aniline Point, °C	62	ASTM D611
Density		ASTM D4052-91
15.6°C, g/mL	0.762	
60 °F, lb/gal	6.36	

\* Actual properties will vary within specification limits.

**Table 3: Drilling Fluid Comparison Table**

Fluid	Aromatic Content, wt%	Polynuclear Aromatic Hydrocarbon (PAH) Content	Viscosity 40°C, cSt	Pour Point	Flash Point
Amodrill 1500 olefin	0%	<0.001%	1.46	-30°C	91°C
Low Tox Mineral Oil	<2.2%	<0.1%	3.78	-21°C	128°C
Isomerized Paraffin	<0.1%	<0.001%	4.15	-57°C	135°C
#2 Diesel Oil	>30%	12.5%	2.07	-33°C	66°C

**Table 2: Environmental Test Properties\***

### Biodegradability:

Aquatic Environment	Biodegradation	Method
Marine Aerobic	Ultimate, 28d 61% THOD <sup>1</sup>	OECD 306

\* Theoretical Oxygen Demand

### Drilling Performance of Olefin Fluids

- Olefin fluids have been used offshore for more than a decade.
- In land drilling trials, the low density of LAO fluids has led to improved rates of penetration.

### Health Safety and Environmental Attributes of Amodrill Synthetic Olefins

- Reduced exposure to fugitive emissions of aromatic compounds vs. diesel and mineral oil
- Low volatility
- Flash points above 9100°C
- Lower odor than diesel oil

## Regulatory Information

The product and uses described herein may require global registrations for chemical inventory listings, or for use in specific applications. For further information, send an e-mail to: [bpcares@bp.com](mailto:bpcares@bp.com)

## Health and Safety Information

The product described herein may require precautions in handling and use because of toxicity, flammability, or other considerations. The available product health safety information for this material is contained in the Material Safety Data Sheet (MSDS) that may be obtained by calling +1-866-427-6737 (Toll Free-North America), or by sending an e-mail to: [bpcares@bp.com](mailto:bpcares@bp.com). Before using any material a customer is advised to consult the MSDS for the product under consideration for use.

The Material Safety Data Sheet for this product contains shipping descriptions and should be consulted, before transportation, as a reference in determining the proper shipping description of this product. If the material shipped by BP is altered or modified, different shipping descriptions may apply and therefore the original material MSDS should not be used.

Amodrill 1500 olefin has a low level of acute toxicity with an oral and dermal LD<sub>50</sub> of greater than 10,000 mg/kg. Amodrill 1500 olefin is not an eye or skin irritant. Because of its low vapor pressure, significant Amodrill 1500 olefin exposure by inhalation is unlikely. Good industrial hygiene practice dictates that eye and hand protection be worn when handling Amodrill 1500 olefin. In case of a spill on the skin or in the eyes, flushing with water is recommended. Avoid ingestion.

BP accepts no liability whatsoever arising out of the use of information supplied, the application, adaptation or processing of the products described herein, the use of other materials in lieu of BP materials or the use of other BP materials in conjunction with such other materials.

## Further Information

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