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Form 3160-3
(June 2015)

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

APPLICATION FOR PERMIT TO DRILL OR REENTER

5. Lease Serial No.
NMNM127449

6. If Indian, Allotee or Tribe Name

1a. Type of work: ☑ DRILL ☐ REENTER

1b. Type of Well: ☑ Oil Well ☐ Gas Well ☐ Other

1c. Type of Completion: ☐ Hydraulic Fracturing ☑ Single Zone ☐ Multiple Zone

7. If Unit or CA Agreement, Name and No.

8. Lease Name and Well No.
BLACK MARLIN FEDERAL COM
2H 327300

2. Name of Operator
IMPETRO OPERATING LLC 373281

9. API Well No.
30-025-46977

3a. Address
201 Main Street, Ste 700 Fort Worth TX 76102

3b. Phone No. *(include area code)*
(817)585-9010

10. Field and Pool, or Exploratory 97813
UPPER WOLFCAMP / JAL; WOLFCAMP

4. Location of Well *(Report location clearly and in accordance with any State requirements. *)*
At surface NENE / 120 FNL / 1290 FEL / LAT 32.1373439 / LONG -103.2998603
At proposed prod. zone SESE / 100 FSL / 330 FEL / LAT 32.1088811 / LONG -103.2967471

11. Sec., T. R. M. or Blk. and Survey or Area
SEC 18 / T25S / R36E / NMP

14. Distance in miles and direction from nearest town or post office*
6.95 miles

12. County or Parish
LEA

13. State
NM

15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drlg. unit line, if any)
120 feet

16. No of acres in lease
320

17. Spacing Unit dedicated to this well
640

18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft.
937 feet

19. Proposed Depth
12350 feet / 22626 feet

20. BLM/BIA Bond No. in file
FED: NMB001593

21. Elevations (Show whether DF, KDB, RT, GL, etc.)
3186 feet

22. Approximate date work will start*
06/01/2019

23. Estimated duration
180 days

24. Attachments

The following, completed in accordance with the requirements of Onshore Oil and Gas Order No. 1, and the Hydraulic Fracturing rule per 43 CFR 3162.3-3 (as applicable)

1. Well plat certified by a registered surveyor.
2. A Drilling Plan.
3. A Surface Use Plan (if the location is on National Forest System Lands, the SUPO must be filed with the appropriate Forest Service Office).
4. Bond to cover the operations unless covered by an existing bond on file (see Item 20 above).
5. Operator certification.
6. Such other site specific information and/or plans as may be requested by the BLM.

25. Signature	Name *(Printed/Typed)*	Date
(Electronic Submission)	Blair Brummell / Ph: (210)999-5400	04/15/2019
Title: Senior Landman		
Approved by *(Signature)*	Name *(Printed/Typed)*	Date
(Electronic Submission)	Cody Layton / Ph: (575)234-5959	12/13/2019
Title: Assistant Field Manager Lands & Minerals	Office: CARLSBAD	

Application approval does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.
Conditions of approval, if any, are attached.

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

REQUESTED GCP 03/10/2020
REC GCP 3/11/2020

KZ 03/11/2020

APPROVED WITH CONDITIONS

Approval Date: 12/13/2019

(Continued on page 2)

*(Instructions on page 2)

PECOS DISTRICT
DRILLING OPERATIONS
CONDITIONS OF APPROVAL

OPERATOR'S NAME:	**Impetro Operating LLC**
LEASE NO.:	**NMNM127449**
WELL NAME & NO.:	**Black Marlin Federal Com 2H**
SURFACE HOLE FOOTAGE:	**120' FNL & 1290' FEL**
BOTTOM HOLE FOOTAGE	**100' FSL & 330' FEL**
LOCATION:	**Section 18, T 25S, R 36E, NMPM**
COUNTY:	**Lea County, New Mexico**

H2S	☐ Yes	◉ No	
Potash	◉ None	☐ Secretary	☐ R-111-P
Cave/Karst Potential	◉ Low	☐ Medium	☐ High
Variance	☐ None	◉ Flex Hose	☐ Other
Wellhead	◉ Conventional	☐ Multibowl	☐ Both
Other	☐ 4 String Area	☑ Capitan Reef	☐ WIPP
Other	☑ Fluid Filled	☐ Cement Squeeze	☐ Pilot Hole
Special Requirements	☐ Water Disposal	☑ COM	☐ Unit

A. HYDROGEN SULFIDE

1. Hydrogen Sulfide (H2S) monitors shall be installed prior to drilling out the surface shoe. If H2S is detected in concentrations greater than 100 ppm, the Hydrogen Sulfide area shall meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, provide measured values and formations to the BLM.

B. CASING

1. The **13-3/8"** surface casing shall be set at approximately **1350'** (a minimum of 25' into the Rustler Anhydrite and above the salt) and cemented to surface.
   a. **If cement does not circulate to surface,** the appropriate BLM office shall be notified and a temperature survey utilizing an electronic type temperature survey with surface log readout will be used or a cement bond log shall be run to verify the top of the cement. Temperature survey will be run a minimum of **6 hours** after pumping cement, ideally between 8-10 hours after.
   b. WOC time for a primary cement job will be a minimum of **8 hours** or **500 psi** compressive strength, whichever is greater. This is to include the lead cement.
   c. If cement falls back, remedial cementing will be done prior to drilling out the shoe.
   d. WOC time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 psi compressive strength, whichever is greater.

2. The **10-3/4"** intermediate casing shall be set at approximately **5300'** and cemented to surface.
   a. **If cement does not circulate to surface,** see B.1.a, c & d.
   b. This casing must be kept at least 1/3 full at all times in order to meet BLM collapse requirements.
3. The **7-5/8"** intermediate casing shall be cemented with at least **200' tie-back** into the previous casing. Operator shall provide method of verification.
   a. **If cement does not circulate to surface,** see B.1.a, c & d.
   b. This casing must be kept at least 1/3 full at all times in order to meet BLM collapse requirements.
4. The **5-1/2"** production casing shall be cemented with at least **500' tie-back** into the previous casing. Operator shall provide method of verification.

C. PRESSURE CONTROL

1. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **5000 (5M)** psi.
2. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the first intermediate casing shoe shall be **10,000 (10M)** psi. **Variance approved to use a 5M annular. The annular must be tested to full working pressure (5000 psi).**

D. SPECIAL REQUIREMENTS

1. Submit a Communitization Agreement to the Carlsbad Field Office, 620 E Greene St. Carlsbad, New Mexico 88220, at least 90 days before the anticipated date of first production from a well subject to a spacing order issued by the New Mexico Oil Conservation Division. The Communitization Agreement will include the signatures of all working interest owners in all Federal and Indian leases subject to the Communitization Agreement (i.e., operating rights owners and lessees of record), or certification that the operator has obtained the written signatures of all such owners and will make those signatures available to the BLM immediately upon request.
   a. The well sign on location shall include the surface and bottom hole lease numbers. When the Communitization Agreement number is known, it shall also be on the sign.

DR 12/05/2019

GENERAL REQUIREMENTS

1. The BLM is to be notified in advance for a representative to witness:
   a. Spudding the well (minimum of 24 hours)
   b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
   c. BOP/BOPE tests (minimum of 4 hours)
      ☒ Eddy County: Call the Carlsbad Field Office, (575) 361-2822
      ☒ Lea County: Call the Hobbs Field Station, (575) 393-3612
2. Unless the production casing has been run and cemented or the well has been properly plugged, the drilling rig shall not be removed from over the hole without prior approval.
   a. In the event the operator has proposed to drill multiple wells utilizing a skid/walking rig. Operator shall secure the wellbore on the current well, after installing and testing the wellhead, by installing a blind flange of like pressure rating to the wellhead and a pressure gauge that can be monitored while drilling is performed on the other well(s).
   b. When the operator proposes to set surface casing with Spudder Rig:
      i. Notify the BLM when moving in and removing the Spudder Rig.
      ii. Notify the BLM when moving in the 2nd Rig. Rig to be moved in within 90 days of notification that Spudder Rig has left the location.
      iii. BOP/BOPE test to be conducted per Onshore Oil and Gas Order No. 2 as soon as 2nd Rig is rigged up on well.
3. Floor controls are required for 3M or Greater systems. These controls will be on the rig floor, unobstructed, readily accessible to the driller and will be operational at all times during drilling and/or completion activities. Rig floor is defined as the area immediately around the rotary table; the area immediately above the substructure on which the draw works are located, this does not include the dog house or stairway area.
4. The record of the drilling rate along with the GR/N well log run from TD to surface (horizontal well – vertical portion of hole) shall be available upon request. The Rustler top and top and bottom of Salt are to be recorded on the Completion Report.

A. CASING

1. Changes to the approved APD casing program need prior approval if the items substituted are of lesser grade or different casing size or are Non-API. The Operator can exchange the components of the proposal with that of superior strength (i.e. changing from J-55 to N-80, or from 36# to 40#). Changes to the approved cement program need prior approval if the altered cement plan has less volume or strength or if the changes are substantial (i.e. Multistage tool, ECP, etc.). The initial wellhead installed on the well will remain on the well with spools used as needed.
2. Wait on cement (WOC) for Potash Areas: After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the

following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi for all cement blends, 2) until cement has been in place at least 24 hours. WOC time will be recorded in the driller's log. The casing intergrity test can be done (prior to the cement setting up) immediately after bumping the plug.

3. Wait on cement (WOC) for Water Basin: After cementing but before commencing any tests, the casing string shall stand cemented under pressure until both of the following conditions have been met: 1) cement reaches a minimum compressive strength of 500 psi at the shoe, 2) until cement has been in place at least 8 hours. WOC time will be recorded in the driller's log. See individual casing strings for details regarding lead cement slurry requirements. The casing intergrity test can be done (prior to the cement setting up) immediately after bumping the plug.
4. Provide compressive strengths including hours to reach required 500 pounds compressive strength prior to cementing each casing string. Have well-specific cement details onsite prior to pumping the cement for each casing string.
5. No pea gravel permitted for remedial or fall back remedial without prior authorization from the BLM engineer.
6. On the portion of well approved for a 5M BOPE system or greater, a pressure integrity test of each casing shoe shall be performed. Formation at the shoe shall be tested to a minimum of the mud weight equivalent anticipated to control the formation pressure to the next casing depth or at total depth of the well. This test shall be performed before drilling more than 20 feet of new hole.
7. If hardband drill pipe is rotated inside casing, returns will be monitored for metal. If metal is found in samples, drill pipe will be pulled and rubber protectors which have a larger diameter than the tool joints of the drill pipe will be installed prior to continuing drilling operations.
8. Whenever a casing string is cemented in the R-111-P potash area, the NMOCD requirements shall be followed.

B. PRESSURE CONTROL

1. All blowout preventer (BOP) and related equipment (BOPE) shall comply with well control requirements as described in Onshore Oil and Gas Order No. 2 and API RP 53 Sec. 17.
2. If a variance is approved for a flexible hose to be installed from the BOP to the choke manifold, the following requirements apply: The flex line must meet the requirements of API 16C. Check condition of flexible line from BOP to choke manifold, replace if exterior is damaged or if line fails test. Line to be as straight as possible with no hard bends and is to be anchored according to Manufacturer's requirements. The flexible hose can be exchanged with a hose of equal size and equal or greater pressure rating. Anchor requirements, specification sheet and hydrostatic pressure test certification matching the hose in service, to be onsite for review. These documents shall be posted in the company man's trailer and on the rig floor.
3. If the operator has proposed a multi-bowl wellhead assembly in the APD. The following requirements must be met:

a. Wellhead shall be installed by manufacturer's representatives, submit documentation with subsequent sundry.

b. If the welding is performed by a third party, the manufacturer's representative shall monitor the temperature to verify that it does not exceed the maximum temperature of the seal.

c. Manufacturer representative shall install the test plug for the initial BOP test.

d. If the cement does not circulate and one inch operations would have been possible with a standard wellhead, the well head shall be cut off, cementing operations performed and another wellhead installed.

e. Whenever any seal subject to test pressure is broken, all the tests in Onshore Order 2 III.A.2.i must be followed.

5. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the BOP/BOPE tests.

a. In a water basin, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. The casing cut-off and BOP installation can be initiated four hours after installing the slips, which will be approximately six hours after bumping the plug. For those casing strings not using slips, the minimum wait time before cut-off is eight hours after bumping the plug. BOP/BOPE testing can begin after cut-off or once cement reaches 500 psi compressive strength (including lead when specified), whichever is greater. However, if the float does not hold, cut-off cannot be initiated until cement reaches 500 psi compressive strength (including lead when specified).

b. In potash areas, for all casing strings utilizing slips, these are to be set as soon as the crew and rig are ready and any fallback cement remediation has been done. For all casing strings, casing cut-off and BOP installation can be initiated at twelve hours after bumping the plug. However, **no tests** shall commence until the cement has had a minimum of 24 hours setup time, except the casing pressure test which can be initiated immediately after bumping the plug (only applies to single-stage cement jobs).

c. The tests shall be done by an independent service company utilizing a test plug. The results of the test shall be made available upon request.

d. The test shall be run on a 5000 psi chart for a 2-3M BOP/BOP, on a 10000 psi chart for a 5M BOP/BOPE and on a 15000 psi chart for a 10M BOP/BOPE. If a linear chart is used, it shall be a one hour chart. A circular chart shall have a maximum 2 hour clock. If a twelve hour or twenty-four hour chart is used, tester shall make a notation that it is run with a two hour clock.

e. The BOP/BOPE test shall include a low pressure test from 250 to 300 psi. The test will be held for a minimum of 10 minutes. This test shall be performed prior to the test at full stack pressure.

f. BOP/BOPE must be tested within 500 feet of the top of the Wolfcamp formation if the time between the setting of the intermediate casing and reaching this depth

exceeds 20 days. This test does not exclude the test prior to drilling out the casing shoe as per Onshore Order No. 2.

C. DRILLING MUD

1. Mud system monitoring equipment, with derrick floor indicators and visual and audio alarms, shall be operating before drilling into the Wolfcamp formation, and shall be used until production casing is run and cemented.

D. WASTE MATERIAL AND FLUIDS

1. All waste (i.e. drilling fluids, trash, salts, chemicals, sewage, gray water, etc.) created as a result of drilling operations and completion operations shall be safely contained and disposed of properly at a waste disposal facility. No waste material or fluid shall be disposed of on the well location or surrounding area.
2. Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

Form 3160–8
(February 1987)

(Submit in triplicate to appropriate BLM District Office)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

DESIGNATION OF OPERATOR

The undersigned is, on the records of the Bureau of Land Management, holder of lease

STATE OFFICE: Carlsbad
SERIAL NO.: NM 018644

and hereby designates

NAME: Impetro Operating, LLC
ADDRESS: 300 E. Sonterra Blvd. Ste. 1220, San Antonio, TX 78258

as his operator and local agent, with full authority to act in his behalf in complying with the terms of the lease and regulations applicable thereto and on whom the authorized officer may serve written or oral instructions in securing compliance with the Operating Regulations (43 CFR 3160) with respect to (describe acreage to which this designation is applicable):

Bond coverage under 43 CFR 3104 for lease activities conducted by the above named designated operator is under Bond Number NMB001593.

It is understood that this designation of operator does not relieve the lessee of responsibility for compliance with the terms of the lease and the Operating Regulations. It is also understood that this designation of operator does not constitute an assignment of any interest in the lease.

In case of default on the part of the designated operator, the lessee will make full and prompt compliance with all regulations, lease terms, stipulations, or orders of the Secretary of the Interior or his representative.

The lessee agrees promptly to notify the authorized officer of any change in the designated operator.

LLIPS Energy, Inc

(Signature of lessee)

1/28/2019
(Date)

1500 Bonny Drive, Suite 510, Houston, TX 77057
(Address)

This form does not constitute an information collection as defined by 44 U.S.C. 3502 and therefore does not require OMB approval.

Wolfcamp Casing Design

SURFACE	13-3/8"			
WEIGHT:	54.5 #/ft		COLLAPSE RATING:	1,130 PSI
GRADE:	J-55		BURST RATING:	2,730 PSI
CONNECTION:	BTC		JOINT STRENGTH:	909,000 LBS
SHOE MD	1,300 ' MD		MW @ SURFACE TD	9.3 ppg
SHOE TVD	1,300 ' TVD		FG @ SURFACE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.5 PPG EMW		GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	5100 ' TVD		MWT FOR NEXT HOLE SECT	10.0000 ppg
MASP CONSIDERATION	MUD%	GAS DENS	OPEN HOLE MAX PORE PSI	8.5000 ppg
LESS THAN 10,000'	30	0.10	MUD % FOR MASP CALC	0.3000 %
BETWEEN 10,000' - 12,000'	40	0.15	GAS CUT MUD EQ DENSITY	0.226 PSI/FT
MORE THAN 12,000'	50	0.15		

COLLAPSE SAFTEY FACTOR = **2.3**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **12.8**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **4.0**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **681** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 681 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 1102 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **565 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		1857	PSI
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	1857	9.3	TEST MWT
MASP + 500 PSI	1181		

CASING SLIP WEIGHT = **61,000 Pounds**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	70,850 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8580
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	60,790 LBS

Wolfcamp Casing Design

SURFACE	13-3/8"		
WEIGHT:	54.5 #/ft	COLLAPSE RATING:	1,130 PSI
GRADE:	J-55	BURST RATING:	2,730 PSI
CONNECTION:	BTC	JOINT STRENGTH:	909,000 LBS
SHOE MD	2,050 ' MD	MW @ SURFACE TD	9.3 ppg
SHOE TVD	2,050 ' TVD	FG @ SURFACE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.5 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	5300 ' TVD	MWT FOR NEXT HOLE SECT	10.0000 ppg
		OPEN HOLE MAX PORE PSI	8.5000 ppg
		MUD % FOR MASP CALC	0.3000 %
		GAS CUT MUD EQ DENSITY	0.226 PSI/FT

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

COLLAPSE SAFTEY FACTOR	=	1.4

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR	=	8.1

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR	=	2.5

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD)	1,074	PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 1,074 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 1145 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE	=	565	PSI

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		1826	PSI
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	1826	9.3	TEST MWT
MASP + 500 PSI	1574		

CASING SLIP WEIGHT	=	96,000	Pounds

STRING WEIGHT IN AIR = CASING WT * MD @ TD = 111,725 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) = 0.8580
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR = 95,862 LBS

Wolfcamp Casing Design
TAPERED STRING (0'-4,100')

FIRST INTERMEDIATE 10-3/4"

WEIGHT:	45.5 #/ft	COLLAPSE RATING:	2,090 PSI
GRADE:	J-55	BURST RATING:	3,580 PSI
CONNECTION:	BTC	JOINT STRENGTH:	796,000 LBS
SHOE MD	4,100 ' MD	MW @ INTERMEDIATE TD	10.5 ppg
SHOE TVD	4,100 ' TVD	FG @ INTERMEDIATE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.9 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	12212 ' TVD	MWT FOR NEXT HOLE SECT	9.7000 ppg
		OPEN HOLE MAX PORE PSI	9.5000 ppg
		MUD % FOR MASP CALC	0.3000 %
		GAS CUT MUD EQ DENSITY	0.22132 PSI/FT

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

COLLAPSE SAFTEY FACTOR = 1.1

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = 4.3

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = 1.7

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) 2,148 PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 2,148 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,330 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = 1,045 PSI

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**2648**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	2165	**10.5**	**TEST MWT**
MASP + 500 PSI	2648		

CASING SLIP WEIGHT = 157,000 LBS

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	186,550 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8397
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	156,645 LBS

Wolfcamp Casing Design
TAPERED STRING (4,100'-5,300')

FIRST INTERMEDIATE 10-3/4"

WEIGHT:	45.5 #/ft	COLLAPSE RATING:	3,130 PSI
GRADE:	HCK-55	BURST RATING:	3,580 PSI
CONNECTION:	BTC	JOINT STRENGTH:	1,037,000 LBS
SHOE MD	5,300 ' MD	MW @ INTERMEDIATE TD	10.5 ppg
SHOE TVD	5,300 ' TVD	FG @ INTERMEDIATE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.9 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	12212 ' TVD	MWT FOR NEXT HOLE SECT	9.7000 ppg
		OPEN HOLE MAX PORE PSI	9.5000 ppg
		MUD % FOR MASP CALC	0.3000 %
		GAS CUT MUD EQ DENSITY	0.22132 PSI/FT

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

COLLAPSE SAFTEY FACTOR = **1.3**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **4.3**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.3**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **2,777 PSI**

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 2,777 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,330 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **1,565 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**3277**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	2065	**10.5**	**TEST MWT**
MASP + 500 PSI	3277		

CASING SLIP WEIGHT = **202,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	241,150 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8397
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	202,492 LBS

Wolfcamp Casing Design
TAPERED STRING (0'-11,800')

SECOND INTERMEDIATE 7-5/8"

WEIGHT:	29.7 #/ft		COLLAPSE RATING:	4,790 PSI
GRADE:	N-80		BURST RATING:	6,890 PSI
CONNECTION:	LTC		JOINT STRENGTH:	575,000 LBS
SHOE MD	11,800 ' MD		MW @ INTERMEDIATE TD	9.7 ppg
SHOE TVD	11,800 ' TVD		FG @ INTERMEDIATE SHOE:	17.3 PPG EMW
BACK-UP GRADIENT	9.5 PPG EMW		GAS GRADIENT:	0.1500 psi/ft
TVD NEXT HOLE SECTION	12350 ' TVD		MWT FOR NEXT HOLE SECT	13.0000 ppg
MASP CONSIDERATION	MUD%GAS DENS		OPEN HOLE MAX PORE PSI	13.0000 ppg
LESS THAN 10,000'	30 0.10		MUD % FOR MASP CALC	0.4000 %
BETWEEN 10,000' - 12,000'	40 0.15		GAS CUT MUD EQ DENSITY	0.3604 PSI/FT
MORE THAN 12,000'	50 0.15			

COLLAPSE SAFTEY FACTOR	=	1.1

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR	=	1.6

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR	=	1.8

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD)	3,898	PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 9,152 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,898 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE	=	2,395	PSI

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		4398	PSI
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	4700	9.7	TEST MWT
MASP + 500 PSI	4398		

CASING SLIP WEIGHT	=	299,000	LBS

STRING WEIGHT IN AIR = CASING WT * MD @ TD = 350,460 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) = 0.8519
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR = 298,560 LBS

Wolfcamp Casing Design

TAPERED STRING (11,800'-12212' TVD/12300' MD)

SECOND INTERMEDIATE 7-5/8"

WEIGHT:	29.7 #/ft	COLLAPSE RATING:	5,340 PSI
GRADE:	P-110	BURST RATING:	9,470 PSI
CONNECTION:	LTC	JOINT STRENGTH:	769,000 LBS
SHOE MD	[redacted]' MD	MW @ INTERMEDIATE TD	9.7 ppg
SHOE TVD	[redacted]' TVD	FG @ INTERMEDIATE SHOE:	17.3 PPG EMW
BACK-UP GRADIENT	9.5 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
TVD NEXT HOLE SECTION	12350 ' TVD	MWT FOR NEXT HOLE SECT	13.0000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	13.0000 ppg
MUD % FOR MASP CALC	0.5000 %
GAS CUT MUD EQ DENSITY	0.413 PSI/FT

COLLAPSE SAFTEY FACTOR = **1.2**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **2.1**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.0**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **3,248 PSI**

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 9,472 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,248 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **2,670 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**3748 PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	6502	9.7 TEST MWT
MASP + 500 PSI	3748	

CASING SLIP WEIGHT = **311,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	365,310 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8519
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	311,211 LBS

Wolfcamp Casing Design

TAPERED STRING (0'-11,800')

*STILL INSIDE SECOND INTERMEDIATE CASING @ RUNNING DEPTH

PRODUCTION CASING 5-1/2"

WEIGHT:	23.0 #/ft	COLLAPSE RATING:	15,990 PSI
GRADE:	P-110	BURST RATING:	14,530 PSI
CONNECTION:	ULTRA QX	JOINT STRENGTH:	729,000 LBS
CSG TOP MD	0 ' MD		
CSG TOP TVD	0 ' TVD	RESERVOIR PORE PRESSURE	12.3 PPG
SHOE MD	11,800 ' MD	MW @ TD	13.0 PPG EMW
SHOE TVD	11,800 ' TVD	FG @ TD	17.3 PPG EMW
BACK-UP GRADIENT	9.7 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
PREVIOUS SHOE MD	12300	ABANDONMENT RESERVOIR PSI	1770.0000 PSI
PREVIOUS SHOE TVD	12212	COMPLETION FLUID DENSITY	8.3300 PPG
PREVIOUS SHOE FRAC	17.3		

COLLAPSE SAFTEY FACTOR = **2.6**

COLLAPSE SAFETY FACTOR = ABANDONMENT RESERVOIR PRESSURE WITH MWT ON BACKSIDE
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - RESERVOIR ABANDON PSI)

TENSION SAFTEY FACTOR = **2.7**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **2.9**

BURST SAFETY FACTOR = BURST RATING / (MASP + (CMP FLUID PPG - BACKUP PPG) * 0.052 * TD TVD)

MAXIMUM ANTICIPATED SURFACE PRESSURE **5,777** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (PERFORATED RESERVIOR WITH GAS TO SURFACE) 5,777 PSI
MASP = (TVD*.052*PORE PSI) - (GAS GRADIENT *TVD)

CASING TEST PRESSURE (70% OF CASING BURST, OR MASP + 500 PSI, PREV LOT + 500)		**6277**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	8146	**13.0**	**TEST MWT**
MASP + 500 PSI	6277		
PREVIOUS SHOE LOT + 500 PSI TO INSURE LAP ISOLATION	3231		

CASING SLIP WEIGHT = **218,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	271,400 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8024
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	217,771 LBS

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TAPERED STRING (11800'-12350' TVD/22620' MD)

PRODUCTION CASING 5-1/2"

WEIGHT:	23.0 #/ft	COLLAPSE RATING:	14,540 PSI
GRADE:	P-110	BURST RATING:	14,530 PSI
CONNECTION:	ULTRA FJ	JOINT STRENGTH:	724,000 LBS
CSG TOP MD	11800 ' MD		
CSG TOP TVD	11800 ' TVD	RESERVOIR PORE PRESSURE	12.3 PPG
SHOE MD	[redacted] ' MD	MW @ TD	13.0 PPG EMW
SHOE TVD	' TVD	FG @ TD	17.3 PPG EMW
BACK-UP GRADIENT	9.7 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
PREVIOUS SHOE MD	12300	ABANDONMENT RESERVOIR PSI	1852.5000 PSI
PREVIOUS SHOE TVD	12212	COMPLETION FLUID DENSITY	8.3300 PPG
PREVIOUS SHOE FRAC	17.3		

COLLAPSE SAFTEY FACTOR	=	2.2

COLLAPSE SAFETY FACTOR = ABANDONMENT RESERVOIR PRESSURE WITH MWT ON BACKSIDE
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - RESERVOIR ABANDON PSI)

TENSION SAFTEY FACTOR	=	2.9

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR	=	2.8

BURST SAFETY FACTOR = BURST RATING / (MASP + (CMP FLUID PPG - BACKUP PPG) * 0.052 * TD TVD)

MAXIMUM ANTICIPATED SURFACE PRESSURE	6,047	PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (PERFORATED RESERVIOR WITH GAS TO SURFACE) 6,047 PSI
MASP = (TVD*.052*PORE PSI) - (GAS GRADIENT *TVD)

CASING TEST PRESSURE (70% OF CASING BURST, OR MASP + 500 PSI, PREV LOT + 500)		6547	PSI
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	8052	13.0	TEST MWT
MASP + 500 PSI	6547		
PREVIOUS SHOE LOT + 500 PSI TO INSURE LAP ISOLATION	3231		

CASING SLIP WEIGHT	=	200,000	LBS

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	248,860 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8024
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	199,685 LBS

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SURFACE	13-3/8"		
WEIGHT:	54.5 #/ft	COLLAPSE RATING:	1,130 PSI
GRADE:	J-55	BURST RATING:	2,730 PSI
CONNECTION:	BTC	JOINT STRENGTH:	909,000 LBS
SHOE MD	2,050 ' MD	MW @ SURFACE TD	9.3 ppg
SHOE TVD	2,050 ' TVD	FG @ SURFACE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.5 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	5300 ' TVD	MWT FOR NEXT HOLE SECT	10.0000 ppg

MASP CONSIDERATION	MUD%	GAS DENS		
LESS THAN 10,000'	30	0.10	OPEN HOLE MAX PORE PSI	8.5000 ppg
BETWEEN 10,000' - 12,000'	40	0.15	MUD % FOR MASP CALC	0.3000 %
MORE THAN 12,000'	50	0.15	GAS CUT MUD EQ DENSITY	0.226 PSI/FT

COLLAPSE SAFTEY FACTOR	=	1.4

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR	=	8.1

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR	=	2.5

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD)	1,074	PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 1,074 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 1145 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE	=	565	PSI

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		1826	PSI
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	1826	9.3	TEST MWT
MASP + 500 PSI	1574		

CASING SLIP WEIGHT	=	96,000	Pounds

STRING WEIGHT IN AIR = CASING WT * MD @ TD = 111,725 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) = 0.8580
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR = 95,862 LBS

Wolfcamp Casing Design
TAPERED STRING (0'-4,100')

FIRST INTERMEDIATE 10-3/4"

WEIGHT:	45.5 #/ft	COLLAPSE RATING:	2,090 PSI
GRADE:	J-55	BURST RATING:	3,580 PSI
CONNECTION:	BTC	JOINT STRENGTH:	796,000 LBS
SHOE MD	4,100 ' MD	MW @ INTERMEDIATE TD	10.5 ppg
SHOE TVD	4,100 ' TVD	FG @ INTERMEDIATE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.9 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	12212 ' TVD	MWT FOR NEXT HOLE SECT	9.7000 ppg
		OPEN HOLE MAX PORE PSI	9.5000 ppg
		MUD % FOR MASP CALC	0.3000 %
		GAS CUT MUD EQ DENSITY	0.22132 PSI/FT

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

COLLAPSE SAFTEY FACTOR = **1.1**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **4.3**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.7**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **2,148** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 2,148 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,330 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **1,045 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**2648 PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	2165	**10.5 TEST MWT**
MASP + 500 PSI	2648	

CASING SLIP WEIGHT = **157,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	186,550 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8397
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	156,645 LBS

Wolfcamp Casing Design
TAPERED STRING (4,100'-5,300')

FIRST INTERMEDIATE 10-3/4"

WEIGHT:	45.5 #/ft	COLLAPSE RATING:	3,130 PSI
GRADE:	HCK-55	BURST RATING:	3,580 PSI
CONNECTION:	BTC	JOINT STRENGTH:	1,037,000 LBS
SHOE MD	5,300 ' MD	MW @ INTERMEDIATE TD	10.5 ppg
SHOE TVD	5,300 ' TVD	FG @ INTERMEDIATE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.9 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	12212 ' TVD	MWT FOR NEXT HOLE SECT	9.7000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	9.5000 ppg
MUD % FOR MASP CALC	0.3000 %
GAS CUT MUD EQ DENSITY	0.22132 PSI/FT

COLLAPSE SAFTEY FACTOR = **1.3**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **4.3**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.3**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **2,777 PSI**

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 2,777 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,330 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **1,565 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**3277**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	2065	**10.5**	**TEST MWT**
MASP + 500 PSI	3277		

CASING SLIP WEIGHT = **202,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	241,150 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8397
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	202,492 LBS

Wolfcamp Casing Design
TAPERED STRING (0'-11,800')

SECOND INTERMEDIATE 7-5/8"

WEIGHT:	29.7 #/ft	COLLAPSE RATING:	4,790 PSI
GRADE:	N-80	BURST RATING:	6,890 PSI
CONNECTION:	LTC	JOINT STRENGTH:	575,000 LBS
SHOE MD	11,800 ' MD	MW @ INTERMEDIATE TD	9.7 ppg
SHOE TVD	11,800 ' TVD	FG @ INTERMEDIATE SHOE:	17.3 PPG EMW
BACK-UP GRADIENT	9.5 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
TVD NEXT HOLE SECTION	12350 ' TVD	MWT FOR NEXT HOLE SECT	13.0000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	13.0000 ppg
MUD % FOR MASP CALC	0.4000 %
GAS CUT MUD EQ DENSITY	0.3604 PSI/FT

COLLAPSE SAFTEY FACTOR = 1.1

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = 1.6

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = 1.8

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) 3,898 PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 9,152 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,898 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = 2,395 PSI

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**4398**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	4700	**9.7**	**TEST MWT**
MASP + 500 PSI	4398		

CASING SLIP WEIGHT = 299,000 LBS

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	350,460 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8519
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	298,560 LBS

Wolfcamp Casing Design

TAPERED STRING (11,800'-12212' TVD/12300' MD)

SECOND INTERMEDIATE 7-5/8"

WEIGHT:	29.7 #/ft	COLLAPSE RATING:	5,340 PSI
GRADE:	P-110	BURST RATING:	9,470 PSI
CONNECTION:	LTC	JOINT STRENGTH:	769,000 LBS
SHOE MD	[redacted] ' MD	MW @ INTERMEDIATE TD	9.7 ppg
SHOE TVD	[redacted] ' TVD	FG @ INTERMEDIATE SHOE:	17.3 PPG EMW
BACK-UP GRADIENT	9.5 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
TVD NEXT HOLE SECTION	12350 ' TVD	MWT FOR NEXT HOLE SECT	13.0000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	13.0000 ppg
MUD % FOR MASP CALC	0.5000 %
GAS CUT MUD EQ DENSITY	0.413 PSI/FT

COLLAPSE SAFTEY FACTOR = **1.2**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **2.1**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.0**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **3,248 PSI**

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 9,472 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,248 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **2,670 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**3748**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	6502	**9.7**	**TEST MWT**
MASP + 500 PSI	3748		

CASING SLIP WEIGHT = **311,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	365,310 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8519
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	311,211 LBS

Wolfcamp Casing Design

TAPERED STRING (0'-11,800')

*STILL INSIDE SECOND INTERMEDIATE CASING @ RUNNING DEPTH

PRODUCTION CASING 5-1/2"

WEIGHT:	23.0 #/ft	COLLAPSE RATING:	15,990 PSI
GRADE:	P-110	BURST RATING:	14,530 PSI
CONNECTION:	ULTRA QX	JOINT STRENGTH:	729,000 LBS
CSG TOP MD	0 ' MD		
CSG TOP TVD	0 ' TVD	RESERVOIR PORE PRESSURE	12.3 PPG
SHOE MD	11,800 ' MD	MW @ TD	13.0 PPG EMW
SHOE TVD	11,800 ' TVD	FG @ TD	17.3 PPG EMW
BACK-UP GRADIENT	9.7 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
PREVIOUS SHOE MD	12300	ABANDONMENT RESERVOIR PSI	1770.0000 PSI
PREVIOUS SHOE TVD	12212	COMPLETION FLUID DENSITY	8.3300 PPG
PREVIOUS SHOE FRAC	17.3		

COLLAPSE SAFTEY FACTOR = **2.6**

COLLAPSE SAFETY FACTOR = ABANDONMENT RESERVOIR PRESSURE WITH MWT ON BACKSIDE
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - RESERVOIR ABANDON PSI)

TENSION SAFTEY FACTOR = **2.7**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **2.9**

BURST SAFETY FACTOR = BURST RATING / (MASP + (CMP FLUID PPG - BACKUP PPG) * 0.052 * TD TVD)

MAXIMUM ANTICIPATED SURFACE PRESSURE **5,777** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (PERFORATED RESERVIOR WITH GAS TO SURFACE) 5,777 PSI
MASP = (TVD*.052*PORE PSI) - (GAS GRADIENT *TVD)

CASING TEST PRESSURE (70% OF CASING BURST, OR MASP + 500 PSI, PREV LOT + 500)		**6277**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	8146	**13.0**	**TEST MWT**
MASP + 500 PSI	6277		
PREVIOUS SHOE LOT + 500 PSI TO INSURE LAP ISOLATION	3231		

CASING SLIP WEIGHT = **218,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	271,400 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8024
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	217,771 LBS

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TAPERED STRING (11800'-12350' TVD/22620' MD)

PRODUCTION CASING 5-1/2"

WEIGHT:	23.0 #/ft	COLLAPSE RATING:	14,540 PSI
GRADE:	P-110	BURST RATING:	14,530 PSI
CONNECTION:	ULTRA FJ	JOINT STRENGTH:	724,000 LBS
CSG TOP MD	11800 ' MD		
CSG TOP TVD	11800 ' TVD	RESERVOIR PORE PRESSURE	12.3 PPG
SHOE MD	[redacted] ' MD	MW @ TD	13.0 PPG EMW
SHOE TVD	[redacted] ' TVD	FG @ TD	17.3 PPG EMW
BACK-UP GRADIENT	9.7 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
PREVIOUS SHOE MD	12300	ABANDONMENT RESERVOIR PSI	1852.5000 PSI
PREVIOUS SHOE TVD	12212	COMPLETION FLUID DENSITY	8.3300 PPG
PREVIOUS SHOE FRAC	17.3		

COLLAPSE SAFTEY FACTOR = **2.2**

COLLAPSE SAFETY FACTOR = ABANDONMENT RESERVOIR PRESSURE WITH MWT ON BACKSIDE
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - RESERVOIR ABANDON PSI)

TENSION SAFTEY FACTOR = **2.9**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **2.8**

BURST SAFETY FACTOR = BURST RATING / (MASP + (CMP FLUID PPG - BACKUP PPG) * 0.052 * TD TVD)

MAXIMUM ANTICIPATED SURFACE PRESSURE **6,047** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (PERFORATED RESERVIOR WITH GAS TO SURFACE) 6,047 PSI
MASP = (TVD*.052*PORE PSI) - (GAS GRADIENT *TVD)

CASING TEST PRESSURE (70% OF CASING BURST, OR MASP + 500 PSI, PREV LOT + 500)		**6547**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	8052	**13.0**	**TEST MWT**
MASP + 500 PSI	6547		
PREVIOUS SHOE LOT + 500 PSI TO INSURE LAP ISOLATION	3231		

CASING SLIP WEIGHT = **200,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	248,860 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8024
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	199,685 LBS

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SURFACE	13-3/8"			
WEIGHT:	54.5 #/ft		COLLAPSE RATING:	1,130 PSI
GRADE:	J-55		BURST RATING:	2,730 PSI
CONNECTION:	BTC		JOINT STRENGTH:	909,000 LBS
SHOE MD	2,050 ' MD		MW @ SURFACE TD	9.3 ppg
SHOE TVD	2,050 ' TVD		FG @ SURFACE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.5 PPG EMW		GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	5300 ' TVD		MWT FOR NEXT HOLE SECT	10.0000 ppg
MASP CONSIDERATION	MUD% GAS DENS		OPEN HOLE MAX PORE PSI	8.5000 ppg
LESS THAN 10,000'	30 0.10		MUD % FOR MASP CALC	0.3000 %
BETWEEN 10,000' - 12,000'	40 0.15		GAS CUT MUD EQ DENSITY	0.226 PSI/FT
MORE THAN 12,000'	50 0.15			

COLLAPSE SAFTEY FACTOR	=	1.4

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR	=	8.1

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR	=	2.5

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD)	1,074	PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 1,074 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 1145 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE	=	565	PSI

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		1826	PSI
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	1826	9.3	TEST MWT
MASP + 500 PSI	1574		

CASING SLIP WEIGHT	=	96,000	Pounds

STRING WEIGHT IN AIR = CASING WT * MD @ TD = 111,725 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) = 0.8580
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR = 95,862 LBS

Wolfcamp Casing Design
TAPERED STRING (0'-4,100')

FIRST INTERMEDIATE 10-3/4"

WEIGHT:	45.5 #/ft	COLLAPSE RATING:	2,090 PSI
GRADE:	J-55	BURST RATING:	3,580 PSI
CONNECTION:	BTC	JOINT STRENGTH:	796,000 LBS
SHOE MD	4,100 ' MD	MW @ INTERMEDIATE TD	10.5 ppg
SHOE TVD	4,100 ' TVD	FG @ INTERMEDIATE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.9 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	12212 ' TVD	MWT FOR NEXT HOLE SECT	9.7000 ppg
		OPEN HOLE MAX PORE PSI	9.5000 ppg
		MUD % FOR MASP CALC	0.3000 %
		GAS CUT MUD EQ DENSITY	0.22132 PSI/FT

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

COLLAPSE SAFTEY FACTOR = **1.1**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **4.3**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.7**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **2,148** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 2,148 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,330 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **1,045 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**2648**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	2165	**10.5**	**TEST MWT**
MASP + 500 PSI	2648		

CASING SLIP WEIGHT = **157,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	186,550 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8397
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	156,645 LBS

Wolfcamp Casing Design
TAPERED STRING (4,100'-5,300')

FIRST INTERMEDIATE 10-3/4"

WEIGHT:	45.5 #/ft	COLLAPSE RATING:	3,130 PSI
GRADE:	HCK-55	BURST RATING:	3,580 PSI
CONNECTION:	BTC	JOINT STRENGTH:	1,037,000 LBS
SHOE MD	5,300 ' MD	MW @ INTERMEDIATE TD	10.5 ppg
SHOE TVD	5,300 ' TVD	FG @ INTERMEDIATE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.9 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	12212 ' TVD	MWT FOR NEXT HOLE SECT	9.7000 ppg
		OPEN HOLE MAX PORE PSI	9.5000 ppg
		MUD % FOR MASP CALC	0.3000 %
		GAS CUT MUD EQ DENSITY	0.22132 PSI/FT

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

COLLAPSE SAFTEY FACTOR = **1.3**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **4.3**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.3**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **2,777** **PSI**

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 2,777 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,330 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **1,565** **PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**3277**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	2065	**10.5**	**TEST MWT**
MASP + 500 PSI	3277		

CASING SLIP WEIGHT = **202,000** **LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	241,150 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8397
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	202,492 LBS

Wolfcamp Casing Design
TAPERED STRING (0'-11,800')

SECOND INTERMEDIATE 7-5/8"

WEIGHT:	29.7 #/ft	COLLAPSE RATING:	4,790 PSI
GRADE:	N-80	BURST RATING:	6,890 PSI
CONNECTION:	LTC	JOINT STRENGTH:	575,000 LBS
SHOE MD	11,800 ' MD	MW @ INTERMEDIATE TD	9.7 ppg
SHOE TVD	11,800 ' TVD	FG @ INTERMEDIATE SHOE:	17.3 PPG EMW
BACK-UP GRADIENT	9.5 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
TVD NEXT HOLE SECTION	12350 ' TVD	MWT FOR NEXT HOLE SECT	13.0000 ppg
MASP CONSIDERATION	MUD%GAS DENS	OPEN HOLE MAX PORE PSI	13.0000 ppg
LESS THAN 10,000'	30 0.10	MUD % FOR MASP CALC	0.4000 %
BETWEEN 10,000' - 12,000'	40 0.15	GAS CUT MUD EQ DENSITY	0.3604 PSI/FT
MORE THAN 12,000'	50 0.15		

COLLAPSE SAFTEY FACTOR = **1.1**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **1.6**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.8**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **3,898** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 9,152 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,898 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **2,395 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**4398**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	4700	**9.7**	**TEST MWT**
MASP + 500 PSI	4398		

CASING SLIP WEIGHT = **299,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	350,460 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8519
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	298,560 LBS

Wolfcamp Casing Design

TAPERED STRING (11,800'-12212' TVD/12300' MD)

SECOND INTERMEDIATE 7-5/8"

WEIGHT:	29.7 #/ft	COLLAPSE RATING:	5,340 PSI
GRADE:	P-110	BURST RATING:	9,470 PSI
CONNECTION:	LTC	JOINT STRENGTH:	769,000 LBS
SHOE MD	[redacted] ' MD	MW @ INTERMEDIATE TD	9.7 ppg
SHOE TVD	[redacted] ' TVD	FG @ INTERMEDIATE SHOE:	17.3 PPG EMW
BACK-UP GRADIENT	9.5 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
TVD NEXT HOLE SECTION	12350 ' TVD	MWT FOR NEXT HOLE SECT	13.0000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	13.0000 ppg
MUD % FOR MASP CALC	0.5000 %
GAS CUT MUD EQ DENSITY	0.413 PSI/FT

COLLAPSE SAFTEY FACTOR = **1.2**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **2.1**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.0**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **3,248** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 9,472 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,248 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **2,670 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**3748**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	6502	9.7	TEST MWT
MASP + 500 PSI	3748		

CASING SLIP WEIGHT = **311,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	365,310 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8519
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	311,211 LBS

Wolfcamp Casing Design

TAPERED STRING (0'-11,800')

*STILL INSIDE SECOND INTERMEDIATE CASING @ RUNNING DEPTH

PRODUCTION CASING 5-1/2"

WEIGHT:	23.0 #/ft	COLLAPSE RATING:	15,990 PSI
GRADE:	P-110	BURST RATING:	14,530 PSI
CONNECTION:	ULTRA QX	JOINT STRENGTH:	729,000 LBS
CSG TOP MD	0 ' MD		
CSG TOP TVD	0 ' TVD	RESERVOIR PORE PRESSURE	12.3 PPG
SHOE MD	11,800 ' MD	MW @ TD	13.0 PPG EMW
SHOE TVD	11,800 ' TVD	FG @ TD	17.3 PPG EMW
BACK-UP GRADIENT	9.7 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
PREVIOUS SHOE MD	12300	ABANDONMENT RESERVOIR PSI	1770.0000 PSI
PREVIOUS SHOE TVD	12212	COMPLETION FLUID DENSITY	8.3300 PPG
PREVIOUS SHOE FRAC	17.3		

COLLAPSE SAFTEY FACTOR = **2.6**

COLLAPSE SAFETY FACTOR = ABANDONMENT RESERVOIR PRESSURE WITH MWT ON BACKSIDE
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - RESERVOIR ABANDON PSI)

TENSION SAFTEY FACTOR = **2.7**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **2.9**

BURST SAFETY FACTOR = BURST RATING / (MASP + (CMP FLUID PPG - BACKUP PPG) * 0.052 * TD TVD)

MAXIMUM ANTICIPATED SURFACE PRESSURE **5,777** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (PERFORATED RESERVIOR WITH GAS TO SURFACE) 5,777 PSI
MASP = (TVD*.052*PORE PSI) - (GAS GRADIENT *TVD)

CASING TEST PRESSURE (70% OF CASING BURST, OR MASP + 500 PSI, PREV LOT + 500)		**6277**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	8146	**13.0**	**TEST MWT**
MASP + 500 PSI	6277		
PREVIOUS SHOE LOT + 500 PSI TO INSURE LAP ISOLATION	3231		

CASING SLIP WEIGHT = **218,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	271,400 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8024
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	217,771 LBS

Wolfcamp Casing Design

TAPERED STRING (11800'-12350' TVD/22620' MD)

PRODUCTION CASING 5-1/2"

WEIGHT:	23.0 #/ft	COLLAPSE RATING:	14,540 PSI
GRADE:	P-110	BURST RATING:	14,530 PSI
CONNECTION:	ULTRA FJ	JOINT STRENGTH:	724,000 LBS
CSG TOP MD	11800 ' MD		
CSG TOP TVD	11800 ' TVD	RESERVOIR PORE PRESSURE	12.3 PPG
SHOE MD	[redacted] ' MD	MW @ TD	13.0 PPG EMW
SHOE TVD	' TVD	FG @ TD	17.3 PPG EMW
BACK-UP GRADIENT	9.7 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
PREVIOUS SHOE MD	12300	ABANDONMENT RESERVOIR PSI	1852.5000 PSI
PREVIOUS SHOE TVD	12212	COMPLETION FLUID DENSITY	8.3300 PPG
PREVIOUS SHOE FRAC	17.3		

COLLAPSE SAFTEY FACTOR = **2.2**

COLLAPSE SAFETY FACTOR = ABANDONMENT RESERVOIR PRESSURE WITH MWT ON BACKSIDE
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - RESERVOIR ABANDON PSI)

TENSION SAFTEY FACTOR = **2.9**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **2.8**

BURST SAFETY FACTOR = BURST RATING / (MASP + (CMP FLUID PPG - BACKUP PPG) * 0.052 * TD TVD)

MAXIMUM ANTICIPATED SURFACE PRESSURE **6,047 PSI**

MAXIMUM ANTICIPATED SURFACE PRESSURE (PERFORATED RESERVIOR WITH GAS TO SURFACE) 6,047 PSI
MASP = (TVD*.052*PORE PSI) - (GAS GRADIENT *TVD)

CASING TEST PRESSURE (70% OF CASING BURST, OR MASP + 500 PSI, PREV LOT + 500)		**6547**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	8052	**13.0**	**TEST MWT**
MASP + 500 PSI	6547		
PREVIOUS SHOE LOT + 500 PSI TO INSURE LAP ISOLATION	3231		

CASING SLIP WEIGHT = **200,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	248,860 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8024
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	199,685 LBS

Wolfcamp Casing Design

SURFACE	13-3/8"			
WEIGHT:	54.5 #/ft	COLLAPSE RATING:	1,130	PSI
GRADE:	J-55	BURST RATING:	2,730	PSI
CONNECTION:	BTC	JOINT STRENGTH:	909,000	LBS
SHOE MD	2,050 ' MD	MW @ SURFACE TD	9.3	ppg
SHOE TVD	2,050 ' TVD	FG @ SURFACE SHOE:	11.5	PPG EMW
BACK-UP GRADIENT	8.5 PPG EMW	GAS GRADIENT:	0.1000	psi/ft
TVD NEXT HOLE SECTION	5300 ' TVD	MWT FOR NEXT HOLE SECT	10.0000	ppg
		OPEN HOLE MAX PORE PSI	8.5000	ppg
		MUD % FOR MASP CALC	0.3000	%
		GAS CUT MUD EQ DENSITY	0.226	PSI/FT

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

COLLAPSE SAFTEY FACTOR	=	1.4

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR	=	8.1

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR	=	2.5

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD)	1,074	PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 1,074 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 1145 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE	=	565	PSI

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		1826	PSI
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	1826	9.3	TEST MWT
MASP + 500 PSI	1574		

CASING SLIP WEIGHT	=	96,000	Pounds

STRING WEIGHT IN AIR = CASING WT * MD @ TD = 111,725 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) = 0.8580
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR = 95,862 LBS

Wolfcamp Casing Design
TAPERED STRING (0'-4,100')

FIRST INTERMEDIATE 10-3/4"

WEIGHT:	45.5 #/ft	COLLAPSE RATING:	2,090 PSI
GRADE:	J-55	BURST RATING:	3,580 PSI
CONNECTION:	BTC	JOINT STRENGTH:	796,000 LBS
SHOE MD	4,100 ' MD	MW @ INTERMEDIATE TD	10.5 ppg
SHOE TVD	4,100 ' TVD	FG @ INTERMEDIATE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.9 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	12212 ' TVD	MWT FOR NEXT HOLE SECT	9.7000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	9.5000 ppg
MUD % FOR MASP CALC	0.3000 %
GAS CUT MUD EQ DENSITY	0.22132 PSI/FT

COLLAPSE SAFTEY FACTOR = **1.1**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **4.3**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.7**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **2,148 PSI**

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 2,148 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,330 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **1,045 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF) **2648 PSI**

70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	2165	10.5 TEST MWT
MASP + 500 PSI	2648	

CASING SLIP WEIGHT = **157,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	186,550 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8397
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	156,645 LBS

Wolfcamp Casing Design
TAPERED STRING (4,100'-5,300')

FIRST INTERMEDIATE 10-3/4"

WEIGHT:	45.5 #/ft	COLLAPSE RATING:	3,130 PSI
GRADE:	HCK-55	BURST RATING:	3,580 PSI
CONNECTION:	BTC	JOINT STRENGTH:	1,037,000 LBS
SHOE MD	5,300 ' MD	MW @ INTERMEDIATE TD	10.5 ppg
SHOE TVD	5,300 ' TVD	FG @ INTERMEDIATE SHOE:	11.5 PPG EMW
BACK-UP GRADIENT	8.9 PPG EMW	GAS GRADIENT:	0.1000 psi/ft
TVD NEXT HOLE SECTION	12212 ' TVD	MWT FOR NEXT HOLE SECT	9.7000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	9.5000 ppg
MUD % FOR MASP CALC	0.3000 %
GAS CUT MUD EQ DENSITY	0.22132 PSI/FT

COLLAPSE SAFTEY FACTOR = **1.3**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **4.3**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.3**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) 2,777 PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 2,777 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,330 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **1,565 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**3277**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	2065	**10.5**	**TEST MWT**
MASP + 500 PSI	3277		

CASING SLIP WEIGHT = **202,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	241,150 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8397
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	202,492 LBS

Wolfcamp Casing Design
TAPERED STRING (0'-11,800')

SECOND INTERMEDIATE 7-5/8"

WEIGHT:	29.7 #/ft	COLLAPSE RATING:	4,790 PSI
GRADE:	N-80	BURST RATING:	6,890 PSI
CONNECTION:	LTC	JOINT STRENGTH:	575,000 LBS
SHOE MD	11,800 ' MD	MW @ INTERMEDIATE TD	9.7 ppg
SHOE TVD	11,800 ' TVD	FG @ INTERMEDIATE SHOE:	17.3 PPG EMW
BACK-UP GRADIENT	9.5 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
TVD NEXT HOLE SECTION	12350 ' TVD	MWT FOR NEXT HOLE SECT	13.0000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	13.0000 ppg
MUD % FOR MASP CALC	0.4000 %
GAS CUT MUD EQ DENSITY	0.3604 PSI/FT

COLLAPSE SAFTEY FACTOR = **1.1**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **1.6**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.8**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **3,898 PSI**

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 9,152 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,898 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **2,395 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**4398 PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	4700	**9.7 TEST MWT**
MASP + 500 PSI	4398	

CASING SLIP WEIGHT = **299,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	350,460 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8519
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	298,560 LBS

Wolfcamp Casing Design

TAPERED STRING (11,800'-12212' TVD/12300' MD)

SECOND INTERMEDIATE 7-5/8"

WEIGHT:	29.7 #/ft	COLLAPSE RATING:	5,340 PSI
GRADE:	P-110	BURST RATING:	9,470 PSI
CONNECTION:	LTC	JOINT STRENGTH:	769,000 LBS
SHOE MD	[redacted]' MD	MW @ INTERMEDIATE TD	9.7 ppg
SHOE TVD	[redacted]' TVD	FG @ INTERMEDIATE SHOE:	17.3 PPG EMW
BACK-UP GRADIENT	9.5 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
TVD NEXT HOLE SECTION	12350 ' TVD	MWT FOR NEXT HOLE SECT	13.0000 ppg

MASP CONSIDERATION	MUD%	GAS DENS
LESS THAN 10,000'	30	0.10
BETWEEN 10,000' - 12,000'	40	0.15
MORE THAN 12,000'	50	0.15

OPEN HOLE MAX PORE PSI	13.0000 ppg
MUD % FOR MASP CALC	0.5000 %
GAS CUT MUD EQ DENSITY	0.413 PSI/FT

COLLAPSE SAFTEY FACTOR = **1.2**

COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (HYDROSTATIC PRESS @ SHOE - GAS BACKUP)
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - GAS GRAD * TVD @ TD)

TENSION SAFTEY FACTOR = **2.1**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **1.0**

BURST SAFETY FACTOR = CASING BURST RATING / MAXIMUM ANTICIPATED SURFACE PRESSURE
BURST SAFETY FACTOR = CASING BURST / (((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRADIENT* TVD @ SHOE))

MAXIMUM ANTICIPATED SURFACE PRESSURE (LESSER OF SHOE FRAC, OR GAS CUT MUD) **3,248** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (SHOE FRACTURE WITH GAS TO SURFACE) 9,472 PSI
MASP = ((FRAC GRAD +0.5) * 0.052 * TVD @ SHOE) - (GAS GRAD * TVD @ SHOE)

MASP = MAXIMUM SURFACE PRESSURE (GAS CUT MUD TO BALANCE MAX OPEN HOLE PORE PSI) 3,248 PSI
MASP = (TD PP * 0.052* TD TVD) - (TD TVD * EQUIV GAS MUD PSI/FT)

WELL HEAD TEST PRESSURE = **2,670 PSI**

WELL HEAD TEST PRESSURE = 50% OF CASING COLLAPSE RATING

CASING TEST PRESSURE (70% OF CASING BURST OR MASP + 500 PSI - LESSER OF)		**3748**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	6502	**9.7**	**TEST MWT**
MASP + 500 PSI	3748		

CASING SLIP WEIGHT = **311,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	365,310 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8519
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	311,211 LBS

Wolfcamp Casing Design

TAPERED STRING (0'-11,800')

*STILL INSIDE SECOND INTERMEDIATE CASING @ RUNNING DEPTH

PRODUCTION CASING 5-1/2"

WEIGHT:	23.0 #/ft	COLLAPSE RATING:	15,990 PSI
GRADE:	P-110	BURST RATING:	14,530 PSI
CONNECTION:	ULTRA QX	JOINT STRENGTH:	729,000 LBS
CSG TOP MD	0 ' MD		
CSG TOP TVD	0 ' TVD	RESERVOIR PORE PRESSURE	12.3 PPG
SHOE MD	11,800 ' MD	MW @ TD	13.0 PPG EMW
SHOE TVD	11,800 ' TVD	FG @ TD	17.3 PPG EMW
BACK-UP GRADIENT	9.7 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
PREVIOUS SHOE MD	12300	ABANDONMENT RESERVOIR PSI	1770.0000 PSI
PREVIOUS SHOE TVD	12212	COMPLETION FLUID DENSITY	8.3300 PPG
PREVIOUS SHOE FRAC	17.3		

COLLAPSE SAFTEY FACTOR = **2.6**

COLLAPSE SAFETY FACTOR = ABANDONMENT RESERVOIR PRESSURE WITH MWT ON BACKSIDE
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - RESERVOIR ABANDON PSI)

TENSION SAFTEY FACTOR = **2.7**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **2.9**

BURST SAFETY FACTOR = BURST RATING / (MASP + (CMP FLUID PPG - BACKUP PPG) * 0.052 * TD TVD)

MAXIMUM ANTICIPATED SURFACE PRESSURE **5,777** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (PERFORATED RESERVIOR WITH GAS TO SURFACE) 5,777 PSI
MASP = (TVD*.052*PORE PSI) - (GAS GRADIENT *TVD)

CASING TEST PRESSURE (70% OF CASING BURST, OR MASP + 500 PSI, PREV LOT + 500)		**6277**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	8146	**13.0**	**TEST MWT**
MASP + 500 PSI	6277		
PREVIOUS SHOE LOT + 500 PSI TO INSURE LAP ISOLATION	3231		

CASING SLIP WEIGHT = **218,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	271,400 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8024
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	217,771 LBS

Wolfcamp Casing Design

TAPERED STRING (11800'-12350' TVD/22620' MD)

PRODUCTION CASING 5-1/2"

WEIGHT:	23.0 #/ft	COLLAPSE RATING:	14,540 PSI
GRADE:	P-110	BURST RATING:	14,530 PSI
CONNECTION:	ULTRA FJ	JOINT STRENGTH:	724,000 LBS
CSG TOP MD	11800 ' MD		
CSG TOP TVD	11800 ' TVD	RESERVOIR PORE PRESSURE	12.3 PPG
SHOE MD	[redacted] ' MD	MW @ TD	13.0 PPG EMW
SHOE TVD	[redacted] ' TVD	FG @ TD	17.3 PPG EMW
BACK-UP GRADIENT	9.7 PPG EMW	GAS GRADIENT:	0.1500 psi/ft
PREVIOUS SHOE MD	12300	ABANDONMENT RESERVOIR PSI	1852.5000 PSI
PREVIOUS SHOE TVD	12212	COMPLETION FLUID DENSITY	8.3300 PPG
PREVIOUS SHOE FRAC	17.3		

COLLAPSE SAFTEY FACTOR = **2.2**

COLLAPSE SAFETY FACTOR = ABANDONMENT RESERVOIR PRESSURE WITH MWT ON BACKSIDE
COLLAPSE SAFETY FACTOR = COLLAPSE RATING / (MW@TD * 0.052 * TVD - RESERVOIR ABANDON PSI)

TENSION SAFTEY FACTOR = **2.9**

TENSION SAFETY FACTOR = CASING JOINT STRENGTH / CASING WEIGHT IN AIR
TENSION SAFETY FACTOR = CASING JOINT STRENGTH / (CASING WEIGHT * MD @TD)

BURST SAFTEY FACTOR = **2.8**

BURST SAFETY FACTOR = BURST RATING / (MASP + (CMP FLUID PPG - BACKUP PPG) * 0.052 * TD TVD)

MAXIMUM ANTICIPATED SURFACE PRESSURE **6,047** PSI

MAXIMUM ANTICIPATED SURFACE PRESSURE (PERFORATED RESERVIOR WITH GAS TO SURFACE) 6,047 PSI
MASP = (TVD*.052*PORE PSI) - (GAS GRADIENT *TVD)

CASING TEST PRESSURE (70% OF CASING BURST, OR MASP + 500 PSI, PREV LOT + 500)		**6547**	**PSI**
70% OF CASING BURST = (0.7* BURST RATING) - ((TEST MWT - BACKUP) * .052*SHOE TVD))	8052	**13.0**	**TEST MWT**
MASP + 500 PSI	6547		
PREVIOUS SHOE LOT + 500 PSI TO INSURE LAP ISOLATION	3231		

CASING SLIP WEIGHT = **200,000 LBS**

STRING WEIGHT IN AIR = CASING WT * MD @ TD =	248,860 LBS
BOUYANCY FACTOR = (PPG STEEL - MW) / PPG STEEL) =	0.8024
BOUYED WEIGHT = STRING WEIGHT * BOUYANCY FACTOR =	199,685 LBS

LILIS ENERGY

Well Description:
PATTERSON 762
Antelope 1H
Latitude: 31.98453
Longitude: -103.25875
TRRC Permit #: 834879

H_2S Contingency Plan

Marsz Safety

(210) 560-6705

Table of Contents

I. EMERGENCY ASSISTANCE TELEPHONE LIST

PUBLIC SAFETY:			**911 or**
Winkler County Sheriff's Department			(432) 586-3461
Fire Department:			
	Kermit, TX		(432) 586-2577
	Wink, TX		(432) 527-3333
EMS:	Kermit EMS		(432) 547-2240
	Wink EMS		(432) 586-2055
Hospitals:	Reeves Co. Hospital (Pecos)		(432)447-3551
	Ward Memorial Hospital (Monahans)		(432) 943-2511
	Winkler Co. Hospital (Kermit)		(432) 586-5864
Texas Dept. of Transportation:	Kermit		(432) 586-3134
	Pecos	Joel Griner	(432) 445-4737
Texas Railroad Commission:	Main Line		(887)228-5740
	24hr. Accident Reporting		(512) 463-6788
OSHA 24 Hr. Reporting			(800) 321-6742

(8 hrs after death or 24 hrs after in-patient, amputation, loss of an eye)

Lilis Energy Offices

- Kermit Office (432) 248-3816
- San Antonio Office (210) 999-5400

Drilling General Manager

	Office	Cell
Patterson UTI Rig Manager		
Bobby Burngardner		(361) 793-8330
Clay Bennett		(601) 467-3117

Lilis Drilling and Completion Superintendent

David A. Jordan — Office (805) 890-4492, Cell (505) 357-8895

Field Superintendent:

Trae Laird — (575) 441-4006
Randy Bridges — (806) 891-4760

Production Operations Manager

George M. Placke — Office (210) 999-5400, Cell (210) 865-1239

Drilling Rig Name:

Patterson 762

Drilling Consultant:

Brent New — (361) 235-9611

Emergency Accommodations

Pecos Lodge (Pecos) — (855) 582-7438
Southern Inn & Suites (Kermit) — (432) 586-2540

Safety Consultants

Marsz Safety — Sean Farnsworth — Cell (210) 560-6705

II. H_2S CONTINGENCY PLAN SECTION

Scope:

This contingency plan provides an organized plan of action for alerting and protecting the public within an area of exposure prior to an intentional release, or following the accidental release of a potentially hazardous volume of hydrogen sulfide. The plan establishes guidelines for all personnel whose work activity may involve exposure to Hydrogen Sulfide Gas (H_2S).

Objective:

Prevent any and all accidents, and prevent the uncontrolled release of H_2S into the atmosphere.
Provide proper evacuation procedures to cope with emergencies.
Provide immediate and adequate medical attention should an injury occur.

Purpose, Distribution and Updating of Contingency Plan:

The Purpose of this contingency plan is to protect the general public from the harmful effects of H_2S accidentally escaping from the subject producing well. This plan is designed to accomplish its purpose by assuring the preparedness necessary to:

1. Minimize the possibility of releasing H_2S into the atmosphere during related operations.
2. Provide for the logical, efficient, and safe emergency actions required to protect the general public in the event of an accidental release of a potentially hazardous quantity of H_2S.

Supplemental information is included with this plan and is intended as reference material for anyone needing a more detailed understanding of the many factors pertinent to H_2S drilling operations safety. The release of a potentially hazardous quantity of H_2S is highly unlikely. If such a release should occur however, obviously the exact time, rate, duration, and other pertinent facts will be known in advance thus, this contingency plan must necessarily be somewhat general. The plan does review in detail, as is reasonably possible, the type of accidental release that could possibly endanger the general public, the probable extent of such danger, and the emergency actions generally appropriate. In the event of such an accidental release, the specific actions to be taken will have to be determined at the time of release by the responsible personnel at the drilling location. Complete familiarity with this plan will help such personnel make the proper decisions rapidly. Familiarity with this plan is so required al all operators, operator representatives, and drilling contractor supervisory personnel who could possibly be on duty at the drilling location at the time of an H2S emergency.

IT IS THE RESPONSIBILITY OF THE OPERATOR TO ASSURE SUCH FAMILIARITY BEFORE DRILLING WITHIN 1000' OR THREE DAYS PRIOR TO PENETRATION OF THE SHALLOWEST FORMATION KNOWN OR SUSPECTED TO CONTAIN H_2S IN POTENTIALLY HAZARDOUS QUANTITIES, AND ALSO TO ASSURE THE TIMELY ACCOMPLISHMENT OF ALL THE OTHER ACTION SPECIFIED HERE IN.

As this contingency plan was prepared considerably in advance of the anticipated H_2S operation, the plan must be kept current if it is to effectively serve its purpose. The operators will be responsible for seeing that all copies are updated. Updating the plan is required when any changes to the personnel Call List (Section) including telephone numbers occur or when any pertinent data or plans for the well are altered. The plan must also be updated when any changes in the general public likely to be within the exposure area in the event of an

accidental release from the well bore of a potentially hazardous quantity of H_2S. Two copies of this plan shall be retained at the office of Anadarko Petroleum Corporation. Two copies shall be retained at the drilling location.

Discussion of Plan:

Suspected Problem Zones:

Implementation: This plan, with all details, is to be fully implemented 1000' before drilling into the first sour zone.

Emergency Response Procedure: This section outlines the conditions and denotes steps to be taken in the event of an emergency.

Emergency Equipment and Procedure: This section outlines the safety and emergency equipment that will be required for the drilling of this well.

Training Provisions: This section outlines the training provisions that must be adhered to 1000' before drilling into the first sour zone.

Emergency call list: Included are the telephone numbers of all persons that would need to be contacted, should an H_2S emergency occur.

Briefing: This section deals with the briefing of all persons involved with the drilling of this well.

Public Safety: Public Safety Personnel will be made aware of the drilling of this well.

Check Lists: Status check lists and procedural check lists have been included to ensure adherence to the plan.

General Information: A general information section has been included to supply support information.

III. OPERATING PROCEDURES

A. Blowout Preventer Drills

Due to the special piping and manifolding necessary to handle poisonous gas, particular care will be taken to insure that all rig personnel are completely familiar with their jobs during the drills. The Drilling Consultant and Tool Pusher (Rig Superintendent) in particular are thoroughly familiar with the additional controls and piping necessary.

B. H_2S Alarm Drills

The Company Man and/ or designee will conduct frequent H_2S alarm drills for each crew by injecting a trace of H_2S where the detector will give an alarm. Under these conditions all personnel on location will put on air equipment and remain masked until all clear is announced.

C. Surface Annular Preventer/ Diverter System Testing

After installation of the surface annular preventer, Hydraulic Control Valve and diverter system, both of these are to be function tested. They also should be function tested frequently while drilling surface hole.

D. Blowout Preventer

After installation of the Blowout Preventer Stack, the stack will be pressure tested. The Choke manifold is also to be pressure tested at this time. This procedure will be repeated as required by the TRRC or if any of the stack is nippled down. Also at this time, the Blind and Pipe Rams are checked for correct operation.

E. Well Control Practice Drills and Safety Meeting for Crew Members

Pit drills are for the purpose of acquainting each member of the drilling crew with his duties in the event of an emergency. Drills will be held with each crew as frequently as required to thoroughly familiarize each man with his duties. Drills are to be held at least weekly from that time forward.

1. BOP Drill while on Bottom Drilling:
    A. Signal will be three or more long blast given by driller on the horn.

    B. Procedure will be as follows:
        1. Tool Pusher: Supervises entire operation.
        2. Driller
            a. Gives signal.
            b. Picks up Kelly.
            c. Stops pumps.
            d. Observes flow.
            e. Signal to close (pipe rams if necessary).
            f. Check that Choke Manifold is closed.
            g. Record drill pipe pressure, casing pressure and determine mud volume gain.
        3. Motorman
            a. Go to closing unit and standby for signal to close BOP.
            b. Close BOP in signal.
            c. Check on BOP closing.

d. Go to floor to assist driller. (NOTE: During test drills the BOP need not be completely closed at the discretion of the supervisor. Supervisor should make it very clear that it is a test drill only!)

4. Derrickman
   a. Check pumps.
   b. Go to floor for directions from the driller.
5. Floorman
   a. Go to manifold.
   b. Observe and record pressure.
   c. Check manifold and BOP for leaks.
   d. Check with driller for additional instructions.

2. BOP Drill While Making Trip:
   A. During trip driller will fill hole every five (5) stands and check the pits to be sure hole is taking mud.
   B. Drill Procedure is as follows:
      1. Driller
         a. Order Safety valve installed.
         b. Alert those not on the floor.
         c. Go to stations as described in above drill.

3. Safety Meetings
   A. Every person involved in the operating will be informed of the characteristics of H_2S, its danger and safety procedures to be used when it is encountered, and recommended first-aid procedure for regular rig personnel. This will be done through a series of talks made before spud.

   B. The Safety Advisor or Drilling Supervisor will conduct these training sessions and will repeat them as deemed necessary by him. Talks may include the following subjects:
      1. Dangers of Hydrogen Sulfide (H_2S).
      2. Use and limitations of air equipment.
      3. Use of resuscitator.
      4. Organize Buddy System.
      5. First Aid procedures.
      6. Use of H_2S detection devices.
      7. Designate responsible people.
      8. Explain rig layout and policy to visitors.
         a. Designate smoking and safety or Muster area.
         b. Emphasize the importance of wind directions.
      9. Describe and explain operation of BOP stack, manifold, separator, and pit piping. Include maximum allowable pressure for casing procedure.
      10. Explain functions of Safety Supervisor.
      11. Explain organize H_2S Drills.
      12. Explain the overall emergency plan with emphasis given to the evacuation phase of the plans.

- Note: The above talks will be attended by every person involved in the operation. When drilling has reached a depth where H_2S is anticipated, temporary service personnel and visitors will be directed to the Drilling Consultant, who will designate the air equipment to be used by them in case of emergency, acquaint them with the dangers involved and be sure of their safety while they are in the area. He will point out the Briefing Areas, Wind Socks, and Smoking Areas. He may refuse entrance to anyone, who in his opinion should not be admitted because of lack of safety equipment, special operations in progress or for other reasons involving personnel safety.

F. Outside Service Personnel

All service people such as cementing crews, logging crews, specialist, mechanics, and welders will furnish their own safety equipment. The Company Man/ or designee will be sure that the number of people on location does not exceed the number of masks on location, and they have been briefed in regard to safety procedures. He will also be sure each of these people know about smoking and "Briefing Areas", and know what to do in case of an emergency alert or drill. Visitors will be restricted, except with special permission from the Drilling Consultant, when H_2S might be encountered. They will be briefed as to what to do in case of an alert or drill.

G. Onsite/ off shift workers

All workers that are staying on site must be identified as to where they are staying while off tour. If a drill/ or emergency takes place related to an H2S release, each crew must have a designated person(s) that will wake them up and ensure that they are cleared to the appropriate muster area immediately.

H. Simultaneous Operations (SIMOPS)

If work is going on adjacent to the location is the responsibility of the Drilling Consultant or designee to communicate any applicable risks that may affect personnel working on that adjacent location. In the case of an H2S drill or event, there should be a designated crew member that is responsible for making contact with personnel on adjacent locations. This could include just communication on potential events or in case of an event, notification to evacuate location. Drilling Consultant or designee are the Point of Contact and are in charge of all activities at such point of an H2S event occurrence.

I. Area Residences/ Occupied Locations/ Public Roads

Any occupied residences/ businesses that are within a reasonable perimeter of the location (attached map will identify a 3000' radius around location) should be identified as part of this contingency and a reasonable effort will be made to gain contact information for them. As part of the briefing of the contingency plan, the team reviewing should identify where these potential receptors are and make a plan on who will contact them in case of a release that may impact that area.

J. Drilling Fluids

Drilling Fluid Monitoring – On Any Hazardous H_2S gas well, the earlier the warning of danger the better chance to control operations. Mud Company will be in daily contact with Anadarko Petroleum Corporation Consultant. The Mud Engineer will take samples of the mud, analyze these samples, and make necessary recommendations to prevent H_2S gas from the formation, the pH will be increased as necessary for corrosion control.

pH Control – For normal drilling, pH of 10.5 – 11.5. Would be sufficient for corrosion protection. If there is an influx of H_2S gas from the formation, the pH will be increased as necessary for corrosion control.

H_2S Scavengers – If necessary H_2S scavengers will be added to the drilling mud.

IV. OPERATING CONDITIONS

A. Posting Well Condition Flags

Post the green, yellow or red well condition flag, as appropriate, on the well condition sign at the location entrance, and take necessary precautions as indicated below:

1. **Green Flag**: Potential Danger- When Drilling in known H_2S zones or when H_2S has been detected in the drilling fluid atmosphere. Protective breathing equipment shall be inspected, and all personnel on duty shall be alerted to be ready to use this equipment.
2. **Yellow Flag**: Potential Danger- When the threshold limit value of H_2S (10 PPM) or of SO_2 (5 PPM) is reached. If the concentration of H_2S or SO_2 reaches 10 PPM, protective breathing equipment shall be worn by all working personnel, and non-working personnel shall go to the upwind Safe Briefing Area.
3. **Red Flag**: Extreme danger*- When the ambient concentration of H_2S or SO_2 is reasonably believed or determined to have exceeded the potentially hazardous level. All non-essential personnel shall leave the drilling location taking the route most likely to exposure to escapinggas.

B. Requiring Air Masks Conditions

1. Whenever air masks are used, the person must be clean shaven as shown in the APC Guidelines
2. When breaking out any line where H_2S can reasonably be expected.
3. When sampling air in areas to determine if toxic concentrations of H_2S exist.
4. When working in areas where 10 PPM or more of H_2S has been detected.
5. At any time there is doubt as to the H_2S level in the area to be entered.

C. Kick Procedure

1. It is very important that the driller be continuously alert, especially when approaching a gas formation.
2. Should gas come into the well bore, it is very important to be aware of a kick at the earliest time.
3. If a kick is identified, follow appropriate diverter or shut in procedures according to the situation that is presented utilizing appropriate kick procedures.

V. EMERGENCY PROCEDURES

I. In the event of any evidence of H_2S level above 10ppm, take the following steps immediately:
   a. Secure breathing apparatus.
   b. Order non-essential personnel out of the danger zone.
   c. Take steps to determine if the H_2S level can be corrected or suppressed, and if so, proceed with normal operations.

II. If uncontrollable conditions occur, proceed with the following:
   a. Take steps to protect and/or remove any public downwind of the rig, including partial evacuation or isolation. Notify necessary public safety personnel.
   b. Remove all personnel to the Safe Briefing Area.
   c. Notify public safety personnel for help with maintaining roadblocks, thus limiting traffic and implementing evacuation.
   d. Determine and proceed with the best possible plan to regain control of the well. Maintain tight security and safety measures.

III. Responsibility
   a. The Company Approved Supervisor shall be responsible for the total implementation of the plan.
   b. The Company Approved Supervisor shall be in complete command during any emergency.
   c. The Company Approved Supervisor shall designate a backup Supervisor in the event that he/she is not available.

IV. Actions to be taken

   a. Assign specific tasks to drilling location personnel
   b. Evacuate the general public from the exposure area
   c. Cordon off the exposure area to prevent entry by unauthorized persons
   d. Request assistance if and as needed and initiate emergency notifications
   e. Stop the dispersion of H_2S
   f. Complete emergency notifications as required
   g. Return the situation to normal

EMERGENCY PROCEDURE IMPLEMENTATION

I. Drilling or Tripping

a. *All Personnel*

i. When alarm sounds, don escape unit and report to upwind Safe Briefing Area.
ii. Check status of other personnel (buddy system).
iii. Secure breathing apparatus.
iv. Wait for orders from supervisor.

b. *Drilling Foreman*

i. Report to the upwind Safe Briefing Area.
ii. Don Breathing Apparatus and return to the point of release with the Tool Pusher or Driller (buddy system).
iii. Determine the concentration of H_2S.
iv. Assess the situation and take appropriate control measures.

c. *Tool Pusher*

i. Report to the upwind Safe Briefing Area.
ii. Don Breathing Apparatus and return to the point of release with the Drilling Foreman or the Driller (buddy system).
iii. Determine the concentration of H_2S.
iv. Assess the situation and take appropriate control measures.

d. *Driller*

i. Check the status of other personnel (in a rescue attempt, always use the buddy system).
ii. Assign the least essential person to notify the Drilling Consultant and Tool Pusher, in the event of their absence.
iii. Assume the responsibility of the Drilling Consultant and the Tool Pusher until they arrive, in the event of their absence.

e. *Derrick Man and Floor Hands*

i. Remain in the upwind Safe Briefing Area until otherwise instructed by a supervisor.

f. *Mud Engineer*

i. Report to the upwind Safe Briefing Area.
ii. When instructed, begin check of mud for pH level and H_2S level.

g. *Safety Personnel*

i. Don Breathing Apparatus.
ii. Check status of personnel.
iii. Wait for instructions from Drilling Consultant or Tool Pusher.

II. Taking a Kick

a. All Personnel report to the upwind Safe Briefing Area.
b. Follow standard BOP/ diverter procedures.

III. Open Hole Logging

a. All unnecessary personnel should leave the rig floor.
b. Drilling Consultant and Safety Personnel should monitor the conditions and make necessary safety equipment recommendations.

IV. Running Casing or Plugging

a. Follow "Drilling or Tripping" procedures.
b. Assure that all personnel have access to protective equipment.

VI. POST EMERGENCY ACTIONS

In the event this plan is activated, the following post emergency actions shall be taken in an effort to reduce the possibility of a reoccurrence of the type of problem that required its activation, and/or assure that any future activation of a similar plan will be as effective as possible.

A. Review the factors that caused or permitted the emergency occur, and if the need is indicated, modify operating, maintenance and/or surveillance procedures.
B. If the need is indicated, retrain employees in blowout prevention, H_2S emergency procedures and etc.
C. Clean up, recharge, restock, repair, and/ or replace H_2S emergency equipment as necessary, and return it to its proper place. (For whatever rental equipment is used, this will be the responsibility of Rental Company).
D. See that future H_2S drilling contingency plans are modified accordingly, if the need is indicated.

VII. IGNITION PROCEDURES

Responsibilities:

The decision to ignite the well is the responsibility of the DRILLING Consultant in concurrence with the STATE POLICE. In the event the Drilling Consultant is incapacitated, it becomes the responsibility of the RIG TOOL PUSHER. This decision should be made only as a last resort and in a situation where it is clear that:

1. Human life and property are endangered.
2. There is no hope of controlling the blowout under the prevailing conditions.

If time permits, notify the main office, but do not delay if human life is in danger. Initiate the first phase of the evacuation plan.

Instructions for Igniting the Well:

1. Two people are required for the actual igniting operation. Both men must wear self-contained breathing apparatus and must use a full body harness and attach a retrievable safety line to the D-Ring in the back. One man must monitor the atmosphere for explosive gases with the LEL monitor, while the Drilling Consultant is responsible for igniting the well.
2. The primary method to ignite is a 25mm flare gun with a range of approximately 500 feet.
3. Ignite from upwind and do not approach any closer than is warranted.
4. Select the ignition site best suited for protection and which offers an easy escape route.
5. Before igniting, check for the presence of combustible gases.
6. After igniting, continue emergency actions and procedures as before.
7. All unassigned personnel will limit their actions to those directed by the Drilling Consultant.

Note: After the well is ignited, burning Hydrogen Sulfide will convert to Sulfur Dioxide, which is also highly toxic. Also both are heavier than air. Do not assume the area is safe even after the well is ignited.

VII. TRAINING ROGRAM

When working in an area where Hydrogen Sulfide (H_2S) might be encountered, definite training requirements must be carried out. The Company Supervisor will ensure that all personnel, at the well site, have had adequate training in the following:

1. Hazards and characteristics of Hydrogen Sulfide (H_2S).
2. Physicals effects of Hydrogen Sulfide on the human body.
3. Toxicity of Hydrogen Sulfide and Sulfur Dioxide.
4. H_2S detection, Emergency alarm and sensor location.
5. Don and Doff of SCBA and be clean shaven.
6. Emergency rescue.
7. Resuscitators.
8. First aid and artificial resuscitation.
9. The effects of Hydrogen Sulfide on metals.
10. Location safety.

Service company personnel and visiting personnel must be notified if the zone contains H_2S, and each service company must provide adequate training and equipment for their employees before they arrive at the well site.

IX. EMERGENCY EQUIPMENT

Lease Entrance Sign:

Should be located at the lease entrance with the following information:

CAUTION – POTENTIAL POISON GAS
HYDROGEN SULFIDE
NO ADMITTANCE WITHOUT AUTHORIZATION

Respiratory Equipment:

- Fresh air breathing equipment should be placed at the safe briefing areas and should include the following:

- Two SCBA's at each briefing area.

- Enough airline units to operate safely, anytime the H_2S concentration reaches the IDLH level (100ppm).

- Cascade system with enough breathing air hose and manifolds to reach the rig floor, the derrickman and the other operation areas.

Windsocks or Wind Streamers:

- A minimum of two 10" windsocks located at strategic locations so that they may be seen from any point on location.

- Wind streamers (if preferred) should be placed at various locations on the well site to ensure wind consciousness at all times. (Corners of location).

Hydrogen Sulfide Detector and Alarms:

- 1 - Four channel H_2S monitor with alarms.

- Three (3) sensors located as follows: #1 – Rig Floor, #2 – Shale Shaker, #3 –Cellar.

- Gastec or Draeger pump with tubes.

- Sensor test gas.

Well Condition Sign and Flags:

The Well Condition Sign w/flags should be placed a minimum of 150' before you enter the location. It should have three (3) color coded flags (green, yellow and red) that will be used to denote the following location conditions:

GREEN – Normal Operating Conditions
YELLOW – Potential Danger
RED – Danger, H_2S Gas Present

Auxiliary Rescue Equipment:

- Stretcher
- 2 – 100' Rescue lines.
- First Aid kit properly stocked.

Mud Inspection Equipment:

Garret Gas Train or Hach Tester for inspection of Hydrogen Sulfide in the drilling mud system.

Fire Extinguishers:

Adequate fire extinguishers shall be located at strategic locations.

Blowout Preventer:

- The well shall have hydraulic BOP equipment for the anticipated bottom hole pressure (BHP).
- The BOP should be tested upon installation.
- BOP, Choke Line and Kill Line will be tested as specified by Operator.

Confined Space Monitor:

There should be a portable multi-gas monitor with at least 3 sensors (O_2, LEL H_2S), preferably 4 (O_2, LEL, H_2S, CO). This instrument should be used to test the atmosphere of any confined space before entering. It should also be used for atmospheric testing for LEL gas before beginning any type of Hot Work. Proper calibration documentation will need to be provided.

Communication Equipment:

- Proper communication equipment such as cell phones or 2-way radios should be available at the rig.

- Radio communication shall be available for communication between the company man's trailer, rig floor and the tool pusher's trailer.

- Communication equipment shall be available on the vehicles.

Special Control Equipment:

- Hydraulic BOP equipment with remote control on the ground.

- Rotating head at the surface casing point.

Evacuation Plan:

- Evacuation routes should be established prior to spudding the well.

- Should be discussed with all rig personnel.

Designated Areas:

Parking and Visitor area:

- All vehicles are to be parked at a pre-determined safe distance from the wellhead.

- Designated smoking area.

Safe Briefing Areas:

- Two Safe Briefing Areas shall be designated on either side of the location at the maximum allowable distance from the well bore so they offset prevailing winds or they are at a 180 degree angle if wind directions tend to shift in the area.

- Personal protective equipment should be stored at both briefing areas or if a moveable cascade trailer is used, it should be kept upwind of existing winds. When wind is from the prevailing direction, both briefing areas should be accessible.

Note:

- Additional equipment will be available at the H2S Provider Safety office.

- Additional personal H_2S monitors are available for all employees on location.

- Automatic Flare Igniters are recommended for installation on the rig.

X. PROCEDURAL CHECKLIST

Perform the following on each tour:

1. Check fire extinguishers to see that they have the proper charge.
2. Check breathing equipment to ensure that they have not been tampered with.
3. Check pressure on the supply air bottles to make sure they are capable of recharging.
4. Make sure all of the Hydrogen Sulfide detection systems are operative.
5. Ensure that all BOP/ Surface Annular/ Diverter systems are functioning and operational.

Perform the following each week:

1. Check each piece of breathing equipment to make sure that they are fully charged and operational. This requires that the air cylinder be opened and the mask assembly be put on and tested to make sure that the regulators and masks are properly working. Negative and Positive pressure should be conducted on all masks.
2. BOP skills.
3. Check supply pressure on BOP accumulator stand-by source.
4. Check all breathing air mask assemblies to see that straps are loosened and turned back, ready for use.
5. Check pressure on cascade air cylinders to make sure they are fully charged and ready to use for refill purposes if necessary.
6. Check all cascade system regulators to make sure they work properly.
7. Perform breathing drills with on-site personnel.
8. Check the following supplies for availability (may be with H2S Techs On-call):
    - Stretcher
    - Safety Belts and Ropes
    - Spare air Bottles
    - Spare Oxygen Bottles (if resuscitator required)
    - Gas Detector Pump and Tubes
    - Emergency telephone lists
    - Test the Confined Space Monitor to verify the batteries are good.

XI. BRIEFING PROCEDURES

The following scheduled briefings will be held to ensure the effective drilling and operation of this project:

Pre-Spud Meeting

Date: Prior to spudding the well.

Attendance:
- Drilling Supervisor
- Drilling Engineer
- Drilling Consultant
- Rig Tool Pushers
- Rig Drillers
- Mud Engineer
- All Safety Personnel
- Key Service Company Personnel

Purpose: Review and discuss the well program, step-by-step, to insure complete understanding of assignments and responsibilities.

XII. EVACUATION PLAN

General Plan

The direct lines of action prepared by Anadarko Petroleum Corporation to protect the public from hazardous gas situations are as follows:

1. When the company approved supervisor (Drilling Consultant, Tool Pusher or Driller) determine that Hydrogen Sulfide gas cannot be limited to the well location, and the public will be involved, he will activate the evacuation plan. Escape routes are noted on the area map.

2. Company safety personnel or designee will notify the appropriate local government agency that a hazardous condition exists and evacuation needs to be implemented.

3. Company approved safety personnel that have been trained in the use of the proper emergency equipment will be utilized.

4. Law enforcement personnel (State Police, Local Police Department, Fire Department, and the Sheriff's Department) will be called to aid in setting up and maintaining road blocks. Also, they will aid in evacuation of the public if necessary.

NOTE: Law enforcement personnel will not be asked to come into a contaminated area. Their assistance will be limited to uncontaminated areas. Constant radio contact will be maintained with them.

5. After the discharge of gas has been controlled, "Company" personnel will determine when the area is safe for re-entry.

6. If a major release is secured, all exposed housing, vehicles, rig buildings, and low lying areas and other structures downwind must be tested and clear with SCBAs donned to ensure that all residual H2S is cleared. Fans, or opening of doors is recommended to ensure that areas are cleared out as part of this process.

XIII. PERMITS AND PLATS

RAILROAD COMMISSION OF TEXAS
OIL & GAS DIVISION

PERMIT TO DRILL, DEEPEN, PLUG BACK, OR RE-ENTER ON A REGULAR OR ADMINISTRATIVE EXCEPTION LOCATION

PERMIT NUMBER	DATE PERMIT ISSUED OR AMENDED	DISTRICT
834879	Jan 12, 2018	* 08
API NUMBER	FORM W-1 RECEIVED	COUNTY
42-495-34034	Jan 05, 2018	WINKLER
TYPE OF OPERATION	WELLBORE PROFILE(S)	ACRES
NEW DRILL	Horizontal	713

OPERATOR 423519
IMPETRO OPERATING LLC
300 E SONTERRA BLVD SUITE 1220
SAN ANTONIO, TX 78258-0000

NOTICE
This permit and any allowable assigned may be revoked if payment for fee(s) submitted to the Commission is not honored.
District Office Telephone No:
(432) 684-5581

LEASE NAME	WELL NUMBER
ANTELOPE	1H
LOCATION	TOTAL DEPTH
13 miles NW direction from KERMIT	11200

Section, Block and/or Survey
SECTION 13 BLOCK C23 ABSTRACT 1386
SURVEY PSL / COWDEN, C C

DISTANCE TO SURVEY LINES	DISTANCE TO NEAREST LEASE LINE
250 ft. S 1267 ft. W	200 ft.
DISTANCE TO LEASE LINES	DISTANCE TO NEAREST WELL ON LEASE
250 ft. S 1267 ft. W	See FIELD(s) Below

FIELD(s) and LIMITATIONS:
* SEE FIELD DISTRICT FOR REPORTING PURPOSES *

FIELD NAME / LEASE NAME	ACRES / NEAREST LEASE	DEPTH	WELL # / NEAREST WE	DIST
SANDBAR (BONE SPRING)	713.00	11,200	1H	08
ANTELOPE	200		0	

WELLBORE PROFILE(s) FOR FIELD: Horizontal

RESTRICTIONS: Permitted for oil only.
Lateral: TH1
Penetration Point Location
Lease Lines: 250.0 F S L
1267.0 F W L
Terminus Location
RR County: WINKLER
Section: 13 Block: C23 Abstract: 1386
Survey: PSL
Lease Lines: 200.0 F N L
990.0 F W L
Survey Lines: 200.0 F N L
990.0 F W L

PHANTOM (WOLFCAMP)	713.00	11,200	1H	08
ANTELOPE	200		0	

WELLBORE PROFILE(s) FOR FIELD: Horizontal

RESTRICTIONS: Permitted for oil only.
This is a hydrogen sulfide field. Hydrogen Sulfide Fields with perforations may be

RAILROAD COMMISSION OF TEXAS
OIL & GAS DIVISION

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PERMIT NUMBER	DATE PERMIT ISSUED OR AMENDED	DISTRICT
834879	Jan 12, 2018	* 08
API NUMBER 42-495-34034	FORM W-1 RECEIVED Jan 05, 2018	COUNTY WINKLER
TYPE OF OPERATION NEW DRILL	WELLBORE PROFILE(S) Horizontal	ACRES 713

OPERATOR 423519

IMPETRO OPERATING LLC

300 E SONTERRA BLVD SUITE 1220
SAN ANTONIO, TX 78258-0000

NOTICE
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District Office Telephone No:
(432) 684-5581

LEASE NAME	WELL NUMBER
ANTELOPE	1H
LOCATION 13 miles NW direction from KERMIT	TOTAL DEPTH 11200

Section, Block and/or Survey

SECTION 13 BLOCK C23 ABSTRACT 1386

SURVEY PSL / COWDEN, C C

DISTANCE TO SURVEY LINES	DISTANCE TO NEAREST LEASE LINE
250 ft. S 1267 ft. W	200 ft.
DISTANCE TO LEASE LINES 250 ft. S 1267 ft. W	DISTANCE TO NEAREST WELL ON LEASE See FIELD(s) Below

FIELD(s) and LIMITATIONS:

* SEE FIELD DISTRICT FOR REPORTING PURPOSES *

FIELD NAME LEASE NAME	ACRES NEAREST LEASE	DEPTH	WELL # NEAREST WE	DIST

isolated and tested per State Wide Rule 36 and a Form H-9 filed with the district office. Fields with SWR 10 authority to downhole commingle must be isolated and tested individually prior to commingling production.

Lateral: TH1
Penetration Point Location
Lease Lines: 250.0 F S L
1267.0 F W L
Terminus Location
Lease Lines: 200.0 F N L
990.0 F W L
Survey Lines: 200.0 F N L
990.0 F W L

THE FOLLOWING RESTRICTIONS APPLY TO ALL FIELDS

This well shall be completed and produced in compliance with applicable special field or statewide spacing and density rules. If this well is to be used for brine mining, underground storage of liquid hydrocarbons in salt formations, or underground storage of gas in salt formations, a permit for that specific purpose must be obtained from Environmental Services prior to construction, including drilling, of the well in accordance with Statewide Rules 81, 95, and 97.

This well must comply to the new SWR 3.13 requirements concerning the isolation of any potential flow zones and zones with corrosive formation fluids. See approved permit for those formations that have been identified for the county in which you are drilling the well in.

RAILROAD COMMISSION OF TEXAS
OIL & GAS DIVISION

PERMIT TO DRILL, DEEPEN, PLUG BACK, OR RE-ENTER ON A REGULAR OR ADMINISTRATIVE EXCEPTION LOCATION

PERMIT NUMBER	DATE PERMIT ISSUED OR AMENDED	DISTRICT
834879	Jan 12, 2018	* 08
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42-495-34034	Jan 05, 2018	WINKLER
TYPE OF OPERATION	WELLBORE PROFILE(S)	ACRES
NEW DRILL	Horizontal	713

OPERATOR 423519

IMPETRO OPERATING LLC

300 E SONTERRA BLVD SUITE 1220
SAN ANTONIO, TX 78258-0000

NOTICE
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District Office Telephone No:
(432) 684-5581

LEASE NAME	WELL NUMBER
ANTELOPE	1H
LOCATION	TOTAL DEPTH
13 miles NW direction from KERMIT	11200

Section, Block and/or Survey

SECTION 13 BLOCK C23 ABSTRACT 1386

SURVEY PSL / COWDEN, C C

DISTANCE TO SURVEY LINES	DISTANCE TO NEAREST LEASE LINE
250 ft. S 1267 ft. W	200 ft.
DISTANCE TO LEASE LINES	DISTANCE TO NEAREST WELL ON LEASE
250 ft. S 1267 ft. W	See FIELD(s) Below

FIELD(s) and LIMITATIONS:

* SEE FIELD DISTRICT FOR REPORTING PURPOSES *

FIELD NAME / LEASE NAME	ACRES / NEAREST LEASE	DEPTH	WELL # / NEAREST WE	DIST

The designated interval for one or more of the fields approved in this permit appears to overlap with the designated interval of another field or fields in this district. In the case of conflicting designated intervals you will be required to be consistent in field designation on this lease. Further, if the designated interval overlap of wells on this lease results in an actual or potential double assignment of reservoir and the applicant cannot conclusively demonstrate that there is no double assignment, the permitted well may not be assigned an allowable until the conflict is resolved. Because of the overlapping designated intervals in this area, issuance of this permit does not guarantee that the completion of the well will be approved or that the well will receive an allowable in any given field, even if that field is listed on the approved permit application.

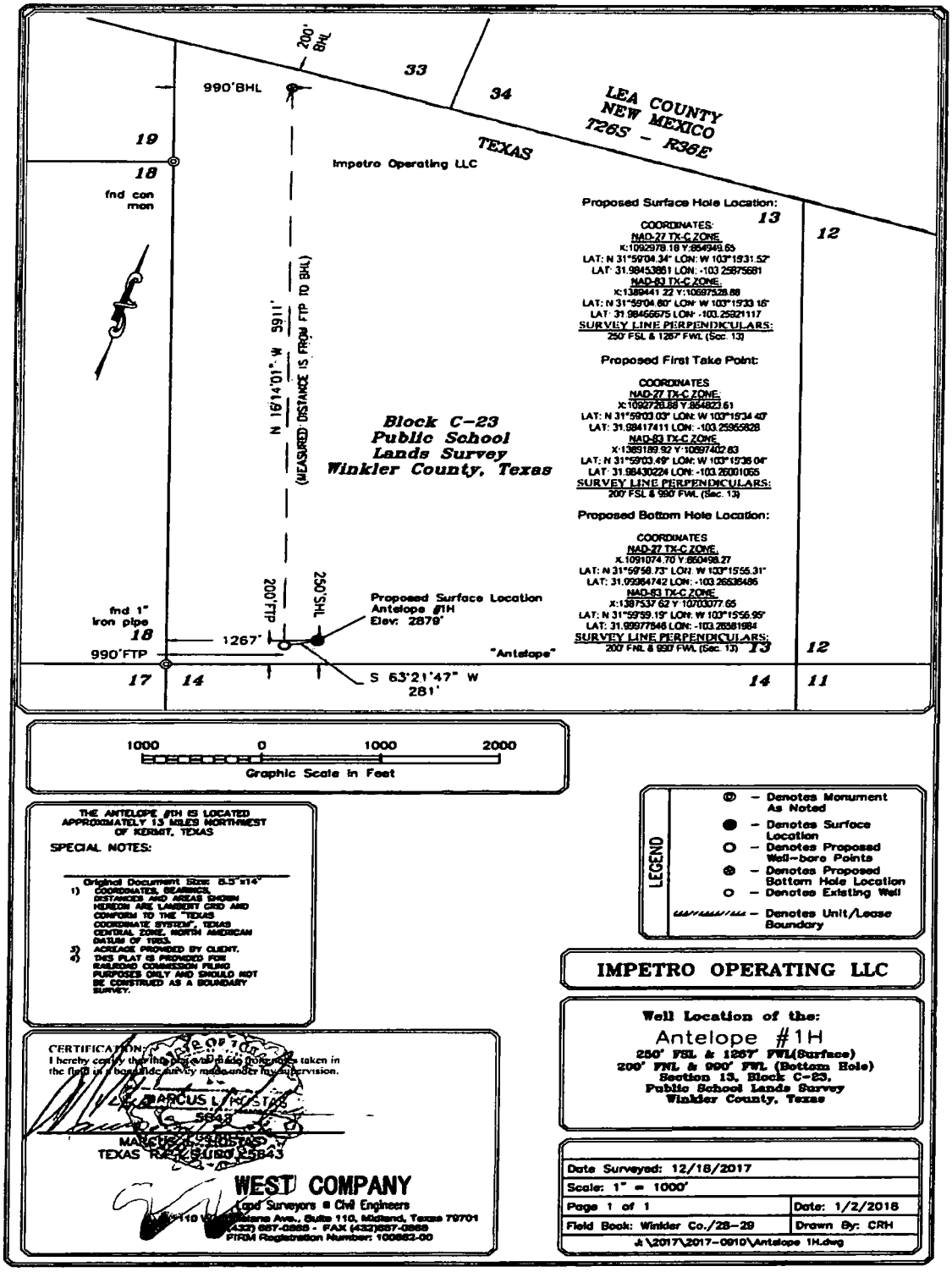
RAILROAD COMMISSION OF TEXAS
OIL & GAS DIVISION

SWR #13 Formation Data

WINKLER (495) County

Formation	Shallow Top	Deep Top	Remarks	Geological Order	Effective Date
RUSTLER	725	725	possible flow; possible usable quality water	1	12/17/2013
COLBY-QUEEN	2,900	3,200		2	12/17/2013
YATES	2,280	3,200		3	12/17/2013
QUEEN-SEVEN RIVERS	2,700	3,400		4	12/17/2013
SAN ANDRES	3,600	4,400	high flows, H2S, corrosive	5	12/17/2013
HOLT	4,500	4,800		6	12/17/2013
DELAWARE	4,300	5,000		7	12/17/2013
GLORIETA	4,900	5,600		8	12/17/2013
CLEARFORK	4,750	6,200		9	12/17/2013
WICHITA ALBANY	6,600	6,850		10	12/17/2013
BRUSHY CANYON	7,300	7,300		11	12/17/2013
CHERRY CANYON	6,000	7,800		12	12/17/2013
CANYON	8,400	8,400		13	12/17/2013
BONE SPRINGS	9,000	9,800		14	12/17/2013
MONTOYA	10,300	10,300		15	12/17/2013
WADDELL	11,000	11,000		16	12/17/2013
WOLFCAMP	7,600	12,400		17	12/17/2013
ATOKA	12,900	12,900		18	12/17/2013
STRAWN	8,100	14,800		19	12/17/2013
PENNSYLVANIAN	8,000	15,500		20	12/17/2013
MISSISSIPPIAN	10,200	17,300		21	12/17/2013
DEVONIAN	7,900	17,800		22	12/17/2013
SILURIAN	8,500	18,000		23	12/17/2013
FUSSELMAN	9,700	18,800		24	12/17/2013
ELLENBURGER	9,500	21,400		25	12/17/2013

The above list may not be all inclusive, and may also include formations that do not intersect all wellbores. Formation "TOP" information listed reflects an estimated range based on geologic variances across the county. To clarify, the "Deep Top" is not the bottom of the formation; it is the deepest depth at which the "TOP" of the formation has been or might be encountered. This is a dynamic list subject to updates and revisions. It is the operator's responsibility to make sure that at the time of spudding the well the most current list is being referenced. Refer to the RRC website at the following address for the most recent information.
http://www.rrc.texas.gov/oil-gas/compliance-enforcement/rule-13-geologic-formation-info



THE ANTELOPE #1H IS LOCATED APPROXIMATELY 13 MILES NORTHWEST OF KERMIT, TEXAS

SPECIAL NOTES:

Original Document Size: 8.5"x14"

1) COORDINATES, BEARINGS, DISTANCES AND AREAS SHOWN HEREON ARE LAMBERT GRID AND CONFORM TO THE "TEXAS COORDINATE SYSTEM", TEXAS CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.

2) ACREAGE PROVIDED BY CLIENT.

3) THIS PLAT IS PROVIDED FOR RAILROAD COMMISSION FILING PURPOSES ONLY AND SHOULD NOT BE CONSTRUED AS A BOUNDARY SURVEY.

LEGEND

- ⊙ – Denotes Monument As Noted
- ● – Denotes Surface Location
- ○ – Denotes Proposed Well-bore Points
- ⊛ – Denotes Proposed Bottom Hole Location
- ○ – Denotes Existing Well
- – Denotes Unit/Lease Boundary

IMPETRO OPERATING LLC

Well Location of the:

Antelope #1H

250' FSL & 1267' FWL(Surface)
200' FNL & 990' FWL (Bottom Hole)
Section 13, Block C-23,
Public School Lands Survey
Winkler County, Texas

CERTIFICATION:

I hereby certify that this plat and the information taken in the field is a bona fide survey made under my supervision.

STATE OF TEXAS
MARCUS L. HOSTAS
5843
MARCUS L. HOSTAS
TEXAS REG. NO. 5843

WEST COMPANY
Land Surveyors ■ Civil Engineers
[illegible] Wall Plaza Suite 110, Midland, Texas 79701
(432) 687-0865 - FAX (432)687-0868
PTRM Registration Number: 100662-00

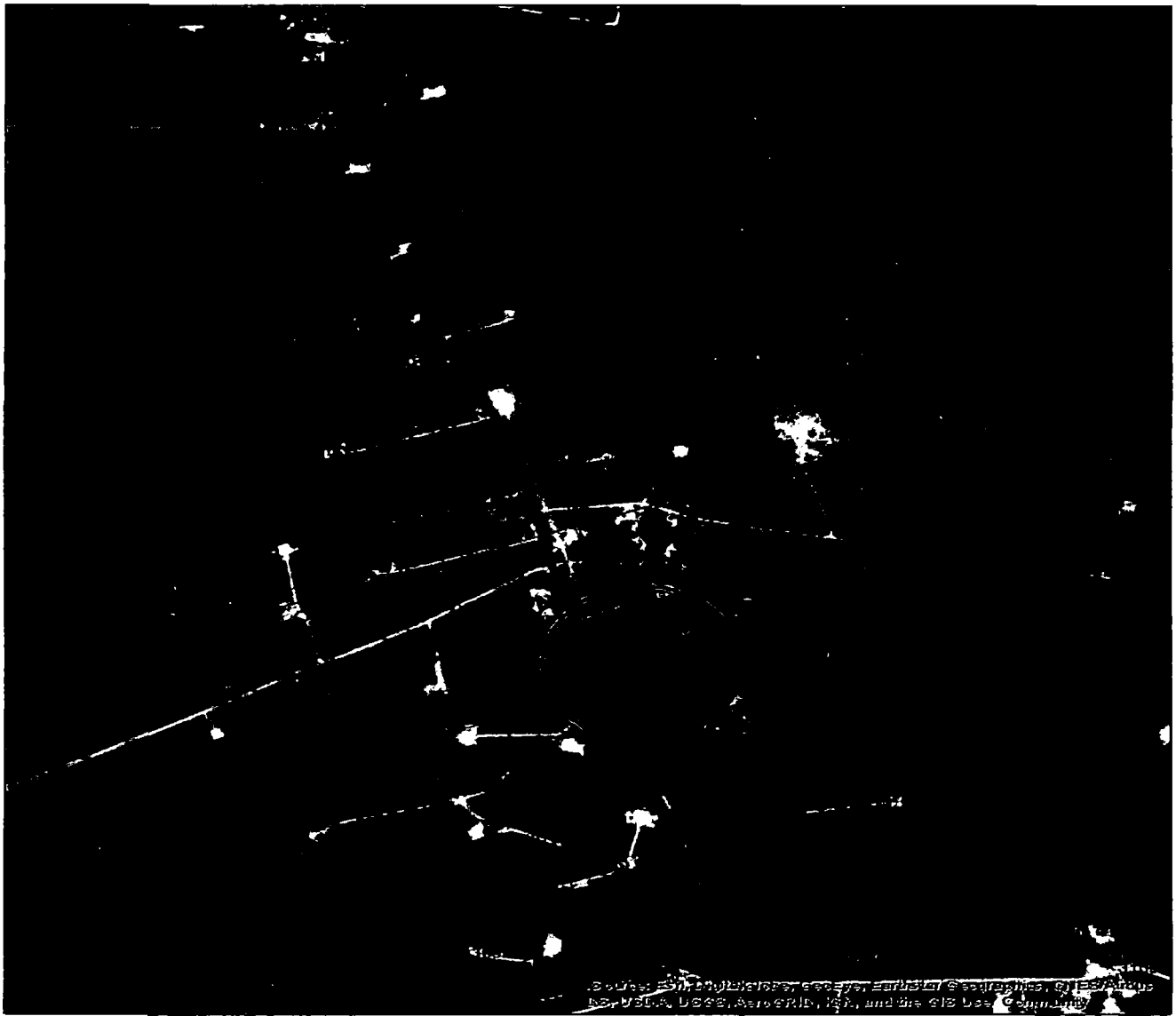
Date Surveyed: 12/18/2017	
Scale: 1" = 1000'	
Page 1 of 1	Date: 1/2/2018
Field Book: Winkler Co./28-29	Drawn By: CRH
J:\2017\2017-0010\Antelope 1H.dwg	

XIV. DIRECTIONS / 3,000' RADIUS MAP

Antelope 1H **(N31.98453/W-103.25875)**

Winkler Co.

Directions: From the intersection of State Hwy 302 and CR 101 go north 12.5 miles . Well is located 417' off to the east side of CR 101.



XV. APPENDICES AND GENERAL INFORMATION

Radius of Exposure
Affected Notification List

(within a 65' radius of exposure @100ppm)

The geologic zones that will be encountered during drilling are known to contain hazardous quantities of H2S. The accompanying map illustrates the affected areas of the community. The residents within this radius will be notified via a hand delivered written notice describing the activities, potential hazards, conditions of evacuation, evacuation drill siren alarms and other precautionary measures.

Evacuee Description:
Residents:

Notification Process:

A continuous siren audible to all residence will be activated, signaling evacuation of previously notified and informed residents.

Evacuation Plan:

All evacuees will migrate lateral to the wind direction.

The Operating Company will identify all home bound or highly susceptible individuals and make special evacuation preparations, interfacing with the local and emergency medical service as necessary.

Toxic Effects of H_2S Poisoning

Hydrogen Sulfide is extremely toxic. The acceptable ceiling concentration for eight-hour exposure is 10 PPM, which is .001% by volume. Hydrogen Sulfide is heavier than air (specific gravity – 1.192) and is colorless and transparent. Hydrogen Sulfide is almost as toxic as Hydrogen Cyanide and is 5-6 times more toxic than Carbon Monoxide. Occupational exposure limits for Hydrogen Sulfide and other gases are compared below in Table 1. Toxicity table for H_2S and physical effects are shown in Table 2.

Table 1
Permissible Exposure Limits of Various Gases

Common Name	Symbol	Sp. Gravity	TLV	STEL	IDLH
Hydrogen Cyanide	HCN	.94	4.7 ppm	4.7 ppm	50 ppm
Hydrogen Sulfide	H_2S	1.192	10 ppm	15 ppm	100 ppm

Sulfide Dioxide	SO_2	2.21	2 ppm	5 ppm	100 ppm
Chlorine	CL	2.45	.5 ppm	1 ppm	10 ppm
Carbon Monoxide	CO	.97	25 ppm	200 ppm	1200 ppm
Carbon Dioxide	CO_2	1.52	5000 ppm	30,000 ppm	40,000 ppm
Methane	CH_4	.55	5% LEL	15% UEL	

Definitions

A. TLV – Threshold Limit Value is the concentration employees may be exposed based on a TWA (time weighted average) for eight (8) hours in one day for 40 hours in one (1) week. This is set by ACGIH (American Conference of Governmental Hygienists) and regulated by OSHA.

B. STEL – Short Term Exposure Limit is the 15 minute average concentration an employee may be exposed to providing that the highest exposure never exceeds the OEL (Occupational Exposure Limit). The OEL for H_2S is 20 PPM.

C. IDLH – Immediately Dangerous to Life and Health is the concentration that has been determined by the ACGIH to cause serious health problems or death if exposed to this level. The IDLH for H_2S is 100 PPM.

D. TWA – Time Weighted Average is the average concentration of any chemical or gas for an eight (8) hour period. This is the concentration that any employee may be exposed based on a TWA.

Toxicity Table of H_2S

Percent %	PPM	Physical Effects
.0001	1	Can smell less than 1 ppm.
.001	10	TLV for 8 hours of exposure.
.0015	15	STEL for 15 minutes of exposure.
.01	100	Immediately Dangerous to Life & Health. Kills sense of smell in 3 to 5 minutes.
.02	200	Kills sense of smell quickly, may burn eyes and throat.
.05	500	Dizziness, cessation of breathing begins in a few minutes.
.07	700	Unconscious quickly, death will result if not rescued promptly.
.10	1000	Death will result unless rescued promptly. Artificial resuscitation may be necessary.

PHYSICAL PROPERTIES OF H_2S

The properties of all gases are usually described in the context of seven major categories:

COLOR
ODOR
VAPOR DENSITY
EXPLOSIVE LIMITS
FLAMMABILITY
SOLUBILITY (IN WATER)
BOILING POINT

Hydrogen Sulfide is no exception. Information from these categories should be considered in order to provide a fairly complete picture of the properties of the gas.

COLOR – TRANSPARENT

Hydrogen Sulfide is colorless so it is invisible. This fact simply means that you can't rely on your eyes to detect its presence. In fact that makes this gas extremely dangerous to be around.

ODOR – ROTTEN EGGS

Hydrogen Sulfide has a distinctive offensive smell, similar to "rotten eggs". For this reason it earned its common name "sour gas". However, H_2S, even in low concentrations, is so toxic that it attacks and quickly impairs a victim's sense of smell, so it could be fatal to rely on your nose as a detection device.

VAPOR DENSITY – SPECIFIC GRAVITY OF 1.192

Hydrogen Sulfide is heavier than air so it tends to settle in low-lying areas like pits, cellars or tanks. If you find yourself in a location where H_2S is known to exist, protect yourself. Whenever possible, work in an area upwind and keep to higher ground.

EXPLOSIVE LIMITS – 4.0% TO 44%

Mixed with the right proportion of air or oxygen, H_2S will ignite and burn or explode, producing another alarming element of danger besides poisoning.

FLAMMABILITY

Hydrogen Sulfide will burn readily with a distinctive clear blue flame, producing Sulfur Dioxide (SO_2), another hazardous gas that irritates the eyes and lungs.

SOLUBILITY – 4 TO 1 RATIO WITH WATER

Hydrogen Sulfide can be dissolved in liquids, which means that it can be present in any container or vessel used to carry or hold well fluids including oil, water, emulsion and sludge. The solubility of H2S is dependent on temperature and pressure, but if conditions are right, simply agitating a fluid containing H2S may release the gas into the air.

BOILING POINT – (-77° Fahrenheit)

Liquefied Hydrogen Sulfide boils at a very low temperature, so it is usually found as a gas.

RESPIRATOR USE

The Occupational Safety and Health Administration (OSHA) regulate the use of respiratory protection to protect the health of employees. OSHA's requirements are written in the Code of Federal Regulations, Title 29, Part 1910, Section 134, Respiratory Protection. This regulation requires that all employees who might be required to wear respirators, shall complete an OSHA mandated medical evaluation questionnaire. The employee then should be fit tested prior to wearing any respirator while being exposed to hazardous gases.

Written procedures shall be prepared covering safe use of respirators in dangerous atmospheric situations, which might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators.

Respirators shall be inspected prior to and after each use to make sure that the respirator has been properly cleaned, disinfected and that the respirator works properly. The unit should be fully charged prior to being used.

Anyone who may use respirators shall be properly trained in how to properly seal the face piece. They shall wear respirators in normal air and then in a test atmosphere. (Note: Such items as facial hair (beard or sideburns) and eyeglass temple pieces will not allow a proper seal.) Anyone who may be expected to wear respirators should have these items removed before entering a toxic atmosphere. A special mask must be obtained for anyone who must wear eyeglasses. Contact lenses should not be allowed.

Respirators shall be worn during the following conditions:

A. Any employee who works near the top or on the top of any tank unless tests reveal less than 20 ppm of H_2S.

B. When breaking out any line where H_2S can reasonably be expected.

C. When sampling air in areas where H_2S may be present.

D. When working in areas where the concentration of H_2S exceeds the Threshold Limit Value for H_2S (10 ppm).

E. At any time where there is a doubt as to the H_2S level in the area to be entered.

EMERGENCY RESCUE PROCEDURES

DO NOT PANIC!!!

Remain Calm – Think

1. Before attempting any rescue you must first get out of the hazardous area yourself. Go to a safe briefing area.

2. Sound alarm and activate the 911 system.

3. Put on breathing apparatus. At least two persons should do this, when available use the buddy system.

4. Rescue the victim and return them to a safe briefing area.

5. Perform an initial assessment and begin proper First Aid/CPR procedures.

6. Keep victim lying down with a blanket or coat, etc.., under the shoulders to keep airway open. Conserve body heat and do not leave unattended.

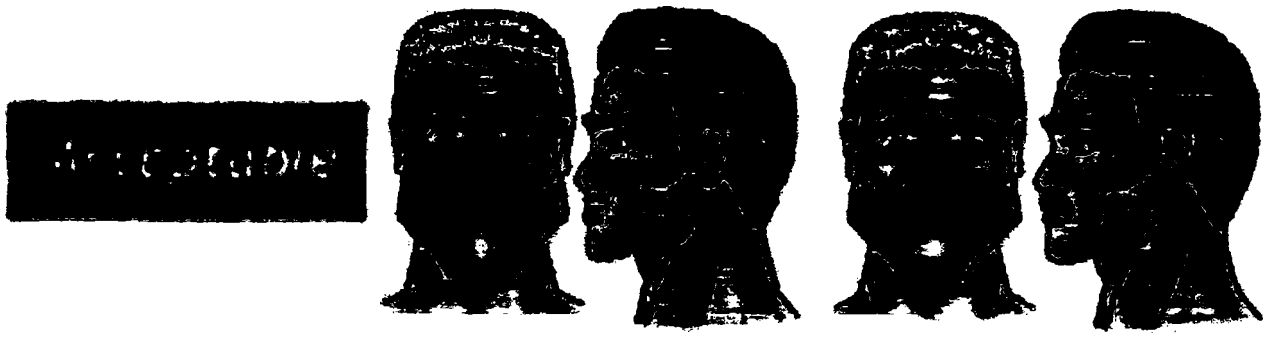
7. If the eyes are affected by H_2S, wash them thoroughly with potable water. For slight irritation, cold compresses are helpful.

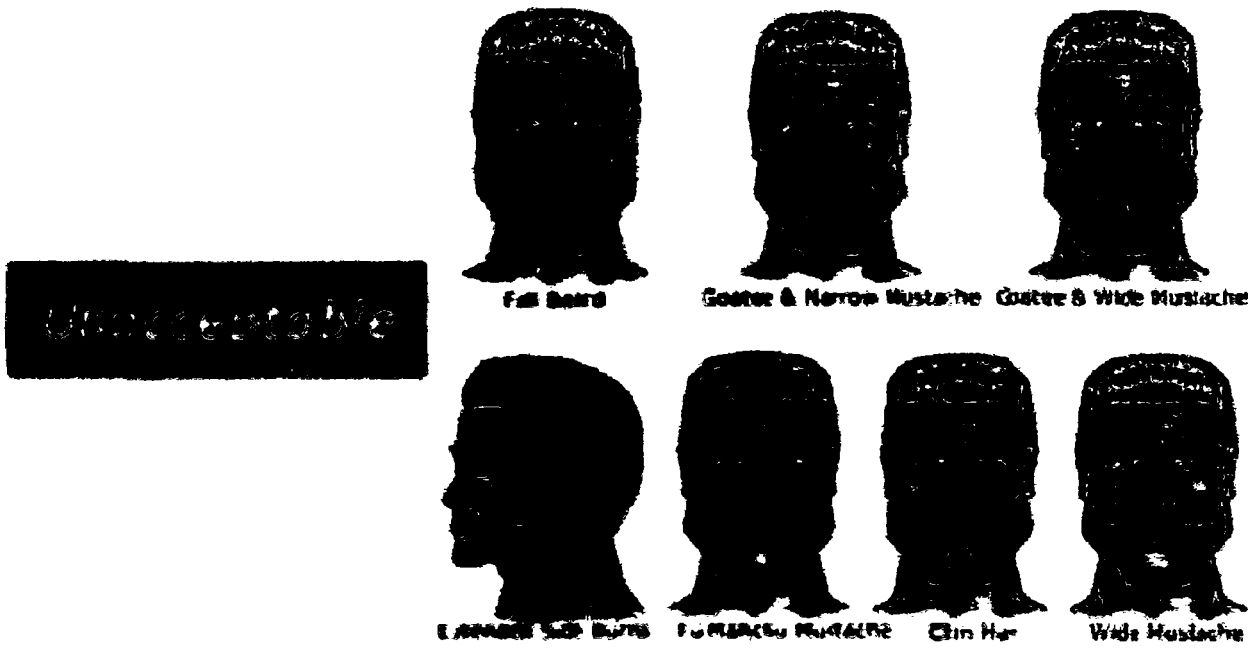
8. In case a person has only minor exposure and does not lose consciousness totally, it's best if he doesn't return to work until the following day.

9. Any personnel overcome by H_2S should always be examined by medical personnel. They should always be transported to a hospital or doctor.

Facial Hair – Clean Shaven Examples

Purpose: To define clean shaven expectations in the field for: 1) Respirator Use, if applicable and 2) First Aid Administration, if situation occurs related to H2S exposure, having no facial hair can greatly benefit response time and treatment ability.





Impetro Operating, LLC

Lea County, NM (NAD83)
Sec 19-25S-36E
Black Marlin Fed Com #2H

Wellbore #1

Plan: Plan #1

Standard Planning Report

10 April, 2019

Database:	EDM 5000.15 Single User Db	**Local Co-ordinate Reference:**	Well Black Marlin Fed Com #2H
Company:	Impetro Operating, LLC	**TVD Reference:**	GL @ 3186.00usft
Project:	Lea County, NM (NAD83)	**MD Reference:**	GL @ 3186.00usft
Site:	Sec 19-25S-36E	**North Reference:**	Grid
Well:	Black Marlin Fed Com #2H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan #1		

Project	Lea County, NM (NAD83)		
Map System:	US State Plane 1983	**System Datum:**	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site	Sec 19-25S-36E				
Site Position:		**Northing:**	415,236.19 usft	**Latitude:**	32.13734
From:	Lat/Long	**Easting:**	861,230.92 usft	**Longitude:**	-103.29986
Position Uncertainty:	0.00 usft	**Slot Radius:**	13-3/16 "	**Grid Convergence:**	0.55 °

Well	Black Marlin Fed Com #2H					
Well Position	**+N/-S**	0.00 usft	**Northing:**	415,236.19 usft	**Latitude:**	32.13734
	+E/-W	0.00 usft	**Easting:**	861,230.92 usft	**Longitude:**	-103.29986
Position Uncertainty		0.00 usft	**Wellhead Elevation:**		**Ground Level:**	3,186.00 usft

Wellbore	Wellbore #1				
Magnetics	**Model Name**	**Sample Date**	**Declination (°)**	**Dip Angle (°)**	**Field Strength (nT)**
	IGRF2015	12/31/2004	8.21	60.32	49,256.03749830

Design	Plan #1				
Audit Notes:					
Version:		**Phase:**	PLAN	**Tie On Depth:**	0.00
Vertical Section:	**Depth From (TVD) (usft)**	**+N/-S (usft)**	**+E/-W (usft)**	**Direction (°)**	
	0.00	0.00	0.00	174.17	

Plan Survey Tool Program **Date** 4/9/2019

	Depth From (usft)	Depth To (usft)	Survey (Wellbore)	Tool Name	Remarks
1	0.00	22,705.80	Plan #1 (Wellbore #1)	MWD	
				MWD - Standard	

Plan Sections

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	TFO (°)	Target
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2,000.00	0.00	0.00	2,000.00	0.00	0.00	0.00	0.00	0.00	0.00	
2,300.00	6.00	84.95	2,299.45	1.38	15.63	2.00	2.00	0.00	84.95	
11,211.25	6.00	84.95	11,161.88	83.37	943.50	0.00	0.00	0.00	0.00	
11,511.25	0.00	0.00	11,461.34	84.76	959.13	2.00	-2.00	0.00	180.00	
11,922.45	0.00	0.00	11,872.54	84.76	959.13	0.00	0.00	0.00	0.00	
12,672.45	90.00	179.43	12,350.00	-392.68	963.90	12.00	12.00	23.92	179.43	
22,625.80	90.00	179.43	12,350.00	-10,345.54	1,063.33	0.00	0.00	0.00	0.00	LTP Black Marlin Fed
22,705.80	90.00	179.43	12,350.00	-10,425.53	1,064.13	0.00	0.00	0.00	0.00	

Database:	EDM 5000.15 Single User Db	**Local Co-ordinate Reference:**	Well Black Marlin Fed Com #2H
Company:	Impetro Operating, LLC	**TVD Reference:**	GL @ 3186.00usft
Project:	Lea County, NM (NAD83)	**MD Reference:**	GL @ 3186.00usft
Site:	Sec 19-25S-36E	**North Reference:**	Grid
Well:	Black Marlin Fed Com #2H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	0.00
300.00	0.00	0.00	300.00	0.00	0.00	0.00	0.00	0.00	0.00
400.00	0.00	0.00	400.00	0.00	0.00	0.00	0.00	0.00	0.00
500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00
600.00	0.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00
700.00	0.00	0.00	700.00	0.00	0.00	0.00	0.00	0.00	0.00
800.00	0.00	0.00	800.00	0.00	0.00	0.00	0.00	0.00	0.00
900.00	0.00	0.00	900.00	0.00	0.00	0.00	0.00	0.00	0.00
1,000.00	0.00	0.00	1,000.00	0.00	0.00	0.00	0.00	0.00	0.00
1,100.00	0.00	0.00	1,100.00	0.00	0.00	0.00	0.00	0.00	0.00
1,200.00	0.00	0.00	1,200.00	0.00	0.00	0.00	0.00	0.00	0.00
1,300.00	0.00	0.00	1,300.00	0.00	0.00	0.00	0.00	0.00	0.00
1,400.00	0.00	0.00	1,400.00	0.00	0.00	0.00	0.00	0.00	0.00
1,500.00	0.00	0.00	1,500.00	0.00	0.00	0.00	0.00	0.00	0.00
1,600.00	0.00	0.00	1,600.00	0.00	0.00	0.00	0.00	0.00	0.00
1,700.00	0.00	0.00	1,700.00	0.00	0.00	0.00	0.00	0.00	0.00
1,800.00	0.00	0.00	1,800.00	0.00	0.00	0.00	0.00	0.00	0.00
1,900.00	0.00	0.00	1,900.00	0.00	0.00	0.00	0.00	0.00	0.00
2,000.00	0.00	0.00	2,000.00	0.00	0.00	0.00	0.00	0.00	0.00
2,100.00	2.00	84.95	2,099.98	0.15	1.74	0.02	2.00	2.00	0.00
2,200.00	4.00	84.95	2,199.84	0.61	6.95	0.09	2.00	2.00	0.00
2,300.00	6.00	84.95	2,299.45	1.38	15.63	0.21	2.00	2.00	0.00
2,400.00	6.00	84.95	2,398.90	2.30	26.04	0.36	0.00	0.00	0.00
2,500.00	6.00	84.95	2,498.36	3.22	36.46	0.50	0.00	0.00	0.00
2,600.00	6.00	84.95	2,597.81	4.14	46.87	0.64	0.00	0.00	0.00
2,700.00	6.00	84.95	2,697.26	5.06	57.28	0.78	0.00	0.00	0.00
2,800.00	6.00	84.95	2,796.71	5.98	67.69	0.92	0.00	0.00	0.00
2,900.00	6.00	84.95	2,896.17	6.90	78.11	1.06	0.00	0.00	0.00
3,000.00	6.00	84.95	2,995.62	7.82	88.52	1.21	0.00	0.00	0.00
3,100.00	6.00	84.95	3,095.07	8.74	98.93	1.35	0.00	0.00	0.00
3,200.00	6.00	84.95	3,194.52	9.66	109.34	1.49	0.00	0.00	0.00
3,300.00	6.00	84.95	3,293.97	10.58	119.76	1.63	0.00	0.00	0.00
3,400.00	6.00	84.95	3,393.43	11.50	130.17	1.77	0.00	0.00	0.00
3,500.00	6.00	84.95	3,492.88	12.42	140.58	1.92	0.00	0.00	0.00
3,600.00	6.00	84.95	3,592.33	13.34	150.99	2.06	0.00	0.00	0.00
3,700.00	6.00	84.95	3,691.78	14.26	161.40	2.20	0.00	0.00	0.00
3,800.00	6.00	84.95	3,791.23	15.18	171.82	2.34	0.00	0.00	0.00
3,900.00	6.00	84.95	3,890.69	16.10	182.23	2.48	0.00	0.00	0.00
4,000.00	6.00	84.95	3,990.14	17.02	192.64	2.63	0.00	0.00	0.00
4,100.00	6.00	84.95	4,089.59	17.94	203.05	2.77	0.00	0.00	0.00
4,200.00	6.00	84.95	4,189.04	18.86	213.47	2.91	0.00	0.00	0.00
4,300.00	6.00	84.95	4,288.50	19.78	223.88	3.05	0.00	0.00	0.00
4,400.00	6.00	84.95	4,387.95	20.70	234.29	3.19	0.00	0.00	0.00
4,500.00	6.00	84.95	4,487.40	21.62	244.70	3.34	0.00	0.00	0.00
4,600.00	6.00	84.95	4,586.85	22.54	255.11	3.48	0.00	0.00	0.00
4,700.00	6.00	84.95	4,686.30	23.46	265.53	3.62	0.00	0.00	0.00
4,800.00	6.00	84.95	4,785.76	24.38	275.94	3.76	0.00	0.00	0.00
4,900.00	6.00	84.95	4,885.21	25.30	286.35	3.90	0.00	0.00	0.00
5,000.00	6.00	84.95	4,984.66	26.22	296.76	4.05	0.00	0.00	0.00
5,100.00	6.00	84.95	5,084.11	27.14	307.18	4.19	0.00	0.00	0.00
5,200.00	6.00	84.95	5,183.57	28.06	317.59	4.33	0.00	0.00	0.00
5,300.00	6.00	84.95	5,283.02	28.98	328.00	4.47	0.00	0.00	0.00

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Company:	Impetro Operating, LLC	**TVD Reference:**	GL @ 3186.00usft
Project:	Lea County, NM (NAD83)	**MD Reference:**	GL @ 3186.00usft
Site:	Sec 19-25S-36E	**North Reference:**	Grid
Well:	Black Marlin Fed Com #2H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
5,400.00	6.00	84.95	5,382.47	29.90	338.41	4.61	0.00	0.00	0.00
5,500.00	6.00	84.95	5,481.92	30.83	348.83	4.75	0.00	0.00	0.00
5,600.00	6.00	84.95	5,581.37	31.75	359.24	4.90	0.00	0.00	0.00
5,700.00	6.00	84.95	5,680.83	32.67	369.65	5.04	0.00	0.00	0.00
5,800.00	6.00	84.95	5,780.28	33.59	380.06	5.18	0.00	0.00	0.00
5,900.00	6.00	84.95	5,879.73	34.51	390.47	5.32	0.00	0.00	0.00
6,000.00	6.00	84.95	5,979.18	35.43	400.89	5.46	0.00	0.00	0.00
6,100.00	6.00	84.95	6,078.64	36.35	411.30	5.61	0.00	0.00	0.00
6,200.00	6.00	84.95	6,178.09	37.27	421.71	5.75	0.00	0.00	0.00
6,300.00	6.00	84.95	6,277.54	38.19	432.12	5.89	0.00	0.00	0.00
6,400.00	6.00	84.95	6,376.99	39.11	442.54	6.03	0.00	0.00	0.00
6,500.00	6.00	84.95	6,476.44	40.03	452.95	6.17	0.00	0.00	0.00
6,600.00	6.00	84.95	6,575.90	40.95	463.36	6.32	0.00	0.00	0.00
6,700.00	6.00	84.95	6,675.35	41.87	473.77	6.46	0.00	0.00	0.00
6,800.00	6.00	84.95	6,774.80	42.79	484.18	6.60	0.00	0.00	0.00
6,900.00	6.00	84.95	6,874.25	43.71	494.60	6.74	0.00	0.00	0.00
7,000.00	6.00	84.95	6,973.71	44.63	505.01	6.88	0.00	0.00	0.00
7,100.00	6.00	84.95	7,073.16	45.55	515.42	7.03	0.00	0.00	0.00
7,200.00	6.00	84.95	7,172.61	46.47	525.83	7.17	0.00	0.00	0.00
7,300.00	6.00	84.95	7,272.06	47.39	536.25	7.31	0.00	0.00	0.00
7,400.00	6.00	84.95	7,371.51	48.31	546.66	7.45	0.00	0.00	0.00
7,500.00	6.00	84.95	7,470.97	49.23	557.07	7.59	0.00	0.00	0.00
7,600.00	6.00	84.95	7,570.42	50.15	567.48	7.74	0.00	0.00	0.00
7,700.00	6.00	84.95	7,669.87	51.07	577.90	7.88	0.00	0.00	0.00
7,800.00	6.00	84.95	7,769.32	51.99	588.31	8.02	0.00	0.00	0.00
7,900.00	6.00	84.95	7,868.77	52.91	598.72	8.16	0.00	0.00	0.00
8,000.00	6.00	84.95	7,968.23	53.83	609.13	8.30	0.00	0.00	0.00
8,100.00	6.00	84.95	8,067.68	54.75	619.54	8.44	0.00	0.00	0.00
8,200.00	6.00	84.95	8,167.13	55.67	629.96	8.59	0.00	0.00	0.00
8,300.00	6.00	84.95	8,266.58	56.59	640.37	8.73	0.00	0.00	0.00
8,400.00	6.00	84.95	8,366.04	57.51	650.78	8.87	0.00	0.00	0.00
8,500.00	6.00	84.95	8,465.49	58.43	661.19	9.01	0.00	0.00	0.00
8,600.00	6.00	84.95	8,564.94	59.35	671.61	9.15	0.00	0.00	0.00
8,700.00	6.00	84.95	8,664.39	60.27	682.02	9.30	0.00	0.00	0.00
8,800.00	6.00	84.95	8,763.84	61.19	692.43	9.44	0.00	0.00	0.00
8,900.00	6.00	84.95	8,863.30	62.11	702.84	9.58	0.00	0.00	0.00
9,000.00	6.00	84.95	8,962.75	63.03	713.25	9.72	0.00	0.00	0.00
9,100.00	6.00	84.95	9,062.20	63.95	723.67	9.86	0.00	0.00	0.00
9,200.00	6.00	84.95	9,161.65	64.87	734.08	10.01	0.00	0.00	0.00
9,300.00	6.00	84.95	9,261.11	65.79	744.49	10.15	0.00	0.00	0.00
9,400.00	6.00	84.95	9,360.56	66.71	754.90	10.29	0.00	0.00	0.00
9,500.00	6.00	84.95	9,460.01	67.63	765.32	10.43	0.00	0.00	0.00
9,600.00	6.00	84.95	9,559.46	68.55	775.73	10.57	0.00	0.00	0.00
9,700.00	6.00	84.95	9,658.91	69.47	786.14	10.72	0.00	0.00	0.00
9,800.00	6.00	84.95	9,758.37	70.39	796.55	10.86	0.00	0.00	0.00
9,900.00	6.00	84.95	9,857.82	71.31	806.97	11.00	0.00	0.00	0.00
10,000.00	6.00	84.95	9,957.27	72.23	817.38	11.14	0.00	0.00	0.00
10,100.00	6.00	84.95	10,056.72	73.15	827.79	11.28	0.00	0.00	0.00
10,200.00	6.00	84.95	10,156.18	74.07	838.20	11.43	0.00	0.00	0.00
10,300.00	6.00	84.95	10,255.63	74.99	848.61	11.57	0.00	0.00	0.00
10,400.00	6.00	84.95	10,355.08	75.91	859.03	11.71	0.00	0.00	0.00
10,500.00	6.00	84.95	10,454.53	76.83	869.44	11.85	0.00	0.00	0.00
10,600.00	6.00	84.95	10,553.98	77.75	879.85	11.99	0.00	0.00	0.00
10,700.00	6.00	84.95	10,653.44	78.67	890.26	12.13	0.00	0.00	0.00

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Site:	Sec 19-25S-36E	**North Reference:**	Grid
Well:	Black Marlin Fed Com #2H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
10,800.00	6.00	84.95	10,752.89	79.59	900.68	12.28	0.00	0.00	0.00
10,900.00	6.00	84.95	10,852.34	80.51	911.09	12.42	0.00	0.00	0.00
11,000.00	6.00	84.95	10,951.79	81.43	921.50	12.56	0.00	0.00	0.00
11,100.00	6.00	84.95	11,051.24	82.35	931.91	12.70	0.00	0.00	0.00
11,200.00	6.00	84.95	11,150.70	83.27	942.32	12.84	0.00	0.00	0.00
11,211.25	6.00	84.95	11,161.88	83.37	943.50	12.86	0.00	0.00	0.00
11,300.00	4.22	84.95	11,250.28	84.07	951.37	12.97	2.00	-2.00	0.00
11,400.00	2.22	84.95	11,350.12	84.57	956.98	13.04	2.00	-2.00	0.00
11,500.00	0.22	84.95	11,450.09	84.75	959.11	13.07	2.00	-2.00	0.00
11,511.25	0.00	0.00	11,461.34	84.76	959.13	13.07	2.00	-2.00	0.00
11,600.00	0.00	0.00	11,550.09	84.76	959.13	13.07	0.00	0.00	0.00
11,700.00	0.00	0.00	11,650.09	84.76	959.13	13.07	0.00	0.00	0.00
11,800.00	0.00	0.00	11,750.09	84.76	959.13	13.07	0.00	0.00	0.00
11,900.00	0.00	0.00	11,850.09	84.76	959.13	13.07	0.00	0.00	0.00
11,922.45	0.00	0.00	11,872.54	84.76	959.13	13.07	0.00	0.00	0.00
11,925.00	0.31	179.43	11,875.09	84.75	959.13	13.08	12.00	12.00	0.00
11,950.00	3.31	179.43	11,900.07	83.96	959.14	13.86	12.00	12.00	0.00
11,975.00	6.31	179.43	11,924.98	81.87	959.16	15.95	12.00	12.00	0.00
12,000.00	9.31	179.43	11,949.75	78.47	959.19	19.33	12.00	12.00	0.00
12,025.00	12.31	179.43	11,974.30	73.79	959.24	24.00	12.00	12.00	0.00
12,050.00	15.31	179.43	11,998.58	67.82	959.30	29.94	12.00	12.00	0.00
12,075.00	18.31	179.43	12,022.51	60.59	959.37	37.14	12.00	12.00	0.00
12,100.00	21.31	179.43	12,046.02	52.12	959.45	45.57	12.00	12.00	0.00
12,125.00	24.31	179.43	12,069.07	42.44	959.55	55.22	12.00	12.00	0.00
12,150.00	27.31	179.43	12,091.57	31.55	959.66	66.05	12.00	12.00	0.00
12,175.00	30.31	179.43	12,113.47	19.51	959.78	78.05	12.00	12.00	0.00
12,200.00	33.31	179.43	12,134.72	6.34	959.91	91.17	12.00	12.00	0.00
12,225.00	36.31	179.43	12,155.24	-7.93	960.05	105.38	12.00	12.00	0.00
12,250.00	39.31	179.43	12,174.99	-23.25	960.21	120.64	12.00	12.00	0.00
12,275.00	42.31	179.43	12,193.91	-39.59	960.37	136.90	12.00	12.00	0.00
12,300.00	45.31	179.43	12,211.95	-56.89	960.54	154.13	12.00	12.00	0.00
12,325.00	48.31	179.43	12,229.06	-75.11	960.73	172.28	12.00	12.00	0.00
12,350.00	51.31	179.43	12,245.20	-94.21	960.92	191.29	12.00	12.00	0.00
12,375.00	54.31	179.43	12,260.31	-114.12	961.12	211.12	12.00	12.00	0.00
12,400.00	57.31	179.43	12,274.36	-134.80	961.32	231.71	12.00	12.00	0.00
12,425.00	60.31	179.43	12,287.30	-156.18	961.54	253.01	12.00	12.00	0.00
12,450.00	63.31	179.43	12,299.11	-178.21	961.76	274.95	12.00	12.00	0.00
12,475.00	66.31	179.43	12,309.75	-200.83	961.98	297.47	12.00	12.00	0.00
12,500.00	69.31	179.43	12,319.20	-223.97	962.21	320.52	12.00	12.00	0.00
12,525.00	72.31	179.43	12,327.41	-247.58	962.45	344.03	12.00	12.00	0.00
12,550.00	75.31	179.43	12,334.39	-271.58	962.69	367.93	12.00	12.00	0.00
12,575.00	78.31	179.43	12,340.09	-295.92	962.93	392.16	12.00	12.00	0.00
12,600.00	81.31	179.43	12,344.51	-320.52	963.18	416.66	12.00	12.00	0.00
12,625.00	84.31	179.43	12,347.64	-345.32	963.43	441.36	12.00	12.00	0.00
12,650.00	87.31	179.43	12,349.47	-370.25	963.67	466.19	12.00	12.00	0.00
12,672.45	90.00	179.43	12,350.00	-392.68	963.90	488.53	12.00	12.00	0.00
12,700.00	90.00	179.43	12,350.00	-420.24	964.17	515.97	0.00	0.00	0.00
12,800.00	90.00	179.43	12,350.00	-520.23	965.17	615.55	0.00	0.00	0.00
12,900.00	90.00	179.43	12,350.00	-620.23	966.17	715.13	0.00	0.00	0.00
13,000.00	90.00	179.43	12,350.00	-720.22	967.17	814.71	0.00	0.00	0.00
13,100.00	90.00	179.43	12,350.00	-820.22	968.17	914.29	0.00	0.00	0.00
13,200.00	90.00	179.43	12,350.00	-920.21	969.17	1,013.87	0.00	0.00	0.00
13,300.00	90.00	179.43	12,350.00	-1,020.21	970.17	1,113.44	0.00	0.00	0.00
13,400.00	90.00	179.43	12,350.00	-1,120.20	971.17	1,213.02	0.00	0.00	0.00

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Project:	Lea County, NM (NAD83)	**MD Reference:**	GL @ 3186.00usft
Site:	Sec 19-25S-36E	**North Reference:**	Grid
Well:	Black Marlin Fed Com #2H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
13,500.00	90.00	179.43	12,350.00	-1,220.20	972.17	1,312.60	0.00	0.00	0.00
13,600.00	90.00	179.43	12,350.00	-1,320.19	973.16	1,412.18	0.00	0.00	0.00
13,700.00	90.00	179.43	12,350.00	-1,420.19	974.16	1,511.76	0.00	0.00	0.00
13,800.00	90.00	179.43	12,350.00	-1,520.18	975.16	1,611.34	0.00	0.00	0.00
13,900.00	90.00	179.43	12,350.00	-1,620.18	976.16	1,710.92	0.00	0.00	0.00
14,000.00	90.00	179.43	12,350.00	-1,720.17	977.16	1,810.50	0.00	0.00	0.00
14,100.00	90.00	179.43	12,350.00	-1,820.17	978.16	1,910.08	0.00	0.00	0.00
14,200.00	90.00	179.43	12,350.00	-1,920.16	979.16	2,009.66	0.00	0.00	0.00
14,300.00	90.00	179.43	12,350.00	-2,020.16	980.16	2,109.24	0.00	0.00	0.00
14,400.00	90.00	179.43	12,350.00	-2,120.15	981.16	2,208.82	0.00	0.00	0.00
14,500.00	90.00	179.43	12,350.00	-2,220.15	982.15	2,308.40	0.00	0.00	0.00
14,600.00	90.00	179.43	12,350.00	-2,320.14	983.15	2,407.98	0.00	0.00	0.00
14,700.00	90.00	179.43	12,350.00	-2,420.14	984.15	2,507.56	0.00	0.00	0.00
14,800.00	90.00	179.43	12,350.00	-2,520.13	985.15	2,607.14	0.00	0.00	0.00
14,900.00	90.00	179.43	12,350.00	-2,620.13	986.15	2,706.72	0.00	0.00	0.00
15,000.00	90.00	179.43	12,350.00	-2,720.12	987.15	2,806.30	0.00	0.00	0.00
15,100.00	90.00	179.43	12,350.00	-2,820.12	988.15	2,905.88	0.00	0.00	0.00
15,200.00	90.00	179.43	12,350.00	-2,920.11	989.15	3,005.46	0.00	0.00	0.00
15,300.00	90.00	179.43	12,350.00	-3,020.11	990.15	3,105.04	0.00	0.00	0.00
15,400.00	90.00	179.43	12,350.00	-3,120.10	991.15	3,204.62	0.00	0.00	0.00
15,500.00	90.00	179.43	12,350.00	-3,220.10	992.14	3,304.20	0.00	0.00	0.00
15,600.00	90.00	179.43	12,350.00	-3,320.09	993.14	3,403.78	0.00	0.00	0.00
15,700.00	90.00	179.43	12,350.00	-3,420.09	994.14	3,503.36	0.00	0.00	0.00
15,800.00	90.00	179.43	12,350.00	-3,520.08	995.14	3,602.93	0.00	0.00	0.00
15,900.00	90.00	179.43	12,350.00	-3,620.08	996.14	3,702.51	0.00	0.00	0.00
16,000.00	90.00	179.43	12,350.00	-3,720.07	997.14	3,802.09	0.00	0.00	0.00
16,100.00	90.00	179.43	12,350.00	-3,820.07	998.14	3,901.67	0.00	0.00	0.00
16,200.00	90.00	179.43	12,350.00	-3,920.06	999.14	4,001.25	0.00	0.00	0.00
16,300.00	90.00	179.43	12,350.00	-4,020.06	1,000.14	4,100.83	0.00	0.00	0.00
16,400.00	90.00	179.43	12,350.00	-4,120.05	1,001.13	4,200.41	0.00	0.00	0.00
16,500.00	90.00	179.43	12,350.00	-4,220.05	1,002.13	4,299.99	0.00	0.00	0.00
16,600.00	90.00	179.43	12,350.00	-4,320.04	1,003.13	4,399.57	0.00	0.00	0.00
16,700.00	90.00	179.43	12,350.00	-4,420.04	1,004.13	4,499.15	0.00	0.00	0.00
16,800.00	90.00	179.43	12,350.00	-4,520.03	1,005.13	4,598.73	0.00	0.00	0.00
16,900.00	90.00	179.43	12,350.00	-4,620.03	1,006.13	4,698.31	0.00	0.00	0.00
17,000.00	90.00	179.43	12,350.00	-4,720.02	1,007.13	4,797.89	0.00	0.00	0.00
17,100.00	90.00	179.43	12,350.00	-4,820.02	1,008.13	4,897.47	0.00	0.00	0.00
17,200.00	90.00	179.43	12,350.00	-4,920.01	1,009.13	4,997.05	0.00	0.00	0.00
17,300.00	90.00	179.43	12,350.00	-5,020.01	1,010.13	5,096.63	0.00	0.00	0.00
17,400.00	90.00	179.43	12,350.00	-5,120.00	1,011.12	5,196.21	0.00	0.00	0.00
17,500.00	90.00	179.43	12,350.00	-5,220.00	1,012.12	5,295.79	0.00	0.00	0.00
17,600.00	90.00	179.43	12,350.00	-5,319.99	1,013.12	5,395.37	0.00	0.00	0.00
17,700.00	90.00	179.43	12,350.00	-5,419.99	1,014.12	5,494.95	0.00	0.00	0.00
17,800.00	90.00	179.43	12,350.00	-5,519.98	1,015.12	5,594.53	0.00	0.00	0.00
17,900.00	90.00	179.43	12,350.00	-5,619.98	1,016.12	5,694.11	0.00	0.00	0.00
18,000.00	90.00	179.43	12,350.00	-5,719.97	1,017.12	5,793.69	0.00	0.00	0.00
18,100.00	90.00	179.43	12,350.00	-5,819.97	1,018.12	5,893.27	0.00	0.00	0.00
18,200.00	90.00	179.43	12,350.00	-5,919.96	1,019.12	5,992.84	0.00	0.00	0.00
18,300.00	90.00	179.43	12,350.00	-6,019.96	1,020.11	6,092.42	0.00	0.00	0.00
18,400.00	90.00	179.43	12,350.00	-6,119.95	1,021.11	6,192.00	0.00	0.00	0.00
18,500.00	90.00	179.43	12,350.00	-6,219.95	1,022.11	6,291.58	0.00	0.00	0.00
18,600.00	90.00	179.43	12,350.00	-6,319.94	1,023.11	6,391.16	0.00	0.00	0.00
18,700.00	90.00	179.43	12,350.00	-6,419.94	1,024.11	6,490.74	0.00	0.00	0.00
18,800.00	90.00	179.43	12,350.00	-6,519.93	1,025.11	6,590.32	0.00	0.00	0.00

Database:	EDM 5000.15 Single User Db	**Local Co-ordinate Reference:**	Well Black Marlin Fed Com #2H
Company:	Impetro Operating, LLC	**TVD Reference:**	GL @ 3186.00usft
Project:	Lea County, NM (NAD83)	**MD Reference:**	GL @ 3186.00usft
Site:	Sec 19-25S-36E	**North Reference:**	Grid
Well:	Black Marlin Fed Com #2H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)
18,900.00	90.00	179.43	12,350.00	-6,619.93	1,026.11	6,689.90	0.00	0.00	0.00
19,000.00	90.00	179.43	12,350.00	-6,719.92	1,027.11	6,789.48	0.00	0.00	0.00
19,100.00	90.00	179.43	12,350.00	-6,819.92	1,028.11	6,889.06	0.00	0.00	0.00
19,200.00	90.00	179.43	12,350.00	-6,919.91	1,029.10	6,988.64	0.00	0.00	0.00
19,300.00	90.00	179.43	12,350.00	-7,019.91	1,030.10	7,088.22	0.00	0.00	0.00
19,400.00	90.00	179.43	12,350.00	-7,119.90	1,031.10	7,187.80	0.00	0.00	0.00
19,500.00	90.00	179.43	12,350.00	-7,219.90	1,032.10	7,287.38	0.00	0.00	0.00
19,600.00	90.00	179.43	12,350.00	-7,319.89	1,033.10	7,386.96	0.00	0.00	0.00
19,700.00	90.00	179.43	12,350.00	-7,419.89	1,034.10	7,486.54	0.00	0.00	0.00
19,800.00	90.00	179.43	12,350.00	-7,519.88	1,035.10	7,586.12	0.00	0.00	0.00
19,900.00	90.00	179.43	12,350.00	-7,619.88	1,036.10	7,685.70	0.00	0.00	0.00
20,000.00	90.00	179.43	12,350.00	-7,719.87	1,037.10	7,785.28	0.00	0.00	0.00
20,100.00	90.00	179.43	12,350.00	-7,819.87	1,038.10	7,884.86	0.00	0.00	0.00
20,200.00	90.00	179.43	12,350.00	-7,919.86	1,039.09	7,984.44	0.00	0.00	0.00
20,300.00	90.00	179.43	12,350.00	-8,019.86	1,040.09	8,084.02	0.00	0.00	0.00
20,400.00	90.00	179.43	12,350.00	-8,119.85	1,041.09	8,183.60	0.00	0.00	0.00
20,500.00	90.00	179.43	12,350.00	-8,219.85	1,042.09	8,283.18	0.00	0.00	0.00
20,600.00	90.00	179.43	12,350.00	-8,319.84	1,043.09	8,382.76	0.00	0.00	0.00
20,700.00	90.00	179.43	12,350.00	-8,419.84	1,044.09	8,482.33	0.00	0.00	0.00
20,800.00	90.00	179.43	12,350.00	-8,519.83	1,045.09	8,581.91	0.00	0.00	0.00
20,900.00	90.00	179.43	12,350.00	-8,619.83	1,046.09	8,681.49	0.00	0.00	0.00
21,000.00	90.00	179.43	12,350.00	-8,719.82	1,047.09	8,781.07	0.00	0.00	0.00
21,100.00	90.00	179.43	12,350.00	-8,819.82	1,048.08	8,880.65	0.00	0.00	0.00
21,200.00	90.00	179.43	12,350.00	-8,919.81	1,049.08	8,980.23	0.00	0.00	0.00
21,300.00	90.00	179.43	12,350.00	-9,019.81	1,050.08	9,079.81	0.00	0.00	0.00
21,400.00	90.00	179.43	12,350.00	-9,119.80	1,051.08	9,179.39	0.00	0.00	0.00
21,500.00	90.00	179.43	12,350.00	-9,219.80	1,052.08	9,278.97	0.00	0.00	0.00
21,600.00	90.00	179.43	12,350.00	-9,319.79	1,053.08	9,378.55	0.00	0.00	0.00
21,700.00	90.00	179.43	12,350.00	-9,419.79	1,054.08	9,478.13	0.00	0.00	0.00
21,800.00	90.00	179.43	12,350.00	-9,519.78	1,055.08	9,577.71	0.00	0.00	0.00
21,900.00	90.00	179.43	12,350.00	-9,619.78	1,056.08	9,677.29	0.00	0.00	0.00
22,000.00	90.00	179.43	12,350.00	-9,719.77	1,057.08	9,776.87	0.00	0.00	0.00
22,100.00	90.00	179.43	12,350.00	-9,819.77	1,058.07	9,876.45	0.00	0.00	0.00
22,200.00	90.00	179.43	12,350.00	-9,919.76	1,059.07	9,976.03	0.00	0.00	0.00
22,300.00	90.00	179.43	12,350.00	-10,019.76	1,060.07	10,075.61	0.00	0.00	0.00
22,400.00	90.00	179.43	12,350.00	-10,119.75	1,061.07	10,175.19	0.00	0.00	0.00
22,500.00	90.00	179.43	12,350.00	-10,219.75	1,062.07	10,274.77	0.00	0.00	0.00
22,600.00	90.00	179.43	12,350.00	-10,319.74	1,063.07	10,374.35	0.00	0.00	0.00
22,625.80	90.00	179.43	12,350.00	-10,345.54	1,063.33	10,400.03	0.00	0.00	0.00
22,705.80	90.00	179.43	12,350.00	-10,425.53	1,064.13	10,479.70	0.00	0.00	0.00

Database:	EDM 5000.15 Single User Db	**Local Co-ordinate Reference:**	Well Black Marlin Fed Com #2H
Company:	Impetro Operating, LLC	**TVD Reference:**	GL @ 3186.00usft
Project:	Lea County, NM (NAD83)	**MD Reference:**	GL @ 3186.00usft
Site:	Sec 19-25S-36E	**North Reference:**	Grid
Well:	Black Marlin Fed Com #2H	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Plan #1		

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
FTP Black Marlin Fed C - plan hits target center - Point	0.00	0.00	12,086.17	34.30	959.64	415,270.49	862,190.55	32.13741	-103.29676
LTP Black Marlin Fed Cc - plan hits target center - Point	0.00	0.00	12,350.00	-10,345.54	1,063.33	404,890.65	862,294.24	32.10888	-103.29675
PBHL Black Marlin Fed (- plan hits target center - Point	0.00	0.00	12,350.00	-10,425.53	1,064.13	404,810.66	862,295.05	32.10866	-103.29675

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates +N/-S (usft)	Local Coordinates +E/-W (usft)	Comment
2,000.00	2,000.00	0.00	0.00	Nudge 2°/100'
2,300.00	2,299.45	1.38	15.63	EON HLD 6° Inc.
11,211.25	11,161.88	83.37	943.50	DROP 2°/100'
11,511.25	11,461.34	84.76	959.13	EOD HLD 0° Inc.
11,922.45	11,872.54	84.76	959.13	KOP BLD 12°/100'
12,672.45	12,350.00	-392.68	963.90	EOB HLD 90° Inc.
22,625.80	12,350.00	-10,345.54	1,063.33	CONT HLD 90° Inc.
22,705.80	12,350.00	-10,425.53	1,064.13	TD at 22705.80

Well Control: Soft Shut in Procedure

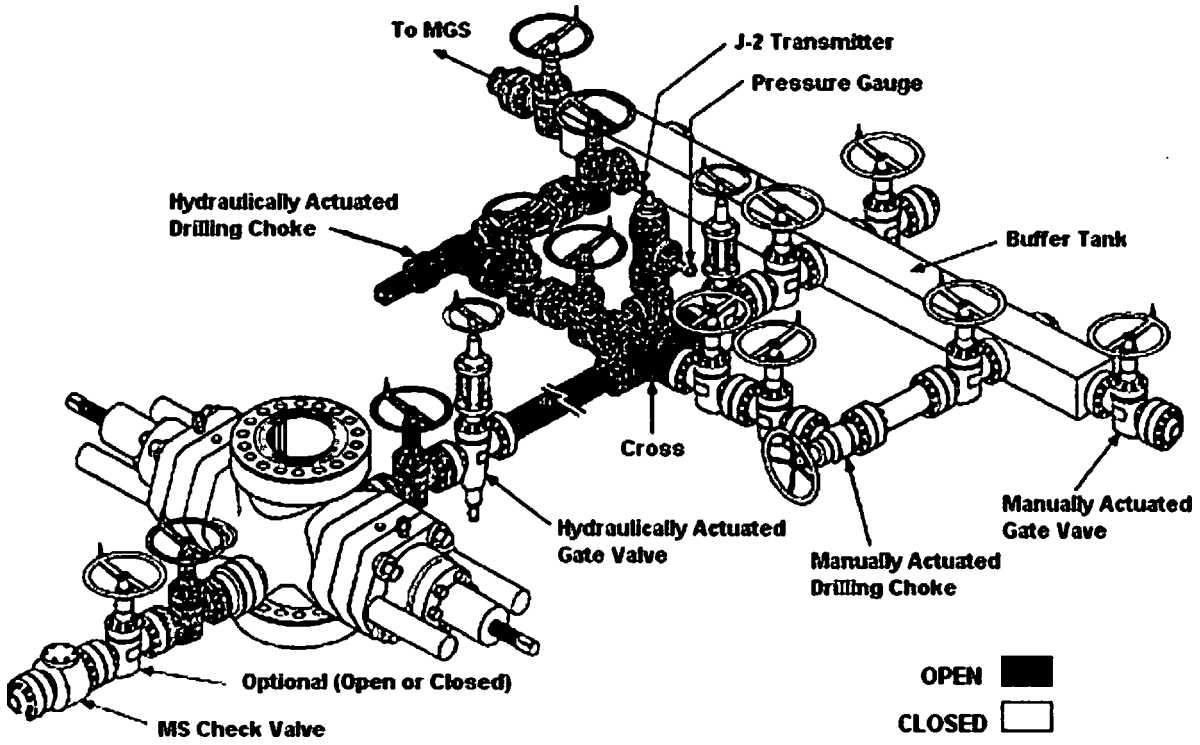
If any positive kick indication is noticed and the flow check has showed that the well is flowing, it should be shut in immediately. If there is any doubt about the kick, the safest procedure is to shut the well in the check for surface pressures. A small gain can quickly turn into an uncontrolled situation leading to a blowout. There are a level of hesitation to shut the well in due the fear of stuck pipe. In general, the stuck pipe is minimized if the well is closed early, the influx will be small and the wellbore pressures will be reduced and controlled. Other issues which can lead to hesitate to close the well is the possibility of breaking down the formation, especially at the casing shoe.

There are different methods to close the well for different rig type. In this article, the procedures for a fixed rig are presented:
- Shut in while drilling
- Shut in while tripping

Soft shut in procedure

Circuit alignment during operations

During operations the circuit has to be aligned as follows:
- Manuel valve on choke line is opened
- Hydraulic valve on choke line has to be closed
- The choke on choke manifold has to be opened
- All the valves leading to the separator passing by the choke (downstream valves) have to be in open positions.
- Beside these valves, all the valves have to be in closed position.



Soft Shut in procedure while drilling

The procedure is performed as follows:

- if there is any kick indication, stop rotary, pick up off bottom and space out (Tool joint one meter above rotary table to avoid getting the next tool joint on the pipe rams)
- Stop pumps, perform flow check. If the well is flowing then:
- Open choke line valve at the BOP stack (Called HCR)
- Close annular BOP
- Close Choke
- Read and Record pressures and times. Check pit volume gain in order to prepare the kill sheet
- If the gas is migrating , control the wellbore pressures during the shut in

Soft Shut in procedure while tripping

If there is any kick indication, stop tripping immediately. Here, two different situations can be identified:

a) The well is flowing, then the shut in is proceeded as follows:

- Set the string on the slips
- Install a fully opening safety valve in open position. Close the valve once is installed
- Open choke line valve at BOP stack (HCR valve)
- Close annular BOP

- Close choke.
- Read and record pressures and times, check pit volumes

It depends on the situation to weather to start killing procedures or to strip back to the bottom.

- If the stripping is faced, then, Stab IBOP (Grey valve)
- Open the fully opening safety valve
- Reduce the annular pressure and start stripping the string to the bottom

b) The well is not flowing:

- Set the string on the slips
- Install IBOP (grey valve or non-return valve)
- Run back in the hole with controlling the volumes, if any anomalies are noticed then proceed to the stripping. Once on bottom, circulate annular volume and evaluate the situation.

Well Control: Hard Shut in Procedure

Circuit alignment during operations

During operations the circuit has to be aligned as follows:

- Manuel valve on choke line is opened
- Hydraulic valve on choke line has to be closed
- The choke on choke manifold has to be closed
- All the valves leading to the separator passing by the choke (downstream valves) have to be in open positions.
- Beside these valves, all the valves have to be in closed position.

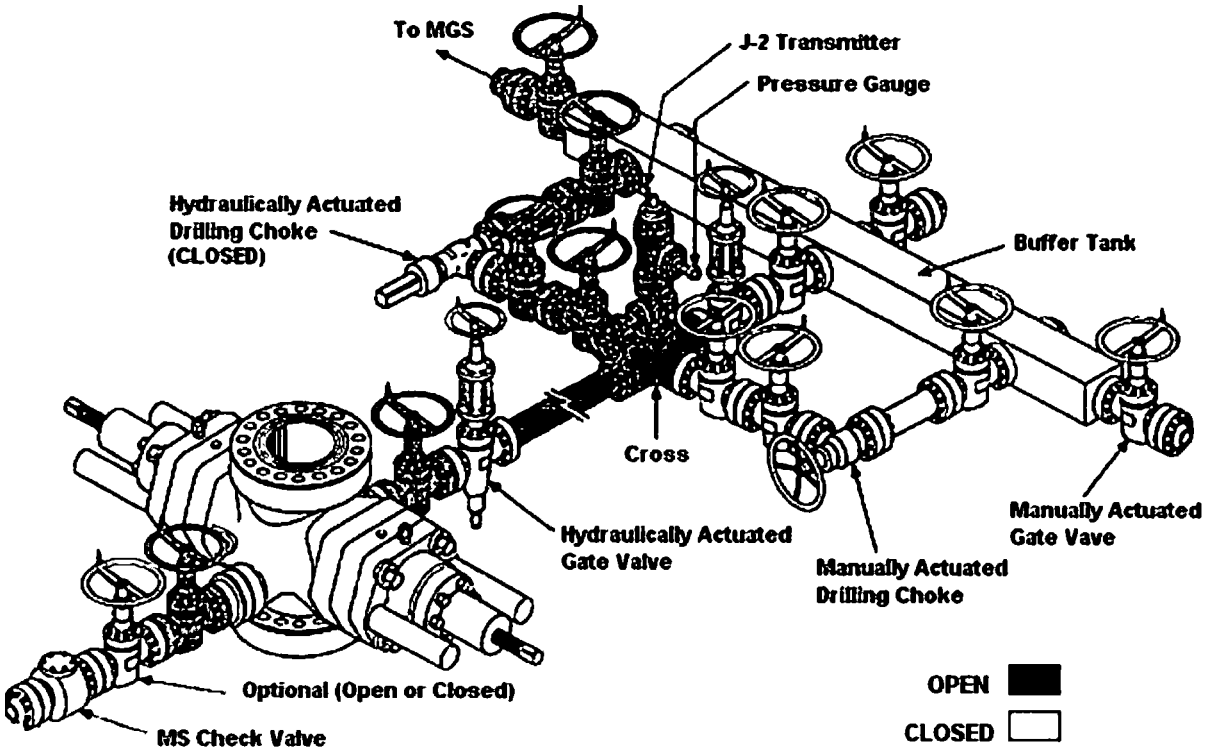


Fig 01- Circuit Alignment in Hard Shut in Procedure

Hard shut in procedure while drilling

- if there is any kick indication, stop rotary, pick up off bottom and space out (Tool joint one meter above rotary table to avoid getting the next tool joint on the pipe rams)
- Stop pumps, perform flow check. If the well is flowing then:
- Close annular or pipe rams
- Open choke line HCR valve
- Start plotting the trend of pressures, drill pipe pressure and casing pressure, note also the gain.

Hard shut in procedure while tripping

If any kick indication is noticed, the tripping has to be ceased immediately and the next steps have to be performed. Two situations ca be faced:

a) The well is flowing:

- Set the drilling string on the slips
- Install the fully opening safety valve in opened position

- Close the safety valve
- Close the annular BOP
- Open the HCR valve on the choke line
- Record the pressures with the time and the gain volume

b) If the well is not flowing

- Set the drilling string on the slips
- Install the IBOP (grey valve or the non-return valve)
- Trip back in the hole with controlling the volumes, if any anomalies are detected shut the well in following the hard procedure then continue the running in the hole with stripping. Once on bottom, circulate a bottom up volume and evaluate the situation.