

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

1a. Type of work: <input checked="" type="checkbox"/> DRILL <input type="checkbox"/> REENTER 1b. Type of Well: <input checked="" type="checkbox"/> Oil Well <input type="checkbox"/> Gas Well <input type="checkbox"/> Other 1c. Type of Completion: <input type="checkbox"/> Hydraulic Fracturing <input checked="" type="checkbox"/> Single Zone <input type="checkbox"/> Multiple Zone		5. Lease Serial No. NMNM4986 6. If Indian, Allottee or Tribe Name 7. If Unit or CA Agreement, Name and No. 8. Lease Name and Well No. BOLANDER 32 STATE FED COM 121H
2. Name of Operator COLGATE OPERATING LLC		9. API Well No. 30-015-47732
3a. Address 306 W. Wall St., Suite 500, Midland, TX 79701	3b. Phone No. (include area code) (432) 695-4224	10. Field and Pool, or Exploratory WINCHESTER/2ND BONE SPRING
4. Location of Well (Report location clearly and in accordance with any State requirements. *) At surface NENE / 1298 FNL / 300 FEL / LAT 32.62078 / LONG -104.1910091 At proposed prod. zone NWNW / 965 FNL / 10 FWL / LAT 32.6212566 / LONG -104.2239588		11. Sec., T. R. M. or Blk. and Survey or Area SEC 32/T19S/R28E/NMP
14. Distance in miles and direction from nearest town or post office*		12. County or Parish EDDY
13. State NM		
15. Distance from proposed* location to nearest property or lease line, ft. (Also to nearest drig. unit line, if any) 4927 feet	16. No of acres in lease 	17. Spacing Unit dedicated to this well 320.0
18. Distance from proposed location* to nearest well, drilling, completed, applied for, on this lease, ft. 57 feet	19. Proposed Depth 6990 feet / 17454 feet	20. BLM/BIA Bond No. in file FED: NMB001382
21. Elevations (Show whether DF, KDB, RT, GL, etc.) 3368 feet	22. Approximate date work will start* 10/31/2020	23. Estimated duration 90 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 (Electronic Submission)	Name (Printed/Typed) MIKAH THOMAS / Ph: (432) 695-4224	Date 09/01/2020
Title Operations Tech		
Approved by (Signature) (Electronic Submission)	Name (Printed/Typed) Cody Layton / Ph: (575) 234-5959	Date 11/23/2020
Title Assistant Field Manager Lands & Minerals		
Office Carlsbad Field Office		

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.

Oil base muds are not to be used until fresh water zones are cased and cemented providing isolation from the oil or diesel. This includes synthetic oils. Oil based mud, drilling fluids and solids must be contained in a steel closed loop system.

- Will require a directional survey with the C-104
 - Surface casing must be set 25' below top of Rustler Anhydrite
 - in order to seal off protectable water
- SL

Once the well is spud, to prevent ground water contamination through whole or partial conduits from the surface, the operator shall drill without interruption through the fresh water zone or zones and shall immediately set in cement the water protection string

KP 11/30/2020 GEO Review

*(Instructions on page 2)

(Continued on page 2)

APPROVED WITH CONDITIONS

Approval Date: 11/23/2020

JAG 12/1/2020

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

DISTRICT II
611 S. First St., Artesia, N.M. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
Phone: (505) 334-6178 Fax: (505) 334-6170

DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, N.M. 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION

1220 South St. Francis Dr.
Santa Fe, N.M. 87505

Form C-102

Revised August 1, 2011

Submit one copy to appropriate
District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

¹ API Number 30-015-47732	² Pool Code 97569	³ Pool Name Winchester; Bone Spring, West
⁴ Property Code 329862	⁵ Property Name Bolander 32 State Fed Com	⁶ Well Number 121H
⁷ GRID No. 371449	⁸ Operator Name Colgate Operating, LLC	⁹ Elevation 3368

¹⁰ Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
A	32	19 S	28 E		1298	North	300	East	Eddy

¹¹ Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
D	31	19 S	28 E		965	North	10	West	Eddy

¹² Dedicated Acres 320	¹³ Joint or Infill	¹⁴ Consolidation Code	¹⁵ Order No.
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NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED
OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

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Legend:
● = Surface Location
○ = Bottom Hole Location
△ = First Take Point (FTP)
□ = Last Take Point (LTP)
⊙ = Found 1941 USGLO Brass Cap
⊙ = Found Monument

FIRST TAKE POINT
NAD 83 NMSPC ZONE 3001
965' FNL, 100' FEL
SEC. 32, T19S, R28E
Y= 589937.89 N
X= 585378.73 E
LAT.= 32.6217082° N
LONG.= 104.1902858° W

17 OPERATOR CERTIFICATION
I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Signature: Mikah Thomas Date: 08/25/2020
Printed Name: Mikah Thomas
E-mail Address: mthomas@colgateenergy.com

18 SURVEYOR CERTIFICATION
I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

6/16/20
Date of Survey
Plat Revised: 8/20/20
Signature and Seal of Professional Surveyor: Marshall W. Linden

17078
Certificate Number

BOTTOM HOLE LOCATION
NAD 83 NMSPC ZONE 3001
Y= 589761.29 N
X= 575011.70 E
LAT.= 32.6212566° N
LONG.= 104.2239588° W

LAST TAKE POINT
NAD 83 NMSPC ZONE 3001
965' FNL, 100' FWL
SEC. 31, T19S, R28E
Y= 589761.28 N
X= 575101.70 E
LAT.= 32.6212563° N
LONG.= 104.2236665° W

SURFACE LOCATION
NAD 83 NMSPC ZONE 3001
Y= 589599.89 N
X= 585156.50 E
LAT.= 32.6207800° N
LONG.= 104.1910091° W

Additional Operator Remarks

Location of Well

0. SHL: NENE / 1298 FNL / 300 FEL / TWSP: 19S / RANGE: 28E / SECTION: 32 / LAT: 32.62078 / LONG: -104.1910091 (TVD: 0 feet, MD: 0 feet)

PPP: NENE / 965 FNL / 0 FEL / TWSP: 19S / RANGE: 28E / SECTION: 31 / LAT: 32.6216415 / LONG: -104.2069944 (TVD: 7144 feet, MD: 12226 feet)

PPP: NENE / 965 FNL / 100 FEL / TWSP: 19S / RANGE: 28E / SECTION: 32 / LAT: 32.6217082 / LONG: -104.1902858 (TVD: 7114 feet, MD: 7188 feet)

BHL: NWNW / 965 FNL / 10 FWL / TWSP: 19S / RANGE: 28E / SECTION: 31 / LAT: 32.6212566 / LONG: -104.2239588 (TVD: 6990 feet, MD: 17454 feet)

BLM Point of Contact

Name: Gavin Mickwee

Title: Land Law Examiner

Phone: (575) 234-5972

Email: gmickwee@blm.gov

PECOS DISTRICT DRILLING CONDITIONS OF APPROVAL

OPERATOR'S NAME:	Colgate Operating LLC
LEASE NO.:	NMNM004986
LOCATION:	Section 32, T.19 S., R.28 E., NMPM
COUNTY:	Eddy County, New Mexico

WELL NAME & NO.:	Bolander 32 State Fed Com 121H
SURFACE HOLE FOOTAGE:	1298'/N & 300'/E
BOTTOM HOLE FOOTAGE:	965'/N & 10'/W

WELL NAME & NO.:	Bolander 32 State Fed Com 131H
SURFACE HOLE FOOTAGE:	1253'/N & 300'/E
BOTTOM HOLE FOOTAGE:	945'/N & 10'/W

COA

H2S	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Potash	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Secretary	<input type="checkbox"/> R-111-P
Cave/Karst Potential	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Medium	<input type="checkbox"/> High
Cave/Karst Potential	<input type="checkbox"/> Critical		
Variance	<input checked="" type="checkbox"/> None	<input checked="" type="checkbox"/> Flex Hose	<input type="checkbox"/> Other
Wellhead	<input checked="" type="checkbox"/> Conventional	<input checked="" type="checkbox"/> Multibowl	<input checked="" type="checkbox"/> Both
Other	<input type="checkbox"/> 4 String Area	<input type="checkbox"/> Capitan Reef	<input type="checkbox"/> WIPP
Other	<input type="checkbox"/> Fluid Filled	<input type="checkbox"/> Cement Squeeze	<input type="checkbox"/> Pilot Hole
Special Requirements	<input type="checkbox"/> Water Disposal	<input checked="" type="checkbox"/> COM	<input type="checkbox"/> Unit

A. HYDROGEN SULFIDE

A Hydrogen Sulfide (H2S) Drilling Plan shall be activated 500 feet prior to drilling into the **Cherry Canyon, Brushy Canyon** formation. As a result, the Hydrogen Sulfide area must meet Onshore Order 6 requirements, which includes equipment and personnel/public protection items. If Hydrogen Sulfide is encountered, please provide measured values and formations to the BLM.

B. CASING

1. The **13-3/8** inch surface casing shall be set at approximately **200 feet** (a minimum of **70 feet (Eddy County)** into the Rustler Anhydrite and above the salt) and cemented to the surface.
 - a. If cement does not circulate to the 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 six hours after pumping cement and ideally between 8-10 hours after completing the cement job.

- b. Wait on cement (WOC) time for a primary cement job will be a minimum of **8 hours** or 500 pounds compressive strength, whichever is greater. (This is to include the lead cement)
 - c. Wait on cement (WOC) time for a remedial job will be a minimum of 4 hours after bringing cement to surface or 500 pounds compressive strength, whichever is greater.
 - d. If cement falls back, remedial cementing will be done prior to drilling out that string.
2. The minimum required fill of cement behind the **9-5/8** inch intermediate casing shall be set at approximately **2920 feet** is:
 - Cement to surface. If cement does not circulate see B.1.a, c-d above.
Wait on cement (WOC) time for a primary cement job is to include the lead cement slurry due to cave/karst or potash.
- ❖ In Medium Cave/Karst Areas if cement does not circulate to surface on the first two casing strings, the cement on the 3rd casing string must come to surface.
3. The minimum required fill of cement behind the **5-1/2** inch production casing is:
 - Cement should tie-back at least **200 feet** into previous casing string. Operator shall provide method of verification.
Cement excess is less than 25%, more cement might be required.

C. PRESSURE CONTROL

1. Variance approved to use flex line from BOP to choke manifold. Manufacturer's specification to be readily available. No external damage to flex line. Flex line to be installed as straight as possible (no hard bends).'
- 2.

Option 1:

- a. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the surface casing shoe shall be **2000 (2M)** psi.
- b. Minimum working pressure of the blowout preventer (BOP) and related equipment (BOPE) required for drilling below the intermediate casing shoe shall be **5000 (5M)** psi.

Option 2:

1. Operator has proposed a multi-bowl wellhead assembly. This assembly will only be tested when installed on the surface casing. 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.
 - 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 OOGO2.III.A.2.i must be followed.

D. SPECIAL REQUIREMENT (S)

Communitization Agreement

- The operator will submit a Communitization Agreement to the Santa Fe Office, 301 Dinosaur Trail Santa Fe, New Mexico 87508, 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.
- If the operator does not comply with this condition of approval, the BLM may take enforcement actions that include, but are not limited to, those specified in 43 CFR 3163.1.
- In addition, the well sign shall include the surface and bottom hole lease numbers. When the Communitization Agreement number is known, it shall also be on the sign.

GENERAL REQUIREMENTS

The BLM is to be notified in advance for a representative to witness:

- a. Spudding well (minimum of 24 hours)
- b. Setting and/or Cementing of all casing strings (minimum of 4 hours)
- c. BOPE tests (minimum of 4 hours)

☒ Eddy County

Call the Carlsbad Field Office, 620 East Greene St., Carlsbad, NM 88220,
(575) 361-2822

☒ Lea County

Call the Hobbs Field Station, 414 West Taylor, Hobbs NM 88240, (575)
393-3612

1. 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
 - Notify the BLM when moving in and removing the Spudder Rig.
 - 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.
 - BOP/BOPE test to be conducted per Onshore Oil and Gas Order No. 2 as soon as 2nd Rig is rigged up on well.
2. 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.
3. 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 submitted to the BLM office as well as all other logs run on the borehole 30 days from completion. If available, a digital copy of the logs is to be submitted in addition to the paper copies. 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 integrity 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 integrity 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 that portion of any 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. 5M or higher system requires an HCR valve, remote kill line and annular to match. The remote kill line is to be installed prior to testing the system and tested to stack pressure.
4. 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. Whenever any seal subject to test pressure is broken, all the tests in OOGO2.III.A.2.i must be followed.
 - e. 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.
5. The appropriate BLM office shall be notified a minimum of 4 hours in advance for a representative to witness the 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 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 not a cup or J-packer. The operator also has the option of utilizing an independent tester to test without a plug (i.e. against the casing) pursuant to Onshore Order 2 with the pressure not to exceed 70% of the burst rating for the casing. Any test against the casing must meet the WOC time for water basin (8 hours) or potash (24 hours) or 500 pounds compressive strength, whichever is greater, prior to initiating the test (see casing segment as lead cement may be critical item).
- 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 results of the test shall be reported to the appropriate BLM office.
- f. All tests are required to be recorded on a calibrated test chart. A copy of the BOP/BOPE test chart and a copy of independent service company test will be submitted to the appropriate BLM office.
- g. 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 if test is done with a test plug and 30 minutes without a test plug. This test shall be performed prior to the test at full stack pressure.
- h. BOP/BOPE must be tested by an independent service company 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

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

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.

Porto-johns and trash containers will be on-location during fracturing operations or any other crew-intensive operations.

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Submit Original
to Appropriate
District Office

GAS CAPTURE PLAN

Date: 08/25/2020

☒ Original

Operator & OGRID No.: Colgate Operating, LLC (371449)

☐ Amended - Reason for Amendment: _____

This Gas Capture Plan outlines actions to be taken by the Operator to reduce well/production facility flaring/venting for new completion (new drill, recomple to new zone, re-frac) activity.

Note: Form C-129 must be submitted and approved prior to exceeding 60 days allowed by Rule (Subsection A of 19.15.18.12 NMAC).

Well(s)/Production Facility – Name of facility

The well(s) that will be located at the production facility are shown in the table below.

Well Name	API	Well Location (ULSTR)	Footages	Expected MCF/D	Flared or Vented	Comments
Bolander 32 State Fed Com 121H	30-015					

Gathering System and Pipeline Notification

Well(s) will be connected to a production facility after flowback operations are complete, if gas transporter system is in place. The gas produced from production facility is dedicated to LM Touchdown, LLC and will be connected to LM Touchdown, LLC low/high pressure gathering system located in Eddy County, New Mexico. It will require 10' of pipeline to connect the facility to low/high pressure gathering system. Colgate Operating, LLC provides (periodically) to LM Touchdown, LLC a drilling, completion and estimated first production date for wells that are scheduled to be drilled in the foreseeable future. In addition, Colgate Operating, LLC and LM Touchdown, LLC have periodic conference calls to discuss changes to drilling and completion schedules. Gas from these wells will be processed at LM Touchdown, LLC Processing Plant located in Sec. 22, Twn. 19S Rng. 28E Eddy County, New Mexico. The actual flow of the gas will be based on compression operating parameters and gathering system pressures.

Flowback Strategy

After the fracture treatment/completion operations, well(s) will be produced to production facilities. During flowback, the fluids and sand content will be monitored. Gas sales should start as soon as the wells start flowing through the production facilities, unless there are operational issues on LM Touchdown, LLC system at that time. Based on current information, it is Colgate Operating, LLC belief the system can take this gas upon completion of the well(s).

Safety requirements during cleanout operations from the use of underbalanced air cleanout systems may necessitate that sand and non-pipeline quality gas be vented and/or flared rather than sold on a temporary basis.

Alternatives to Reduce Flaring

Below are alternatives considered from a conceptual standpoint to reduce the amount of gas flared.

- Power Generation – On lease
 - Only a portion of gas is consumed operating the generator, remainder of gas will be flared
- Compressed Natural Gas – On lease
 - Gas flared would be minimal, but might be uneconomical to operate when gas volume declines

- NGL Removal – On lease
 - Plants are expensive, residue gas is still flared, and uneconomical to operate when gas volume declines



APD ID: 10400060859

Submission Date: 09/01/2020

Highlighted data
reflects the most
recent changes

Operator Name: COLGATE OPERATING LLC

Well Name: BOLANDER 32 STATE FED COM

Well Number: 121H

[Show Final Text](#)

Well Type: OIL WELL

Well Work Type: Drill

Section 1 - Geologic Formations

Formation ID	Formation Name	Elevation	True Vertical Depth	Measured Depth	Lithologies	Mineral Resources	Producing Formation
836963	QUATERNARY	3393	26	26	OTHER : None	NONE	N
836964	RUSTLER	3200	193	193	ANHYDRITE, LIMESTONE	NONE	N
836965	TOP SALT	3145	248	248	ANHYDRITE, SALT	NONE	N
836966	BASE OF SALT	2838	555	555	ANHYDRITE, SALT	NONE	N
1128646	TANSILL	2783	610	610	ANHYDRITE, DOLOMITE	NONE	N
836967	YATES	2620	773	773	ANHYDRITE, SHALE, SILTSTONE	NONE	N
1128647	SEVEN RIVERS	2188	1205	1205	ANHYDRITE, DOLOMITE, SANDSTONE	NONE	N
1128648	QUEEN	1743	1650	1650	ANHYDRITE, DOLOMITE, SANDSTONE, SHALE	NONE	N
1128649	GRAYBURG	1393	2000	2000	ANHYDRITE, DOLOMITE, SANDSTONE, SHALE	NONE	N
1128650	SAN ANDRES	998	2395	2395	ANHYDRITE, DOLOMITE	NONE	N
836968	CHERRY CANYON	395	2998	3003	LIMESTONE, SANDSTONE, SILTSTONE	NONE	N
836969	LOWER BRUSHY CANYON 8A	-14	3407	3414	CHERT, LIMESTONE, SANDSTONE, SILTSTONE	NATURAL GAS, OIL	N
836970	BONE SPRING LIME	-450	3843	3852	LIMESTONE, SHALE	NATURAL GAS, OIL	N
836971	BONE SPRING 1ST	-2390	5783	5799	CHERT, LIMESTONE, SHALE	NATURAL GAS, OIL	N
836972	2ND BONE SPRING LIME	-2450	5843	5860	CHERT, LIMESTONE, SHALE	NATURAL GAS, OIL	N
836973	BONE SPRING 2ND	-3575	6968	6999	LIMESTONE, SANDSTONE, SHALE	NATURAL GAS, OIL	Y

Section 2 - Blowout Prevention

Operator Name: COLGATE OPERATING LLC

Well Name: BOLANDER 32 STATE FED COM

Well Number: 121H

Pressure Rating (PSI): 10M

Rating Depth: 15000

Equipment: BOPE with working pressure ratings in excess of anticipated maximum surface pressure will be utilized for well control from drill out of surface casing to TMD. A rotating head will also be installed and utilized as needed. All BOPE connections shall be flanged, welded or clamped. All choke lines shall be straight unless targeted with running tees or tee blocks are used, and choke lines shall be anchored to prevent whip and reduce vibrations. All valves in the choke line & the choke manifold shall be full opening as to not cause restrictions and to allow for straight fluid paths to minimize potential erosion. All gauges utilized in the well control system shall be of a type designed for drilling fluid service. A top drive inside BOP valve will be utilized at all times. Subs equipped with full opening valves sized to fit the drill pipe and collars will be available on the rig floor in the open position. The key to operate said valve equipped subs will be on the rig floor at all times. The accumulator system will have sufficient capacity to open the HCR and close all three sets of rams plus the annular preventer while retaining at least 300 psi above precharge on the closing manifold (accumulator system shall be capable of doing so without using the closing unit pumps). The fluid reservoir capacity will be double the usable fluid volume of the accumulator system capacity, and the fluid level will be maintained at the manufacturer's recommended level. Prior to connecting the closing unit to the BOP stack, an accumulator precharge pressure test shall be performed to ensure the precharge pressure is within 100 psi of the desired precharge pressure (only nitrogen gas will be used to precharge). Two independent power sources will be made available at all times to power the closing unit pumps so that the pumps can automatically start when the closing valve manifold pressure has decreased to the preset level. Closing unit pumps will be sized to allow opening of HCR and closing of annular preventer on 5" drill pipe achieving at least 200 psi above precharge pressure with the accumulator system isolated from service in less than two minutes. A valve shall be installed in the closing line as close to the annular preventer as possible to act as a locking device; the valve shall be maintained in the open position and shall be closed only when the power source for the accumulator system is inoperative. Remote controls capable of opening and closing all preventers & the HCR shall be readily accessible to the driller; master controls with the same capability will be operable at the accumulator. The wellhead will be a multibowl speed head allowing for hangoff of intermediate casing & isolation of the 133/8 x 95/8 annulus without breaking the connection between the BOP & wellhead to install an additional casing head. A wear bushing will be installed & inspected frequently to guard against internal wear to wellhead.

Requesting Variance? YES

Variance request: Colgate Energy requests a variance to drill this well using a co flex line between the BOP and choke manifold. Certification for proposed coflex hose is attached. The hose is not required by the manufacturer to be anchored. In the event the specific hose is not available, one of equal or higher rating will be used.

Testing Procedure: After surface casing is set and the BOPE installed, pressure tests of BOPE will be performed by a third party tester utilizing water and a test plug to 250 psi low and 10,000 psi high. To deem a pressure test successful, pressure must be maintained for ten minutes without any bleedoff. A valve on the wellhead below seat of test plug will be open at all time during BOPE tests to guard against damage to casing. The BOPE will be retested in this manner after any connection breaks or passage of allotted time (25 days). Any BOPE which fails to pass pressure tests after initial install will be replaced prior to drilling out of surface casing shoe. If at any time a BOPE component cannot function to secure the hole, the hole shall be secured utilizing a retrievable packer, and the nonfunctioning BOPE component shall be repair or replaced. After repair or replacement, a pressure test of the repaired or replaced component and any connections broken to repair or replace the nonfunctioning component will be tested in the same manner as described for initial install of BOPE. The annular preventer will be function tested at least weekly, and the ramtype preventers will be function tested on each trip. BOPE pit level drills will be conducted weekly with each drilling crews. All pressure tests performed on BOPE and BOPE pit level drills will be logged in the drilling log. Isolation of 133/8" x 95/8" casing annulus shall be confirmed by pressure testing of wellhead sealing component after said sealing component is installed.

Choke Diagram Attachment:

Bolander_32_State_Fed_Com_121H_Choke_Layout_20200825120239.pdf

BOP Diagram Attachment:

Bolander_32_State_Fed_Com_121H_BOP_Stack_20200825120256.pdf

Operator Name: COLGATE OPERATING LLC

Well Name: BOLANDER 32 STATE FED COM

Well Number: 121H

Section 3 - Casing

Casing ID	String Type	Hole Size	Csg Size	Condition	Standard	Tapered String	Top Set MD	Bottom Set MD	Top Set TVD	Bottom Set TVD	Top Set MSL	Bottom Set MSL	Calculated casing length MD	Grade	Weight	Joint Type	Collapse SF	Burst SF	Joint SF Type	Joint SF	Body SF Type	Body SF
1	SURFACE	17.5	13.375	NEW	API	N	0	200	0	200	3368	3168	200	J-55	54.5	BUTT	1.125	1.2	DRY	1.6	DRY	1.6
2	INTERMEDIATE	12.25	9.625	NEW	API	N	0	2920	0	2915	3368	453	2920	J-55	36	BUTT	1.125	1.2	DRY	1.6	DRY	1.6
3	PRODUCTION	8.75	5.5	NEW	API	N	0	17453	0	6990	3368	-3622	17453	HCP-110	20	OTHER - CDC HTQ	1.125	1.2	DRY	1.6	DRY	1.6

Casing Attachments

Casing ID: 1 **String Type:** SURFACE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Casing_Design_Assumptions_20200825120911.pdf

Bolander_32_State_Fed_Com_121H___Casing_Design_Summary_20200825133559.pdf

Operator Name: COLGATE OPERATING LLC

Well Name: BOLANDER 32 STATE FED COM

Well Number: 121H

Casing Attachments

Casing ID: 2 **String Type:** INTERMEDIATE

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Casing_Design_Assumptions_20200825122118.pdf

Bolander_32_State_Fed_Com_121H___Casing_Design_Summary_20200825133616.pdf

Casing ID: 3 **String Type:** PRODUCTION

Inspection Document:

Spec Document:

Tapered String Spec:

Casing Design Assumptions and Worksheet(s):

Casing_Design_Assumptions_20200825122347.pdf

Bolander_32_State_Fed_Com_121H___Casing_Design_Summary_20200825133630.pdf

Section 4 - Cement

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
SURFACE	Lead		0	0	0	0	0	0		0	0
SURFACE	Tail		0	200	139	1.8	13.5	250.2	100	Class C	salt, accelerator, extender & LCM additives
PRODUCTION	Lead		0	0	0	0	0	0	0	0	0

Operator Name: COLGATE OPERATING LLC

Well Name: BOLANDER 32 STATE FED COM

Well Number: 121H

String Type	Lead/Tail	Stage Tool Depth	Top MD	Bottom MD	Quantity(sx)	Yield	Density	Cu Ft	Excess%	Cement type	Additives
PRODUCTION	Tail		2050	1745 3	3736	1.24	14.2	4632. 64	20	Class H	Fluid loss, dispersant, retarder & LCM additives
INTERMEDIATE	Lead		0	2336	644	2.19	12.7	1410. 36	100	Class C	salt, extender & LCM additives
INTERMEDIATE	Tail		2336	2920	172	1.33	14.8	228.7 6	25	Class C	accelerator & LCM additives

Section 5 - Circulating Medium

Mud System Type: Closed

Will an air or gas system be Used? NO

Description of the equipment for the circulating system in accordance with Onshore Order #2:

Diagram of the equipment for the circulating system in accordance with Onshore Order #2:

Describe what will be on location to control well or mitigate other conditions: All necessary mud products for weight addition and fluid loss control will be on location at all times.

Describe the mud monitoring system utilized: Mud program is subject to change due to hole conditions. The mud monitoring system is an electronic Pason system satisfying requirements of Onshore Order #1. Both visual and electronic mud monitoring equipment will be utilized to detect volume changes indicating loss or gain of circulating system fluid volume. Slow pump rates will be taken & recorded tourly in the drilling log. Mud engineer will perform tests and provide written report at least every 12 hours while circulating. A trip tank will be utilized and trip sheet will be recorded to ensure wellbore is taking proper fill or displacing proper fluid volume during all tripping operations. Gas detecting equipment will be utilized to monitor for hydrocarbon gas at the shakers while drilling and/or circulating. H2S monitoring equipment with both visual & auditory alarms will be installed and operational at the shakers, rig floor and cellar while drilling and/or circulating. A flare system with an effective method for ignition & discharge more than 100 feet from the wellbore will be utilized to gather and burn all gas; lines will be straight unless targeted with running tees. A mud gas separator will be installed and operable at least 500 feet before first anticipated hydrocarbon zone.

Circulating Medium Table

Top Depth	Bottom Depth	Mud Type	Min Weight (lbs/gal)	Max Weight (lbs/gal)	Density (lbs/cu ft)	Gel Strength (lbs/100 sqft)	PH	Viscosity (CP)	Salinity (ppm)	Filtration (cc)	Additional Characteristics
0	200	SPUD MUD	8.6	9							
200	2920	SALT SATURATED	10	10.2							

Operator Name: COLGATE OPERATING LLC

Well Name: BOLANDER 32 STATE FED COM

Well Number: 121H

Top Depth	Bottom Depth	Mud Type	Min Weight (lbs/gal)	Max Weight (lbs/gal)	Density (lbs/cu ft)	Gel Strength (lbs/100 sqft)	PH	Viscosity (CP)	Salinity (ppm)	Filtration (cc)	Additional Characteristics
2920	1745 3	WATER-BASED MUD	9	10							

Section 6 - Test, Logging, Coring

List of production tests including testing procedures, equipment and safety measures:

Directional surveys will be collected at no greater than 200' intervals while drilling through the MWD tools. A GR log will be collected while drilling through the MWD tools from intermediate casing to TD. No DSTs or cores are planned at this time. No CBL or temperature logs planned at this time. A formation integrity test (FIT) will be performed on all casing strings after BOPE is installed to at least 1 ppge over planned section mud weight after drilling ten feet of new hole.

List of open and cased hole logs run in the well:

GAMMA RAY LOG,

Coring operation description for the well:

No openhole logs are planned at this time.

Section 7 - Pressure

Anticipated Bottom Hole Pressure: 3143

Anticipated Surface Pressure: 1571

Anticipated Bottom Hole Temperature(F): 120

Anticipated abnormal pressures, temperatures, or potential geologic hazards? NO

Describe:

Contingency Plans geohazards description:

Contingency Plans geohazards attachment:

Hydrogen Sulfide drilling operations plan required? YES

Hydrogen sulfide drilling operations plan:

Colgate_H2S_Contingency_Plan_20200825124817.pdf

Operator Name: COLGATE OPERATING LLC

Well Name: BOLANDER 32 STATE FED COM

Well Number: 121H

Section 8 - Other Information

Proposed horizontal/directional/multi-lateral plan submission:

Bolander_32_State_Fed_Com_121H___Rev0_AC_20200825125530.pdf

Bolander_32_State_Fed_Com_121H___Rev0_WM_20200825125535.pdf

Bolander_32_State_Fed_Com_121H___Rev0_20200825125539.pdf

Other proposed operations facets description:

After cement has been allowed to sit undisturbed for eight hours and has reached a compressive strength of 500 psi across the zone of interest, the 133/8 surface casing will be pressured to 1,500 psi and held for 30 minutes. Lab reports with the 500 psi compressive strength time for the cement will be onsite for review. A casing test will be deemed successful if test pressure does not decline more than 10% over the thirty minute period. The casing pressure test will be completed against the blind rams of 135/8 10M BOPE prior to PU tools to drill out. After cement has been allowed to sit undisturbed for eight hours and has reached a compressive strength of 500 psi across the zone of interest, the 95/8 intermediate casing will be pressured to 2,500 psi and held for 30 minutes. Lab reports with the 500 psi compressive strength time for the cement will be onsite for review. A casing test will be deemed successful if test pressure does not decline more than 10% over the thirty minute period. Casing pressure test will be completed against the lower pipe rams of 135/8 10M BOPE immediately prior to drilling out float equipment. Casing pressure test on 51/2 production casing will occur more than 72 hours after cement is placed and reached ultimate compressive strength. Lab reports with the 500 psi compressive strength time for the cement will be onsite for review. A casing test will be deemed successful if test pressure does not decline more than 10% over the thirty minute period. Casing will be tested by pressuring up to 10,000 psi and holding pressure for 30 minutes prior to the beginning of perforating & stimulating operations.

Cement will be placed on all casing strings utilizing the pump and plug method. A float will be installed in the casing shoe and float collar on all casing strings to hold cement in place once pumping is completed. A top plug will be utilized on all casing strings to prevent contamination of the cement by the displacement fluid. A preflush fluid will be pumped prior to cement to aid in removal of drilling mud from the wellbore, eliminate drilling mud contamination of the cement slurry and prepare the surface of both the wellbore and casing for cement.

No abnormal pressures or temperatures are expected. In accordance with Onshore Order No. 6, Colgate Energy does not anticipate that there will be enough H2S from the surface to the Wolfcamp formations to meet the BLMs minimum requirements for the submission of an H2S Drilling Operation Plan or Public Protection Plan for the drilling and completion of this well. Since we have an H2S safety package on all wells, attached is an H2S Drilling Operations Plan. Adequate flare lines will be installed off the mud/gas separator where gas may be flared safely. All personnel will be familiar with all aspects of safe operation of equipment being used.

Other proposed operations facets attachment:

Encore_Wellhead_Multi_Bowl_20200825125405.docx

Bolander_32_State_Fed_Com_121H_Gas_Capture_Plan_20200825125420.docx

Bolander_32_State_Fed_Com_121H_APD_Procedure_20200825125429.pdf

Choke_Hose_SN_20200825125455.pdf

Other Variance attachment:



H₂S Contingency Plan



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I. EMERGENCY ASSISTANCE TELEPHONE LIST

PUBLIC SAFETY

911 or

Sheriff's Department:

Eddy County Sheriff's Office (575) 887-7551

Fire Department:

Carlsbad Fire Department (575) 885-3125

Artesia Fire Department (575) 746-5051

Ambulance:

Elite Medical Transport (Carlsbad) (915) 542-1144

Trans Aero MedEvac (Artesia) (970) 657-7449

Hospitals:

Carlsbad Medical Center (575) 887-4100

Artesia General Hospital (575) 748-3333

New Mexico Dept. of Transportation:

Highway & Transportation Department (505) 795- 1401

New Mexico Railroad Commission:

Main Line (505) 476-3441

OSHA 24 Hr. Reporting

(800) 321-6742

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

Office Contacts**911 or****Colgate Energy LLC.****(432) 695-4222****Vice President of Operations:**

Casey McCain

(432) 664-6140

Drilling Engineering Supervisor

Rafael Madrid

(432) 556-6387

Drilling Engineering Technical Adviser

Steven Segrest

(405) 550-0277

Operations Superintendent

Rick Lawson

(432) 530- 3188

Drilling Superintendent

Daniel Cameron

(405) 933-0435

Onsite Supervision (H&P 481 Rig Managers)

Juan Gutierrez

(970)394-4768

Jonathan Jackson

(970)394-4768

Onsite Supervision (H&P 481 Company Men)

Pierre Dupuis

(432)438-0114

Eric Rutherford

(432)438-0114

Rolando Torres

(432)438-0114

Trevor Hein

(432)438-0114

Emergency Accommodations

Safety Solutions Office

(432) 563-0400

Safety Solutions Dispatch

(432) 556-2002

Craig Strasner

(432) 894-0341 (Cell)

II. H₂S 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 (H₂S).

Objective:

Prevent any and all accidents and prevent the uncontrolled release of H₂S 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 H₂S 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 H₂S 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 H₂S.

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 H₂S drilling operations safety. The release of a potentially hazardous quantity of H₂S 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 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 H₂S 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 H₂S 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 H₂S. Two copies of this plan shall be retained at the office of Colgate Energy. 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 H₂S 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 Mani folding necessary to handle poisonous gas, particular care will be taken to ensure that all rig personnel are completely familiar with their jobs during the drills. The Drilling Consultant and Tool Pusher (Rig Superintendent) are thoroughly familiar with the additional controls and piping necessary.

B. H₂S Alarm Drills

The Company Man and/ or designee will conduct frequent H₂S alarm drills for each crew by injecting a trace of H₂S 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 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 NMOCD, the BLM, or if any of the stack is nipped 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 H₂S, 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 or as instructed by Colgate Energy. Talks may include the following subjects:

1. Dangers of Hydrogen Sulfide (H₂S).
2. Use and limitations of air equipment.
3. Use of resuscitator.
4. Organize Buddy System.
5. First Aid procedures.
6. Use of H₂S 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 H₂S 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 H₂S 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, Windsocks, 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 regarding 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 H₂S 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 contacting 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 oversee 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 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 H₂S gas well, the earlier the warning of danger the better chance to control operations. Mud Company will be in daily contact with Colgate Energy Consultant. The Mud Engineer will take samples of the mud, analyze these samples, and make necessary recommendations to prevent H₂S 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 enough for corrosion protection. If there is an influx of H₂S gas from the formation, the pH will be increased as necessary for corrosion control.

H₂S Scavengers – If necessary H₂S 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 H₂S zones or when H₂S 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 H₂S (10 PPM) or of SO₂ (5 PPM) is reached. If the concentration of H₂S or SO₂ 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 H₂S or SO₂ 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 escaping gas.

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 H₂S can reasonably be expected.
3. When sampling air in areas to determine if toxic concentrations of H₂S exist.
4. When working in areas where 10 PPM or more of H₂S has been detected.
5. At any time, there is doubt as to the H₂S 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 H₂S 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 H₂S 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 if 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 H₂S
 - 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 Consultant

- 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 H₂S.
- 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 Consultant or the Driller (buddy system).
- iii. Determine the concentration of H₂S.
- 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 H₂S 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, H₂S emergency procedures and etc.
- C. Clean up, recharge, restock, repair, and/ or replace H₂S 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 H₂S 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.

VIII. TRAINING PROGRAM

When working in an area where Hydrogen Sulfide (H₂S) 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 (H₂S).
2. Physical effects of Hydrogen Sulfide on the human body.
3. Toxicity of Hydrogen Sulfide and Sulfur Dioxide.
4. H₂S 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 H₂S, 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 H₂S concentration reaches the IDLH level (100 ppm).

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

Windssocks or Wind Streamers:

- A minimum of two 10" windssocks located at strategic locations so that they may be seen from any point on location.
- Wind streamers (if preferred) should always be placed at various locations on the well site to ensure wind consciousness. (Corners of location).

Hydrogen Sulfide Detector and Alarms:

- 1 - Four channel H₂S 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, H₂S 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 (O₂, LEL H₂S), preferably 4 (O₂, LEL, H₂S, 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 and 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 H₂S monitors are available for all employees on location.
- Automatic Flare Igniters are recommended for installation on the rig.

X. CHECKLISTS

Rig-up & Equipment Status Check List

Note: Initial & Date each item as they are implemented. Multiple wells require additional Columns to be Dated/ Initialed

	Date & Initial 1 st Well	Date & Initial 2 nd Well	Date & Initial 3 rd Well	Date & Initial 4 th Well
Sign at location entrance.				
Two (2) windsocks (in required locations).				
Wind Streamers (if required).				
SCBA's on location (Minimum of 2 @ each Muster Area)				
Air packs (working packs and escape packs), inspected and ready for use.				
Spare bottles for each air pack (if required).				
Cascade system and hose line hook up.				
Choke manifold hooked-up and tested. (before drilling out surface casing.)				
Remote Hydraulic BOP control tested (before drilling out surface casing).				
BOP tested (before drilling out surface casing).				
Safe Briefing Areas set-up				
Well Condition sign and flags on location and ready.				
Hydrogen Sulfide detection/ alarm system hooked-up & tested.				
Stretcher on location				
2 – 100' Lifelines on location.				
1 – 20# Fire Extinguisher in safety trailer.				
Confined Space monitor on location and tested.				
All rig crews and supervisor trained (as required).				
All rig crews and supervision medically qualified and fit tested on proper respirators				
Access restricted for unauthorized personnel.				
Pre-spud meeting held reviewing Contingencies				
Drills on H ₂ S and well control procedures.				
All outside service contractors advised of potential H ₂ S on the well.				
25mm Flare Gun on location w/flares.				

Procedural Check List

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 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 Colgate Energy 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 roadblocks. 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. 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 H₂S 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 H₂S and physical effects are shown in Table 2.

Table 1
Permissible Exposure Limits of Various Gases

<u>Common Name</u>	<u>Symbol</u>	<u>Sp. Gravity</u>	<u>TLV</u>	<u>STEL</u>	<u>IDLH</u>
Hydrogen Cyanide	HCN	.94	4.7 ppm	4.7 ppm	50 ppm
Hydrogen Sulfide	H ₂ S	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 H₂S 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 H₂S 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 H₂S

<u>Percent %</u>	<u>PPM</u>	<u>Physical Effects</u>
.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 H₂S

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 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, like "rotten eggs". For this reason, it earned its common name "sour gas". However, H₂S, 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 H₂S 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, H₂S 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 (SO₂), 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 H₂S.
- B. When breaking out any line where H₂S can reasonably be expected.
- C. When sampling air in areas where H₂S may be present.
- D. When working in areas where the concentration of H₂S exceeds the Threshold Limit Value for H₂S (10 ppm).
- E. At any time where there is a doubt as to the H₂S level in the area to be entered.

EMERGENCY RESCUE PROCEDURES

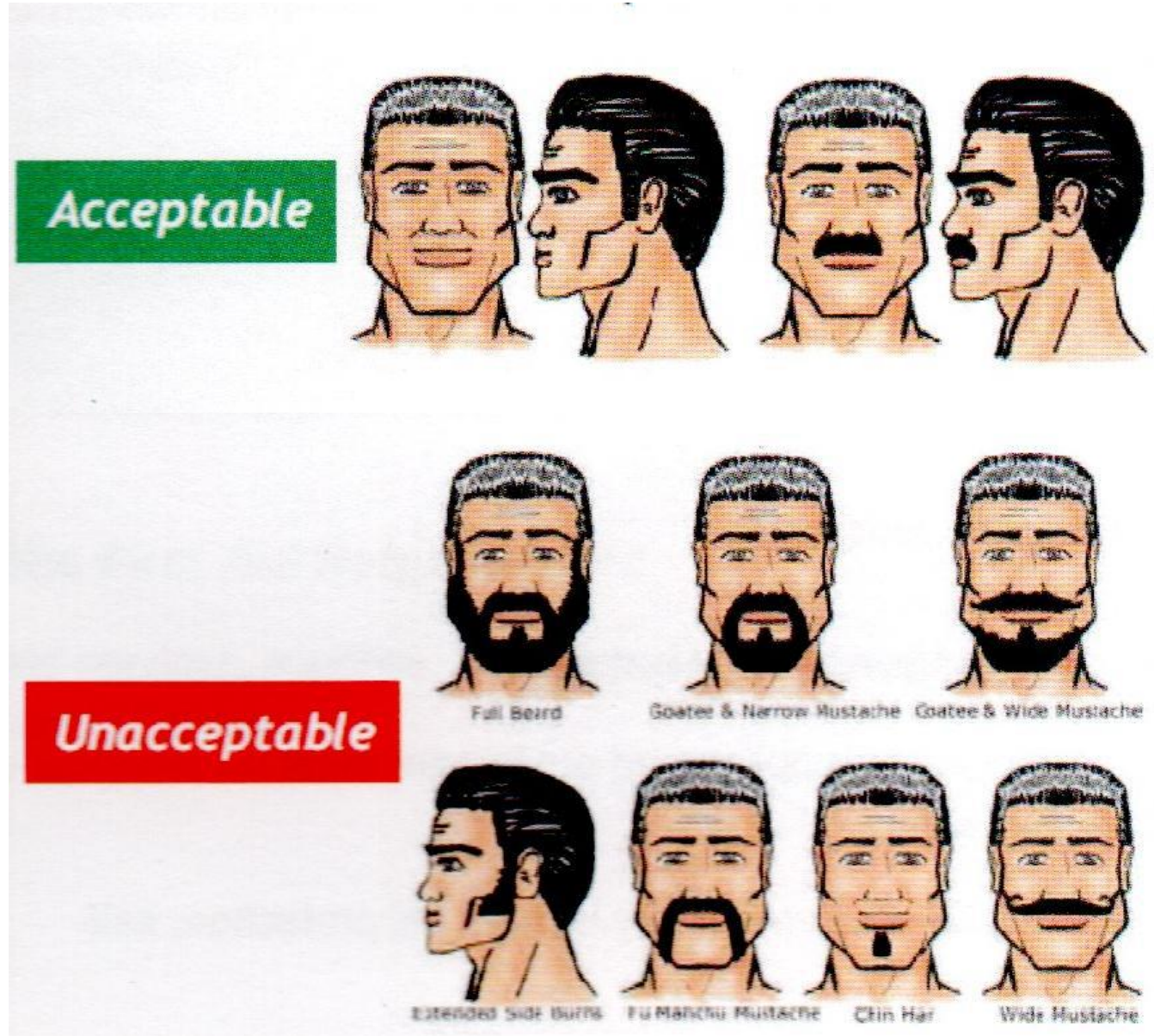
DO NOT PANIC!!!

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 H₂S, 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 H₂S 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.





Colgate Energy

Eddy County, NM (N83-NME)

Bolander 32

02 Bolander 32 State Fed Com 121H

Permit

Plan: APD-Rev 0 269.02

Standard Planning Report

25 August, 2020

Database:	EDM 5000.14 Single User Db	Local Co-ordinate Reference:	Well 02 Bolander 32 State Fed Com 121H
Company:	Colgate Energy	TVD Reference:	3368+25 @ 3393.00usft (Permit)
Project:	Eddy County, NM (N83-NME)	MD Reference:	3368+25 @ 3393.00usft (Permit)
Site:	Bolander 32	North Reference:	Grid
Well:	02 Bolander 32 State Fed Com 121H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Permit		
Design:	APD-Rev 0 269.02		

Project	Eddy County, NM (N83-NME)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site		Bolander 32			
Site Position:		Northing:	589,599.89 usft	Latitude:	32.62077994
From:	Map	Easting:	585,156.50 usft	Longitude:	-104.19100908
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	0.08 °

Well	02 Bolander 32 State Fed Com 121H					
Well Position	+N/-S	0.00 usft	Northing:	589,599.89 usft	Latitude:	32.62077994
	+E/-W	0.00 usft	Easting:	585,156.50 usft	Longitude:	-104.19100908
Position Uncertainty		0.00 usft	Wellhead Elevation:		Ground Level:	3,368.00 usft

Wellbore	Permit				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2020	8/17/2020	6.96	60.20	47,750.14594701

Design	APD-Rev 0 269.02			
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	269.02

Plan Survey Tool Program	Date	8/25/2020		
Depth From (usft)	Depth To (usft)	Survey (Wellbore)	Tool Name	Remarks
1	0.00	17,453.05	APD-Rev 0 269.02 (Permit)	OWSG MWD Rev 4
				OWSG MWD - Standard

Database:	EDM 5000.14 Single User Db	Local Co-ordinate Reference:	Well 02 Bolander 32 State Fed Com 121H
Company:	Colgate Energy	TVD Reference:	3368+25 @ 3393.00usft (Permit)
Project:	Eddy County, NM (N83-NME)	MD Reference:	3368+25 @ 3393.00usft (Permit)
Site:	Bolander 32	North Reference:	Grid
Well:	02 Bolander 32 State Fed Com 121H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Permit		
Design:	APD-Rev 0 269.02		

Plan Sections										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.00	0.00	0.00	0.00	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	
1,633.45	5.00	39.64	1,633.03	11.20	9.28	1.50	1.50	0.00	39.64	
6,183.72	5.00	39.64	6,165.97	316.68	262.40	0.00	0.00	0.00	0.00	
6,517.17	0.00	0.00	6,499.00	327.88	271.68	1.50	-1.50	0.00	180.00	L02-00-EON (Bol32-1
6,704.11	0.00	0.00	6,685.94	327.88	271.68	0.00	0.00	0.00	0.00	
7,304.11	60.00	270.80	7,182.14	331.88	-14.77	10.00	10.00	0.00	270.80	
7,621.49	91.72	269.68	7,258.69	332.94	-318.61	10.00	9.99	-0.35	-2.13	
9,809.75	91.72	269.68	7,193.00	320.73	-2,505.85	0.00	0.00	0.00	0.00	
9,838.25	91.15	269.68	7,192.29	320.57	-2,534.34	2.00	-2.00	0.00	180.00	
12,310.43	91.15	269.68	7,142.67	306.76	-5,005.98	0.00	0.00	0.00	0.00	
12,397.23	92.29	268.37	7,140.07	305.29	-5,092.73	2.00	1.31	-1.51	-48.94	
14,812.55	92.29	268.37	7,043.56	236.64	-7,505.15	0.00	0.00	0.00	0.00	
14,869.77	91.15	268.37	7,041.84	235.01	-7,562.32	2.00	-2.00	0.00	-179.86	
17,453.82	91.15	268.37	6,990.18	161.40	-10,144.80	0.00	0.00	0.00	0.00	L02-03-PBHL(Bol32-1

Database:	EDM 5000.14 Single User Db	Local Co-ordinate Reference:	Well 02 Bolander 32 State Fed Com 121H
Company:	Colgate Energy	TVD Reference:	3368+25 @ 3393.00usft (Permit)
Project:	Eddy County, NM (N83-NME)	MD Reference:	3368+25 @ 3393.00usft (Permit)
Site:	Bolander 32	North Reference:	Grid
Well:	02 Bolander 32 State Fed Com 121H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Permit		
Design:	APD-Rev 0 269.02		

Planned Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
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
193.00	0.00	0.00	193.00	0.00	0.00	0.00	0.00	0.00	0.00
Rustler									
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	0.00
248.00	0.00	0.00	248.00	0.00	0.00	0.00	0.00	0.00	0.00
Top of Salt									
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
555.00	0.00	0.00	555.00	0.00	0.00	0.00	0.00	0.00	0.00
Base of Salt									
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
773.00	0.00	0.00	773.00	0.00	0.00	0.00	0.00	0.00	0.00
Yates									
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	1.50	39.64	1,399.99	1.01	0.84	-0.85	1.50	1.50	0.00
1,500.00	3.00	39.64	1,499.91	4.03	3.34	-3.41	1.50	1.50	0.00
1,600.00	4.50	39.64	1,599.69	9.07	7.51	-7.67	1.50	1.50	0.00
1,613.35	4.70	39.64	1,613.00	9.89	8.20	-8.36	1.50	1.50	0.00
Capitan									
1,633.45	5.00	39.64	1,633.03	11.20	9.28	-9.47	1.50	1.50	0.00
1,700.00	5.00	39.64	1,699.32	15.67	12.98	-13.25	0.00	0.00	0.00
1,800.00	5.00	39.64	1,798.94	22.38	18.54	-18.93	0.00	0.00	0.00
1,900.00	5.00	39.64	1,898.56	29.10	24.11	-24.60	0.00	0.00	0.00
2,000.00	5.00	39.64	1,998.18	35.81	29.67	-30.28	0.00	0.00	0.00
2,100.00	5.00	39.64	2,097.80	42.52	35.23	-35.96	0.00	0.00	0.00
2,200.00	5.00	39.64	2,197.42	49.24	40.80	-41.63	0.00	0.00	0.00
2,300.00	5.00	39.64	2,297.04	55.95	46.36	-47.31	0.00	0.00	0.00
2,400.00	5.00	39.64	2,396.66	62.66	51.92	-52.99	0.00	0.00	0.00
2,500.00	5.00	39.64	2,496.28	69.38	57.48	-58.66	0.00	0.00	0.00
2,600.00	5.00	39.64	2,595.90	76.09	63.05	-64.34	0.00	0.00	0.00
2,700.00	5.00	39.64	2,695.52	82.80	68.61	-70.02	0.00	0.00	0.00
2,800.00	5.00	39.64	2,795.13	89.52	74.17	-75.69	0.00	0.00	0.00
2,900.00	5.00	39.64	2,894.75	96.23	79.73	-81.37	0.00	0.00	0.00
3,000.00	5.00	39.64	2,994.37	102.94	85.30	-87.05	0.00	0.00	0.00
3,003.64	5.00	39.64	2,998.00	103.19	85.50	-87.25	0.00	0.00	0.00
DLWR Mnt. Group									
3,100.00	5.00	39.64	3,093.99	109.66	90.86	-92.72	0.00	0.00	0.00
3,200.00	5.00	39.64	3,193.61	116.37	96.42	-98.40	0.00	0.00	0.00
3,300.00	5.00	39.64	3,293.23	123.08	101.99	-104.08	0.00	0.00	0.00
3,400.00	5.00	39.64	3,392.85	129.80	107.55	-109.75	0.00	0.00	0.00
3,414.20	5.00	39.64	3,407.00	130.75	108.34	-110.56	0.00	0.00	0.00
Lower Brushy Canyon									
3,500.00	5.00	39.64	3,492.47	136.51	113.11	-115.43	0.00	0.00	0.00
3,600.00	5.00	39.64	3,592.09	143.22	118.67	-121.11	0.00	0.00	0.00
3,700.00	5.00	39.64	3,691.71	149.94	124.24	-126.78	0.00	0.00	0.00

Database:	EDM 5000.14 Single User Db	Local Co-ordinate Reference:	Well 02 Bolander 32 State Fed Com 121H
Company:	Colgate Energy	TVD Reference:	3368+25 @ 3393.00usft (Permit)
Project:	Eddy County, NM (N83-NME)	MD Reference:	3368+25 @ 3393.00usft (Permit)
Site:	Bolander 32	North Reference:	Grid
Well:	02 Bolander 32 State Fed Com 121H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Permit		
Design:	APD-Rev 0 269.02		

Planned Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
3,800.00	5.00	39.64	3,791.33	156.65	129.80	-132.46	0.00	0.00	0.00	
3,851.87	5.00	39.64	3,843.00	160.13	132.68	-135.40	0.00	0.00	0.00	
Bone Spring Lime										
3,900.00	5.00	39.64	3,890.95	163.37	135.36	-138.14	0.00	0.00	0.00	
4,000.00	5.00	39.64	3,990.56	170.08	140.92	-143.81	0.00	0.00	0.00	
4,100.00	5.00	39.64	4,090.18	176.79	146.49	-149.49	0.00	0.00	0.00	
4,200.00	5.00	39.64	4,189.80	183.51	152.05	-155.17	0.00	0.00	0.00	
4,300.00	5.00	39.64	4,289.42	190.22	157.61	-160.84	0.00	0.00	0.00	
4,400.00	5.00	39.64	4,389.04	196.93	163.18	-166.52	0.00	0.00	0.00	
4,500.00	5.00	39.64	4,488.66	203.65	168.74	-172.20	0.00	0.00	0.00	
4,600.00	5.00	39.64	4,588.28	210.36	174.30	-177.87	0.00	0.00	0.00	
4,700.00	5.00	39.64	4,687.90	217.07	179.86	-183.55	0.00	0.00	0.00	
4,800.00	5.00	39.64	4,787.52	223.79	185.43	-189.23	0.00	0.00	0.00	
4,900.00	5.00	39.64	4,887.14	230.50	190.99	-194.90	0.00	0.00	0.00	
5,000.00	5.00	39.64	4,986.76	237.21	196.55	-200.58	0.00	0.00	0.00	
5,100.00	5.00	39.64	5,086.38	243.93	202.11	-206.26	0.00	0.00	0.00	
5,200.00	5.00	39.64	5,186.00	250.64	207.68	-211.93	0.00	0.00	0.00	
5,300.00	5.00	39.64	5,285.61	257.35	213.24	-217.61	0.00	0.00	0.00	
5,400.00	5.00	39.64	5,385.23	264.07	218.80	-223.29	0.00	0.00	0.00	
5,500.00	5.00	39.64	5,484.85	270.78	224.36	-228.96	0.00	0.00	0.00	
5,600.00	5.00	39.64	5,584.47	277.49	229.93	-234.64	0.00	0.00	0.00	
5,700.00	5.00	39.64	5,684.09	284.21	235.49	-240.32	0.00	0.00	0.00	
5,799.29	5.00	39.64	5,783.00	290.87	241.01	-245.95	0.00	0.00	0.00	
1st Bone Spring SD										
5,800.00	5.00	39.64	5,783.71	290.92	241.05	-245.99	0.00	0.00	0.00	
5,859.52	5.00	39.64	5,843.00	294.92	244.36	-249.37	0.00	0.00	0.00	
2nd Bone Spring LM										
5,900.00	5.00	39.64	5,883.33	297.64	246.62	-251.67	0.00	0.00	0.00	
6,000.00	5.00	39.64	5,982.95	304.35	252.18	-257.35	0.00	0.00	0.00	
6,100.00	5.00	39.64	6,082.57	311.06	257.74	-263.02	0.00	0.00	0.00	
6,183.72	5.00	39.64	6,165.97	316.68	262.40	-267.78	0.00	0.00	0.00	
6,200.00	4.76	39.64	6,182.19	317.75	263.28	-268.68	1.50	-1.50	0.00	
6,300.00	3.26	39.64	6,281.94	323.13	267.74	-273.23	1.50	-1.50	0.00	
6,400.00	1.76	39.64	6,381.84	326.50	270.53	-276.08	1.50	-1.50	0.00	
6,500.00	0.26	39.64	6,481.83	327.85	271.65	-277.22	1.50	-1.50	0.00	
6,517.17	0.00	0.00	6,499.00	327.88	271.68	-277.25	1.50	-1.50	0.00	
L02-00-EON (Bol32-121H)										
6,600.00	0.00	0.00	6,581.83	327.88	271.68	-277.25	0.00	0.00	0.00	
6,704.11	0.00	0.00	6,685.94	327.88	271.68	-277.25	0.00	0.00	0.00	
KOP: 6704.11' MD, -277.25' VS, 6685.94' TVD										
6,750.00	4.59	270.80	6,731.78	327.91	269.84	-275.41	10.00	10.00	0.00	
6,800.00	9.59	270.80	6,781.38	328.00	263.67	-269.25	10.00	10.00	0.00	
6,850.00	14.59	270.80	6,830.25	328.14	253.21	-258.78	10.00	10.00	0.00	
6,900.00	19.59	270.80	6,878.03	328.35	238.52	-244.10	10.00	10.00	0.00	
6,950.00	24.59	270.80	6,924.35	328.61	219.73	-225.32	10.00	10.00	0.00	
6,999.02	29.49	270.80	6,968.00	328.92	197.45	-203.05	10.00	10.00	0.00	
2nd Bone Spring SD										
7,000.00	29.59	270.80	6,968.85	328.93	196.97	-202.57	10.00	10.00	0.00	
7,050.00	34.59	270.80	7,011.20	329.30	170.42	-176.02	10.00	10.00	0.00	
7,100.00	39.59	270.80	7,051.07	329.72	140.28	-145.90	10.00	10.00	0.00	
7,150.00	44.59	270.80	7,088.16	330.19	106.78	-112.41	10.00	10.00	0.00	
7,187.99	48.39	270.80	7,114.31	330.57	79.24	-84.88	10.00	10.00	0.00	
L02-01-FTP (Bol32-121H)										

Database:	EDM 5000.14 Single User Db	Local Co-ordinate Reference:	Well 02 Bolander 32 State Fed Com 121H
Company:	Colgate Energy	TVD Reference:	3368+25 @ 3393.00usft (Permit)
Project:	Eddy County, NM (N83-NME)	MD Reference:	3368+25 @ 3393.00usft (Permit)
Site:	Bolander 32	North Reference:	Grid
Well:	02 Bolander 32 State Fed Com 121H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Permit		
Design:	APD-Rev 0 269.02		

Planned Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
7,200.00	49.59	270.80	7,122.20	330.70	70.17	-75.82	10.00	10.00	0.00	
7,250.00	54.59	270.80	7,152.91	331.25	30.74	-36.40	10.00	10.00	0.00	
7,304.11	60.00	270.80	7,182.14	331.88	-14.77	9.09	10.00	10.00	0.00	
7,350.00	64.59	270.61	7,203.47	332.38	-55.38	49.69	10.00	9.99	-0.41	
7,400.00	69.58	270.42	7,222.93	332.80	-101.42	95.71	10.00	9.99	-0.38	
7,450.00	74.58	270.24	7,238.31	333.07	-148.98	143.26	10.00	9.99	-0.36	
7,500.00	79.58	270.07	7,249.48	333.21	-197.70	191.97	10.00	9.99	-0.34	
7,550.00	84.57	269.91	7,256.38	333.20	-247.20	241.47	10.00	9.99	-0.33	
7,600.00	89.57	269.75	7,258.93	333.05	-297.12	291.38	10.00	9.99	-0.32	
7,621.49	91.72	269.68	7,258.69	332.94	-318.61	312.87	10.00	9.99	-0.32	
EOC: 7621.49' MD, 312.87' VS, 7258.69' TVD										
7,700.00	91.72	269.68	7,256.33	332.51	-397.08	391.34	0.00	0.00	0.00	
7,800.00	91.72	269.68	7,253.33	331.95	-497.04	491.29	0.00	0.00	0.00	
7,900.00	91.72	269.68	7,250.33	331.39	-596.99	591.23	0.00	0.00	0.00	
8,000.00	91.72	269.68	7,247.32	330.83	-696.94	691.18	0.00	0.00	0.00	
8,100.00	91.72	269.68	7,244.32	330.27	-796.90	791.13	0.00	0.00	0.00	
8,200.00	91.72	269.68	7,241.32	329.71	-896.85	891.08	0.00	0.00	0.00	
8,300.00	91.72	269.68	7,238.32	329.16	-996.80	991.03	0.00	0.00	0.00	
8,400.00	91.72	269.68	7,235.32	328.60	-1,096.76	1,090.98	0.00	0.00	0.00	
8,500.00	91.72	269.68	7,232.32	328.04	-1,196.71	1,190.92	0.00	0.00	0.00	
8,600.00	91.72	269.68	7,229.32	327.48	-1,296.66	1,290.87	0.00	0.00	0.00	
8,700.00	91.72	269.68	7,226.31	326.92	-1,396.62	1,390.82	0.00	0.00	0.00	
8,800.00	91.72	269.68	7,223.31	326.36	-1,496.57	1,490.77	0.00	0.00	0.00	
8,900.00	91.72	269.68	7,220.31	325.81	-1,596.52	1,590.72	0.00	0.00	0.00	
9,000.00	91.72	269.68	7,217.31	325.25	-1,696.48	1,690.67	0.00	0.00	0.00	
9,100.00	91.72	269.68	7,214.31	324.69	-1,796.43	1,790.61	0.00	0.00	0.00	
9,200.00	91.72	269.68	7,211.31	324.13	-1,896.38	1,890.56	0.00	0.00	0.00	
9,300.00	91.72	269.68	7,208.30	323.57	-1,996.34	1,990.51	0.00	0.00	0.00	
9,400.00	91.72	269.68	7,205.30	323.01	-2,096.29	2,090.46	0.00	0.00	0.00	
9,500.00	91.72	269.68	7,202.30	322.46	-2,196.24	2,190.41	0.00	0.00	0.00	
9,600.00	91.72	269.68	7,199.30	321.90	-2,296.20	2,290.36	0.00	0.00	0.00	
9,700.00	91.72	269.68	7,196.30	321.34	-2,396.15	2,390.30	0.00	0.00	0.00	
9,809.75	91.72	269.68	7,193.00	320.73	-2,505.85	2,500.00	0.00	0.00	0.00	
9,838.25	91.15	269.68	7,192.29	320.57	-2,534.34	2,528.49	2.00	-2.00	0.00	
9,900.00	91.15	269.68	7,191.05	320.22	-2,596.08	2,590.22	0.00	0.00	0.00	
10,000.00	91.15	269.68	7,189.04	319.67	-2,696.06	2,690.19	0.00	0.00	0.00	
10,100.00	91.15	269.68	7,187.04	319.11	-2,796.03	2,790.17	0.00	0.00	0.00	
10,200.00	91.15	269.68	7,185.03	318.55	-2,896.01	2,890.14	0.00	0.00	0.00	
10,300.00	91.15	269.68	7,183.02	317.99	-2,995.99	2,990.11	0.00	0.00	0.00	
10,400.00	91.15	269.68	7,181.02	317.43	-3,095.97	3,090.09	0.00	0.00	0.00	
10,500.00	91.15	269.68	7,179.01	316.87	-3,195.95	3,190.06	0.00	0.00	0.00	
10,600.00	91.15	269.68	7,177.00	316.31	-3,295.93	3,290.03	0.00	0.00	0.00	
10,700.00	91.15	269.68	7,175.00	315.76	-3,395.90	3,390.01	0.00	0.00	0.00	
10,800.00	91.15	269.68	7,172.99	315.20	-3,495.88	3,489.98	0.00	0.00	0.00	
10,900.00	91.15	269.68	7,170.98	314.64	-3,595.86	3,589.95	0.00	0.00	0.00	
11,000.00	91.15	269.68	7,168.97	314.08	-3,695.84	3,689.93	0.00	0.00	0.00	
11,100.00	91.15	269.68	7,166.97	313.52	-3,795.82	3,789.90	0.00	0.00	0.00	
11,200.00	91.15	269.68	7,164.96	312.96	-3,895.79	3,889.87	0.00	0.00	0.00	
11,300.00	91.15	269.68	7,162.95	312.41	-3,995.77	3,989.85	0.00	0.00	0.00	
11,400.00	91.15	269.68	7,160.95	311.85	-4,095.75	4,089.82	0.00	0.00	0.00	
11,500.00	91.15	269.68	7,158.94	311.29	-4,195.73	4,189.79	0.00	0.00	0.00	
11,600.00	91.15	269.68	7,156.93	310.73	-4,295.71	4,289.77	0.00	0.00	0.00	
11,700.00	91.15	269.68	7,154.93	310.17	-4,395.69	4,389.74	0.00	0.00	0.00	
11,800.00	91.15	269.68	7,152.92	309.61	-4,495.66	4,489.71	0.00	0.00	0.00	

Database:	EDM 5000.14 Single User Db	Local Co-ordinate Reference:	Well 02 Bolander 32 State Fed Com 121H
Company:	Colgate Energy	TVD Reference:	3368+25 @ 3393.00usft (Permit)
Project:	Eddy County, NM (N83-NME)	MD Reference:	3368+25 @ 3393.00usft (Permit)
Site:	Bolander 32	North Reference:	Grid
Well:	02 Bolander 32 State Fed Com 121H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Permit		
Design:	APD-Rev 0 269.02		

Planned Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
11,900.00	91.15	269.68	7,150.91	309.06	-4,595.64	4,589.68	0.00	0.00	0.00
12,000.00	91.15	269.68	7,148.90	308.50	-4,695.62	4,689.66	0.00	0.00	0.00
12,100.00	91.15	269.68	7,146.90	307.94	-4,795.60	4,789.63	0.00	0.00	0.00
12,200.00	91.15	269.68	7,144.89	307.38	-4,895.58	4,889.60	0.00	0.00	0.00
12,226.39	91.15	269.68	7,144.36	307.23	-4,921.96	4,915.99	0.00	0.00	0.00
Sec31: 12226.39' MD, 7144.36' TVD - Sec31: 32.62164154, -104.20699440									
12,261.85	91.15	269.68	7,143.65	307.04	-4,957.41	4,951.43	0.00	0.00	0.00
L02-01-MP (Bol32-121H)									
12,300.00	91.15	269.68	7,142.88	306.82	-4,995.56	4,989.58	0.00	0.00	0.00
12,310.43	91.15	269.68	7,142.67	306.76	-5,005.98	5,000.00	0.00	0.00	0.00
12,397.23	92.29	268.37	7,140.07	305.29	-5,092.73	5,086.76	2.00	1.31	-1.51
12,400.00	92.29	268.37	7,139.96	305.21	-5,095.50	5,089.53	0.00	0.00	0.00
12,500.00	92.29	268.37	7,135.96	302.37	-5,195.38	5,189.44	0.00	0.00	0.00
12,600.00	92.29	268.37	7,131.97	299.52	-5,295.25	5,289.36	0.00	0.00	0.00
12,700.00	92.29	268.37	7,127.97	296.68	-5,395.13	5,389.27	0.00	0.00	0.00
12,800.00	92.29	268.37	7,123.98	293.84	-5,495.01	5,489.18	0.00	0.00	0.00
12,900.00	92.29	268.37	7,119.98	291.00	-5,594.89	5,589.10	0.00	0.00	0.00
13,000.00	92.29	268.37	7,115.98	288.16	-5,694.77	5,689.01	0.00	0.00	0.00
13,100.00	92.29	268.37	7,111.99	285.31	-5,794.65	5,788.93	0.00	0.00	0.00
13,200.00	92.29	268.37	7,107.99	282.47	-5,894.53	5,888.84	0.00	0.00	0.00
13,300.00	92.29	268.37	7,104.00	279.63	-5,994.41	5,988.75	0.00	0.00	0.00
13,400.00	92.29	268.37	7,100.00	276.79	-6,094.29	6,088.67	0.00	0.00	0.00
13,500.00	92.29	268.37	7,096.01	273.94	-6,194.17	6,188.58	0.00	0.00	0.00
13,600.00	92.29	268.37	7,092.01	271.10	-6,294.05	6,288.49	0.00	0.00	0.00
13,700.00	92.29	268.37	7,088.01	268.26	-6,393.93	6,388.41	0.00	0.00	0.00
13,800.00	92.29	268.37	7,084.02	265.42	-6,493.81	6,488.32	0.00	0.00	0.00
13,900.00	92.29	268.37	7,080.02	262.58	-6,593.69	6,588.24	0.00	0.00	0.00
14,000.00	92.29	268.37	7,076.03	259.73	-6,693.57	6,688.15	0.00	0.00	0.00
14,100.00	92.29	268.37	7,072.03	256.89	-6,793.45	6,788.06	0.00	0.00	0.00
14,200.00	92.29	268.37	7,068.04	254.05	-6,893.33	6,887.98	0.00	0.00	0.00
14,300.00	92.29	268.37	7,064.04	251.21	-6,993.21	6,987.89	0.00	0.00	0.00
14,400.00	92.29	268.37	7,060.04	248.36	-7,093.09	7,087.80	0.00	0.00	0.00
14,500.00	92.29	268.37	7,056.05	245.52	-7,192.97	7,187.72	0.00	0.00	0.00
14,600.00	92.29	268.37	7,052.05	242.68	-7,292.85	7,287.63	0.00	0.00	0.00
14,700.00	92.29	268.37	7,048.06	239.84	-7,392.73	7,387.55	0.00	0.00	0.00
14,800.00	92.29	268.37	7,044.06	237.00	-7,492.61	7,487.46	0.00	0.00	0.00
14,812.55	92.29	268.37	7,043.56	236.64	-7,505.15	7,500.00	0.00	0.00	0.00
14,869.77	91.15	268.37	7,041.84	235.01	-7,562.32	7,557.19	2.00	-2.00	0.00
14,900.00	91.15	268.37	7,041.24	234.15	-7,592.53	7,587.41	0.00	0.00	0.00
15,000.00	91.15	268.37	7,039.24	231.30	-7,692.46	7,687.38	0.00	0.00	0.00
15,100.00	91.15	268.37	7,037.24	228.45	-7,792.40	7,787.36	0.00	0.00	0.00
15,200.00	91.15	268.37	7,035.24	225.60	-7,892.34	7,887.33	0.00	0.00	0.00
15,300.00	91.15	268.37	7,033.24	222.75	-7,992.28	7,987.30	0.00	0.00	0.00
15,400.00	91.15	268.37	7,031.24	219.91	-8,092.22	8,087.28	0.00	0.00	0.00
15,500.00	91.15	268.37	7,029.24	217.06	-8,192.16	8,187.25	0.00	0.00	0.00
15,600.00	91.15	268.37	7,027.24	214.21	-8,292.10	8,287.22	0.00	0.00	0.00
15,700.00	91.15	268.37	7,025.24	211.36	-8,392.04	8,387.20	0.00	0.00	0.00
15,800.00	91.15	268.37	7,023.25	208.51	-8,491.98	8,487.17	0.00	0.00	0.00
15,900.00	91.15	268.37	7,021.25	205.66	-8,591.92	8,587.15	0.00	0.00	0.00
16,000.00	91.15	268.37	7,019.25	202.81	-8,691.86	8,687.12	0.00	0.00	0.00
16,100.00	91.15	268.37	7,017.25	199.97	-8,791.80	8,787.09	0.00	0.00	0.00
16,200.00	91.15	268.37	7,015.25	197.12	-8,891.74	8,887.07	0.00	0.00	0.00
16,300.00	91.15	268.37	7,013.25	194.27	-8,991.68	8,987.04	0.00	0.00	0.00

Database:	EDM 5000.14 Single User Db	Local Co-ordinate Reference:	Well 02 Bolander 32 State Fed Com 121H
Company:	Colgate Energy	TVD Reference:	3368+25 @ 3393.00usft (Permit)
Project:	Eddy County, NM (N83-NME)	MD Reference:	3368+25 @ 3393.00usft (Permit)
Site:	Bolander 32	North Reference:	Grid
Well:	02 Bolander 32 State Fed Com 121H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Permit		
Design:	APD-Rev 0 269.02		

Planned Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
16,400.00	91.15	268.37	7,011.25	191.42	-9,091.62	9,087.01	0.00	0.00	0.00	
16,500.00	91.15	268.37	7,009.25	188.57	-9,191.56	9,186.99	0.00	0.00	0.00	
16,600.00	91.15	268.37	7,007.25	185.72	-9,291.50	9,286.96	0.00	0.00	0.00	
16,700.00	91.15	268.37	7,005.25	182.87	-9,391.43	9,386.93	0.00	0.00	0.00	
16,800.00	91.15	268.37	7,003.25	180.03	-9,491.37	9,486.91	0.00	0.00	0.00	
16,900.00	91.15	268.37	7,001.25	177.18	-9,591.31	9,586.88	0.00	0.00	0.00	
17,000.00	91.15	268.37	6,999.25	174.33	-9,691.25	9,686.85	0.00	0.00	0.00	
17,100.00	91.15	268.37	6,997.25	171.48	-9,791.19	9,786.83	0.00	0.00	0.00	
17,200.00	91.15	268.37	6,995.25	168.63	-9,891.13	9,886.80	0.00	0.00	0.00	
17,300.00	91.15	268.37	6,993.26	165.78	-9,991.07	9,986.77	0.00	0.00	0.00	
17,363.84	91.15	268.37	6,991.98	163.96	-10,054.87	10,050.60	0.00	0.00	0.00	
L02-02-LTP (Bol32-121H)										
17,400.00	91.15	268.37	6,991.26	162.93	-10,091.01	10,086.75	0.00	0.00	0.00	
17,453.82	91.15	268.37	6,990.18	161.40	-10,144.80	10,140.55	0.00	0.00	0.00	
TD: 17453.82' MD, 10140.55' VS, 6990.18' TVD - L02-03-PBHL(Bol32-121H)										

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	
L02-00-EON (Bol32-121 - plan hits target center - Point	0.00	0.00	6,499.00	327.88	271.68	589,927.78	585,428.18	32.62168020	-104.19012523	
L02-03-PBHL(Bol32-121 - plan hits target center - Point	0.00	0.00	6,990.18	161.40	-10,144.80	589,761.29	575,011.70	32.62125660	-104.22395882	
L02-02-LTP (Bol32-121H - plan misses target center by 2.57usft at 17363.84usft MD (6991.98 TVD, 163.96 N, -10054.87 E) - Point	0.00	0.00	6,991.98	161.39	-10,054.80	589,761.28	575,101.70	32.62125632	-104.22366650	
L02-01-MP (Bol32-121H - plan misses target center by 1.81usft at 12261.85usft MD (7143.65 TVD, 307.04 N, -4957.41 E) - Point	0.00	0.00	7,143.84	308.84	-4,957.42	589,908.73	580,199.08	32.62164606	-104.20710958	
L02-01-FTP (Bol32-121H - plan misses target center by 210.05usft at 7187.99usft MD (7114.31 TVD, 330.57 N, 79.24 E) - Point	0.00	0.00	7,268.00	338.00	222.23	589,937.89	585,378.73	32.62170819	-104.19028580	

Database:	EDM 5000.14 Single User Db	Local Co-ordinate Reference:	Well 02 Bolander 32 State Fed Com 121H
Company:	Colgate Energy	TVD Reference:	3368+25 @ 3393.00usft (Permit)
Project:	Eddy County, NM (N83-NME)	MD Reference:	3368+25 @ 3393.00usft (Permit)
Site:	Bolander 32	North Reference:	Grid
Well:	02 Bolander 32 State Fed Com 121H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Permit		
Design:	APD-Rev 0 269.02		

Formations						
Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)	
193.00	193.00	Rustler				
248.00	248.00	Top of Salt				
555.00	555.00	Base of Salt				
773.00	773.00	Yates				
1,613.35	1,613.00	Capitan				
3,003.64	2,998.00	DLWR Mnt. Group				
3,414.20	3,407.00	Lower Brushy Canyon				
3,851.87	3,843.00	Bone Spring Lime				
5,799.29	5,783.00	1st Bone Spring SD				
5,859.52	5,843.00	2nd Bone Spring LM				
6,999.02	6,968.00	2nd Bone Spring SD				

Plan Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
6,704.11	6,685.94	327.88	271.68	KOP: 6704.11' MD, -277.25' VS, 6685.94' TVD
7,621.49	7,258.69	332.94	-318.61	EOC: 7621.49' MD, 312.87' VS, 7258.69' TVD
12,226.39	7,144.36	307.23	-4,921.96	Sec31: 12226.39' MD, 7144.36' TVD
12,226.39	7,144.36	307.23	-4,921.96	Sec31: 32.62164154, -104.20699440
17,453.82	6,990.18	161.40	-10,144.80	TD: 17453.82' MD, 10140.55' VS, 6990.18' TVD



MULTI-BOWL WELLHEAD SYSTEM RUNNING PROCEDURE



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1.0 DIAGRAM OF STACK-UP

1.1 DIMENSIONS FOR CONFIGURATION



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2.0 CASING HEAD SECTION

2.1 PREPARATION

- 2.1.1 Check and record Multi-bowl Assembly part numbers and serial numbers.
- 2.1.2 Inspect assembly's upper and lower bowl. Ensure seal areas are in good condition and free from damage.
- 2.1.3 Inspect ring groove for burrs, damage and any defects. If burrs exist, redress using emery cloth.
- 2.1.4 Ensure SOW O-Ring is in good condition. Replace if damaged.

2.2 LANDING

- 2.2.1 Determine 13-3/8" casing cutoff height. Cut and bevel accordingly.
- 2.2.2 Clean scale off casing OD.



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- 2.2.3 Lift Multi-bowl Assembly with certified wire rope harness or landing & flange and lower carefully over casing stub.
- 2.2.4 Ensure Multi-bowl Assembly is level and outlet orientation will match flow lines. Remove 1/2" NPT pipe plug from bottom of casing head.
- 2.2.5 Tack weld Multi-bowl SOW to casing at four points. Recheck level.

NOTE: DO NOT USE HOT HEADS OR SIMILAR METHODS OF PREHEATING, AS IT MAY DAMAGE SEALS AND PACKING

- 2.2.6 Preheat casing and Multi-bowl to specifications, 3" on either side of weld areas. Use heat sensitive crayons to monitor temperature limits.
- 2.2.7 Complete external weld. Perform post weld heat treatment.



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NOTE: STEPS 2.2.4 TO 2.2.6 ARE TO BE COMPLETED BY OPERATOR'S AUTHORIZED WELDER ONLY. SEE SECTION 3.0 FOR FIELD WELDING PROCEDURE.

- 2.2.8 When weld is cool, test weld to 80% of casing collapse for minimum of 15 minutes.
Use only water as test fluid, do not use oil.
- 2.2.9 Bleed off pressure after successful test. Replace pipe plug.
- 2.2.10 Install outlet accessories as required.

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FIGURE 1 – LANDING MULTI-BOWL

3.0 TEST PLUG SECTION

3.1 PREPARATION

3.1.1 Check and record BOP Test Plug Assembly part & serial numbers.



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3.1.2 Inspect test plug's LP threads and Tool Joint threads for damage. Ensure O-rings & lift lugs are in good condition.

3.2 RUNNING – TEST PLUG

3.2.1 Make up a joint of drill pipe to test plug. Ensure O-rings are in down position.

NOTE: IF PUMPING THROUGH DRILL PIPE, MAKE SURE 1/2" LP PIPE PLUGS ARE REMOVED. IF PRESSURIZING THROUGH CHOKE OR KILL LINE, 1/2" LP PIPE PLUGS MUST BE INSTALLED AND DRILL PIPE MUST BE PROPERLY TORQUED TO TEST PLUG.



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- 3.2.2 Open casing head outlet valve to check for leakage during BOP test.
- 3.2.3 Lightly oil test plug's O-rings.
- 3.2.4 Lower test plug through BOP and riser stack, land on casing head load shoulder.
- 3.2.5 Test BOP stack per operator's requirements. Never exceed connection's max working pressure. Monitor any leakage through open outlet valve.

3.3 RETRIEVING – TEST PLUG

- 3.3.1 After a successful test, release pressure and open BOP rams.
- 3.3.2 Drain fluid from BOP stack.
- 3.3.3 Pull and retrieve test plug slowly to avoid damage to seals.
- 3.3.4 Close casing head outlet valve.



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3.3.5 Inspect test plug for damage. Replace O-rings if necessary. Clean, grease, store.

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4.0 **WEAR BUSHING SECTION**

4.1 PREPARATION

- 4.1.1 Check and record wear bushing and running tool part and serial numbers.
- 4.1.2 Inspect wear bushing for damage, ensuring bore, slots are clean and the bore is the correct ID.
- 4.1.3 Inspect running tool for damage, ensure threads and slots are clean.

4.2 RUNNING



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- 4.2.1 Make up drill pipe to running tool. Ensure lift lugs are in the down position.
- 4.2.2 Lower running tool into wear bushing. Rotate 1/4 turn clockwise to lock position.
- 4.2.3 Slowly lower wear bushing through BOP stack and riser, land on casing head load shoulder.
- 4.2.4 Remove Running Tool from Wear Bushing by rotating drill pipe counter-clockwise 1/4 turn and slowly lifting it straight up.

4.2.4.1 **NOTE: WHILE RETRIEVING THE TOOL, MONITOR THE WEIGHT INDICATOR TO ENSURE THE TOOL IS PROPERLY DISENGAGED.**

- 4.2.5 Inspect the Running Tool for any visible damage.
- 4.2.6 Proceed with drilling for next casing size.

4.3 RETRIEVING – WEAR BUSHING



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- 4.3.1 Make up drill pipe to Running Tool. Ensure lift lugs are in the down position.
- 4.3.2 Slowly lower Running Tool through BOP stack until it lands on Wear Bushing.
- 4.3.3 Slowly Rotate tool until it drop. This indicates the lift lugs have aligned with j-slots of the Wear Bushing.
- 4.3.4 Slack off all weight to make sure tool is down.
- 4.3.5 Rotate tool 1/4 turn clockwise to fully engage in Wear Bushing.
- 4.3.6 Inspect Running Tool and Wear Bushing for any damage. Clean, grease, & store.
- 4.3.7 Proceed to running next casing.



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5.0 LOWER CASING HANGER SECTION

5.1 PREPARATION

- 5.1.1 Inspect Mandrel Casing Hanger's casing thread and ACME running threads for damage. Ensure neck seal area is clean and in good condition.
- 5.1.2 Inspect the Running Tool's casing thread and running thread for any damage. Ensure bore and O-ring is clean and in good condition.
- 5.1.3 Verify Running Tool's .50" width OD groove is painted with fluorescent yellow.

5.2 INSTALLATION

- 5.2.1 Make up the Running Tool to the Hanger by rotating counter-clockwise 8 to 9 turns until it bottoms out on the Hanger.



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NOTE: DO NOT TORQUE TO HANGER.

- 5.2.2 Pressure test the Running Tool's seal through the 1/8 LP test port for at least 15 minutes. Do not exceed 5,000psi test pressure.
- 5.2.3 After a successful test, release pressure.
- 5.2.4 Lower the Hanger onto the last joint of casing run. Make up the connection to the API threads recommended optimum torque.
- 5.2.5 Verify all lock-screws are fully retracted.
- 5.2.6 Slowly and carefully lower the Hanger through the BOP and land it in the Multi-bowl.
- 5.2.7 Slack off all weight on the casing.
- 5.2.8 Visually verify the yellow paint marking on the Running Tool is in the center of the upper-most outlet of the Multi-bowl indicating that the Hanger is properly landed.



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NOTE: ENSURE THAT THE WELL IS SAFE AND THERE IS NO PRESSURE BEFORE OPENING THE UPPERMOST OUTLET VALVE. CLOSE THE OUTLET AFTER VISUAL INSPECTION.

- 5.2.9 Cement as required.
- 5.2.10 Back off Running Tool by rotating clockwise until thread jump can be felt.
- 5.2.11 Retrieve the landing joint and running tool to the rig floor.
- 5.2.12 Inspect the running tool for any damage. Clean, grease, and store.
- 5.2.13 Proceed to next operation.

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FIGURE 2 –CASING HANGER MANDREL

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6.0 **PACKOFF SUPPORT BUSHING SECTION**

6.1 PREPARATION

- 6.1.1 Check and record Pack-off Support Bushing and Running Tool part and serial numbers.
- 6.1.2 Inspect the Pack-offs elastomeric seals, bore, and OD for any damage. Ensure that all are clean and in good condition.
- 6.1.3 Inspect the Running Tool's IF thread for any damage. Ensure all are clean and in good condition.
- 6.1.4 Wash out Multi-bowl and top of casing hanger landing flutes and open lower valves in lower head.



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NOTE: WASHING CAN BE DONE MANUALLY USING PRESSURIZED HOSE OR WITH A WASH TOOL.

6.2 INSTALLATION

- 6.2.1 Make up a landing joint to the Running Tool. Ensure to power tight the landing joint to the Running tool per API thread's specification.
- 6.2.2 Lightly oil the Pack-offs elastomeric seals and running threads.
- 6.2.3 Lower Running Tool into Pack-off and rotate 1/4 turn clockwise to lock position.
- 6.2.4 Verify all Lock-screws are fully retracted.
- 6.2.5 Slowly and carefully lower the Pack-off through the BOP and land it on the Hanger inside the Multi-bowl.



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NOTE: HEAVY DRILL PIPE OR DRILL COLLAR MIGHT BE REQUIRED AS ADDITIONAL WEIGHT TO PULL DOWN THE PACK-OFF INTO ITS LANDING POSITION.

- 6.2.6 Verify that the Pack-off has landed properly by making measurement on its setting depth.
- 6.2.7 Run Lock-screws in pairs, 180 degrees apart, at the lower Multi-bowl. Tighten gland nuts to 350 ft.-lbs and Lock-screws to 450 ft.-lbs.
- 6.2.8 Pull the Running Tool to 2,000 lbs to confirm that the Pack-off has been successfully locked down.
- 6.2.9 Slack off tension.
- 6.2.10 Locate the two Flange Test Ports on the upper Multi-bowl and remove the test cap from each of the fittings.
- 6.2.11 Attach a bleeder tool to one of the fittings and open the tool.



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6.2.12 Attach a hydraulic test pump to the other fitting and pump hydraulic fluid until a continuous stream flows from the bleeder tool. Close the bleeder tool.

6.2.13 Perform pressure test to 5,000 psi for at least 15 minutes.

NOTE: IN CASE OF TESTING AGAINST A CASING, DO NOT EXCEED 80% OF CASING COLLAPSE.

6.2.14 After a successful test, release pressure. Replace test caps.

6.2.15 Remove the Running Tool from Pack-off by rotating the drill pipe counter-clockwise 1/4 turn and slowly lifting it straight up.

NOTE: WHILE RETRIEVING THE TOOL, MONITOR THE WEIGHT INDICATOR TO ENSURE THE TOOL IS PROPERLY DISENGAGED.

6.2.16 Retrieve the Running Tool to the rig floor.



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6.2.17 Inspect the Running Tool for any damage. Clean, grease, and store.

6.2.18 Proceed to next operation.



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FIGURE 3 – PACKOFF SUPPORT BUSHING



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7.0 TEST PLUG FOR PACKOFF SECTION

7.1 PREPARATION

- 7.1.1 Check and record the BOP Test plug Assembly part number and serial number.
- 7.1.2 Inspect test plug's LP & tool joints threads for damage. Ensure O-ring & lift lugs are in good condition.

7.2 RUNNING

- 7.2.1 Make up a joint of drill pipe to the test plug. Ensure the O-ring is down and the lift lugs up.

NOTE: IF IT IS INTENDED TO TEST BY PUMPING THROUGH DRILL PIPE, MAKE SURE THAT THE FOUR 1/2" LP PIPE PLUGS ARE



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REMOVED. HOWEVER, IF TEST IS TO BE DONE BY PRESSURIZING THROUGH THE CHOKE OR KILL LINE, THE FOUR 1/2" LP PIPE PLUGS SHOULD BE INSTALLED AND DRILL PIPE MUST BE PROPERLY TORQUED TO THE TEST PLUG.

- 7.2.2 Verify lock-screws in the top flange are fully retracted.
- 7.2.3 Open Multi-bowl upper valve to check for leakage past test plug during BOP test.
- 7.2.4 Lightly oil test plug's O-ring.
- 7.2.5 Lower test plug through BOP stack until it lands on Pack-off Support Bushing.
- 7.2.6 Test BOP stack per operator's requirements. Never exceed connection's maximum working pressure. Monitor any leakage through open lower valve.

7.3 RETRIEVING

- 7.3.1 After a successful test, release pressure and open BOP rams.



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- 7.3.2 Drain the fluid from BOP stack.
- 7.3.3 Pull and retrieve the test plug slowly to avoid damage.
- 7.3.4 Close the Multi-bowl upper outlet valve.
- 7.3.5 Inspect test plug for damage. Replace O-ring if necessary. Clean, grease, & store.

8.0 C-22 HANGER SECTION

8.1 PREPARATION

- 8.1.1 Check and record Slip Casing Hanger Assembly Part serial numbers.



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8.1.2 Inspect Slip Casing Hanger, Ensure all screws are in place & seals are in good condition.

8.2 INSTALLATION

8.2.1 Cement casing as required.

8.2.2 Drain multi-bowl

8.2.3 Separate Upper Multi-bowl from BOP.

NOTE: ENSURE WELL IS SAFE AND THERE IS NO PRESSURE BEFORE BREAKING CONNECTION.

8.2.4 Lift BOP and suspend above Upper Multi-bowl high enough to install Hanger.

8.2.5 Washout as necessary.

8.2.6 Place two boards on Upper Multi-bowl top flange against casing.

8.2.7 Wrap Hanger around casing using boards as support.



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- 8.2.8 Replace latch screw
- 8.2.9 Grease Hanger body and remove slip retaining screws.
- 8.2.10 Remove boards and lower Hanger into Multi-bowl.

NOTE: ENSURE TO CENTER CASING AS MUCH AS POSSIBLE USING CAT-LINE.

- 8.2.11 Ensure Hanger is properly seated by tapping down on slip bowl.
- 8.2.12 Engage slip segments evenly by hammering down on top of segments.
- 8.2.13 Pull tension on casing to desired weight then slack off tension to set load to energize packing.
- 8.2.14 Rough cut casing approximately 18" above casing spool top flange.
- 8.2.15 Clean ring groove and install ring gasket into top flange.
- 8.2.16 Final cut casing at 5-1/2" +/-1/8" above top flange and bevel cut stub to specifications.



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NOTE: ENSURE STUB IS PROPERLY BEVELED WITHOUT ANY ROUGH EDGES THAT COULD DAMAGE THE PACK-OFF SEALS, PICK-UP LANDING JOINT WITH PRE-INSTALLED MANDREL CASING HANGER RUNNING TOOL.

FIGURE 4 – HANGER INSTALLED



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9.0 **TUBING HEAD SECTION**

9.1 **PREPARATION**

- 9.1.1 Check & record tubing head assembly part & serial numbers.
- 9.1.2 Inspect tubing head's bowl & ring groove for burrs, damage and/or any defects.
Ensure seal areas are in good condition and free from damage. If burrs exist, redress using emery cloth.
- 9.1.3 Ensure bore and FS seals are clean and in good condition.

9.2 **INSTALLATION**

- 9.2.1 Place ring gasket into casing spool ring groove.
- 9.2.2 Slowly and carefully lift and orient tubing head assembly over casing spool and casing hanger neck. Line up casing spool to bolt holes on casing head.



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- 9.2.3 Lower tubing head and install onto casing spool. Nipple up tubing head to API recommended specifications.
- 9.2.4 Locate the 1/2 LP flange test port on tubing head assembly bottom flange and remove the test cap from fitting.
- 9.2.5 Torque lock-screw glands to 350 ft.-lbs on the upper multi-bowl flange.
See reference 1

REFERENCE – 1



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- 9.2.6 Attach hydraulic test pump to fitting and pressure test flange to 5,000 psi or 80% of collapse of casing whichever is less, Perform test for at least 15 minutes.
- 9.2.7 After successful test, release pressure, detach test pump and reinstall cap.
- 9.2.8 Locate 1/2 LP seal test port on tubing head assembly bottom flange & remove test cap from fitting.
- 9.2.9 Attach hydraulic test pump to fitting & pressure test seals to 10,000 psi. Perform test for at least 15 minutes.
- 9.2.10 After successful test release pressure, detach test pump & re-install cap.
- 9.2.11 Torque lock-screws glands to 350 ft.-lbs before nipple up of BOP's on 7-1/16" flange.

See reference 2

REFERENCE - 2



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9.2.12 Nipple up BOP to casing spool assembly.

9.2.13 Proceed to drilling and running next casing size.

NOTE: SECONDARY SEAL WILL BE INSTALLED AND LANDED WITH TUBING HEAD.

FIGURE 5 – TUBING HEAD SECTION



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10.0 EMERGENCY CASING HANGER C-21 SECTION

10.1 PREPARATION

- 10.1.1 If casing becomes stuck, follow the steps outlined below.
- 10.1.2 With casing suspended break the flange connection between the casing spool & casing head, lift & secure the casing spool & BOP at a safe working distance above casing head.
- 10.1.3 Examine the C-21 casing hanger for damage.

10.2 INSTALLATION

- 10.2.1 Place two boards on casing to support the casing hanger.
- 10.2.2 Remove the latch screw to open the hanger.



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- 10.2.3 Wrap the hanger around the casing & replace the latch screw, remove slip retainer screws.
- 10.2.4 Prepare to lower the hanger.
- 10.2.5 Remove the boards & carefully lower the hanger. If necessary, use a cat line or tugger to centralize the casing.
- 10.2.6 When the hanger is landed on load shoulder pull tension on the casing to desired hanging weight & then slack off.
- 10.2.7 Nipple up casing spool & BOP to casing head.
- 10.2.8



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FIGURE 6 – EMERGENCY CASING HANGER



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PPENDIX A: RECOMMENDED PROCEDURE FOR FIELD WELDING PIPE TO WELLHEAD PARTS FOR LOW PRESSURE SEAL

The following procedure is a direct extraction (except for the numeric, footnote designators) from the 20th Edition of the API 6A. Editorial footnotes have been added to provide additional information that may be of benefit when developing procedures for specific field welding applications. The recommended procedure and footnotes are for general information purposes and it should be mentioned that Encore is not responsible for determining or administering any field welding practices. The organization performing the welding should qualify their welding procedure(s) and welder(s) in accordance with applicable codes and standards. The success of any field weld should be verified by subsequent hydrostatic test at the direction of the customer.

1. **Introduction and Scope** - The following recommended procedure has been prepared with particular regard to attaining pressure-tight welds when attaching casing heads, flanges, etc., to casing.



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Although most of the high strength casing used (such as P-110) is not normally considered field weldable, some success may be obtained by using the following or similar procedures.

CAUTION: IN SOME WELLHEADS, THE SEAL WELD IS ALSO A STRUCTURAL WELD AND CAN BE SUBJECTED TO HIGH TENSILE STRESSES. CONSIDERATION MUST THEREFORE BE GIVEN BY COMPETENT AUTHORITY TO THE MECHANICAL PROPERTIES OF THE WELD AND ITS HEAT AFFECTED ZONE.

2. The steels used in wellhead parts and in casing are high strength steels that are susceptible to cracking when welded. It is imperative that the finished weld and adjacent metal be free from cracks. The heat from welding also affects the mechanical properties. This is especially serious if the weld is subjected to service tension stresses.



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3. This procedure is offered only as a recommendation. The responsibility for welding lies with the user and results are largely governed by the welder's skill. Weld-ability of the several makes and grades of casing varies widely, thus placing added responsibility on the welder. Transporting a qualified welder to the job, rather than using a less-skilled man who may be at hand, will, in most cases, prove economically. The responsible operating representative should ascertain the welder's qualifications and if necessary, assure himself by instruction or demonstration, that the welder is able to perform the work satisfactorily.



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4. **Welding Conditions** - Unfavorable welding conditions must be avoided or minimized in every way possible, as even the most skilled welder cannot successfully weld steels that are susceptible to cracking under adverse working conditions, or when the work is rushed. Work above the welder on the drilling floor should be avoided. The weld should be protected from dripping mud, water, and oil and from wind, rain, or other adverse weather conditions. The drilling mud, water, or other fluids must be lowered in the casing and kept at a low level until the weld has properly cooled. It is the responsibility of the user to provide supervision that will assure favorable working conditions, adequate time, and the necessary cooperation of the rig personnel.
5. **Welding** - The welding should be done by the shielded metal-arc or other approved process.
6. **Filler Metal** - After the root pass, low hydrogen electrodes or filler wires of a yield strength equal to the casing yield strength should be used. The low hydrogen electrodes include classes EXX15, EXX16, EX18, and EXX28 of AWS A5.1 (latest edition): *Mild Steel Covered Arc-Welding Electrodes** and AWS A5.5 (latest edition): *Low Alloy Steel Covered Arc-Welding Electrodes**. Low hydrogen electrodes should not be exposed to the atmosphere until ready for use. Electrodes exposed



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to atmosphere should be dried 1 to 2 hours at 500 to 600°F (260 to 316°C) just before use.

*Available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

7. **Preparation of Base Metal** - The area to be welded should be dry and free of any paint, grease, scale, rust, or dirt.
8. **Preheating** - Both the casing and the wellhead member should be preheated to 250-400°F (121 to 204°C) for a distance of at least 3 inches (76.2mm) on either side of the weld location, using a suitable preheating torch. Before applying preheat, the fluid should be bailed out of the casing to a point several inches (mm) below the weld location. The preheat temperature should be checked by the use of heat sensitive crayons. Special attention must be given to preheating the thick sections of wellhead parts to be welded, to insure uniform heating and expansion with respect to the relatively thin casing.



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NOTE: PREHEATING MAY HAVE TO BE MODIFIED BECAUSE OF THE EFFECT OF TEMPERATURE ON ADJACENT PACKING ELEMENTS WHICH MAY BE DAMAGED BY EXPOSURE TO TEMPERATURES 200°F (93°C) AND HIGHER. TEMPERATURE LIMITATIONS OF THE PACKING MATERIALS SHOULD BE DETERMINED BEFORE THE APPLICATION OF PREHEAT.



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9. **Welding Technique** - Use a 1/8" or 5/32" (3.2 or 4.0mm) E6010 electrodes and step weld the first beat (root pass); that is, weld approximately 2 to 4 inches (50 to 100mm) and then move diametrically opposite this point and weld 2 to 4 inches (50 to 100mm). Then weld 2 to 4 inches (50 to 100mm) halfway between the first two welds, more diametrically opposite this weld, and so on until the first pass is completed. The second pass should be made with 5/32" (4.0mm) low hydrogen electrode of the proper strength and may be continuous. The balance of the welding groove may then be filled with continuous passes without back stepping or lacing, using a 3/16" (4.8mm) low hydrogen electrode. All beads should be stringer beads with good penetration, and each bead after the root pass should be thoroughly peened before applying the next bead. There should be no undercutting and welds shall be workmanlike in appearance.
- a. Test ports should be open when welding is performed to prevent pressure build-up within the test cavity.
 - b. During welding temperature of base metal on either side of weld should be maintained at 250°F (121°C) minimum.



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- c. Care should be taken to insure that the welding cable is properly grounded to the casing, but ground wire should not be welded to the casing or the wellhead. Ground wire should be firmly clamped to the casing, the wellhead, or fixed in position between pipe slips. Bad contact may cause sparking, with resultant hard spots beneath which incipient cracks may develop; the welding cable should not be grounded to the steel derrick, nor to the rotary-table base.
10. **Cleaning** - All slag or flux remaining on any welding bead should be removed before laying the next bead. This also applies to the completed weld.
11. **Defects** - Any cracks or blow holes that appear on any bead should be removed to sound metal by chipping or grinding before depositing the next bead.



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12. **Post heating** - For the removal of all brittle areas on high strength steel casing, a post heat temperature of 1050-1100°F (566 to 593°C) is desirable. It is recognized, however, that this temperature is difficult or impossible to obtain in the field, and that the mechanical properties of the wellhead parts and the pipe may be considerably reduced by these temperatures. As a practical matter, the temperature range of 500-900°F (260-482°C) has been used with satisfactory results.
13. **Cooling** - Rapid cooling must be avoided. To assure slow cooling, welds should be protected from extreme weather conditions (cold, rain, high winds, etc.). By the use of a blanket made from suitable insulating material. Particular attention should be given to maintaining uniform cooling of the thick sections of the wellhead parts and the relatively thin casing will pull away from the head or hanger if allowed to cool more rapidly. The welds should cool in air to 250°F (121°C) (measured with a heat sensitive crayon) prior to permitting the mud to rise in the casing.



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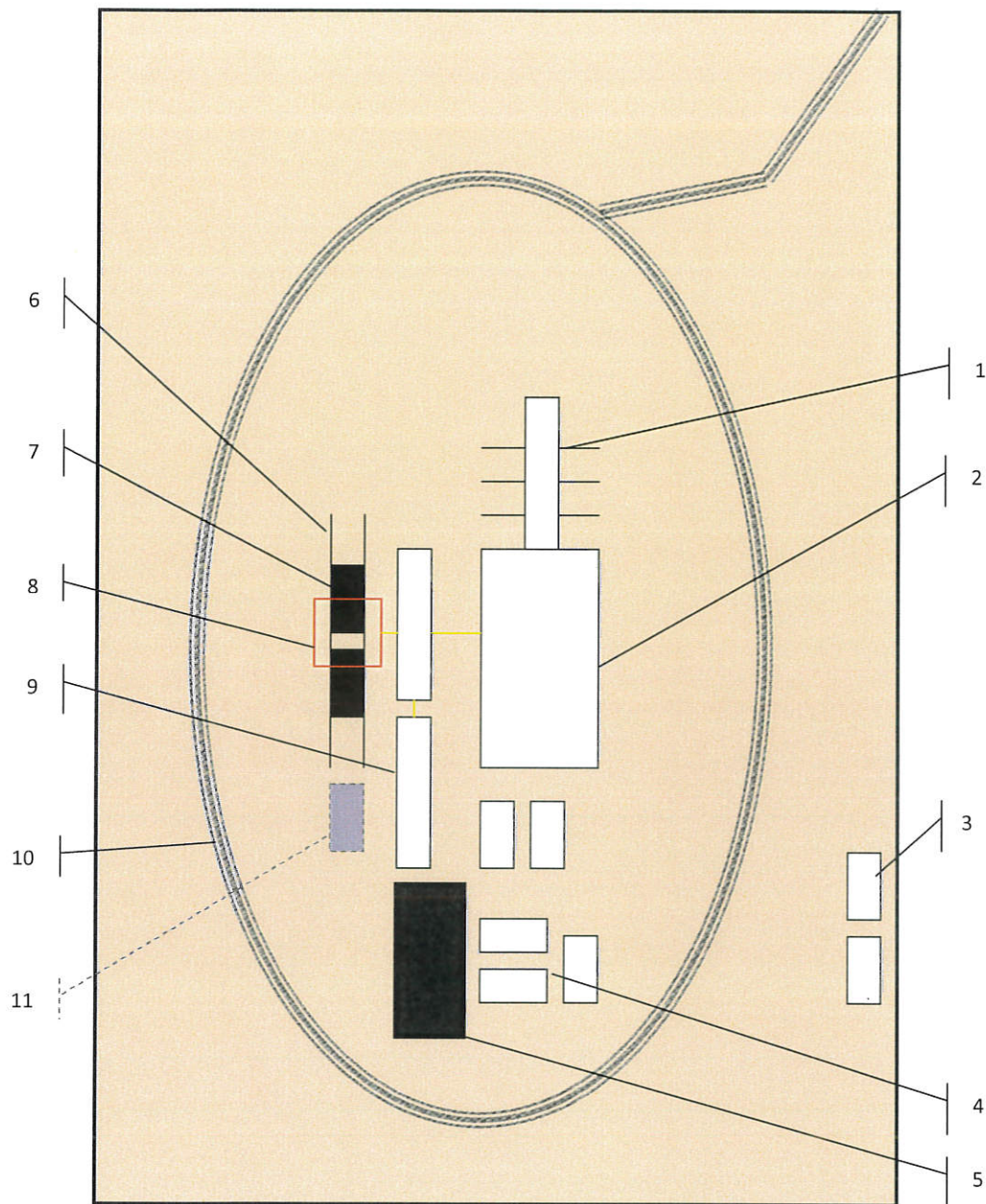
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Schematic Closed Loop Drilling Rig*

1. Pipe Rack
2. Drill Rig
3. House Trailers/ Offices
4. Generator/Fuel/Storage
5. Overflow-Frac Tank
6. Skids
7. Roll Offs
8. Hopper or Centrifuge
9. Mud Tanks
10. Loop Drive
11. Generator (only for use with centrifuge)

*Not drawn to scale: Closed loop system requires at least 30 feet beyond mud tanks. Ideally 60 feet would be available



Above: Centrifugal Closed Loop System



Closed Loop Drilling System: Mud tanks to right (1)
 Hopper in air to settle out solids (2)
 Water return pipe (3)
 Shaker between hopper and mud tanks (4)
 Roll offs on skids (5)

Flow Chart for Drilling Fluids and Solids

