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**Appendix H**  
**Cimarex Drilling Plans**

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April 23, 2008

United States Department of Interior  
Bureau of Land Management  
Division of Oil and Gas  
Pinedale Field Office  
Pinedale, WY

**CIMAREX ENERGY CO  
RILEY RIDGE #20-14  
Engineering and Geology  
WORK COPY**

Attention:

RE: Cimarex Energy Co.  
Application for Permit to Drill (APD)

**Riley Ridge #20-14**

Location: 836' From the South Line and 2242' From East Line (Staked)  
Section 17-T29N-R114W, Sublette County, Wyoming

Gentlemen:

Enclosed herewith you will find our completed APD regarding the referenced tract of land, surveyor's plats, a topographic plat, and several area location plats outlining our proposed oil and gas operations.

The following narrative provides the information required for completing

- I. Form 3160-3 APPLICATION FOR PERMIT TO DRILL,
- II. SUPPLEMENTAL ADMINISTRATIVE, ENGINEERING & GEOLOGICAL INFORMATION TO APD,
- III. SUPPLEMENTAL ENVIRONMENTAL INFORMATION TO APD.

I. Form 3160-3 BASIC INFORMATION

- A. See Attached Form 3160-3

This APD assumes continuous drilling operations on a 24 hours per day, 7 days per week until well is completed in an efficient and economical operation.

Riley Ridge #20-14 is located 19.5 miles from Big Piney, WY on a 260 degree azimuth. The proposed bottom hole location has a displacement of 5,092' on a 200° azimuth.

- B. Signed surveyor's plats are attached. (scale no greater than 1" = 1000')  
See Attachment #1 for surface and bottom hole locations.
- C. NO Signatures have been affixed.
- D. Casing program and cementing program – See Attachment #2, Drilling Prognosis and Attachment #3, Casing Design Table.

E. Supplemental information to the casing program - for each string.

1. Size, weight, grade, thread/coupling, minimum burst, collapse, body and joint yields for new/used API casing. See Attachment #3, Casing Design Table.
2. New casing will be used.
3. Setting depths (TVD) and name of reservoir bed/zone at casing seat.
 

0-140' Conductor	Conglomerate
0-±2600' Surface	Conglomerate
0-±11,750' Intermediate	Below Nugget
0-±16,000' Production	Darby

4. Maximum anticipated hydrostatic fluid weight behind string for collapse, and maximum anticipated bottom hole pressure for burst based on TVD measurements.

	MUD WEIGHT	ESTIMATED BOTTOM HOLE PRESSURE	ANTICIPATED SURFACE SHUT-IN PRESSURE
Conductor	8.3	24	100
Surface	8.5	1,149	700
Intermediate	9.5	5,805	3,200
Production	10.0	8,320	3,400

5. Design factors for joint, tension, collapse, burst.

Joint/Tension/Body	1.7
Collapse	1.125
Burst	1.100

6. Pore pressure and fracture pressure gradients based on TVD measurements.

Pore Pressure @ 2600' TVD =	0.44 psi/ft	1,144 psig
Fracture Pressure @ 2400' TVD =	0.70 psi/ft	1,820 psig
Pore Pressure @ 11,750' TVD =	0.44 psi/ft	5,170 psig
Fracture Pressure @ 11,750' TVD =	0.70 psi/ft	8,225 psig
Pore Pressure @ 16,000' TVD =	0.44 psi/ft	7,040 psig
Fracture Pressure @ 16,000' TVD =	0.70 psi/ft	11,200 psig

F. Supplemental information to the cement program - for each string.

1. Amount and type of cement, including additives to be used, slurry weights, and slurry mixes (cubic ft. per sack).

**ALL CEMENTING PROGRAMS WILL BE REVIEWED AND UPDATED**

BASED ON WATER TESTS, LOG DATA AND HOLE CALIPER SIZE. THIS WILL ALLOW FOR POTENTIAL IMPROVEMENTS IN CEMENTING DESIGN, EQUIPMENT AVAILABILITY, AND WEATHER CONDITIONS. IF CHANGES ARE NECESSARY, A SUNDRY NOTICE WILL BE PREPARED TO DOCUMENT THE CHANGES FOR STATE AND FEDERAL APPROVAL.

**16" Surface:**

Lead: 4340 sx 35:65 Poz:Class G cement + 4% Bentonite gel (D20) + 3% CaCl (S1) + 0.25 pps CelloFlake (D29), Weight 12.5 ppg, Yield 1.88 ft<sup>3</sup>/sx, Excess 124%, Planned TOC: Surface

Estimated Compressive Strength:

3 HR @ 80° F	50 psi
24 HR @ 80° F	267 psi
32 HR @ 80° F	650 psi
72 HR @ 80° F	910 psi

Tail: 860 sx Class G cement + 0.25 ppg CelloFlake (D29), Weight 15.8 ppg, Yield 1.15 ft<sup>3</sup>/sx, Excess 0%, Planned TOC 2,100'

Estimated Compressive Strength:

3 HR @ 80° F	50 psi
5 HR @ 80° F	500 psi
24 HR @ 80° F	3100 psi
72 HR @ 80° F	4850 psi

Top Out: 250 sx Class G cement + 2% CaCl (S1), Yield 1.15 ft<sup>3</sup>/sx, Weight 15.8 ppg, Excess 0% Planned Top Out for 100'

**10-3/4" Intermediate**

Lead: 1990 sx CemCRETE Blend + 0.35% MidTemp Retarder (D800) + 0.2% Antifoam (D46)+ 0.1% Uniflac (D167) +0.5% TIC Dispersant (D65), 11.54 ppg, Yield 1.69, Water 5.39, Excess 25%, Planned TOC: 7,000'

Estimated Compressive Strength:

12 hrs	50 psi,
24 hrs	500 psi
48 hrs	719 psi
72 hrs	1220 psi

Tail: 370 sx Clas G + 0.3% Uniflac (D167) +0.25% Cement Retarder (D198) +0.25% TIC Dispersant (D65) + 0.2% Antifoamer (D46), 15.8 ppg, Yield 1.15, Water 4.99, Excess 25%, Planned TOC 11,800'

Estimated Compressive Strength:

10 hrs	50 psi
12 hrs	500 psi
48 hrs	3094 psi



72 hrs 3190 psi

**7-5/8" x 7" Production Casing:**

Lead: 600 sx CemCRETE Blend cement + 0.5% Mid Temp Retarder (D800) +0.2% Uniflac (D167) +0.5% TIC Dispersant (D65), 11.54 ppg, Yield 1.69, Excess 20%, Planned TOC: 12,200'

Estimated Compressive Strength:

12 hrs 50 psi  
24 hrs 500 psi  
48 hrs 719 psi  
72 hrs 1220 psi

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Tail: 100 sx Class G cement + 3% D20 +0.8% D112 + 0.5% D198 + 0.1% D65 +0.2% D46 +35% D66, 14.5 ppg, Yield 1.88, Water 8.76, TOC 16,400'

Estimated Compressive Strength:

5 hrs 50 psi  
6 hrs 500 psi  
48 hrs 1272 psi  
72 hrs 1272 psi

2. If stage cementing techniques are to be used, identify setting depths of stage collars and description of each stage.

On the 16" surface casing, the bottom of the casing will be cemented conventional. After tail cement has sufficient strength, 1" pipe may be run to 100' from surface and the top of the casing will be cemented.

3. Anticipated fill of each stage, e.g. height above casing shoe.

16" Surface Casing		Surface
Lead	Surface - 2,100'	
Tail	2,100-2,600'	
10-3/4" Intermediate Casing		7,000'
Lead	7,000-11,800'	
Tail	11,800-12,372'	
7-5/8x7" Production Casing	(500' into Int. Csg)	11,900'
Lead	11,900-16,350'	
Tail	16,350-17,025'	

4. For each stage, indicate the anticipated minimum "wait on cement time" to achieve the minimum compressive pressure requirement of 500 psig at the casing shoe with the tail cement. (See Cement Program above - Item E. 1.)

WOC Surface cement at the casing shoe is 5 hrs.

WOC Intermediate cement at the casing shoe is 12 hrs.

WOC Production cement at the casing shoe is 6 hrs.

5. Surface casing statement. Surface casing will be set to a depth of 2,600 feet and cemented to surface. A top cement stage is planned to 100 ft with 1" pipe.

G. Drilling program.

**This APD assumes continuous drilling operations on a 24 hours per day, 7 days per week from start of mobilization until well is completed in an efficient and economical operation.**

1. Lease/well name, surface location and bottom hole location

Riley Ridge #20-14 Surface Location: Lat: 42°29'41.49"  
(NAD 83) Long: 110°26'40.72"

836' FSL & 2242' FEL, Section 17-T29N-R114W, 6<sup>th</sup> P.M., Sublette Co, WY

Bottom Hole Location: Lat: 42°28'53.81" Long: 110°27'02.28" (NAD 83)  
1320' FSL and 1320' FWL, Sec. 20-T29N-R114W, 6<sup>th</sup> P. M., Sublette Co., WY

2. Geologic name of surface formation. Conglomerate
3. Estimated tops and bottoms of all important geologic markers; include over/under pressure data. See Attachment #4, Geologic Formation Tops in TVD Measurement
4. Estimated tops and bottoms of all zones anticipated to have possible fluid occurrence (oil, gas, water) or other minerals; include plan to protect these zones. For treatable water zones, identify the source document that defines top of water. See Attachment #4, Geologic Formation Tops, TVD Measurement

All zones with the possibility of oil & gas production after evaluation of samples, drill rate penetration, mud log, and open hole wireline logs will be covered with cement as warranted.

The anticipated depths at which water bearing formations are expected to be encountered are determined by the State of Wyoming and will be protected by the surface cementing operations.

5. Pressure control equipment:
  - a. A schematic diagram of the final BOP stack showing sizes and pressure ratings is shown in Attachment #5.

The minimum BOPE to be used is 5,000 psi rated. This is based on the maximum 10.0 ppg mud weight to drill to 16,000' TVD for a BHP of 8320 psig less 3,520 psi (0.22 psi/ft x 16,000 ft = 3,520 psi) equals 4,800 psi. The proposed 10,000 psig BOP stack and manifold meet the minimum requirements of the 5,000 psi rated stack.

- b. If stack changes for different depths, indicate depth and stack used for control to that depth (either on diagram or in written procedure)

No stack changes are planned.

- c. Schematic of manifold showing sizes and pressure ratings is attached. See Choke Manifold General Layout, Attachment #5
- d. BOP will be installed on casing head after drilling and setting 16" surface casing. Pressure tests will be conducted as needed & after nipping up on each string of casing. Ram-Type preventers shall be actuated to test proper functioning once during every trip not to exceed once a day. The annular-type blowout preventer shall be actuated on the drill pipe at least once each week.

6. Air drilling will not be used for this proposed action.

7. Mud program

- a. Type, weight, and characteristic of mud to be used in each drilling stage (depth).

Measured Depth	Mud Weight	P.V.	YP	API F.L.	pH	% LGS	% LGS
<b>30" CONDUCTOR SET AT ±140'</b>							
LOW SOLIDS PRE-HYDRATED FRESHWATER MUD							
±140 - 2,600'	8.4-8.6	5-15	6-10	N/C	8.5-9.0		
<b>SET 16" SURFACE CASING</b>							
LOW SOLIDS NON-DISPERSED FRESHWATER MUD							
2,600-3500	8.6-8.8	5-15	6-10	N/C	9.0-9.5		
±3,500'-6,000'	8.8-9.3	5-15	6-10	N/C-15	9.5-10.0	≤8	
LOW SOLIDS / DISPERSED FRESH WATER MUD FOR SHALE CONTROL							
6,000'-±12,393'	8.8-9.3	5-15	6-10	15-8	9.0-9.5	≤8	
<b>SET 10-3/4" INTERMEDIATE CASING</b>							
DISPLACE WITH 8.2-8.4 ppg Oil Based Mud							
				HTHP	OWR	Ca <sub>2</sub> CL	ES Volts
12,393'-16,977'	8.0-8.4	15-20	12-15	15-12	9.0-9.5	20%	500-700
<b>(Option) SET 10-3/4" INTERMEDIATE CASING</b>							
DISPLACE WITH 10.0 SATURATED SALTWATER MUD							
12,393 - 14,800'	10.0	12-20	8-15	15-12	9.0-9.5	≤8	
14,800-16,977'	10.0-10.5	12-25	8-15	12-10	10.0-10.5	≤8	

- b. Types and quantities of mud, weighting material, lost circulation material, etc., to be maintained at location.

<u>Quantity</u>	<u>Product</u>	<u>Use</u>	<u>Size</u>
450 sks	Bentonite	Viscosifier	100 lb bag
40 sks	Lime	pH agent	50 lb bag
90 sks	Caustic Soda	pH agent	50 lb bag
150 sks	Cottonseed Hull	Loss circ. Material	50 lb bag
750 sks	Barite	Weighting Material	100 lb bag
75 sks	Lignite	Ph agent	50 lb bag
75 sks	Mica	Lost circ. Material	50 lb bag
30 sks	Soda Ash	Ph agent	100 lb bag
60 sks	CF Desco	Mud Thinner	25 lb bag
20 sks	Drispac R	Water Loss Control	50 lb bag
150 bbls	ABO	Water Loss Control	bulk tank

- c. Monitoring equipment to be used in the mud system

PVT Equipment from 6,000' to TD

- d. Mud logger identification, if applicable. A mud logger will be utilized from approximately 6,000' to TD.

8. Anticipated types and amounts of testing, logging, and/or coring is as follows:  
Sidewall Cores, RFTs, & DSTs may be planned from open hole log data  
Minimum Logging consisted of

Dual Induction-GR	2,600' - TD,
CNL-FDC-GR	7,000' - TD.

9. Drilling conditions.

- a. Anticipated abnormal pressures; include names and depths.

Madison	15,380' TVD	7.7-7.8 ppg EMW	6,200 psig
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- b. Anticipated abnormal temperatures; include zone names and depths.

Abnormal temperatures are not anticipated.

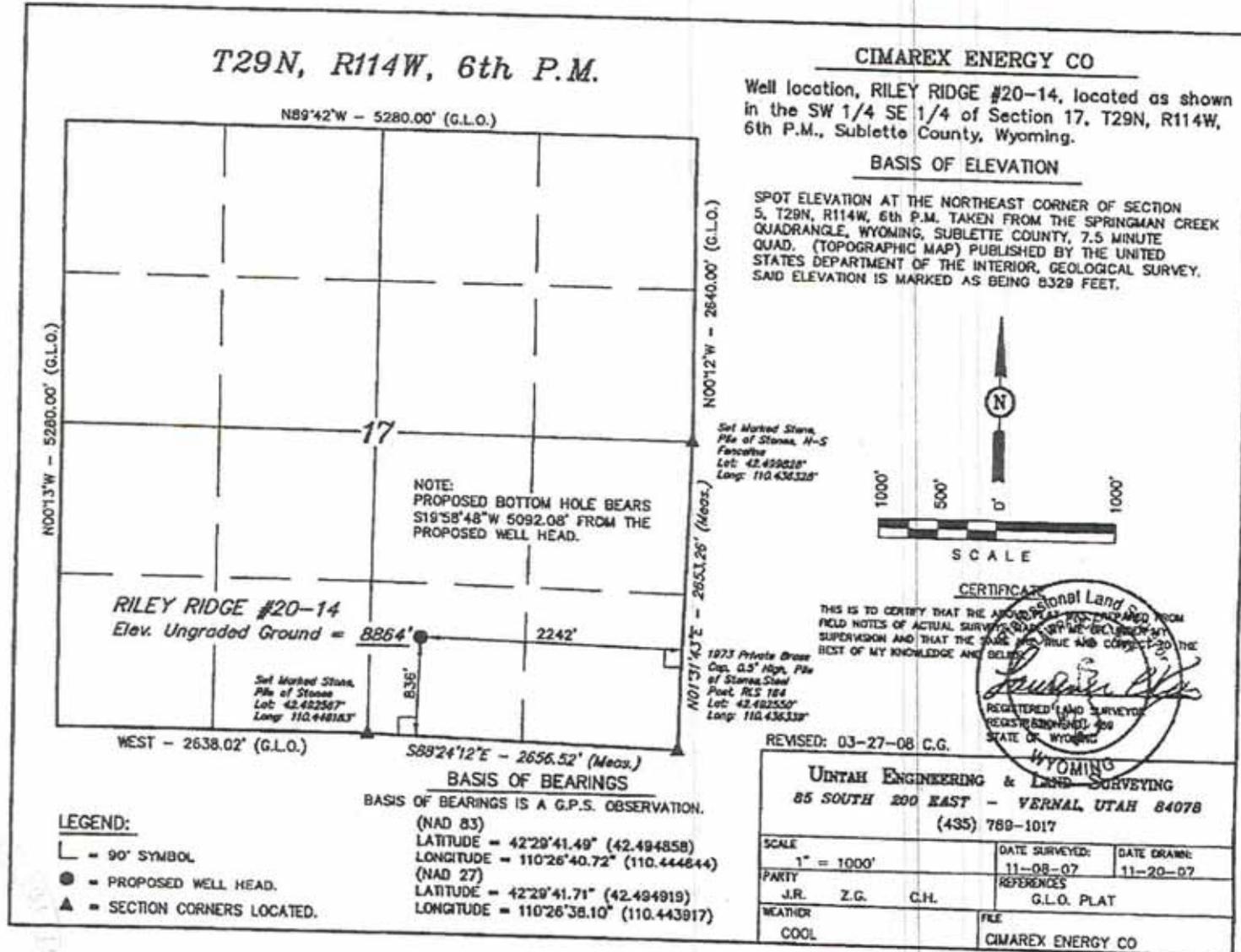
- c. Anticipated lost circulation zones by formation name and depth (ft TVD).

Mesaverde	2,532
Nugget	11,609
Madison	15,380

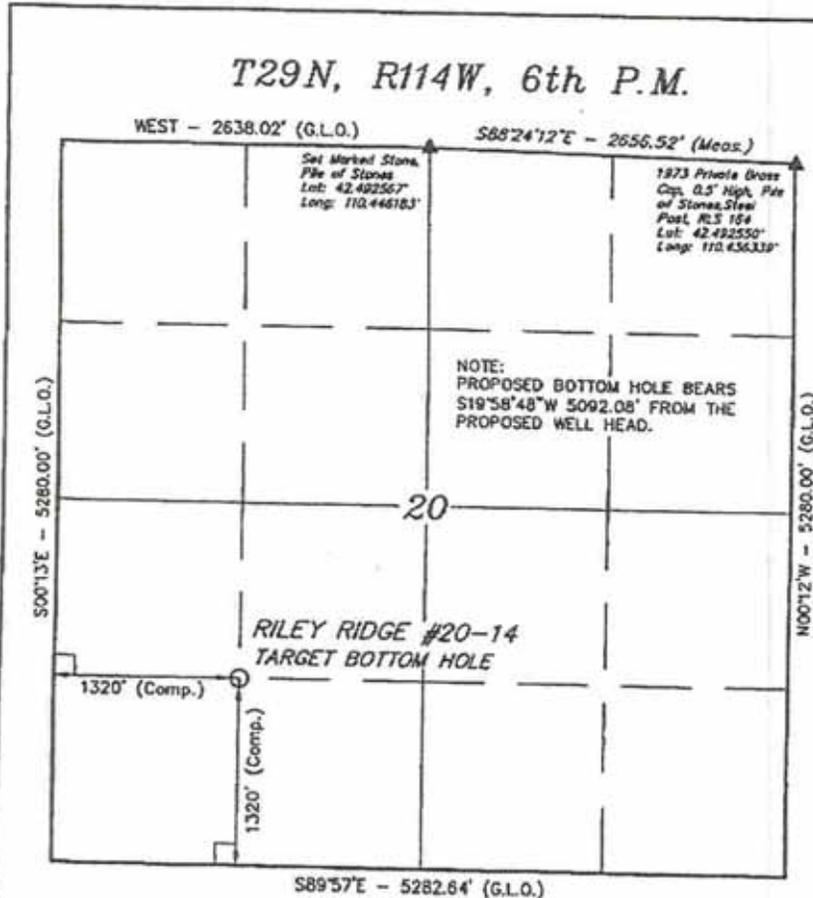
- d. Other potential hazardous zones, e.g., hydrogen sulfide, etc by formation name and depth (ft TVD).

Thaynes	12,827	Potential 400' thick salt formation
Phosphoria	14,212	First H <sub>2</sub> S potential influx
Madison	15,380	H <sub>2</sub> S and CO <sub>2</sub> influxes

- e. Contingency plan for any of the above is as follows:
1. Mud will be pretreated with LCM for loss circulation zones and available to be added as needed in the event other losses are encountered.
  2. The surface and intermediate hole may require Nitrogen to be injected into mud to lighten fluid density and oxygen scavenger may be added to control corrosion.
  3. The mud system will be broke over at ±6,000' to begin controlling the API fluid loss with the addition of lignite.
  4. AN Oil Based Mud (OBM) system will be used below the intermediate casing string to control the salt in the Thaynes formation.
  5. A Garrett Gas Train will be used below 12,000' to identify and determine the concentrations of Hydrogen Sulfide (H<sub>2</sub>S) and Carbon Dioxide (CO<sub>2</sub>). Draeger tubes will be used for quantitative analyses.
  6. The mud system will be treated with a water-soluble zinc chelate liquid design to scavenge the H<sub>2</sub>S beginning at 14,000 ft TVD.
  7. CO<sub>2</sub> will be controlled by maintaining the pH in the recommended range above 10.5.
10. Any other facets of the proposed drilling operation which might aid in the consideration of this application are as follows:
- A. Per BLM Order No. 6, a H<sub>2</sub>S Drilling Operations Plan has been prepared as a separate document.
  - B. Per BLM Order No. 6, a Public Protection Plan has been prepared as a separate document.
  - C. When drilling operations are complete, a temporary abandonment tree will be installed as shown in Attachment #6.
  - D. Manufacturer's casing specifications and thread specifications are shown in Attachment #7.



T29N, R114W, 6th P.M.



LEGEND:

- └ = 90° SYMBOL
- = PROPOSED WELL HEAD.
- ▲ = SECTION CORNERS LOCATED.

BASIS OF BEARINGS

BASIS OF BEARINGS IS A G.P.S. OBSERVATION.

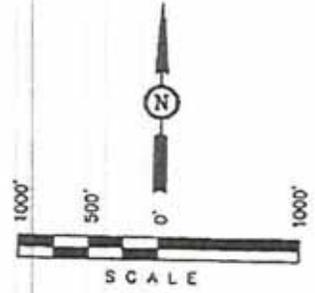
(NAD 83)  
 LATITUDE = 42°28'53.81" (42.481614)  
 LONGITUDE = 110°27'02.28" (110.450633)  
 (NAD 27)  
 LATITUDE = 42°28'54.03" (42.481675)  
 LONGITUDE = 110°26'59.66" (110.449906)

CIMAREX ENERGY CO

Well location, RILEY RIDGE #20-14 (TARGET BOTTOM HOLE), located as shown in the SW 1/4 of Section 20, T29N, R114W, 6th P.M., Sublette County, Wyoming.

BASIS OF ELEVATION

SPOT ELEVATION AT THE NORTHEAST CORNER OF SECTION 5, T29N, R114W, 6th P.M. TAKEN FROM THE SPRINGMAN CREEK QUADRANGLE, WYOMING, SUBLETTE COUNTY, 7.5 MINUTE QUAD. (TOPOGRAPHIC MAP) PUBLISHED BY THE UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY. SAID ELEVATION IS MARKED AS BEING 8329 FEET.



CERTIFICATE  
 THIS IS TO CERTIFY THAT THE ABOVE SURVEY WAS MADE FROM FIELD NOTES OF ACTUAL SURVEYING BY ME, OR UNDER MY SUPERVISION AND THAT THE SAME ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.  
*[Signature]*  
 REGISTERED LAND SURVEYOR  
 REGISTRATION NO. 409  
 STATE OF WYOMING

REVISED: 03-27-08 C.G.

<b>UNTAEH ENGINEERING &amp; LAND SURVEYING</b>			
85 SOUTH 200 EAST - VERNAL UTAH 84078			
(435) 789-1017			
SCALE	DATE SURVEYED:	DATE DRAWN:	
1" = 1000'	11-08-07	11-20-07	
PARTY		REFERENCES	
J.R.	Z.G.	C.H.	G.L.D. PLAT
WEATHER		FIRM	
COOL		CIMAREX ENERGY CO	

Attachment #2 - Drilling Prognosis & Directional Plan



Drilling Prognosis

Well:	Riley Ridge 20-14	AFE No.:	247007
Location:	Sec 17 T29N R114W	Property No.:	497190-003
Country, State:	Sublette Co., WY	Field:	Riley Ridge Field
Surface Location:	836' FSL & 2242' FEL (Staked)	Objective:	Madison @ 15,380' TVD
Target Location:	1,320' FSL & 1,320' FWL Sec 20 T29N R114W	TD (TVD/MD):	16,000' TVD / 16,977' MD
Target Location:		Cementing:	Schlumberger
E-Mail:		Mud:	
Wellhead:	16" 5M SOWx 16-3/4" 5M x 13-5/8" 5M x 11" 5M	Rig:	
Tubing Head:	5-1/8" 5M side valves	Offset Wells:	Riley Ridge #17-34
Xmas Tree:	11" 5M with 5-1/8" 5M bore & side valves	Estimated BHP:	6,200 psig at 1,380' TVD
Tubing:	3-1/2" 12.95# P-110 BTS-6 internally coated	Estimated BHT:	7.75 ppg EMW at 15,380' TVD
Superintendent:	Larry Seigrist	Estimated BHT:	295 deg F at 15,380' TVD
Engineer:	Robert Huizenga Eddie Wright	Vertical Displacement:	5,092' at 200'

Hole Size	Formation Tops	Logs	Cement	Mud Weight
24"	140' 30" Conductor		Lead: 4340 sx 2586 Poz: Class G + 4% D-20 + 3% S1 + 0.25 ppg D29, 12.5 ppg, Yield 1.88, Water 10.14, TOC: Surface Tail: 860 sx Class G + 0.25 ppg D29, 15.6 ppg, Yield 1.15, Water 4.97, TOC 2.100' Top Out: 250 sx Class G + 2% CaCl, 15.8 ppg (top 100')	8.3 Pre-hydrated spud mud
14-3/4"	2,690' 16" 84# H-80 BTC	2,835' KOP - 27100' to 22" 3,908' TVD / 3935' MD End of Build	Lead: 1990 sx CemCRETE Blend + 0.35% D600 + 0.2% D46 + 0.1% D167 + 0.5% D65, 11.54 ppg, Yield 1.69, Water 5.39, TOC: 7.000' Tail: 370 sx Class G + 0.3% D167 + 0.25% D198 + 0.25% D65 + 0.2% D46, 15.8 ppg, Yield 1.15, Water 4.99 TOC 11,800'	8.5 2,600-6,000' LSDM Freshwater Mud 6,000-11,750' LSDM Freshwater Mud System
9-1/2"	11,800' MD Planned TOC 12,299' MD / 11,750' TVD 10-3/4" 60.7# L-80 LTC	6090' MD / 6,729' TVD Planned TOC Frontier 7,517' MD / 7,229' TVD 16,000' MD 3-1/2" 12.95# P-110 BTS-6 internally coated	Lead: 600 sx CemCRETE Blend + 0.6% D600 + 0.2% D167 + 0.5% D65, 11.54 ppg, Yield 1.69, Water 5.4, TOC: 11.900' Tail: 100 sx Class G + 0.3% D20 + 0.6% D112 + 0.6% D198 + 0.1% D65 + 0.2% D46 + 0.3% D66, 14.5 ppg, Yield 1.88, Water 6.76, TOC 16,350'	8.5 Oil Based Mud
	Top 7-5/8" Heavy Wall Csg 13,000' MD / 12,313' TVD Thaynes 12,554' MD / 12,027' TVD 7-5/8" Crossover 14,817' MD / 13,827' TVD Packer set at 16,000' MD / 15,095' TVD Madison 16,306' MD / 15,380' TVD 16,977' MD / 16,000' TVD 7-5/8" 12" Production Csg			10.0

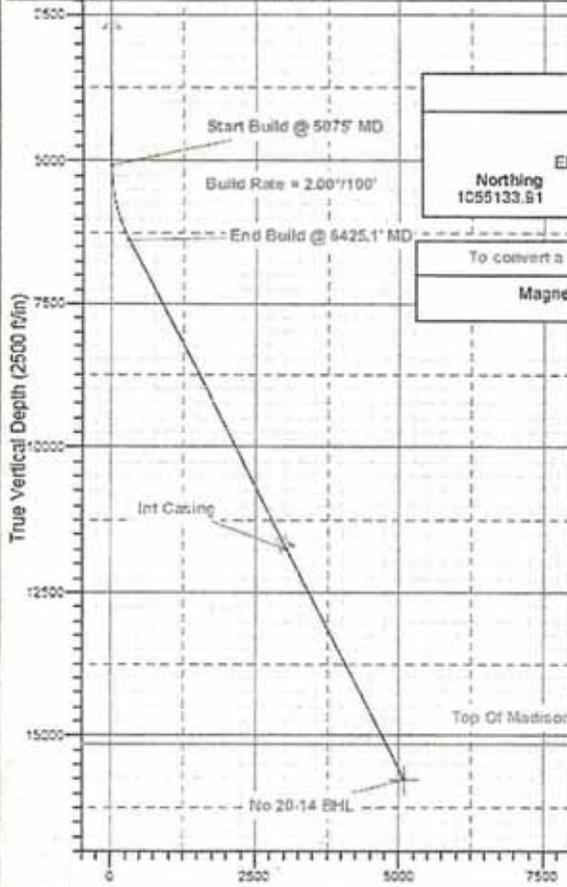
Project: Sublette County, WY (True North/NAD 83)  
Site: Riley Ridge  
Well: No 20-14  
Wellbore: Wellbore #1  
Plan: Plan #1  
Rig: TBD

WELLBORE TARGET DETAILS (MAP CO-ORDINATES)

Name	TVD	+N-S	+E-W	Northing	Easting	Shape
No 20-14 BHL	15760.00	-4796.00	-1718.00	1050337.91	2525607.88	Point

SECTION DETAILS

MD	Inc	Azi	TVD	+N-S	+E-W	DLeg	TFace	VSec	Annotation
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5075.00	0.00	0.00	5075.00	0.00	0.00	0.00	0.00	0.00	Start Build
6425.14	27.00	199.71	6375.71	-294.01	-105.32	2.00	199.71	312.31	End Build
6957.84	27.00	199.71	15760.00	-4796.00	-1718.00	0.00	0.00	5094.42	TD

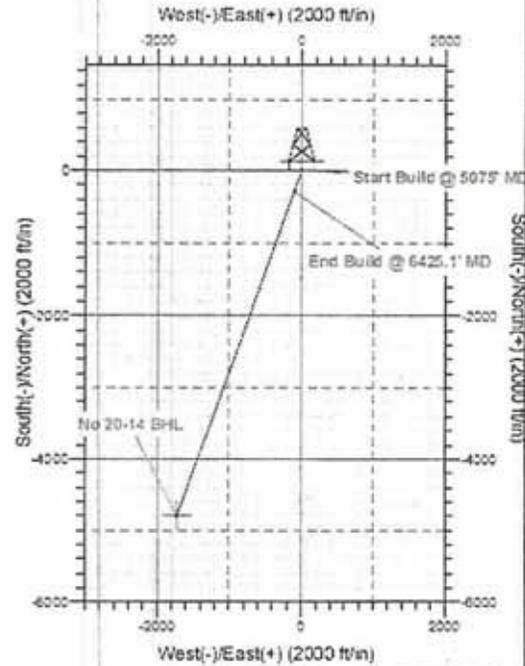


Surface Location:  
US State Plane 1983  
Wyoming Western Zone  
Elevation: GL 8964 - KB 32 @ 8896.00ft (TDD)  
Northing 1055133.91 Easting 2527225.88 Latitude 42° 29' 41.490 N Longitude 112° 26' 40.720 W

To convert a Magnetic Direction to a Grid Direction, Add 12.54°  
Magnetic Model: BGGM2007 Date: 26-Mar-08  
Azimuths to Grid North

CASING DETAILS

TVD	MD	Name
2750.00	2750.00	Surface Casing
11750.00	12457.00	Int Casing



Created by Jeff Harwood Date 3/26/2008

RILEY RIDGE #20-14

SET DEPTH (ft MD)	SET DEPTH (ft TVD)	SECTION LENGTH (ft MD)	Casing OD (in)	WT	GRADE	THREAD	ID	Drill	Op b OD	SI Surface Pressure & BHP (psig)	Mud Wt (ppg)	Mud Wt (psi)	Colapse (psig)	Colapse SF	Burst (psig)	Burst SF	Sect Csg wt in Air (lbs)	Sum Csg Wt in Air (lbs)	Tension Body (lbs)	Body Tension SF	Connectio n Tension (lbs)	Connector Tension SF
Conductor																						
140	140	140	30"							100	8.3	60										
Surface Casing																						
2,600	2,600	2,600	16"	84	N-80	BTC	15	14,823	17.00	700	8.5	1,149	1,480	1.29	4,330	6.19	218,400	218,400	1,929	8.83	1,156	5.29
Intermediate Casing																						
12,372	11,750	12,372	10-3/4"	60.7	L-80 HC	BTC	9.66	9,504	11.75	3,200	9.5	5,805	6,590	1.14	10,650	3.33	750,980	750,980	1,398	1.86	1,428	1.90
Production Casing																						
400	400	400	7-5/8"	39	C-110	TC-II	6.63	6,500	8.5	3,300	10.0	208	11,080	53.27	12,900	3.91	15,600	678,538	1,231	1.81	1,231	1.81
13,000	12,313	12,600	7-5/8"	39	T-95 E	TC-II	6.63	6,500	8.5	5,600	10.0	6,403	10,000	1.56	16,340	2.92	491,400	662,938	1,119	1.69	1,119	1.69
14,817	13,827	1,817	7-5/8"	52.8	L-80	LTC	8.2	6,076	8.5	5,900	10.0	7,190	18,620	2.59	14,050	2.38	95,938	171,538	1,237	7.21	737	4.30
16,077	16,000	2,160	7"	35	L-80	LTC	6	5,879	7.656	6,200	10.0	8,320	10,180	1.22	9,240	1.49	75,600	75,600	814	10.77	734	9.71
Production String																						
16,000	15,085	16,000	3-1/2"	13	P-110	BTS-6	2.75	2,625	5.3125	3,300	10.0	7,849	20,090	2.56	19,690	5.97	207,200	207,200	386	1.86	387	1.87
Top of Madison																						
-	15,390									6,200	7.8											

Attachment #4 – Formation Tops in TVD Measurements from Riley Ridge #17-14

**Riley Ridge #17-34**

Vertical well on existing pad drilled to 16,336' MD/16,333' TVD with drift 172.5' South

Spud	TD Date	TD Depth	Lat.	Long.	Elevation	RKB
9/12/81	3/18/82	16,370	42.4495	-110.444	8,828	8,851
		Zone	TVD	Sub Sea		
Tertiary		Mesaverde	2532	6,319	Possible loss zone	

Set 16" 84# N-80 BTC for Surface Casing at 2,600' TVD with cement to surface

**Upper Cretaceous**

Hilliard	3,838	5,013	
Frontier	7,229	1,822	Possible pressure
	8,000		Begin testing for bacteria in mud at

**Lower Cretaceous**

Mowry	8,943	(92)	Hard Shale
Muddy/Silt/Sh / SD	9,154	(303)	
Thermopolis	9,189	(338)	
Dakota	9,308	(457)	Sand with gas show
Gannett	9,619	(768)	pH sensitive shale

**Jurassic**

	10,000		Begin adding 4ppb LCM and 2-5% mineral oil or Diesel
Stump	10,492	(1,841)	Possible Anhydrite- keep pH at 10.5
Preuss	10,544	(1,693)	Possible Anhydrite- keep pH at 10.5
Twin Creek	10,744	(1,893)	Possible Anhydrite- keep pH at 10.5 Anhydrite may cause high viscosity mud
Gypsum Springs	11,433	(2,582)	High calcium influx
	11,450	(2,599)	Increase LCM to 12 ppb for Loss Circulation Trip for spiral drill collars in BHA
Nugget	11,609	(2,758)	Might be loss zone

Set 10-3/4" 60.7# L-80 LTC at 11,750' TVD for Intermediate Casing with cement to 7,000'  
May lose mud while cementing  
Displace plug with 8.2-8.4 ppg OBM  
No LCM in OBM

**Triassic**

Ankareh	12150	(3,299)	Sand with Lime/Gyp stringers
Thaynes	12827	(3,976)	Salt formation
Woodside	13288	(4,437)	
Dinwoody	14082	(5,231)	

**Permian**

Phosphoria	14212	(5,361)	First H2S shows
Weber	14530	(5,679)	Hard sand with slow drilling

**Pennsylvania**

Amsden	14924	(6,073)	
Darwin	15280	(6,429)	

**Mississippian**

Madison	15380	(6,529)	7.8 ppg EMW (6200 psig) Potential for high CO2 (70%) influx Potential for high H2S (5%) influx Subpressured & possible losses
---------	-------	---------	--

Set 7-5/8" x 7" at 16,000' TVD Production Casing  
with cement into Intermediate Casing.

Verify cement design for 500' into Intermediate Casing

**Devonian**

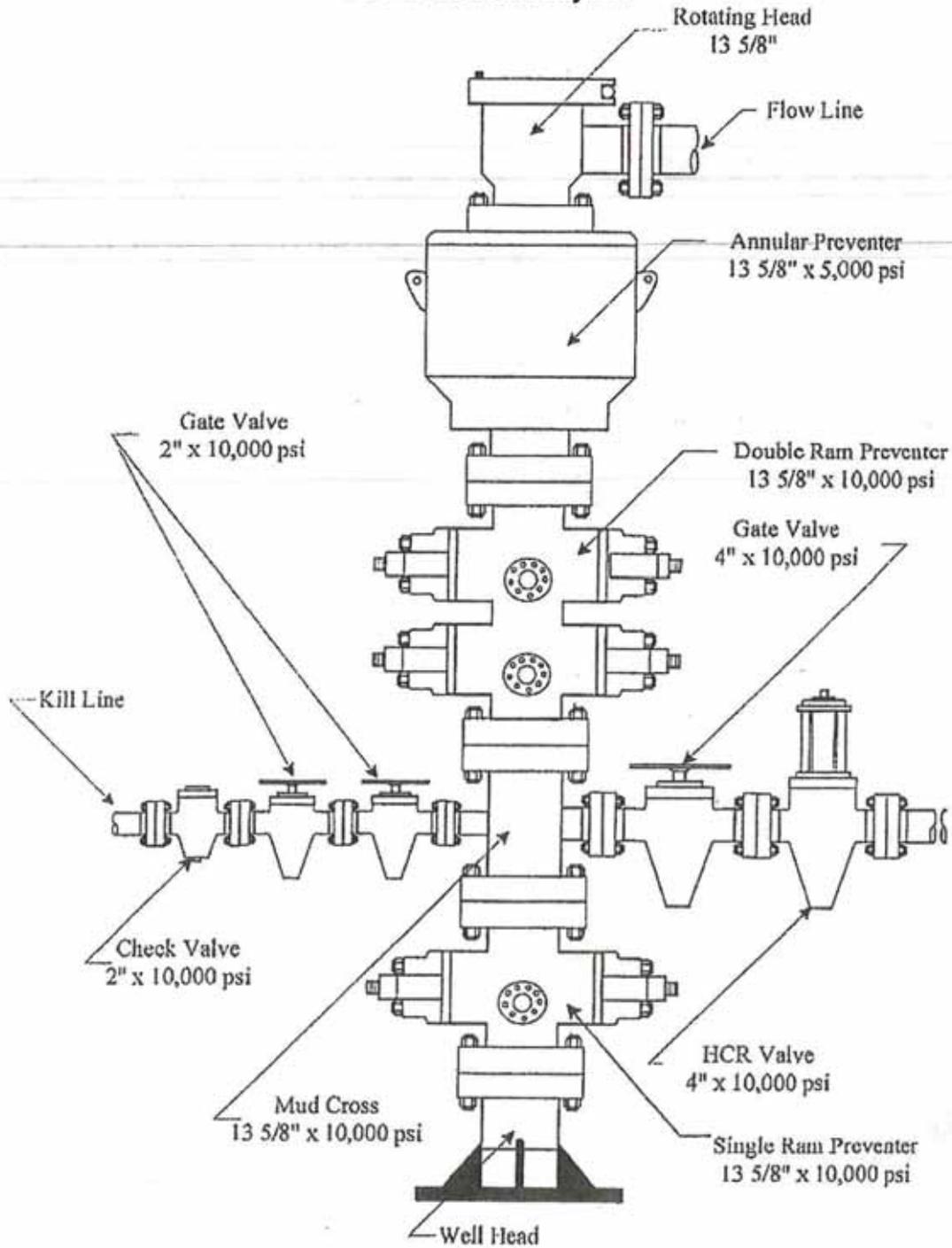
Three Forks	16281	(7,430)	
Darby	16301	(7,450)	
TD	16370	(7,519)	



Attachment# 5 - Pressure control equipment

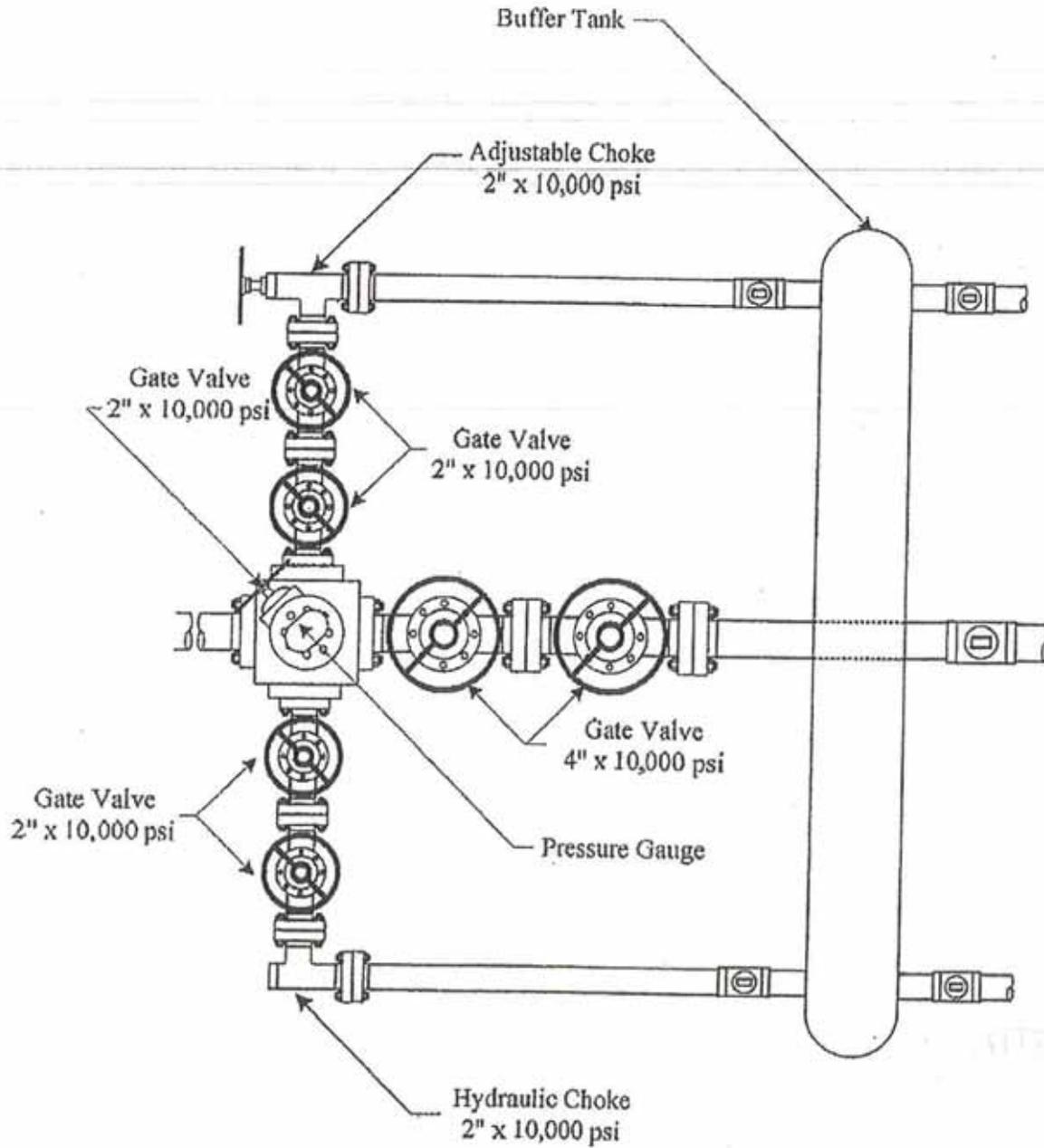
A diagram of the BOP stack showing sizes and pressure ratings is shown below. This equipment exceeds the requirements of the 5M system per Order No. 2.

**BOPE General Layout**



Schematic of manifold showing sizes and pressure ratings which exceeds all requirements of 5M system per Order No. 2

### Choke Manifold General Layout



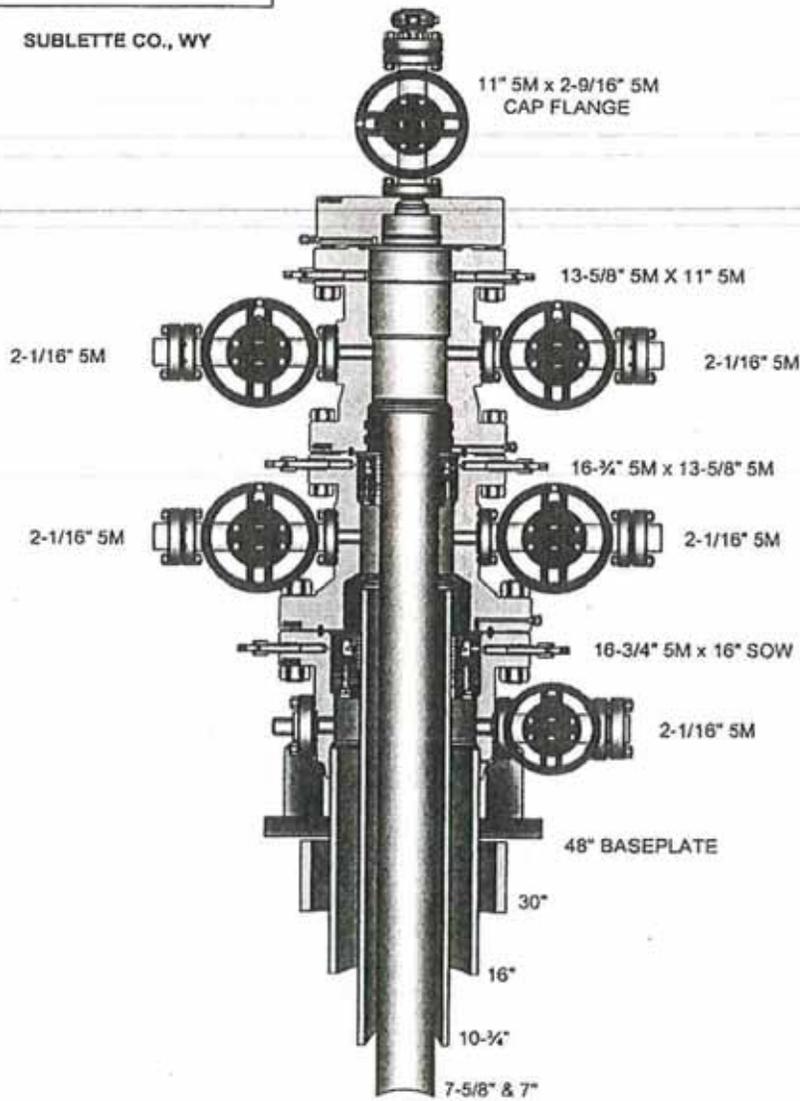
Attachment #6 - Temporary Abandonment Wellhead

TUBULAR PROGRAM  
30" CONDUCTOR  
16" 84# N-80 BT&C  
10-3/4" 60.70# L-80 LT&C  
7-5/8" & 7" TAPERED STRING



RILEY RIDGE UNIT

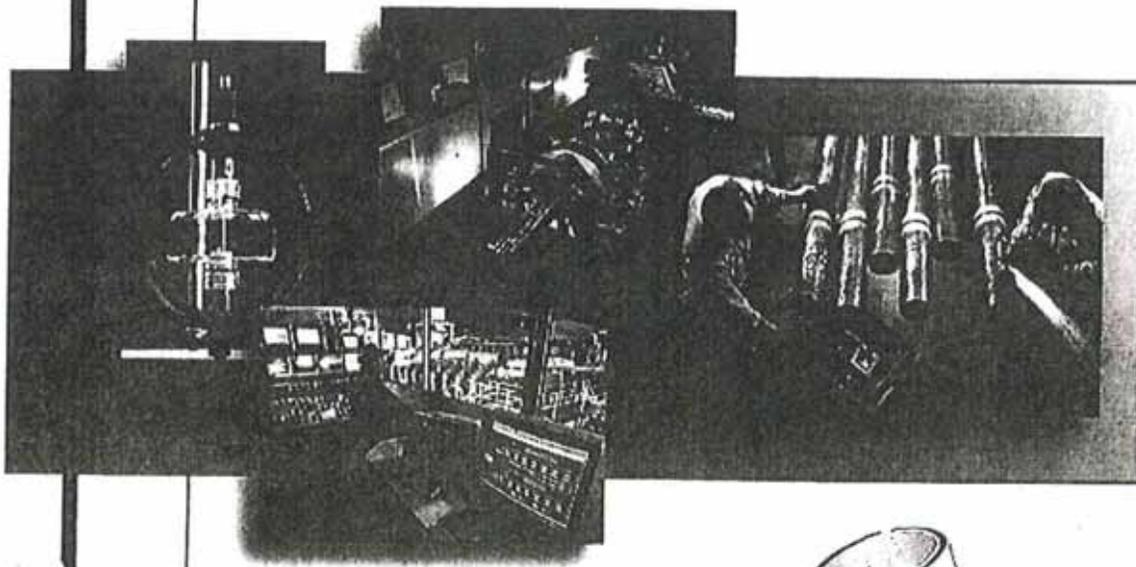
SUBLETTE CO., WY



PREPARED ON 3-31-08

T C A SEAMLESS OIL COUNTRY

API, PROPRIETARY, AND PREMIUM  
TECHNICAL DATA: 5" - 16-1/8" OD



GRANTPRIDECO



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16"

PIPE DATA

Pipe O.D. (in)	Nominal Weight (lb./ft)	Plain End Weight (lb./ft)	Wall Thickness (in)	Inside Diameter (in)	API Standard Drift Diameter (in)	Alternate Drift Diameter (in)
16.000	84.00	82.05	0.495	15.010	14.823	-

Product Grade	Plain End Collapse Resistance Minimum PSI <sup>1</sup>	Plain End Body Yield Strength (1000 lb) <sup>2</sup>	Plain End Internal Yield Pressure Minimum PSI <sup>3</sup>	Round Thread Joint Strength (1000 lb) <sup>4</sup>	Round Thread Internal Yield Pressure Minimum PSI <sup>1</sup>	Buttress Thread Joint Strength (1000 lb) <sup>6</sup>	Buttress Thread Internal Yield Pressure Minimum PSI <sup>7</sup>	ST-L Joint Strength (1000 lb) <sup>8</sup>	ANJIO Joint Strength (1000 lb) <sup>9</sup>	TC-II Joint Strength (1000 lb) <sup>10</sup>
H-80	1480	1929	4330	1167	4330	1898	4330			
H-80 HC	1850	1929	4330	1167	4330	1898	4330			
L-80	1480	1929	4330	1156	4330	1861	4330			
L-80 E	1480	2074	4660	1275	4660	1948	4660			
L-80 HC	1840	1929	4330	1156	4330	1861	4330			
L-80 eXtreme	1840	2074	4660	1275	4660	1948	4660			
C-90	1480	2170	4870	1284	4870	2043	4870			
C-90 HC	1850	2170	4870	1284	4870	2043	4870			
T-95	1480	2291	5140	1354	5140	2153	5140			
T-95 E	1480	2411	5410	1412	5410	2225	5410			
T-95 HC	1860	2291	5140	1354	5140	2153	5140			
T-95 eXtreme	1860	2411	5410	1412	5410	2225	5410			
C-95	1480	2291	5140	1354	5140	2153	5140			
C-95 E	1480	2411	5410	1412	5410	2225	5410			
C-95 HC	1860	2291	5140	1354	5140	2153	5140			
C-95 eXtreme	1860	2411	5410	1412	5410	2225	5410			
C-110	1480	2652	5960	1564	5960	2481	5960			
C-110 HC	1860	2652	5960	1564	5960	2481	5960			
P-110	1480	2652	5960	1575	5960	2518	5960			
P-110 E	1480	3014	6770	1762	6770	2772	6770			
P-110 HC	1870	2652	5960	1575	5960	2518	5960			
P-110 eXtreme	1870	3014	6770	1762	6770	2772	6770			
Q-125	1480	3014	6770	1773	6770	2809	6770			
Q-125 E	1480	3255	7310	1902	7310	2991	7310			
Q-125 HC	1880	3014	6770	1773	6770	2809	6770			
Q-125 eXtreme	1880	3255	7310	1902	7310	2991	7310			
TCA-140	1480	3376	7580	1983	7580	3138	7580			
TCA-150	1480	3617	8120	2123	8120	3356	8120			
TCA-80 GS	1480	1929	4330	1167	4330	1898	4330			
TCA-80 GSS	1480	1929	4330	1156	4330	1861	4330			
TCA-90 GSS	1480	2170	4870	1307	4870	2117	4870			
TCA-95 GSS	1480	2291	5140	1354	5140	2153	5140			

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# TCA PIPE DATA

Continued 10-3/4"

Pipe O.D. (in)	Nominal Weight (lb/ft)	Plain End Weight (lb/ft)	Wall Thickness (in)	Inside Diameter (in)	API Standard Drift Diameter (in)	Alternate Drift Diameter (in)
10.750	60.70	59.45	0.545	9.660	9.504	-

Product Grade	Plain End Collapse Resistance Minimum PSI <sup>1</sup>	Plain End Body Yield Strength (1000 lb)	Plain End Internal Yield Pressure Minimum PSI <sup>2</sup>	Round Thread Joint Strength (1000 lb)	Round Thread Internal Yield Pressure Minimum PSI <sup>3</sup>	Buttress Thread Joint Strength (1000 lb)	Buttress Thread Internal Yield Pressure Minimum PSI <sup>3</sup>	SFL Joint Strength (1000 lb)	APIJO Joint Strength (1000 lb)	TC-II Joint Strength (1000 lb)
N-80	5160	1398	7100	996	7100	1473	7100	974	998	1398
N-80 HC	6950	1398	7100	996	7100	1473	7100	974	998	1398
L-80	5160	1398	7100	983	7100	1428	7100	974	998	1398
L-80 L	5160	1503	7630	1039	7630	1470	7630	1047	1073	1503
L-80 HC	6590	1398	7100	983	7100	1428	7100	974	998	1398
L-80 eXtreme	6590	1503	7630	1039	7630	1470	7630	1047	1073	1503
C-90	5460	1573	7980	1089	7980	1544	7980	1096	1123	1573
C-90 HC	6950	1573	7980	1089	7980	1544	7980	1096	1123	1573
T-95	5590	1660	8430	1148	8430	1625	8430	1157	1185	1660
T-95 E	5590	1747	8870	1195	8870	1660	8870	1218	1248	1747
T-95 HC	7110	1660	8430	1148	8430	1625	8430	1157	1185	1660
T-95 eXtreme	7110	1747	8870	1195	8870	1660	8870	1218	1248	1747
C-95	5590	1660	8430	1148	8430	1625	8430	1157	1185	1660
C-95 E	5590	1747	8870	1195	8870	1660	8870	1218	1248	1747
C-95 HC	7110	1660	8430	1148	8430	1625	8430	1157	1185	1660
C-95 eXtreme	7110	1747	8870	1195	8870	1660	8870	1218	1248	1747
C-110	5880	1922	9760	1325	9760	1867	9760	1339	1372	1922
C-110 HC	7350	1922	9760	1325	9760	1867	9760	1339	1372	1922
P-110	5880	1922	9760	1337	9760	1912	9760	1339	1372	1922
P-110 E	5880	2184	11090	1459	11090	2064	11090	1522	1560	2184
P-110 HC	7700	1922	9760	1337	9760	1912	9760	1339	1372	1922
P-110 eXtreme	7700	2184	11090	1459	11090	2064	11090	1522	1560	2184
Q-125	6070	2184	11990	1502	11990	2109	11990	1522	1560	2184
Q-125 E	6070	2359	11980	1608	11980	2225	11980	1644	1684	2359
Q-125 HC	7840	2184	11990	1502	11990	2109	11990	1522	1560	2184
Q-125 eXtreme	7840	2359	11980	1608	11980	2225	11980	1644	1684	2359
TCA-140	6390	2446	12420	1769	12420	2351	12420	1705	1747	2446
TCA-150	6550	2621	13310	1977	13310	2513	13310	1826	1872	2621
TCA-80 GS	5160	1398	7100	996	7100	1473	7100	974	998	1398
TCA-80 GSS	5160	1398	7100	983	7100	1428	7100	974	998	1398
TCA-90 GSS	5460	1573	7980	1114	7980	1635	7980	1096	1123	1573
TCA-95 GSS	5590	1660	8430	1148	8430	1625	8430	1157	1185	1660

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Pipe O.D. (in)	Nominal Weight (lb/ft)	Plain End Weight (lb/ft)	Wall Thickness (in)	Inside Diameter (in)	API Standard Drift Diameter (in)	Alternate Drift Diameter (in)
7.625	52.80	52.62	0.712	6.201	6.076	-

Product Grade	Plain End Collapse Resistance Minimum PSI <sup>1</sup>	Plain End Body Yield Strength (1000 lb) ±	Plain End Internal Yield Pressure Minimum PSI <sup>3</sup>	Round Thread Joint Strength (1000 lb) ±	Round Thread Internal Yield Pressure Minimum PSI <sup>5</sup>	Buttress Thread Joint Strength (1000 lb) ±	Buttress Thread Internal Yield Pressure Minimum PSI <sup>7</sup>	ST-L Joint Strength (1000 lb) ±	ANJO Joint Strength (1000 lb) ±	TC-II Joint Strength (1000 lb) ±
N-80	13540	1237	13070	1157	10500	1239	9780	737	1011	-
N-80 HC	16280	1237	13070	1157	10500	1239	9790	737	1011	-
L-80	13540	1237	13070	1139	10500	1177	9790	737	1011	-
L-80 E	13540	1330	14050	1199	11280	1177	10530	793	1086	-
L-80 HC	14790	1237	13070	1139	10500	1177	9790	737	1011	-
L-80 eXtreme	14790	1330	14050	1199	11280	1177	10530	793	1086	-
C-90	15240	1392	14710	1257	11816	1239	11020	830	1137	-
C-90 HC	16280	1392	14710	1257	11816	1239	11020	830	1137	-
T-95	16080	1469	15520	1324	12460	1301	11630	876	1200	-
T-95 E	16080	1546	16340	1374	13120	1301	12240	922	1263	-
T-95 HC	17110	1469	15520	1324	12460	1301	11630	876	1200	-
T-95 eXtreme	17110	1546	16340	1374	13120	1301	12240	922	1263	-
C-95	16080	1469	15520	1324	12460	1301	11630	876	1200	-
C-95 E	16080	1546	16340	1374	13120	1301	12240	922	1263	-
C-95 HC	17110	1469	15520	1324	12460	1301	11630	876	1200	-
C-95 eXtreme	17110	1546	16340	1374	13120	1301	12240	922	1263	-
C-110	18620	1701	17980	1528	14430	1487	13460	1014	1390	-
C-110 HC	18740	1701	17980	1528	14430	1487	13460	1014	1390	-
P-110	18620	1701	17980	1546	14430	1549	13460	1014	1390	-
P-110 E	18620	1933	20430	1701	16400	1611	15300	1152	1579	-
P-110 HC	21160	1701	17980	1546	14430	1549	13460	1014	1390	-
P-110 eXtreme	21160	1933	20430	1701	16400	1611	15300	1152	1579	-
Q-125	21160	2088	20430	1731	16400	1673	15300	1152	1579	-
Q-125 E	21160	2088	22060	1837	17710	1735	16530	1244	1705	-
Q-125 HC	22740	1933	20430	1731	16400	1673	15300	1152	1579	-
Q-125 eXtreme	22740	2088	22060	1837	17710	1735	16530	1244	1705	-
TCA-140	23700	2165	22860	1935	18370	1858	17140	1291	1768	-
TCA-150	25400	2319	24510	2070	19680	1982	18360	1383	1895	-
TCA-80 GS	13540	1237	13070	1157	10500	1177	9790	737	1011	-
TCA-80 GSS	13540	1237	13070	1139	10500	1177	9790	737	1011	-
TCA-90 GSS	15240	1392	14710	1253	11816	1239	11020	830	1137	-
TCA-95 GSS	16080	1469	15520	1324	12460	1301	11630	876	1200	-

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# TCA PIPE DATA

continued 7-5/8"

Pipe O.D. (in)	Nominal Weight (lb/ft)	Plain End Weight (lb/ft)	Wall Thickness (in)	Inside Diameter (in)	API Standard Drift Diameter (in)	Alternate Drift Diameter (in)
7.625	39.00	38.08	0.500	6.625	6.500	-

Product Grade	Plain End Collapse Resistance Minimum PSI <sup>1</sup>	Plain End Body Yield Strength (1000 lb) <sup>2</sup>	Plain End Internal Yield Pressure Minimum PSI <sup>3</sup>	Round Thread Joint Strength (1000 lb) <sup>4</sup>	Round Thread Internal Yield Pressure Minimum PSI <sup>5</sup>	Buttress Thread Joint Strength (1000 lb) <sup>6</sup>	Buttress Thread Internal Yield Pressure Minimum PSI <sup>7</sup>	ST-L Joint Strength (1000 lb) <sup>8</sup>	ANJO Joint Strength (1000 lb) <sup>9</sup>	TC-II Joint Strength (1000 lb) <sup>8</sup>
N-80	8820	895	9180	793	9180	581	9180	571	627	835
N-80 HC	10650	895	9180	793	9180	581	9180	571	677	895
L-80	8820	895	9180	766	9180	945	9180	571	627	895
L-80 E	8820	963	9870	817	9870	964	9870	614	674	953
L-80 HC	9770	895	9180	766	9180	945	9180	571	627	895
L-80 eXtreme	9770	963	9870	817	9870	964	9870	614	674	963
C-90	9620	1007	10330	867	10330	1013	10330	642	705	1007
C-90 HC	10650	1007	10330	867	10330	1013	10330	642	705	1007
T-95	10060	1063	10900	914	10900	1065	10900	678	744	1063
T-95 E	10060	1119	11480	948	11480	1081	11480	714	784	1119
T-95 HC	11120	1063	10900	914	10900	1065	10900	678	744	1063
T-95 eXtreme	11120	1119	11480	948	11480	1081	11480	714	784	1119
C-95	10000	1053	10900	914	10900	1065	10900	678	744	1063
C-95 E	10000	1053	10900	914	10900	1065	10900	678	744	1063
C-95 HC	11120	1063	10900	914	10900	1065	10900	678	744	1063
C-95 eXtreme	11120	1119	11480	948	11480	1081	11480	714	784	1119
C-110	11080	1231	12620	1054	12620	1222	12620	785	862	1231
C-110 HC	12010	1231	12620	1054	12620	1222	12620	785	862	1231
P-110	11080	1399	14340	1173	14340	1343	14340	892	979	1399
P-110 E	11080	1399	14340	1173	14340	1343	14340	892	979	1399
P-110 HC	13210	1231	12620	1054	12620	1222	12620	785	862	1231
P-110 eXtreme	13210	1399	14340	1173	14340	1343	14340	892	979	1399
Q-125	12060	1399	14340	1194	14340	1343	14340	892	979	1399
Q-125 E	12060	1511	15490	1264	15490	1447	15490	963	1058	1511
Q-125 HC	13920	1399	14340	1194	14340	1379	14340	892	979	1399
Q-125 eXtreme	13920	1511	15490	1264	15490	1447	15490	963	1058	1511
TCA-140	12930	1567	16070	1335	16070	1536	16070	999	1097	1567
TCA-150	13440	1679	17210	1428	17210	1640	17210	1070	1175	1679
TCA-80 GS	8820	895	9180	798	9180	981	9180	571	627	895
TCA-80 GSS	8820	895	9180	786	9180	945	9180	571	627	895
TCA-90 GSS	9620	1007	10330	892	10330	1085	10330	642	705	1007
TCA-95 GSS	10000	1063	10900	914	10900	1085	10900	678	744	1063

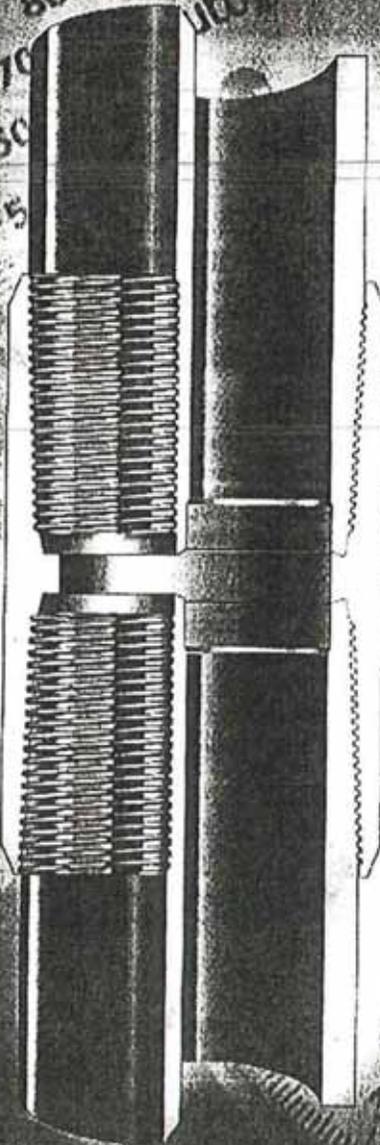
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Pipe O.D. (in)	Nominal Weight (lb/ft)	Plain End Weight (lb/ft)	Wall Thickness (in)	Inside Diameter (in)	API Standard Drift Diameter (in)	Alternate Drift Diameter (in)
7.000	35.00	34.61	0.498	6.004	5.879	-

Product Grade	Plain End Collapse Resistance Minimum PSI		Plain End Body Yield Strength (1000 lb)		Plain End Internal Yield Pressure Minimum PSI		Round Thread Joint Strength (1000 lb)		Round Thread Internal Yield Pressure Minimum PSI		Buttress Thread Joint Strength (1000 lb)		Buttress Thread Internal Yield Pressure Minimum PSI		ST-L Joint Strength (1000 lb)		ANID Joint Strength (1000 lb)		TC-II Joint Strength (1000 lb)	
	PSI	10180	814	814	9950	9240	746	9240	9240	8460	876	876	8460	8460	553	609	814	814		
N-80	10180	814	814	9950	9240	746	9240	9240	8460	876	876	8460	8460	553	609	814	814			
N-80 HC	11840	814	814	9950	9240	746	9240	9240	8460	876	876	8460	8460	553	609	814	814			
L-80	10180	814	814	9950	9240	734	9240	9330	832	832	832	9100	8460	553	609	814	814			
L-80 E	10180	875	814	10710	9330	772	9330	9330	832	832	832	9100	8460	553	609	814	814			
L-80 HC	10820	814	814	9950	9240	734	9240	9330	832	832	832	9100	8460	553	609	814	814			
L-80 eXtreme	10820	875	814	10710	9330	772	9330	9330	832	832	832	9100	8460	553	609	814	814			
C-90	11170	916	916	11210	10400	809	10400	10400	876	876	876	9520	8460	553	609	814	814			
C-90 HC	11840	916	916	11210	10400	809	10400	10400	876	876	876	9520	8460	553	609	814	814			
T-95	11650	966	966	11830	11830	853	10970	10970	920	920	920	10050	8460	553	609	814	814			
T-95 E	11650	1017	1017	12450	11830	860	11550	11550	920	920	920	10050	8460	553	609	814	814			
T-95 HC	12390	966	966	11830	11830	853	10970	10970	920	920	920	10050	8460	553	609	814	814			
T-95 eXtreme	12390	1017	1017	12450	11830	860	11550	11550	920	920	920	10050	8460	553	609	814	814			
C-95	11650	966	966	11830	11830	853	10970	10970	920	920	920	10050	8460	553	609	814	814			
C-95 E	11650	1017	1017	12450	11830	860	11550	11550	920	920	920	10050	8460	553	609	814	814			
C-95 HC	12390	966	966	11830	11830	853	10970	10970	920	920	920	10050	8460	553	609	814	814			
C-95 eXtreme	12390	1017	1017	12450	11830	860	11550	11550	920	920	920	10050	8460	553	609	814	814			
C-110	13020	1119	1119	13700	13700	983	12710	12710	1051	1051	1051	11630	8460	553	609	814	814			
C-110 HC	13470	1119	1119	13700	13700	983	12710	12710	1051	1051	1051	11630	8460	553	609	814	814			
P-110	13020	1119	1119	13700	13700	996	12710	12710	1095	1095	1095	11630	8460	553	609	814	814			
P-110 E	13020	1272	1272	15560	13700	1055	14440	14440	1139	1139	1139	13220	8460	553	609	814	814			
P-110 HC	14980	1119	1119	13700	13700	956	12710	12710	1095	1095	1095	11630	8460	553	609	814	814			
P-110 eXtreme	14980	1272	1272	15560	13700	1065	14440	14440	1139	1139	1139	13220	8460	553	609	814	814			
Q-125	14310	1272	1272	15560	15560	1106	14440	14440	1183	1183	1183	14280	8460	553	609	814	814			
Q-125 E	14310	1373	1373	16810	15560	1147	15900	15900	1227	1227	1227	14280	8460	553	609	814	814			
Q-125 HC	15910	1272	1272	15560	15560	1106	14440	14440	1183	1183	1183	14280	8460	553	609	814	814			
Q-125 eXtreme	15910	1373	1373	16810	15560	1147	15900	15900	1227	1227	1227	14280	8460	553	609	814	814			
TCA-140	15490	1424	1424	17430	16810	1229	16170	16170	1314	1314	1314	14810	8460	553	609	814	814			
TCA-150	16270	1526	1526	18680	17430	1310	17330	17330	1462	1462	1462	15870	8460	553	609	814	814			
TCA-80 GS	10180	814	814	9950	9950	746	9240	9240	876	876	876	9520	8460	553	609	814	814			
TCA-80 GSS	10180	814	814	9950	9950	734	9240	9240	832	832	832	9520	8460	553	609	814	814			
TCA-90 GSS	11170	916	916	11210	11210	833	10400	10400	964	964	964	10050	8460	553	609	814	814			
TCA-95 GSS	11650	966	966	11830	11830	853	10970	10970	920	920	920	10050	8460	553	609	814	814			

While every effort has been made to ensure the accuracy of the data in these tables, this material is presented as a reference guide only. The technical information contained in these pages should not be construed as a recommendation. Grant Pipeco cannot assume responsibility for the results obtained through the use of this material. No expressed or implied warranty is intended.

**TC-II<sup>®</sup>**  
Threaded and Coupled Casing  
and Tubing Connection



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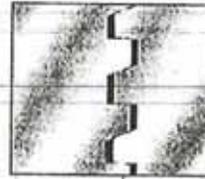


## TC-II®

### Threaded and Coupled Tubing and Casing Connection

#### High Performance Premium Thread Form

- A taller, coarser, field-tough thread form.
- 25° steady/compression lead flank stabs easily, reduces cross threading.
- 5° tension load flank provides optimum tensile performance without the cost of a "hooked" thread design.
- Pressure sealing provided by the tight fitting and precision toleranced thread form design.
- Flank-to-flank contact eliminates galling and prevents movement from tension/compression cycling. Compressive and tensile loads are supported by the thread body.
- Equal joint strength rating in tension and compression.
- Run-out thread design optimizes tensile efficiency.
- Thread body interference distributes thread loads more evenly.
- Torque stored in thread body interference helps prevent back off.
- Although normally produced on modern computer controlled machine tools, when necessary, the TC-II connection can be rethreaded using a manual engine lathe.



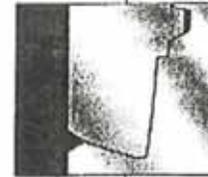
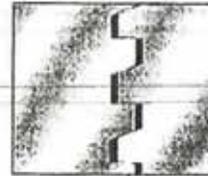
#### Internal Metal Seal

- Seal is generated by radial interference, reducing the effects of tensile load.
- Capable of resisting API pipe body internal pressure.
- Seal mechanism energized by internal and external pressure.
- Seal integrity not affected by multiple trips.

TC-II®

**Threaded and Coupled Tubing and Casing Connection****High Performance Premium Thread Form**

- A taller, coarser, field-tough thread form.
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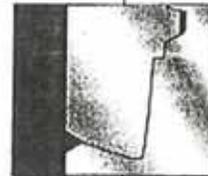
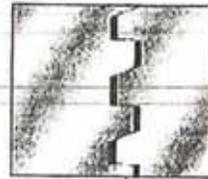
## TC-II® Threaded and Coupled Tubing and Casing Connection

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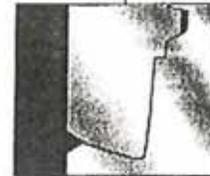
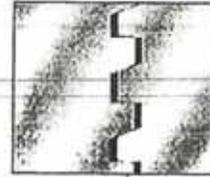


## TC-II®

### Threaded and Coupled Tubing and Casing Connection

#### High Performance Premium Thread Form

- A taller, coarser, field-tough thread form.
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## TC-II® Tubing and Casing Connection Data

Load Data										
E-80/8-10		C-90		C-93/E-15/8C-95		P-110		Q-125		Size OD
Tensile and Compressive Joint Strength	Reference String Length EF - 30									
1000 lbs	ft	in.								
101	14180	117	15950	124	16030	143	19499	161	22150	2-5/8
116	14680	133	16250	140	17200	162	20910	181	22690	
135	14950	152	16410	161	17350	185	20060	212	22800	
145	14160	163	15930	172	16910	199	19470	227	22120	2-7/8
180	14630	231	16460	214	17500	239	20120	262	22800	
199	14140	224	16250	236	17150	273	19000	310	22500	
174	14470	201	16490	214	17100	245	19500	279	22500	3-1/2
207	14660	233	15990	240	16720	265	19160	311	22700	
233	14790	262	16090	277	16970	321	19650	365	22350	
295	14490	331	16310	350	17210	365	19930	460	22950	
214	14100	241	15870	255	16750	295	19200	332	22040	4
246	14110	277	15480	292	16760	335	19410	392	22190	
304	14620	342	16160	361	17380	419	20120	471	22870	
346	14070	346	16130	411	17310	475	20080	511	22810	
241	14450	271	16120	296	17020	334	19700	376	22590	4-1/2
267	14390	300	16190	317	17090	367	19790	417	22600	
288	14420	324	15990	342	16770	399	19480	456	22600	
307	14210	345	15990	361	16970	421	19280	475	22100	
353	14580	397	16480	419	17300	483	20070	531	22600	
350	16670	394	18750	416	19810	481	22500	517	26050	5
422	16750	475	18690	501	19800	568	23020	609	26150	
471	16570	530	18650	559	19670	647	22770	726	25900	
496	16020	546	18730	577	19810	668	22940	759	26060	
501	16720	561	18610	595	19800	689	23000	783	26120	
543	16720	611	18810	645	19860	747	23000	849	26140	
563	16750	636	18850	672	19920	776	23060	881	26200	
561	16540	606	18710	629	19770	697	22600	861	25990	
597	16080	647	18780	671	19700	746	21940	920	26070	
466	16630	525	18750	554	19790	641	22400	729	25940	5-1/2
530	16160	597	18240	630	19570	729	22640	820	25790	
601	20510	676	18570	714	19520	816	22600	929	25600	
628	16740	707	18940	746	19680	854	23030	982	26170	
499	16390	516	18420	545	19460	631	22540	717	25610	
522	16470	567	19070	620	19000	718	22110	816	25120	
555	16520	621	18570	659	19610	763	22710	867	25800	
551	16610	742	18620	773	19720	895	22830	1017	25940	
672	16550	756	18620	798	19660	925	22790	1051	25900	
751	16380	826	18140	872	19460	1010	22540	1147	25600	
695	16130	905	18470	950	19510	1107	21590	1258	25570	
532	16520	599	18000	632	19530	732	22710	832	25440	7
601	16190	679	18050	717	19700	850	22800	944	25920	
676	16690	760	18720	803	19790	920	22840	1056	26010	
743	16630	839	18720	885	19750	1025	22890	1165	26000	
814	16610	916	18600	966	19710	1119	22840	1272	25660	
877	16400	985	18530	1041	19670	1206	22670	1378	25750	
950	16590	1069	18620	1129	19670	1307	22770	1485	25870	

See page 23 for notes to this data table.  
Joint strengths are based on the pipe body yield strength.

## TC-II<sup>®</sup> Tubing and Casing Connection Data

Pipe Data						Connection Data			Load Data	
Size OD	Nominal Weight	Wall Thickness	Nominal ID	API Ref. Diameter	Nominal Pipe Area	Coupling Thread OD	Connection Thread ID	Shoulder Loss	S-S	
									Grade and Compressive Joint Strength	Reference String Length DF = 50
in.	lb/ft	in.	in.	in.	sq. in.	in.	in.	in.	1000 lbs	ft
7-5/8	26.4	0.528	6.999	6.814	2.519	8.109	8.244 <sup>min</sup>	5.31	411	11200
	29.7	0.575	6.875	6.750	2.541	8.180	8.350 <sup>min</sup>	5.31	470	11500
	33.7	0.610	6.765	6.640	2.523	8.277	8.462	5.30	551	11510
	35.8	0.665	6.695	6.570	2.505	8.551	8.601	5.50	575	11470
	39.0	0.700	6.625	6.500	2.492	8.593	8.740	5.50	616	11280
	42.8	0.752	6.561	6.436	2.479	8.687	8.831	5.50	686	11450
47.1	0.825	6.575	6.250	2.474	8.582	8.521	5.31	736	11460	
7-3/4	45.1	0.595	6.591	6.500	2.274	8.660	8.696	5.37	720	11100
	48.0	0.625	6.500	6.375	2.290	8.705	8.645	5.37	769	11440
	49.0	0.640	6.470	6.345	2.293	8.728	8.619	5.37	786	11460
6-5/8	28.0	0.594	6.017	5.892	2.047	8.085	7.988 <sup>min</sup>	5.25	437	11150
	32.0	0.552	5.921	5.875	2.149	8.107	7.992 <sup>min</sup>	5.25	505	11250
	35.0	0.600	5.825	5.750	2.250	8.250	7.911	5.25	560	11270
	38.0	0.650	5.725	5.625	2.357	8.335	7.825	5.25	626	11360
	44.0	0.700	5.625	5.500	2.463	8.415	7.725	5.25	702	11400
	49.0	0.757	5.511	5.386	2.578	8.507	7.630	5.25	776	11510
6-3/8	36.0	0.552	5.921	5.750	2.025	10.100	8.888 <sup>min</sup>	5.25	554	11290
	40.0	0.595	5.825	5.679	2.145	10.225	8.916	5.25	630	11250
	45.0	0.645	5.755	5.595	2.259	10.365	8.816	5.25	711	11350
	47.0	0.672	5.681	5.525	2.372	10.500	8.761	5.25	766	11340
	53.5	0.745	5.535	5.400	2.506	10.487	8.654	5.25	855	11420
	58.1	0.799	5.455	5.275	2.679	10.567	8.566	5.25	928	11350
6-7/8	62.8	0.825	5.625	5.499	2.810	10.800	8.763	5.37	929	11360
10-3/4	40.5	0.590	10.910	9.804	11.425	11.261	10.011 <sup>min</sup>	5.26	629	11090
	45.5	0.602	9.950	9.875	13.006	11.572	10.029	5.26	715	11220
	51.0	0.650	9.850	9.691	14.561	11.458	9.911	5.26	801	11220
	55.5	0.695	9.769	9.625	15.917	11.535	9.812	5.26	877	11295
	60.7	0.745	9.660	9.501	17.473	11.619	9.775	5.26	961	11510
	65.7	0.795	9.560	9.401	18.982	11.702	9.687	5.26	1044	11350
11-3/4	47.0	0.575	11.000	10.814	13.401	12.323	10.914 <sup>min</sup>	5.30	737	11200
	54.0	0.635	10.880	10.724	15.453	12.420	10.914	5.30	816	11250
	60.0	0.680	10.772	10.625	17.300	12.525	10.899	5.28	951	11320
	65.0	0.731	10.662	10.625	18.816	12.600	10.791	5.38	1035	11370
	71.8	0.782	10.580	10.493	20.420	12.680	10.707	5.38	1123	11300
	74.6	0.818	10.514	10.338	21.613	12.741	10.611	5.38	1189	11500
11-7/8	71.00	0.882	10.711	10.555	20.618	12.816	10.831	5.22	1126	11300
13-3/8	54.5	0.580	12.615	12.419	15.515	13.947	12.509 <sup>min</sup>	5.61	853	11100
	61.0	0.630	12.535	12.359	17.487	14.037	12.592	5.61	964	11260
	68.0	0.680	12.435	12.259	19.445	14.126	12.594	5.61	1070	11230
	72.0	0.714	12.317	12.250	20.768	14.185	12.445	5.61	1142	11330
	77.0	0.750	12.275	12.119	22.169	14.248	12.382	5.61	1219	11510
	89.7	0.780	12.215	12.039	23.511	14.299	12.329	5.61	1282	11550
	91.0	0.660	12.055	11.899	26.564	14.435	12.289	5.61	1450	11580
	13-5/8	68.20	0.825	12.375	12.219	23.525	14.626	12.500	5.45	1404

<sup>min</sup>These connections are swaged and bored.

See page 23 for notes to this data table.  
Joint strengths are based on the pipe body yield strength

TC-II® Tubing and Casing Connection Data

Load Data										Size OD in.	
L-10/R-01		C-93		C-11/P-11/MC-55		P-110		Q-117			
Tensile and Compressive Joint Strength	Reference String Length DF = 0.4	Tensile and Compressive Joint Strength	Reference String Length DF = 0.4	Tensile and Compressive Joint Strength	Reference String Length DF = 0.4	Tensile and Compressive Joint Strength	Reference String Length DF = 0.4	Tensile and Compressive Joint Strength	Reference String Length DF = 0.4		
1000 lbs	ft										
662	16290	677	16320	714	16320	827	22500	910	25450	7-5/8	
663	16430	709	16493	611	15500	940	23510	1006	25000		
778	16100	675	16554	925	19500	1009	23060	1215	25750		
837	16511	911	18770	594	19850	1151	23060	1317	26000		
895	16300	1007	18410	1065	19170	1231	24550	1409	25420		
934	16550	1122	18720	1185	19700	1572	22900	1579	26020	7-3/4	
1100	16000	1237	18700	1506	19410	1512	22930	1736	26050		
1070	15580	1204	16000	1271	19000	1471	22700	1672	25910		
1119	16050	1259	16740	1329	19700	1589	22970	1740	26030		
1144	16680	1247	16700	1358	19500	1575	22920	1767	26050		
630	16220	715	16240	755	19200	871	22500	998	25450	8-5/8	
732	16310	821	18370	869	19400	1005	22460	1144	25500		
827	16411	892	18450	982	19400	1137	22910	1282	25400		
925	16520	1049	18570	1026	19810	1271	22700	1444	25900		
1021	16570	1149	18550	1212	19800	1404	22700	1598	25900		
1120	16160	1271	18530	1341	19750	1553	22600	1761	25730	9-5/8	
820	16270	925	18510	971	19320	1124	22380	1282	25110		
916	16190	1031	18410	1040	19400	1263	22900	1432	25570		
1065	16200	1170	18500	1193	19500	1381	23000	1573	25700		
1066	16510	1222	18570	1269	19500	1493	23000	1697	25700		
1244	16610	1399	18690	1477	19700	1709	22830	1913	25910	9-7/8	
1350	16510	1519	18590	1604	19020	1857	22710	2111	25810		
1455	16590	1655	18600	1725	19020	1990	22730	2270	25820		
915	16140	1020	18150	1080	19150	1259	22100	1428	25200		10-3/4
1040	16200	1171	18190	1250	19400	1431	22400	1624	25500		
1165	16420	1311	18360	1404	19370	1602	22410	1824	25400		
1276	16420	1435	18370	1515	19500	1754	22570	1991	25600		
1508	16450	1573	18510	1660	19530	1922	22620	2186	25700		
1519	16510	1708	18570	1805	19000	2088	22700	2373	25900	11-3/4	
1072	16260	1206	18350	1275	19350	1479	22400	1675	25460		
1237	16300	1392	18410	1469	19450	1701	22900	1953	25570		
1388	16480	1557	18510	1643	19500	1903	22650	2162	25700		
1505	16510	1693	18600	1798	19650	2070	22750	2351	25800		
1634	16441	1838	18450	1910	19520	2246	22600	2551	25670	11-7/8	
1729	16550	1943	18620	2033	19660	2377	22700	2701	25870		
1652	16430	1858	18400	1969	19510	2271	22600	2581	25600		
1241	16200	1596	18300	1471	19320	1706	22360	1946	25410		13-3/8
1399	16300	1574	18150	1601	19150	1924	22530	2106	25600		
1556	16310	1750	18280	2017	19400	2159	22670	2431	25500		
1661	16480	1869	18510	1975	19570	2264	22650	2566	25700		
1775	16450	1994	18500	2101	19500	2488	22620	2776	25700		
1855	16510	2098	18570	2215	19610	2565	22700	2914	25700	13-5/8	
2109	16150	2373	18630	2505	19600	2900	22700	3495	25800		
2012	16140	2297	18600	2425	19400	2808	22740	3191	25910		

See page 25 for notes to this data table.  
Joint strengths are based on the pipe body yield strength.

# H<sub>2</sub>S Drilling Operation Plan

## Riley Ridge Project

4-25-08

The Cimarex H<sub>2</sub>S Drilling Operations Plan is prepared to safely drill the Riley Ridge wells which should encounter Hydrogen Sulfide (H<sub>2</sub>S) gas in the Phosphoria formation at 14,212' TVD and the Madison formation at 15,380' TVD. These formations will require additional planning from a safety standpoint, including training and equipment from surface separation to flaring/burning the H<sub>2</sub>S gas. Attachment #1 is a geologic prognosis based on the vertically drilled Riley Ridge #17-34, showing casing setting depths, potential hazards, and hazards mitigation.

This Plan has been prepared per Bureau of Land Management (BLM) Onshore Oil & Gas Order No. 6, Hydrogen Sulfide Operations, effective 1/22/1991 which establishes "the minimum acceptable standards with regard to H<sub>2</sub>S operations. The BLM authorized officer may require additional corrective actions as "determines to be necessary to protect public health and safety, the environment, or to maintain control of a well to prevent waste of Federal mineral resources."

Riley Ridge Federal #10-14 gas analysis data is published in the BLM database and is shown in Attachment #2. The average concentrations of the major components are H<sub>2</sub>S (4.6%), Helium (0.5%), Methane (18.4%), Nitrogen (10.1%), and CO<sub>2</sub> (66.3%). This analysis is representative of the Riley Ridge Madison Unit.

Using the Pasquill -Gifford derived equation, the 100 ppm ROE and 500 ppm ROE are greater than 3,000 feet for a gas rate of 120,000,000 scfd. See Attachment #3.

This H<sub>2</sub>S Drilling Operation Plan and the Public Protection Plan is prepared for submittal with the Riley Ridge #20-14 Application for Permit to Drill (APD). Preparing and submitting these Plans are necessary for a complete APD package.

Within the Cimarex ES&H Manual (Attachment #6) under Hydrogen Sulfide (H<sub>2</sub>S) Safety Program Part II, Training Program states that "Safety training will be provided to all personnel who may be required to work in a known or suspected H<sub>2</sub>S environment. This training must be given prior to entering or working in an H<sub>2</sub>S environment." The training will include annual refresher course. The training will be documented and a wallet size card will be issued at the successful completion of the course.

The Cimarex ES&H training program for H<sub>2</sub>S identifies the following areas that must be covered:

1. Hazards, properties and characteristics of H<sub>2</sub>S and Sulfur Dioxide (SO<sub>2</sub>).
2. Sources of H<sub>2</sub>S and SO<sub>2</sub>
3. Use of H<sub>2</sub>S detection devices
4. Description of H<sub>2</sub>S and SO<sub>2</sub> detection systems used
5. Symptoms of exposure

6. Use and limitations of respiratory equipment and location
7. First Aid procedures, equipment, and location
8. Use of the "buddy system" and emergency rescue procedures
9. Wind direction awareness and routes of egress (exits)
10. Confined space and enclosed space entry procedures
11. Contingency planning

Third party vendor(s) will be selected to implement the H<sub>2</sub>S Safety Plan on site. The vendor will be required to provide training & certification of completion to all workers. The timing of this training and certification will be coordinated with site operations. All training of current workers will be completed prior to setting the intermediate casing at 11,750' TVD. A third party supervisor will be maintained on site to support plan implementation and conduct additional training for additional workers.

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Advance briefings, by visit, meeting or letters may be prepared and conducted to provide additional explanation and information on the following items per BLM Order No. 6, Section III.B.2.b.ii(b), including:

- Hazards of H<sub>2</sub>S and SO<sub>2</sub>;
- Necessity for an emergency action plan;
- Possible sources of H<sub>2</sub>S and SO<sub>2</sub>;
- Instructions for reporting a leak to the operator;
- The manner in which the public shall be notified of an emergency; and
- Steps to be taken in case of an emergency, including evacuation of any people;

The well site diagrams (Attachments #4 & #5) showing the following:

- i. Drill rig orientation
- ii. Prevailing wind direction
- iii. Terrain of surrounding area
- iv. Location of all briefing areas (designate primary briefing area)
- v. Location of access road(s) (including secondary egress)
- vi. Location of flare line(s) and pit(s)
- vii. Location of caution and/or danger signs
- viii. Location of wind direction indicators
- ix. Proposed location construction and contour mapping

The final selection of vendor(s) to support the following H<sub>2</sub>S safety equipment/systems will be made prior to the start of drill site construction:

- i. Well control equipment
  - Flare line(s) and means of ignition (TBD by vendor's availability of equipment)
  - Remote controlled choke - (TBD by vendor's availability of equipment)
  - Flare gun/flares - (TBD by vendor's availability of equipment)
  - Mud-gas separator and rotating head (TBD by vendor's availability of equipment)
- ii. Protective equipment for essential personnel. See Attachment #6.

- Location, type, storage and maintenance of all working and escape breathing apparatus
- Means of communication when using protective breathing apparatus
- iii. H<sub>2</sub>S detection and monitoring equipment. See Attachment #6
  - H<sub>2</sub>S sensors and associated audible/visual alarm(s)
  - Portable H<sub>2</sub>S and SO<sub>2</sub> monitor(s)
- iv. Visual warning systems. See Attachment #4.
  - Wind direction indicators will be mounted on the drill rig and have secondary wind socks on each end of the location.
  - Caution/danger sign(s) and flag(s)
- v. Mud program is outlined in the body of the APD.
  - Mud system and additives
  - Mud degassing system
- vi. Metallurgy.
  - Metallurgical properties of all tubular goods and well control equipment which could be exposed to H<sub>2</sub>S (Section III.C.4.c.) are outlined in the APD.
- vii. Means of communication from wellsite. Communications will be handled by Cimarex owned satellite system. Special satellite phones will be available as secondary communications.

Well Testing Plans will be developed based on the open hole logs and mud log. The Detail Completion/Testing Plan will be prepared and submitted under a sundry notice for approval.

Other Important Items  
Plans and Reports

- a. The H<sub>2</sub>S Drilling Operations Plan shall be reviewed by Cimarex on an annual basis and a copy of any necessary revisions shall be submitted to the BLM authorized officer upon request within 20 to 40 days.
- b. Any release of a potentially hazardous volume of H<sub>2</sub>S shall be reported to the BLM authorized officer as soon as practicable, but no later than 24 hours following identification of the release.

Attachment #1  
Geologic Formations at Riley Ridge

Riley Ridge #17-34

Vertical well on existing pad drilled to 16,336' MD/16,333' TVD with drift 172.5' South

Spud	TD Date	TD Depth	Lat.	Long.	Elevation	RKB
9/12/81	3/18/82	16,370	42.4495	-110.444	8,028	8,851

	Zone	TVD	Sub Sea	
Tertiary	Mesaverde	2532	6,319	Possible loss zone

Set 16" 84# N-80 BTC for Surface Casing at 2,600' TVD with cement to surface

Upper Cretaceous

Hilliard	3,838	5,013	
Frontier	7,229	1,622	Possible pressure
	8,000		Begin testing for bacteria in mud at

Lower Cretaceous

Mowry	8,943	(92)	Hard Shale
Muddy/Silt/Sh / SD	9,154	(303)	
Thermopola	9,189	(338)	
Dakota	9,308	(457)	Sand with gas show
Gannett	9,619	(768)	pH sensitive shale

Jurassic

	10,000		Begin adding 4ppb LCM and 2-5% mineral oil or Diesel
Stump	10,492	(1,641)	Possible Anhydrite- keep pH at 10.5
Preuss	10,544	(1,693)	Possible Anhydrite- keep pH at 10.5
Twin Creek	10,744	(1,893)	Possible Anhydrite- keep pH at 10.5
			Anhydrite may cause high viscosity mud
Gypsum Springs	11,433	(2,582)	High calcium influx
	11,450	(2,599)	Increase LCM to 12 ppb for Loss Circulation
			Trip for spiral drill collars in BHA
Nugget	11,609	(2,758)	Might be loss zone

Set 10-3/4" 60.7# L-80 LTC at 11,750' TVD for Intermediate Casing with cement to 7,000'

May lose mud while cementing  
Displace plug with 8.2-8.4 ppg OBM  
No LCM in OBM

Triassic

Ankareh	12150	(3,299)	Sand with Lime/Gyp stringers
Thaynes	12827	(3,976)	Salt formation
Woodside	13288	(4,437)	
Dinwoody	14082	(5,231)	

Permian

Phosphoria	14212	(5,361)	First H2S shows
Weber	14530	(5,679)	Hard sand with slow drilling

Pennsylvania

Amsden	14924	(6,073)	
Darwin	15280	(6,429)	

Mississippian

Madison	15380	(6,529)	7.8 ppg EMW (6200 psig) Potential for high CO2 (70%) influx Potential for high H2S (5%) influx Subpressured & possible losses
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Set 7-5/8" x 7" at 16,000' TVD Production Casing  
with cement into Intermediate Casing.

Verify cement design for 500' into Intermediate Casing

Devonian

Three Forks	16281	(7,430)	
Darby	16301	(7,450)	
TD	16370	(7,519)	

Attachment #2  
 Riley Ridge Federal #10-14  
 Average Gas Analysis

BLM - AMARILLO FIELD OFFICE

QUAD H GAS CHROMATOGRAPHIC ANALYSIS

COMPANY NAME: WOLD OIL PROPERTIES  
 WELL NAME: RILEY RIDGE FEDERAL 10-14  
 DATE COLLECTED: 080924  
 LAB NUMBER: FS-21588  
 SAMPLED BY: R. KING  
 DATE ANALYZED: 081005  
 #, CO, ST, SEC  
 T&R:

SUBLETTE WY 10 T29N R114W

API #, LAT, LONG: 490352060300S1 N42.5056129' W- 110.4130952'  
 \*UNNAMED\* FIELD, MADISON FORMATION, SE SW SW SPOT, 16160 ft DEEP, 15712-15762 ft DEPTH,  
 8555 ft KB ELEVATION, DEVONIAN,  
 UPPER DEVONIAN AGE

Component	Average	Std. Dev.
Hydrogen	0.16	0.001
Helium	0.63	0.001
Methane	17.15	0.004
Nitrogen	7.33	0.002
Ethane	0.01	0.000
Oxygen	0.00	0.000
H2S	1.34	0.008
Argon	0.05	0.000
CO2	73.28	0.001
Propane	0.00	0.000
I-Butane	0.13	0.003
N-Butane	0.00	0.000
I-Pentane	0.00	0.000
N-Pentane	0.00	0.000
Hexanes+	0.02	0.000
Btu	198.00	0.000
Sp. Gr.	1.300	0.000

ExxonMobil Production Company, U.S. Production  
 LaBarge Operations, Shute Creek Laboratory, Lincoln County, WY

Product Analyst: C.F. Conroy Analysis Date: 10/29/2006

Norm%	He	Ar	N2	CH4	CO2	C2H6	H2S	COS
RUN 1	0.5196	0.0620	10.1338	18.5222	68.2339	0.0123	4.4936	0.0324
RUN 2	0.5228	0.0593	10.0951	18.4806	68.2195	0.0123	4.5791	0.0320
RUN 3	0.5202	0.0590	10.0622	18.4275	68.2789	0.0114	4.6078	0.0340
RUN 4	0.5255	0.0584	10.0652	18.4345	68.2759	0.0111	4.5987	0.0327
RUN 5	0.5242	0.0590	10.0763	18.4492	68.2010	0.0124	4.6463	0.0326
AVG, 3-5	0.523	0.059	10.068	18.437	68.262	0.012	4.617	0.033
Norm%	He	Ar	N2	CH4	CO2	C2H6	H2S	COS

Sample Information:  
 Wold Oil Properties  
 Riley Ridge Fed. 10-14  
 SW SW Sec. 10 T29N R114W  
 Sublette County, WY  
 High Pressure Gas Sample  
 10/28/06 @ 16:30  
 Serial # HDF4 500  
 From: Test Separator Meter Run  
 Pressure: 530 PSI  
 Temp: 103 F  
 Taken By: Pure Energy Services LTD.  
 307-789-4227  
 Wold Company Rep: Rocky Moeller 307-389-4458  
 Formation: Madison

**RILEY RIDGE UNIT**  
**WYW109661X**  
**Federal No. 10-14**  
**WYW78475**  
**SW SW Sec. 10 T29N R114W**  
**630' FSL 827' FWL**  
**Sublette County, Wyoming**  
**8323' GL 8355' KB**  
**API #49-035-20603**

12/29/80 Spud by American Quasar.

10/31/81 Completed. 24" @ 40' GL. 16" 75/84# KSS @ 2017' w/ 1900 sks. DST #1 (2nd Frontier 7695'-7820') weak blow, lost pkr seat. Rec 93' GCM. 10-3/4" 55.7/60.7# L80/SS95 @ 10,956' w/ DV @ 4948'. Cmt 1st stage w/ 4500 sks & 2nd stage w/ 2800 sks. DST #2 (Phosphoria 13,970'-14,200') misrun. 7-5/8" 39# L80/SS95 liner 10,688'-15,195' cmt w/ 865 sks. Perf 11,380'. Sqz w/ 155 sks. Drill to 15,695'. Well blew out during fishing job. Control blow out and repair rig. Tie back 7-5/8" liner to surface w/ 7-5/8" 33.7/39# L80/SS95 set @ 10,697'. Crut w/ 1868 sks. Perf csg @ 1800' w/ 2 shots. Cmt top of tie-back w/ 500 sks. Clean out to top of fish @ 14,475'. Tite spot 13,072'-13,077'. Attempt to recover fish (2 DC-s, jar bbl, JS, BS, bit). No success. Set Baker whipstock @ 15,078'. Cut window in 7-5/8" csg. Drill new 6-1/2" hole to TD 16,220'. Set 5" 18# L80 liner 10,561'-16,217', cmt w/ 500 sks. PBTD 16,200'. Displace hole w/ inhibited water. LD DP.

8/18/87 Change of operator to Wolverine Exploration.

9/24/93 MIT csg 1000 psig OK.

8/1/95 Change of operator to Wold Oil Properties, Inc.

10/4/05 MIT 7-5/8" csg 1000 psig OK. Witnessed by BLM.

11/6/06 Identify minor csg leak 1699'-2137', not repaired. Set pkr on work string @ 15,398', test csg 2500 psig OK. Perf Madison 15,742'-62', 15,712'-22' w/ 1spf. Liven well w/ CTU & N<sub>2</sub>. Flow test, take gas samples. Run BHP survey, wireline parted. Attempt to fish wireline & bombs unsuccessful. Chase fish to 15,698'. Set CIBP on wireline @ 15,430', capped w/ 2 sks cmt. Run TCP perforating & pressure gauge assy, set pkr @ 15,237'. Perf Madison 15,317'-37' w/ 1spf. Flow test, take gas samples. TOH w/ perf assy. Set CIBP on wireline @ 15,215' capped w/ 2 sks cmt. Test csg to 2000 psig OK. Load hole w/ 9.2# inhibited KCl.

Attachment #3

Radius of Exposure (ROE) Calculations

**From BLM Onshore Order 6:**

Radius of exposure means the calculation resulting from using the following Pasquill -Gifford derived equation, or by such other method(s) as may be approved by the authorized officer

1. For determining the 100 ppm radius of exposure where the H<sub>2</sub>S concentration in the gas stream is less than 10 percent:

$$X = [ (1.589)(H_2S \text{ concentration})(Q) ]^{(0.6258)} \text{ or}$$

2. For determining the 500 ppm radius of exposure where the H<sub>2</sub>S concentration in the gas stream is less than 10 percent:

$$X = [ (0.4546)(H_2S \text{ concentration})(Q) ]^{(0.6258)}$$

Where:

X = radius of exposure in feet:

H<sub>2</sub>S Concentration = decimal equivalent of the mole or volume fractions of H<sub>2</sub>S in the gaseous mixture;

Q = maximum volume of gas determined to be available for escape in cubic feet per day (at standard condition of 14.73 psia and 60 °F).

Escape rate means that the maximum volume (Q) used as the escape rate in determining the radius of exposure shall be that specified below, as applicable:

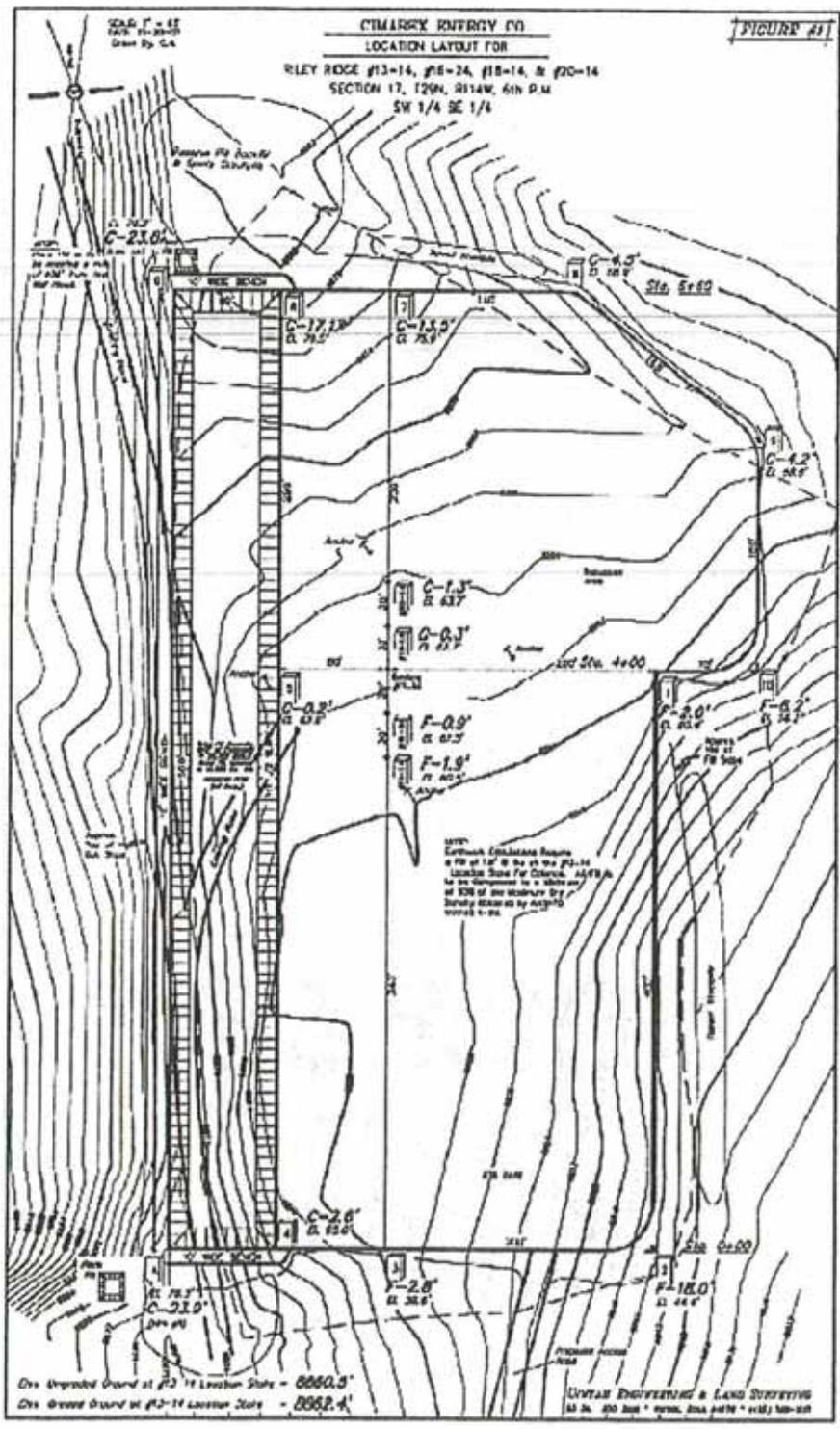
2. For gas wells, the escape rate shall be calculated by using the current daily absolute open flow rate against atmospheric pressure;
4. For a well being drilled in a developed area, the escape rate may be determined by using the offset wells completed in the interval(s) in question.

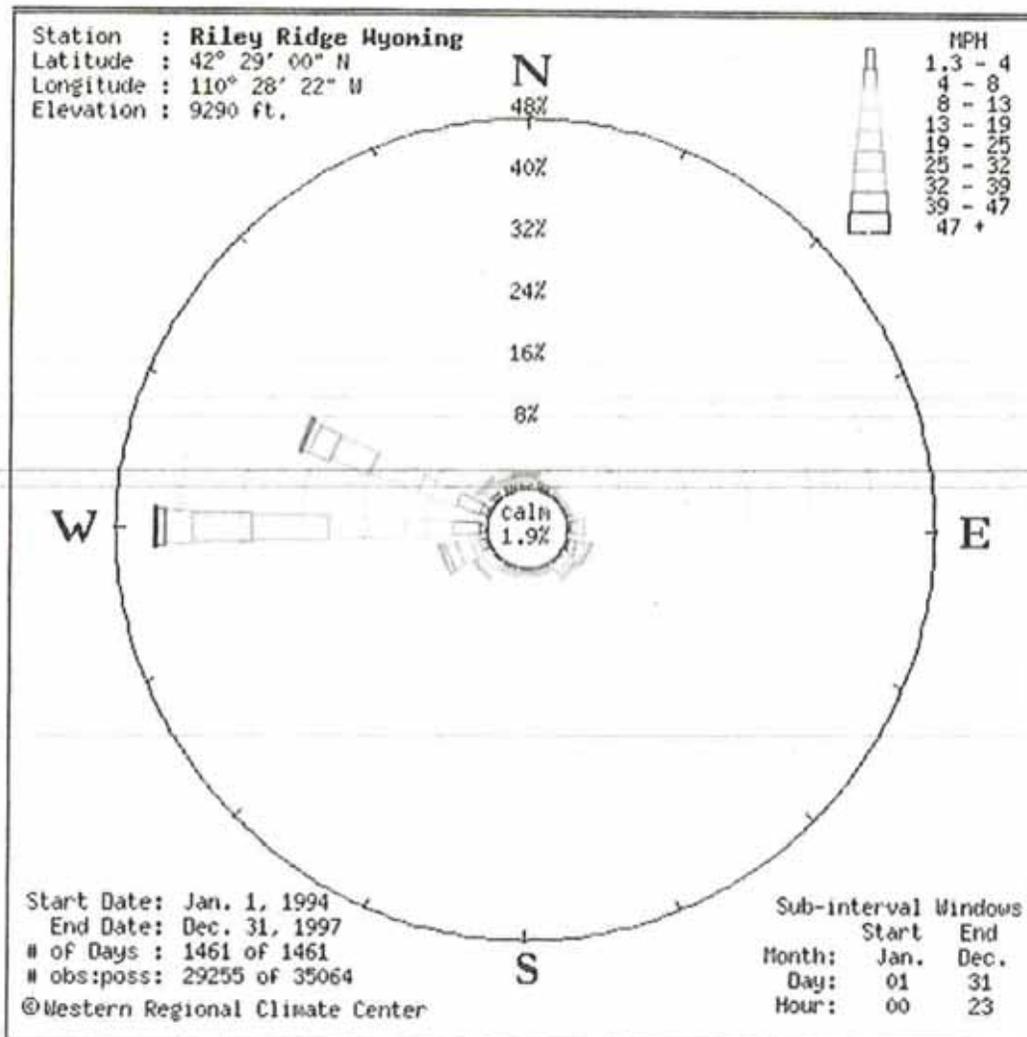
<b>100 PPM ROE</b>	X= [ (1.589)(H <sub>2</sub> S concentration)(Q) ] <sup>(0.6258)</sup>			
	Q,scfd	40,000,000	80,000,000	120,000,000
	H <sub>2</sub> S	0.04617	0.04617	0.04617
	X, feet	11,153	17,210	22,181
	X, Miles	2.1	3.3	4.2

<b>500 PPM ROE</b>	X=[ (0.4546)(H <sub>2</sub> S concentration)(Q) ] <sup>(0.6258)</sup>			
	Q,scfd	40,000,000	80,000,000	120,000,000
	H <sub>2</sub> S	0.04617	0.04617	0.04617
	X, feet	5,096	7,864	10,136
	X, Miles	1.0	1.5	1.9



Attachment #5 – Modified Surveyor's Figure #1  
 Proposed Multi-Well Pad, Wind Rose 1994-1997, Weather Station Map





Prevailing Winds are from West to East



Weather Station is 1.9 miles from Riley Ridge #20-14  
 Riley Ridge #20-14 is 19.5 miles from Big Piney, WY

Cimarex Environmental, Safety & Health Manual



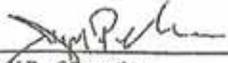
To: All Cimarex Employees  
Date: October 2007  
Subject: Cimarex's Environmental, Safety and Health (ES&H) Manual

Oil and Gas operations by their very nature, involve potentially significant risks. With that in mind, safety is of critical importance. It is everyone's responsibility. All employees are responsible for their individual safety performance and the prevention of accidents. It is the responsibility of each employee to comply with safety guidelines and to work in such a manner as to prevent injuries to themselves and to others.

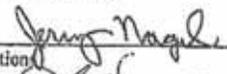
Each employee and supervisor has the responsibility to create a climate of safety awareness, to adopt safe work habits and practices, and to observe safety guidelines. Safety and loss prevention will be part of measuring performance when considering compensation, continued employment or promotions. Again, each employee shares in the responsibility for maintaining a safe and healthful work environment.

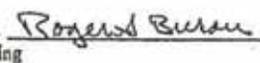
This safety manual sets forth safety guidelines that are to be followed by all company employees. While this manual and our STOP Program will help you recognize and avoid obvious hazards, it cannot cover all situations. When in doubt, consult your immediate supervisor and/or your ES&H Department.

The provisions set forth in this manual shall apply to operations conducted by Cimarex Energy Co. and its subsidiaries. Throughout this manual Cimarex may be referred to as "Company".

Joe Alpi   
Executive V.P. of Operations

Dick Dinkins   
V.P. of Human Resources

Jerry Nagel   
V.P. of Operation

Roger Bureau   
V.P. of Drilling

Bob Jennings   
Manager of ES&H

Cimarex Energy Co.  
Revised September 2007

## INTRODUCTION

This Environmental, Safety & Health (ES&H) Manual is distributed to the Cimarex field employees in an effort to develop safety and environmental awareness and thereby help prevent personal injury, damage to property and the environment, both on and off the job. It covers many situations you may encounter and provides safety principles for you to follow, but it cannot cover every situation that arises, nor can every safe practice be listed.

The Safety & Health of our employees, our contractors, and our co-workers are of the utmost importance. This manual is intended to assist you in performing your work safely. You should familiarize yourself with its content and follow the guidelines that are contained in the manual.

Safety guidelines alone cannot prevent accidents. You, as part of this work force, must develop a personal safety awareness that all accidents and injuries are preventable. This philosophy starts with you and can only be accomplished by developing and practicing safe work habits.

Federal, state, and local laws, from which much of this material was derived, are by extension, to be considered a part of this manual and must be followed. It is the responsibility of each employee to protect themselves, their fellow workers, the public, and the environment. You are urged to become familiar with all sections of this manual, refer to it frequently, and to comply with all the principles contained herein. The ES&H manual consists of five sections, these are:

- I. Cimarex Guidelines
- II. OSHA Procedures
- III. Safe Work Practices
- IV. Environmental
- V. Forms

Contractors performing work on our locations are expected to comply with all health, safety and environmental laws and regulations that pertain to the work they are performing.

If you have any questions regarding this manual or the means necessary to operate safely and in an environmentally sound manner, please discuss them with your immediate supervisor or the ES&H Department.

Upon receipt of this manual, each employee shall sign an Employee Statement of Commitment form and will give it to his/her supervisor who will then forward it to the ES&H department.

Cimarex Energy Co.  
Revised October 2007

# EMPLOYEE SAFETY AND ENVIRONMENTAL GUIDELINES

Company personnel should observe the following guidelines for safe and environmentally sound operations. Failure to do so is grounds for disciplinary action up to and including termination of employment.

## ENVIRONMENTAL

Any unsafe or environmentally threatening conditions or practices should be promptly reported and immediately corrected as long as the act is not Immediately Dangerous to Life and Health (IDLH). Oil, condensate, chemical, produced water, and natural gas reportable spills/leaks should be reported immediately to your supervisor. The supervisors should then follow the proper reporting procedures for making the necessary contacts and filling out the appropriate reporting forms. A copy of the spill report should be sent to your ES&H Department.

No waste should be improperly or illegally disposed of.

## ACCIDENT & INJURY RECORDING PROCEDURES

All injuries, accidents, and damage to Company property should be reported immediately to your supervisor. The supervisors should then follow the proper reporting procedures, making the necessary contacts, and appropriate completion of the accident / incident reporting forms. (Refer to the section on "ACCIDENT/INCIDENT REPORTING PROCEDURES".)

Employees are responsible for exercising care and good judgment in preventing accidents.

## PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personnel should wear the appropriate "Personal Protective Equipment" (PPE) while performing their jobs. (Refer to the section on "PERSONAL PROTECTIVE EQUIPMENT".)

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Revised October 2007

ANSI approved safety-toed footwear should be worn by personnel at all field, drilling and gas plant locations. (Refer to the section on "PERSONAL PROTECTIVE EQUIPMENT".)

Proper eye and face protection should be worn when sanding, grinding, buffing, welding, chipping, working with chemicals, and anywhere else that conditions require. (Refer to the section on "EYE AND FACE PROTECTION".)

Hearing protection should be used as required in posted areas and in other areas where there is high noise levels. (Refer to the section on "HEARING CONSERVATION PROGRAM".)

#### FALL PROTECTION

Employees working at a height above six feet should use fall protection equipment. (Refer to the section on "FALL PROTECTION PROGRAM".)

#### CONFINED SPACE

Personnel should not enter a permit required confined space until a Hazardous Work Permit has been approved by the qualified person on location and/or a Cimarex supervisor. (Refer to the section on "CONFINED SPACE ENTRY PROGRAM".)

#### HOT WORK

Cutting and welding operations carried out in areas where flammable vapors may be present should not be initiated until a combustible gas detector survey has been performed and a Hazardous Work Permit signed by the qualified person on location and/or a Cimarex Supervisor. (Refer to the section on "HOT WORK PROGRAM".)

#### GENERAL SAFETY GUIDELINES

Employees will attend scheduled safety meetings and training sessions unless prior arrangements have been made with the employee's supervisor. Your active participation in these meetings, sharing your thoughts and knowledge, could prevent injuries. Alternative arrangements for safety meeting and training re-scheduling shall be made by the supervisor and or the ES&H Department.

Each employee shall abide by all Cimarex safety and environmental guidelines as well as federal, state, and local laws while performing duties.

Develop safe work habits, attitudes and encourage safe behavior and positive attitudes in your fellow employees.

Never bypass or otherwise make inoperable any safety device or any anti-pollution device unless authorized by a supervisor. Report all safety and anti-pollution device malfunctions to your supervisor promptly and flag the device immediately to warn others of the hazard.

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Smoking or open flame is prohibited within 50 feet of any oil or gas production facility or well site and elsewhere, where "NO SMOKING" signs are posted.

During inclement weather where lightning may occur, employees should avoid working on elevated structures such as tanks, tank walkways, etc.

Safety and warning signs should be posted as required and should be obeyed by all personnel.

Personal misconduct, such as horseplay, fighting or practical jokes is prohibited.

Follow proper procedures and use the proper tools and equipment in your daily work. Only tools in good condition designed for the particular job being done should be used. Any tool or device subject to bearing a load or withstanding pressure should be engineered for the purpose and purchased from a reputable manufacturer.

Protective guards on moving machinery should be in place before start-up and should not be removed while equipment is operating. Equipment should not be operated without guards in place.

High standards of good housekeeping and conduct are aids to safety and should be required of all Cimarex properties. Tools, equipment, Company vehicles and all field locations should be kept clean and orderly.

Personnel should be trained in emergency response and reporting procedures pertaining to their area of operation.

Safety equipment should be located and maintained in each Company vehicle, field office, and other areas as required.

Sleeping while on duty is prohibited, unless housing is provided on location, such as at drilling locations, and the employee is on an "on-call" status.

Possession or use of controlled substances or illegal drugs, and any paraphernalia associated with their use, intoxicating beverages, firearms, fireworks, weapons, or explosives are prohibited on any Company property.

Personnel should report to work in a fit condition to perform the duties required by their job in a safe and healthful manner. Reporting to work in an unfit condition may put you or a co-worker in danger and render you less able to respond effectively in an emergency. Driving Company vehicles under the influence of alcohol is strictly prohibited. Employees should notify their Supervisor of any medication or any physical or mental condition which could affect the safety of their work performance.

USCG approved life jackets or work vests should be worn while working on water, including operating or being transported in small boats.

Employees should use the Think Incident Free (TIF) program as key job planning tools to identify hazards and safeguards associated with tasks they are asked to perform.

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Employees should participate in the STOP program and all unsafe acts and/or conditions should be reported and documented on the STOP Card.

Any employee having doubts about the safety of a job is authorized to immediately stop the work, step back, and re-evaluate the task. Only when all present are satisfied that the work is being done safely should the work resume.

Employees will be responsible and held accountable for their environmental and safety performance.

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## SUPERVISOR'S (AREA SUPERINTENDENTS, SUPERVISORS & FOREMEN) SAFETY AND ENVIRONMENTAL GUIDELINES

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Every supervisor shall strive to see that all work in their area is performed in a safe manner. Supervisors are responsible for seeing that each employee receives the necessary instructions and training they need to complete any assigned task in a safe manner. It is also the responsibility of supervisors to make available to all Company personnel any personal protective equipment, tools, supplies and any other equipment they need to perform their job and to see that all equipment is used in accordance with any safety rules outlined in this manual. Itemized below are specific requirements that a supervisor should follow in order to comply with Cimarex's ES&H Manual. Supervisors should do the following:

Promote Cimarex's ES&H guidelines.

Set a good example for employees to follow.

Be aware of the hazards associated with each operation.

Enforce all safety and environmental guidelines.

Attend or conduct regular safety meetings with all employees.

Report all accidents/incidents to the ES&H Department in a timely manner by telephone, and by using properly completed forms. In coordination with the ES&H Department, investigate all serious accidents/incidents involving Cimarex employees and recommend corrective actions.

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Complete and distribute any required safety and environmental reports, including proper permits for all hazardous work procedures in a timely manner.

Perform safety and environmental evaluations as frequently as required. Corrective actions should be taken and documented.

When possible, hold pre-job safety briefings when new or hazardous work is being undertaken.

Where inherent hazards exist that cannot be eliminated, familiarize the work group with the situation and develop a safe method for controlling it.

If possible, review all design and operational revisions in your area with the ES&H Department during the design and construction phase of any project to make sure they are in accordance with all approved standards and codes. More formal procedures to deal with management of change are prescribed by Process Safety Management (PSM) Standards for certain processing operations.

Contact the ES&H Department to obtain appropriate safety and environmental training for employees when there is a change in their employees' job functions or a new employee is hired.

Actively participate in the STOP and TIF programs.

## COMPANY SAFETY AND ENVIRONMENTAL GUIDELINES AND GOALS

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Taking reasonable steps to protect our employees, contractors, the public, and the environment are essential. Cimarex will diligently strive to provide human health and safety protection and environmental stewardship by establishing and maintaining:

Compliance programs that are intended to meet or exceed the regulatory requirements of the applicable governmental requirements.

Industrial hygiene, personal protection, and medical monitoring programs to control harmful and toxic agents and conditions affecting employee health and welfare.

Programs that will strive to provide an accident free workplace by anticipating, evaluating, and managing risks through emphasis on prevention, preparedness, and response to potential hazards.

Training that will encourage the employees to perform their jobs in a safe and environmentally responsible manner.

Necessary resources to support its safety, health, and environmental goals.

Processes to analyze and review safety & environmental programs to try and detect, eliminate or control, in advance the sources of personal injury, property damage, and harmful environmental releases in our operations.

An effective means of communication, education, and training that will enhance our health, safety, and environmental work procedures and practices.

Promote the STOP and TIF programs.

**NOTE:** Any exceptions to these Safety and Environmental guidelines outlined in this manual should have prior approval from the Vice President of Production, Operations or Drilling, and/or consultation with the Manager of the ES&H Department.

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# STOP PROGRAM

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## Safety Training Observation Program (STOP)

The STOP Program is a behavioral based safety program that trains "you to observe, correct, prevent, and report unsafe acts systematically." Only 4% of injuries are caused by unsafe conditions, the other 96% of all injuries are caused by unsafe acts. Therefore, most of Cimarex's Safety Training will focus on the actions of employees and contractors in an effort to prevent accidents. The remaining training will cover operating exposures and what to do in case of an accident.

Listed below are some of the basic principles that STOP and Cimarex's Safety Program are based on:

- Safety is everyone's responsibility.
- Most if not all injuries and occupational illnesses can be prevented.
- All construction and operating exposures can be reasonably safeguarded.
- Preventing injuries and incidents is good business.
- All employees, both Cimarex and contractor, have the authority to stop any work where imminent danger exists, and are expected to do so.

All employees are expected to participate in this program and the supervisors are responsible for reviewing corrective actions identified by the STOP card and for implementing as appropriate. If an action will not be implemented, the reason for this decision should be reviewed.

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# THINK INCIDENT FREE

## Think Incident Free (TIF)

The TIF process is a tool to aid employee's efforts to work safely. The process consists of a series of questions grouped in four categories, which should be asked by each employee prior to beginning any job.

### Planning

- Do I understand the task and how to perform it?
- Have I identified all hazards associated with the task?
- What could go wrong?
- How will I eliminate or minimize the hazards associated with this task?
- Have I planned all job tasks?
- Have I considered all safe practices/guidelines that apply to this task?
- Can I work the plan safely?
- Do I need help to do this work safely?
- Do I need a permit?

### Proper Tools and Equipment

- Do I have the personal protective equipment (PPE) I need?
- Do I have the right tools and equipment?
- Have I checked if tools/equipment are in good working condition?

### Training

- Am I trained to do this work?
- Am I trained to use the equipment or tools required?

### State of Mind

- Will I give my full attention to this task?
- Will I stop and redo my plan if something unforeseen happens?
- Am I meeting or exceeding safety requirements for this task?

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# ACCIDENT AND INCIDENT INVESTIGATIONS

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## I. Investigations

A. Accident investigations may be required by the ES&H Department or the supervisor in charge at that location for any accidents involving:

1. Serious employee injuries, except fatal employee injuries.
2. Property damage to Company facilities only.
3. Property damage to third parties or their facilities / equipment.
4. Other valid reasons such as near miss incidents or equipment failures.
5. Near miss incidents as defined by the Process Safety Management (PSM) Standard (OSHA 1910.119(m).)

B. Accident investigations shall be conducted in accordance with Company set guidelines.

C. Documentation of investigations should be handled in accordance with Company policies and as directed by the supervisor or the ES&H Department.

## II. Incident / Accident Investigation Procedures

A. The plant or field supervisor and/or the ES&H Department may conduct an investigation within 48 hours of the time of the incident.

1. The investigation will consist of a thorough review of the circumstances leading to the incident/accident.
2. Upon conclusion of the investigation, local operating management should communicate the information in the report to the affected Company or contractor employees.
3. The incident investigation should be documented using the attached form or an equivalent (Appendix A-II).
4. The report shall contain the following:
  - a. Date of the incident;

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- b. Date the investigation began;
  - c. A description of the incident,
  - d. A description of the possible contributing factors. Use facts, **DO NOT SPECULATE**; and
  - e. Possible recommended solutions to avoid recurrence.
5. The report should include a time-table which outlines the implementation schedule for initiation of recommended corrective action(s).
  6. The report will be maintained on file for a minimum of 5 years.

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APPENDIX A-II

### Supervisor's Accident Investigation

(To be completed by the employee's supervisor or other responsible administrative official)

Location where accident occurred:		Employer's Premises: Yes <input type="checkbox"/> No <input type="checkbox"/>	Date of accident or illness:
		Job site: Yes <input type="checkbox"/> No <input type="checkbox"/>	
Who was injured?		<input type="checkbox"/> Employee <input type="checkbox"/> Non-Employee	Time of accident a.m. <input type="checkbox"/> p.m. <input type="checkbox"/>
Length of time with firm	Job title or occupation	Name of dept. normally assigned to	How long has employee worked at job where injury or illness occurred?
What property/ equipment were damaged?		Property/ equipment owned by:	
What was employee doing when injury/ illness occurred? What machine or tool was being used? What type of operation?			
How did injury/ illness occur? List all objects and substances involved?			
Part of body affected/ injured?		Any prior physical conditions? If so, what? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Nature and extent of injury/ illness and property damaged (be specific)			

PLEASE INDICATE ALL OF THE FOLLOWING WHICH CONTRIBUTED TO THE INJURY OR ILLNESS

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Improper instruction          | <input type="checkbox"/> Failure to lockout            | <input type="checkbox"/> Unsafe arrangement or process |
| <input type="checkbox"/> Lack of training or skill     | <input type="checkbox"/> Unsafe position               | <input type="checkbox"/> Poor ventilation              |
| <input type="checkbox"/> Operating without authority   | <input type="checkbox"/> Improper dress                | <input type="checkbox"/> Improper guarding             |
| <input type="checkbox"/> Horseplay                     | <input type="checkbox"/> Improper protective equipment | <input type="checkbox"/> Improper maintenance          |
| <input type="checkbox"/> Physical or mental impairment | <input type="checkbox"/> Unsafe equipment              | <input type="checkbox"/> Inoperative safety device     |
| <input type="checkbox"/> Failure to secure             | <input type="checkbox"/> Poor housekeeping             | <input type="checkbox"/> Other                         |

Supervisor's corrective action to ensure this type of accident does not recur:

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Was employee trained in the appropriate use of Personal Protective Equipment/ Proper safety procedures?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Was employee cautioned for failure to use Personal Protective Equipment/ Proper safety procedures?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Did employee promptly report the injury/ illness?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Is there modified duty available?	Yes <input type="checkbox"/> No <input type="checkbox"/>

Supervisor's Name	Supervisor's Signature	Phone #	Date
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# ACCIDENT REPORTING PROCEDURES FOR PERSONAL INJURY/ILLNESS, VEHICLE AND CONTRACTOR ACCIDENTS

## I. General

- A. All vehicle accidents occurring while operating a Company owned or leased motor vehicle or personal vehicles used on Company business and all injuries occurring to all personnel on Company business should be reported immediately to the employees' immediate supervisor. This should be done immediately via a telephone conversation or a facsimile. The supervisor shall report the incident to the ES&H Department.
- B. One of the following accident reports should be completed for all accidents / injuries depending on the type.
  - 1. Form --Occupational Injury or Illness Report (Appendix A-III)
  - 2. Form --Vehicle Accident Report (Appendix A-IV Minor or Appendix A-IV Major)
  - 3. Form -- Incident Report (Appendix A-V)
- C. The completed accident report will be faxed or emailed to the ES&H Department. The ES&H Department or the Assistant Treasurer upon review will forward it to the Insurance Carrier.

## II. Occupational Injuries and Illnesses - Employees

- A. The injured employee shall report any and all injuries to his immediate supervisor as soon as possible after they occur.
- B. The employee shall complete all sections required on the First Report of Injury / accident form and sign it.
- C. The immediate supervisor must sign the report.
- D. The ES&H Department must be notified of any lost time accident by any employee immediately by phone, electronic mail and/or facsimile.

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### III. Vehicle Accidents - Employees

- A. Employees involved in a motor vehicle accident, shall report all such accidents to their immediate supervisor as soon as possible after the accident occurs.

**NOTE:** A motor vehicle accident is defined as an occurrence that results in death, injury or property damage involving the use of Company owned, rented or personal vehicles used on Company business.

- B. The employee shall complete all sections of the Vehicle accident form (Appendix II), sign it, and forward it to his or her immediate supervisor.
- C. The form must be signed by the employee's immediate supervisor.
- D. If injuries occur to occupants (Cimarex employees) of the vehicle in the course of Company business, then Form must be completed as well to report such injuries. Injuries to non-Cimarex employees, in a Company owned vehicle, must be reported on the form and forwarded to the ES&H Department.
- E. The immediate supervisor shall route the completed signed forms to the ES&H Department.
- F. The Company driver shall obtain personal information along with any insurance information from the other driver, and, if applicable, the name and addresses of any witnesses, police reports and any other related information. This information should be sent to the ES&H Department, the Cimarex Legal Department and the company's insurance carrier depending on how serious the accident is.

### IV. Occupational Injuries and Illnesses to Contractors and/or others

- A. Injuries or illness to contractors should be documented.
- B. The completed contractor's first report of injury or illness form should be requested and filed at field office and a copy sent to the ES&H Department.

### V. Regulatory Reporting Requirements Injuries and Fatalities

- A. ES&H Department will notify the nearest office of the Area Director of the Occupational Safety and Health Administration (OSHA) must be notified within eight (8) hours after the death of any employee from a work related incident or the in-patient hospitalization of three or more employees as a result of a work-related incident. The ES&H Department will make the telephone call to OSHA. All incidents/accidents must be reported immediately to the ES&H Department.

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- B. The report shall be made by the ES&H Department. They will contact the OSHA office nearest the incident or to the OSHA toll free central telephone number at 1-800-321-OSHA (1-800-321-6742).
- C. The report must include the following information: name of establishment, location of incident, time of incident, number of fatalities and/or hospitalized employees, contact person, telephone number, and a brief description of the incident.
- D. Injuries to Cimarex employees that require doctors' services must be filed with workers compensation. Please fill out the appropriate forms, sign them and forward them to your supervisor. The supervisor will review the form and then send it to the ES&H Department.
- E. The immediate supervisor shall complete the previously identified accident report forms and send to the ES&H Department.

## VI. References

1. Occupational Safety and Health Administration, Department of Labor, 29 CFR Part 1904.8.
2. American National Standards Institute, D16.1-1976 and 216.4-1977.

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APPENDIX A-III

**Cimarex Energy Co**

**Employer's First Report of Injury**

Complete this form and fax or email as soon as possible following a Workers' Compensation accident or illness to the ESH Department.

**Employee**

Last Name: \_\_\_\_\_ First Name: \_\_\_\_\_  
Social Security Number: \_\_\_\_\_ Date of Birth: \_\_\_\_\_  
Employee Home Address: \_\_\_\_\_  
Employee Phone Number: \_\_\_\_\_ Gender: \_\_\_\_\_ Marital Status: \_\_\_\_\_  
Injury/Accident Date: \_\_\_\_\_ Injury/Accident Time: \_\_\_\_\_  
Date Employer Notified: \_\_\_\_\_ If fatal, date of death: \_\_\_\_\_  
Missed Work Days: \_\_\_\_\_ State Employee Reports In: \_\_\_\_\_  
Branch Name: \_\_\_\_\_  
Employment Status: Full time  Part time  Date of Hire: \_\_\_\_\_  
Job Description: \_\_\_\_\_  
Department Name: \_\_\_\_\_ Supervisor's Name: \_\_\_\_\_  
# of Days Worked Per Week: \_\_\_\_\_ Average Hours Worked Per Week: \_\_\_\_\_

**Injury or Illness**

Part of body injured: \_\_\_\_\_ Type of injury: \_\_\_\_\_  
Description of injury or illness: (Do not speculate - Facts Only) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Accident location (at branch or other location?) \_\_\_\_\_  
(Give address if other)  
Medical Provider Name: \_\_\_\_\_  
Medical Provider Address: \_\_\_\_\_  
Medical Provider Phone Number: \_\_\_\_\_  
Did Employee leave work?  Yes  No Date Employee returned to work: \_\_\_\_\_  
Witnesses to accident: \_\_\_\_\_  
(Name and Phone Number)  
\_\_\_\_\_  
Paid for Date of Injury: \_\_\_\_\_  
Form completed by: \_\_\_\_\_  
Location: \_\_\_\_\_ Date: \_\_\_\_\_

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APPENDIX A-IV (Minor)

VEHICLE ACCIDENT FORM

\*TIP: Keep a disposable camera in glove department for damage documentation!

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

PHONE: WORK: (    )                      CELL: (    )

HOME: (    )

VEHICLE REGISTRATION # \_\_\_\_\_

YEAR      MAKE                      MODEL

VEHICLE PLATE #: \_\_\_\_\_

DRIVER'S LICENSE # \_\_\_\_\_

INSURANCE CARRIER: \_\_\_\_\_ INSURANCE PHONE #: \_\_\_\_\_

POLICY #: \_\_\_\_\_

INSPECTION UP TO DATE: \_\_\_\_\_

DATE OF ACCIDENT: \_\_\_\_\_

TIME OF ACCIDENT: \_\_\_\_\_

LOCATION (Description & direction of each vehicle at time of collision. Indicate street, flow of traffic, stop signs, etc.):



ROAD CONDITIONS (Clear, rain, Snow, Mist, Fog, etc.): \_\_\_\_\_

CONDITION OF OTHER DRIVER (Sober, Drunk, Hurt, etc.): \_\_\_\_\_

OTHER DESCRIPTION OF DAMAGE: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

CALL POLICE TO REPORT ACCIDENT

NAME OF POLICE OFFICER(S): \_\_\_\_\_

\_\_\_\_\_

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APPENDIX A-IV (Major)

Driver's Name \_\_\_\_\_  
 License No. \_\_\_\_\_  
 Company / Department \_\_\_\_\_  
**DATE & TIME PLACE**  
 Date \_\_\_\_\_ Time \_\_\_\_\_ AM  PM   
 (City or Town) (County) (State)  
 On \_\_\_\_\_  
 (Street or Highway)  
 At \_\_\_\_\_  
 (Street Address or Intersection)  
 Distance and Direction from \_\_\_\_\_  
 (Please use community names, etc.)  
 Open Country  Business/Shopping  
 Residential  Manufacturing/Industrial  
 Other (Specify) \_\_\_\_\_  
 Person(s) leaving the accident will be of service to our driver by giving the report and addresses:  
 NAME \_\_\_\_\_  
 Address \_\_\_\_\_  
 NAME \_\_\_\_\_  
 Address \_\_\_\_\_  
**WITNESSES (If any)**  
 NAME \_\_\_\_\_  
 Sample No. \_\_\_\_\_  
 Witness Title \_\_\_\_\_ Other \_\_\_\_\_

**COMPANY VEHICLE (VEHICLE #1)**  
 Make & Model \_\_\_\_\_  
 Vin No. \_\_\_\_\_  
 Tag No. & State \_\_\_\_\_  
**OTHER VEHICLE (VEHICLE #2)**  
 Make & Model \_\_\_\_\_  
 Tag No. & State \_\_\_\_\_  
 Driver \_\_\_\_\_  
 Address \_\_\_\_\_  
 Make, address and phone of owner (if not the driver) \_\_\_\_\_  
 Insurance Co. \_\_\_\_\_ Policy No. \_\_\_\_\_  
 Insurance Co. Phone # \_\_\_\_\_  
**OTHER VEHICLE (VEHICLE #3)**  
 Make & Model \_\_\_\_\_  
 Tag No. & State \_\_\_\_\_  
 Driver \_\_\_\_\_  
 Address \_\_\_\_\_  
 Owner's License No. \_\_\_\_\_  
 Make, address and phone of owner (if not the driver) \_\_\_\_\_  
 Insurance Co. \_\_\_\_\_ Policy No. \_\_\_\_\_  
 Insurance Co. Phone # \_\_\_\_\_  
**INJURED PERSONS**  
 Number of persons injured \_\_\_\_\_  
 Name \_\_\_\_\_ Sex \_\_\_\_\_  
 Address \_\_\_\_\_ Age \_\_\_\_\_  
 Injured \_\_\_\_\_  
 Where taken \_\_\_\_\_  
 Photo number \_\_\_\_\_

**TYPE OF ACCIDENT**  
 Collision with Other Vehicle  Collision with Fixed Object  
 Ran off Road  Overturn in Road  
 Mechanical Defect  Fire  
 Loading or Unloading  Occupant left seat  
 Occupant injured inside vehicle  Other \_\_\_\_\_  
**PEDESTRIAN ACTION**  
 Crossing in Intersection  Sidewalk Intersection   
 With Sign  Against Sign   
 No Sign  Opportunity   
 Violating a Right-of-Way  Sidewalk  No Sidewalk   
 Other (Describe) \_\_\_\_\_  
**CAUSE OF ACCIDENT**  
 Straight Ahead  Wh. 1  Wh. 2  Wh. 3   
 Turning Right     
 Turning Left     
 Slowing or Stopping     
 Stopped in Traffic     
 Stopping in Traffic     
 Parking     
 Backing     
 U-Turn     
 Slipping     
 Overtaking     
 Weaving     
 Strong Side     
 Control of Road     
 Excessive Action     
 Other \_\_\_\_\_

**VEHICLE CONDITION**  
**MECHANICAL CONDITION**  
 No Defect  Wh. 1  Wh. 2  Wh. 3   
 Lights     
 Brakes     
 Tires/Wheels     
 Windshield/Wipers     
 Directed     
 Other \_\_\_\_\_  
**ROADWAY CONDITIONS AND CONTROLS**  
 No. of Intersection  Bridge/Culvert  
 Street Intersection  Grate/Gaps  
 Drive-in Alley  Private Property  
 Obstacle  Other off-street  
 Other (describe) \_\_\_\_\_  
 Not Divided  Divided  Limited Access  
 No. of Lanes 2 3 4 6  
**ROAD SURFACE**  
 Lumps/Marked  Gravel  
 Gravel  Gravel  
 Rutting  Other (Specify) \_\_\_\_\_  
 Road Cracks (Check) \_\_\_\_\_  
 Other (Specify) \_\_\_\_\_  
 No Defects  Not  
 Dry  Loose Material  
 Wet  Cracks, Holes, etc.  
 Ice  Fresh Oil  
 Snow  Other construction or repair  
 Other (describe) \_\_\_\_\_  
 Street  Lane  Mile  Shoulder  Median  
 Curve  H  S  Drive  Interstate  
**TRAFFIC CONTROLS**  
 Traffic Lights  R/W Crossing Signal/Gate  
 Stop Sign  No Traffic Control  
 Yield Sign  Phase Speed Limit  
 Power Officer  Other \_\_\_\_\_  
 Were controls operating? Yes  No

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APPENDIX (Major)

**WEATHER CONDITIONS**

Clear       Overcast  
 Snow       Snow  
 Sleet       Sleet  
 Fog       Rain or sleet  
 Rain       Rain or sleet  
 Other (specify) \_\_\_\_\_

**VEHICLE DAMAGE**

Point of Impact

	VEH. 1	VEH. 2	VEH. 3
Front	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Right Front	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Left Front	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Right Rear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Left Rear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Right Side	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Left Side	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Roof	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Cargo Weight \_\_\_\_\_

Cargo Damage \_\_\_\_\_

Other Property Damage \_\_\_\_\_

**EMPLOYEE INFORMATION**

Time you reported the day \_\_\_\_\_

Total working hours of day \_\_\_\_\_

Hours since last sleep at time of going to day \_\_\_\_\_

Hours of duty at time of accident \_\_\_\_\_

**INITIALS**

At what distance did you first see damage? \_\_\_\_\_ Ft

How fast were you going? \_\_\_\_\_ MPH

What was your speed at impact? \_\_\_\_\_ MPH

How far did your vehicle go after impact? \_\_\_\_\_ Ft

Describe in your own words the circumstances of the accident \_\_\_\_\_

Describe Damage to \_\_\_\_\_

Your vehicle \_\_\_\_\_

Other vehicles \_\_\_\_\_

**Accident Scene**

Instructions for Accident Diagram

Fill in dotted lines to correspond with marks at accident scene. Show position of all vehicles, pedestrians, etc. as follows:

Your vehicle \_\_\_\_\_

Other vehicles \_\_\_\_\_

Pedestrian \_\_\_\_\_

Traffic Sign \_\_\_\_\_

Indicate type \_\_\_\_\_



Signature \_\_\_\_\_

Date \_\_\_\_\_

**CIMAREX**

FLEET ACCIDENT REPORT  
To be completed at Accident Scene

**WHAT TO DO IN CASE OF AN ACCIDENT**

1. STOP AT ONCE and INVESTIGATE.
2. Protect the scene. Use warning devices. Get help from bystanders. Turn off all engines. No smoking. Stand against fire.
3. Assist injured persons. Don't move them unless absolutely necessary. Summon ambulance if needed.
4. Get help. Use nearby phone or send reliable passerby. Notify police. Give location and nature of accident accurately. Do not leave the accident scene.
5. Identify yourself and company. Show license and registration as required.
6. BE COOPERATIVE. Make no statement about accident except to police or company and insurance company representative.
7. Fill out and check off all applicable information on enclosed form BEFORE YOU LEAVE THE SCENE.
8. File accident report with police.
9. Inform your manager immediately of accident.

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APPENDIX A-V

INCIDENT REPORT			
CASE FILE # _____ <small>(For office use only)</small>			
DATE OF RECORD: _____	REPORTED BY: _____		
DATE OF INCIDENT: _____	REPORTED TO: _____		
DEPARTMENT: _____	DIVISION: _____		
INCIDENT TYPE			
<b>*SECURITY</b>  <input type="checkbox"/> Bomb Threat <input type="checkbox"/> Ethics <input type="checkbox"/> Workplace Violence <input type="checkbox"/> Sexual Harassment <input type="checkbox"/> Threats <input type="checkbox"/> Contraband <input type="checkbox"/> Other	<b>*DESTRUCTION</b>  <input type="checkbox"/> Fired Explosion <input type="checkbox"/> Spill Pollution <input type="checkbox"/> Weather <input type="checkbox"/> Vandalism <input type="checkbox"/> Safety <input type="checkbox"/> Regulatory <input type="checkbox"/> Other	<b>*THEFT</b>  Est. Value: _____ List stolen items on reverse side Include: Description Value Model Serial # Any other identifying marks	
LOCATION OF INCIDENT (Office, Plant, Yard, Lease etc.) _____			
Address of Nearest Town: _____			
	Address	City	State                      County
DESCRIBE WHAT HAPPENED: (Use reverse side for additional space) Do Not Speculate.			
ATTACH DESCRIPTION & DETAILS FOR THEFT/OTHER INCIDENTS FORMS IF APPLICABLE TO THIS CASE			
HAVE LAW ENFORCEMENT/REGULATORY AGENCIES BEEN NOTIFIED? <input type="checkbox"/> YES <input type="checkbox"/> NO			
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THIS REPORT PREPARED BY:			
NAME: _____	DEPARTMENT: _____	DATE & TIME: _____	



# HYDROGEN SULFIDE (H<sub>2</sub>S) SAFETY PROGRAM

## I. Program Overview

- A. Each field or plant location where employee exposures to hydrogen sulfide gas (H<sub>2</sub>S) may exceed 10 parts per million (ppm) by volume in air should have a (H<sub>2</sub>S) safety program to govern Company field activities that may expose employees to H<sub>2</sub>S. This program will satisfy the requirement above if all provisions set forth below are met. Any site specific procedures that may be developed for a location in addition to this program must be as stringent as those outlined herein and established in writing.
- B. Each field or plant location that is considered "sour" as described above shall comply with all aspects of governmental regulations (OSHA) and Company policy regarding operations where H<sub>2</sub>S may be present. The ES&H Department along with the field supervisors will be responsible for implementation and enforcement of the H<sub>2</sub>S safety program.
- C. No person shall enter an area where high concentrations of H<sub>2</sub>S are known or suspected to be greater than ten (10) parts per million (ppm) by volume in the employees breathing zone without wearing proper respiratory protective equipment or having the equipment available.
- D. All contract personnel working for Cimarex should be required to be H<sub>2</sub>S certified and will carry an H<sub>2</sub>S monitor while working on any company location where H<sub>2</sub>S is present. Cimarex employees are required to comply with the same H<sub>2</sub>S safety requirements.
- E. "APPENDIX H-VI" provides background information regarding exposure levels, tank gauging, and various topics concerning H<sub>2</sub>S.
- F. Personnel with perforated eardrum may not be safe even with proper respiratory protection equipment.

## II. Training Program

- A. Safety training will be provided to all personnel who may be required to work in a known or suspected H<sub>2</sub>S environment. This training must be given prior to entering or working in an H<sub>2</sub>S environment. The following areas must be covered in the program:

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1. Hazards, properties and characteristics of H<sub>2</sub>S and sulfur dioxide (SO<sub>2</sub>) gases;
  2. Sources of H<sub>2</sub>S and SO<sub>2</sub>;
  3. Use of H<sub>2</sub>S detection devices;
  4. Description of H<sub>2</sub>S and/or SO<sub>2</sub> detection systems used at some locations;
  5. Symptoms of exposure;
  6. Use and limitations of respiratory protection equipment. Hands-on training is essential;
  7. First aid procedures and equipment including location of safety equipment;
  8. Use of the "buddy system" and emergency rescue procedures;
  9. Wind direction awareness and routes of egress (exits);
  10. Confined space and enclosed space entry procedures;
  11. Contingency plans including gauging procedures; and
  12. Company policy and procedures for H<sub>2</sub>S locations. This should include a discussion of workplace practices and relevant maintenance procedures established to protect personnel.
- B. All personnel who work in or may be required to work in an H<sub>2</sub>S area (employees and contractors) shall complete a refresher course in H<sub>2</sub>S safety annually.
- C. All training shall be documented. In addition, it is recommended that wallet cards be issued to those successfully completing the course.
- D. Contractors shall document and provide verification of such training to Cimarex upon request.

### III. Hydrogen Sulfide Respiratory Protective Equipment

#### A. Type/Selection

1. Only positive pressure self-contained breathing apparatus (SCBA) or positive pressure air line units with an escape unit will be used in any known or suspected H<sub>2</sub>S environment of 20 ppm or greater in the breathing zone. The use of canister type gas masks for protection against H<sub>2</sub>S is prohibited.

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2. Only positive pressure SCBA or positive pressure air line respirators with an emergency egress bottle shall be used when an employee is exposed to hydrogen sulfide (H<sub>2</sub>S), oxygen deficient atmospheres, or atmospheres designated as immediately dangerous to life and health (IDLH). The ES&H Department should be consulted if there are questions as to when or what type respiratory protective equipment is necessary.

#### B. Personnel Requirements

1. Company employees must be physically able to utilize a SCBA or airline unit if they are to be assigned to a work location where H<sub>2</sub>S is present or suspected. Personnel who may be required to wear respiratory protection equipment on a routine basis will undergo an annual pulmonary function test. A physician or a qualified medical person should determine if an employee is physically able to wear a respirator. A routine basis is defined as having to wear respiratory protection at least monthly.
2. Facial hair shall not come into contact with the sealing portion of the face piece. (See the "FACIAL HAIR POLICY")

#### C. Respirator Maintenance, Cleaning, Storage

1. Respirators should be visually inspected prior to and after each use to ensure they are in proper working condition. Visual inspections do not have to be documented. Respirators should be inspected monthly and documented.
2. Supervisors or a designated person at each field location where respirators are available are responsible for ensuring that monthly inspections and any necessary maintenance are performed on the units.
3. Respirators should be cleaned after each use in accordance with the procedures outlined in the "Respiratory Protection Program".
4. Breathing equipment must be stored in its carrying case or other designated container in a convenient location to facilitate easy access in an emergency situation.
5. Respirator air cartridges or tanks should be kept in a full and ready state at all times. They shall be refilled if the air supply falls below 85 percent of the cylinder capacity.
6. Respirator storage areas must be clearly identified.
7. Compressed breathing air cylinders shall be hydrostatically tested in accordance with the manufacturer's recommendation.

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#### IV. Breathing Air Quality

- A. All breathing air in SCBA and airline respirators shall meet or exceed ANSI Z68-1-1973 specifications for Grade D breathing air.
- B. Suppliers of compressed breathing air must furnish written documentation at each batch filling of air cylinders that the air meets Grade D specifications. A copy of this documentation must be kept on file at each operating location where breathing air is used.

#### V. Atmospheric Testing and General Sign Requirements

- A. H<sub>2</sub>S concentrations are to be measured level with the thief hatch on all sour crude, condensate and produced water tanks where there is potential for employee exposure. H<sub>2</sub>S concentration measurements for areas other than tank openings can be performed in the breathing zone. A standby person should be available when performing initial H<sub>2</sub>S concentration testing of areas known or suspected to have H<sub>2</sub>S.
- B. All field and plant locations along with all wells and production facilities that present potential H<sub>2</sub>S exposure shall be so designated at all of their access points with danger signs that warn personnel of potential H<sub>2</sub>S exposure.
- C. Locations with limited public road access may use one H<sub>2</sub>S sign at each given access point to a group of well locations. All H<sub>2</sub>S locations must have the proper signs attached to access points.

#### VI. Specific Work Procedures

- A. No tank, line, valve, flange, etc. which could produce an H<sub>2</sub>S concentration of 10 ppm or greater in the employees breathing zone shall be opened to the atmosphere unless proper respiratory protection is worn by the employee performing the job.
- B. When possible, equipment that contains H<sub>2</sub>S should be depressurized, isolated, purged and cleaned before opening.
- C. After opening equipment to atmosphere, the atmosphere inside the equipment shall be sampled to determine the H<sub>2</sub>S level. Respiratory protection must be worn when opening the equipment to atmosphere and during testing. If concentrations exceed 10 ppm in the breathing zone, respiratory protection must be worn for the duration of the job or until the H<sub>2</sub>S level drops below 10 ppm.
- D. Personal monitoring equipment shall be used by employees working without respiratory equipment where there is a probability that H<sub>2</sub>S levels may exceed 10

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ppm in the breathing zone (i.e. catwalks at sour tanks, water stations and header buildings where dissolved H<sub>2</sub>S in the water may create airborne levels in excess of 10 ppm. The field supervisor will determine where such probabilities might exist in a given facility. The H<sub>2</sub>S personal monitoring alarm must be set to alarm at 10 ppm so the employee is alerted to vacate the area to get respiratory equipment. If the area is equipped with a fixed detection system then personal monitoring devices are optional. These devices shall be calibrated per the manufacturer's specifications.

- E. The buddy system should be used when employees may be exposed to 300 ppm of H<sub>2</sub>S in their breathing zone during the course of their work other than working at or near an open thief hatch. For fieldwork that requires the opening of a thief hatch, a standby person should be utilized when the concentration of H<sub>2</sub>S exceeds 300 ppm measured level with the thief hatch. OSHA equates the breathing zone as being level with the thief hatch for tank gauging operations. The standby person and the employee must be equipped with a SCBA and must wear the SCBA if the potential exists for his exposure to exceed 10 ppm H<sub>2</sub>S.
- F. Relief valves venting dangerous concentrations of (>300 ppm) H<sub>2</sub>S vapors must be vented to flare or where personnel will not be exposed.
- G. Sour gas wells shall not be left unattended during blow-down.

## VII. H<sub>2</sub>S Emergencies

- A. Once the H<sub>2</sub>S alarm goes off Cimarex employees should evacuate the area, account for personnel, secure the area, and isolate the leak, etc.
- B. Field or plant employees should not respond to an H<sub>2</sub>S alarm / leak alone. The buddy system must always be used in response to alarm situations.
- C. All personnel will be trained in their responsibilities regarding H<sub>2</sub>S alarms and emergencies. Training shall be documented.
- D. Contractors and visitors should be aware of their responsibilities during an H<sub>2</sub>S alarm before they begin work on any potential H<sub>2</sub>S location. Unless otherwise defined, their responsibilities shall be to evacuate the area and report to a safe briefing area immediately.
- E. Safe briefing areas shall be established for all manned H<sub>2</sub>S locations.
- F. The supervisor or the designated person in charge of the site has the authority to decide whether an H<sub>2</sub>S leak is to be ignited. Note: Some state law enforcement agencies have jurisdiction on deciding whether or not to ignite an H<sub>2</sub>S leak.

## VIII. H<sub>2</sub>S Detection Equipment

- A. Fixed H<sub>2</sub>S detection systems shall be considered for areas that may experience H<sub>2</sub>S leaks, where employees are present on a daily basis or where the locations are near residences or other public buildings. The system shall activate a distinctive alarm.
- B. Sensors shall be set to annunciate at 10 ppm for a low alarm and at a maximum of 300 ppm for a high alarm on fixed systems.
- C. The system should be calibrated at least every 90 days.
- D. All H<sub>2</sub>S alarms that are activated shall be treated as an actual gas release.
- E. H<sub>2</sub>S alarms shall be distinctive from all other alarms and shall be consistent throughout the facility.
- F. Hand held detection instruments should be utilized for spot-checking areas. All electronic hand held instruments shall be calibrated per the manufacturer's specifications.

## IX. First Aid Treatment of Hydrogen Sulfide Victims

- A. Activate your Emergency Response Plan and telephone for help.
- B. Always put on a SCBA before entering a potential H<sub>2</sub>S area, then remove the victim to a safe area and begin artificial resuscitation.
- C. If breathing has stopped, request mechanical resuscitator (use mouth to mouth resuscitation until it arrives). Employees must be trained in resuscitation techniques when working around any H<sub>2</sub>S location. This training should be taught during the CPR training.
- D. Initiate CPR if no pulse is detected.
- E. Treat for possible shock (keep the victim warm).
- F. Ensure that all Cimarex employees that are overcome by H<sub>2</sub>S are examined by a physician before returning to work.

## X. Safe Operating Procedures for Tank Gauging Operations Containing Hydrogen Sulfide Gas (H<sub>2</sub>S)

- A. Equipment Requirements and Testing:
  - 1. Personal H<sub>2</sub>S monitors should be worn by all employees during tank gauging

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operations in areas known or suspected to contain H<sub>2</sub>S.

2. Personal H<sub>2</sub>S monitors shall be set on 10 ppm.
3. Respiratory protective equipment shall be worn by all employees during tank gauging operations when hydrogen sulfide concentrations in the breathing zone are equal to or greater than 20 ppm. Local exhaust ventilation may be used in lieu of respiratory protective equipment if it is capable of reducing the H<sub>2</sub>S concentrations in the employees breathing zone to less than 20 ppm.
4. Positive pressure supplied airline respirator equipped with a five-minute escape pack, or a positive pressure SCBA shall be used by personnel gauging tanks.
5. When concentrations measured level with the thief hatch exceed 300 ppm of H<sub>2</sub>S, or when performing other functions that equal or exceed 300 ppm in the breathing zone, the use of a standby person should be utilized. The standby person must have a positive pressure SCBA immediately available on the work site so he/she may perform a rescue if needed.
6. Tests may be done using hand held pumps and detector tubes or an approved electronic tester. Preferably, sampling of H<sub>2</sub>S at the thief hatches should be done during the warmer months to determine the highest concentrations that a worker might be exposed to.
7. Testing shall be done in accordance with H<sub>2</sub>S testing Requirements for Production Tanks in "Known or Suspected H<sub>2</sub>S Locations" section XI below.

#### B. Warning Sign Requirements

1. When concentrations of hydrogen sulfide gas, level with the thief hatch exceed 10 ppm a sign, as the one below shall be posted at the base of the stairs. The sign shall be at all locations where the tank vents through the hatch.

**Danger (red, black and white)**

**Hydrogen Sulfide**

**Positive Pressure**

**Respiratory Protection Required**

2. At those locations where concentrations exceed 300 ppm of hydrogen sulfide measured level with the thief hatch, warning signs indicating the need for a standby person shall be posted.
3. A sign shall be installed at the base of the stairs and shall consist of the following wording.

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Danger (red, black and white)

Hydrogen Sulfide

Positive Pressure Respiratory Protection and  
Standby Person Required

4. When concentrations are less than 20 ppm, level with the thief hatch open, no sign or respiratory protection is required for tank gauging operation.
5. Those central tank batteries (CTB) that have various hydrogen sulfide concentration levels in the tank must be properly identified on the individual tank or with the appropriate warning signs installed at the base of the stairs. If a standby man is necessary, it should be appropriately identified.

C. Additional Facility Guidelines – Sour Tank Batteries

1. At all tank battery locations where concentrations of hydrogen sulfide gas, level with the thief hatch can exceed 20 ppm (100 ppm level with the thief hatch open), a windsock or similar wind direction indicator shall be installed.
2. The wind indicators should be installed as to give an accurate indication of the wind direction at the height gauging operations would be performed.

## XI. H<sub>2</sub>S Testing Requirements for Production Tanks in Known or Suspected H<sub>2</sub>S Locations

- A. Production tanks are defined as all tanks that are used in storing, shipping, or holding produced fluids. Produced fluids are oil, condensate, and water, or any combination thereof. These tanks include but are not limited to production, shipping, slop, recycle or pop tanks. Production tanks do not include process vessels, towers, columns, or bullets.
- B. All production tanks in areas known or suspected to have H<sub>2</sub>S contaminated production must be tested initially to determine the H<sub>2</sub>S levels. A standby person is required when performing initial H<sub>2</sub>S concentration testing of areas known or suspected to have H<sub>2</sub>S. Documentation of previous tests will satisfy the initial testing requirement.
- C. All samples can be taken level with the thief hatch or in the vapor space. The thief hatch samples must be taken level with the hatch.
- D. After the initial tests in areas known or suspected to have H<sub>2</sub>S, retesting is required depending on the level of H<sub>2</sub>S, changes in the process which might cause

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concentration levels to change. Check with the ES&H Department for testing intervals.

## II. References

1. Occupational Health and Safety Administration, Department of Labor; 29 CFR 1910.134, 1910.1000
2. American National Standards Institute, 286-1-1973 and 237.2-1972

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## APPENDIX H-VI

### Background – H<sub>2</sub>S Tank Gauging Procedures

Manual tank measurements from the top of crude oil and produced water tanks are sometimes necessary for a variety of reasons. These reasons vary from the need to know the fluid change in a tank not equipped with a LACT (Lease Automatic Custody Transfer) unit to the actual sale and transfer measurements of product from tanks not accessible by pipeline.

The most common measurement made from the tank top is fluid volume. This is made through the thief hatch using a gauge tape and plumb-bob. Other activities that require an employee to open and stand nears tank's thief hatch include measurement of oil temperature, gravity, and sample collection (thieving) for BS&W concentration. None of those measurements require more than approximately five minutes time to complete at the thief hatch.

Opening the thief hatch allows the release of gases and vapors that have accumulated in the vapor space of the storage tank. The rate of release of those gases change with such variables as the rate of fluid influx into the tank, fluid level in the tank, fluid temperature, gas break-out rates, how long the fluid has weathered, etc.

Vapors and gases from petroleum tanks and produced water tanks do not normally present known or recognized health hazards requiring any special precautions unless they contain a toxic chemical such as hydrogen sulfide (H<sub>2</sub>S). The majority of vapors and gases are composed of simple asphyxiants such as methane, ethane, propane and butane. Simple asphyxiants must dilute the oxygen content of air before they become a serious health hazard. Dilution with outside air is rapid once the gas has escaped the thief hatch. The presence of hydrogen sulfide in the vapor space of a tank, however, presents a different problem. Hydrogen sulfide is a toxic gas that has little or no warning properties at lethal concentrations.

The following is a summary of H<sub>2</sub>S exposure limits and appropriate precautions required by Field Locations:

20 ppm is the ACGIH eight-hour, time-weighted average (TWA) exposure limit. Exposures equal to or above this limit require the use of a positive pressure SCBA or supplied air with a five-minute escape pack. Exposures below 10 ppm require no respiratory protection. 20 ppm is the federal OSHA acceptable ceiling concentration.

300 ppm - Requires the use of positive pressure type breathing apparatus and the presence of a standby man trained and equipped for rescue when breathing zone exposures are equal to or above this concentrations wind socks are required when thief hatch concentrations exceed 100 ppm or breathing zone concentrations exceed 10 ppm.

Based on the toxicity of H<sub>2</sub>S as described in API Recommended Practices RP 55 and the ANSI Standard, the current practice is that employees wear a full-face supplied air pressure demand type breathing apparatus when breathing zone exposures equal or exceed 10 ppm.

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A total catastrophic failure of the respiratory equipment during tank gauging operations should not impair employee's ability to lower the thief hatch and move to a safe area when airborne concentrations of H<sub>2</sub>S are below 300 ppm.

Usually, lowering the thief hatch will be the only action necessary to lower the exposure concentration to a safe level.

## H<sub>2</sub>S Health Effects and Exposure Standards

The American Conference of Governmental Industrial Hygienists (ACGIH) has adopted an eight-hour time-weighted average (TWA) exposure limit of 10 parts per million (ppm). The federal OSHA acceptable ceiling concentration is 20 ppm.

The National Institute for Occupational Safety and Health (NIOSH) lists 300 ppm (unprotected exposure) as its 30 minute Immediately Dangerous to Life or Health (IDLH) atmosphere. Concentrations of 1,000 ppm hydrogen sulfide gas may cause cessation of respiration and death if not properly resuscitated.

The API Recommended Practices for Conducting Oil and Gas Operations Involving Hydrogen Sulfide (API RP 55 October, 1981) indicates H<sub>2</sub>S concentrations of 100 ppm will cause "coughing, eye irritation, loss of sense of smell after 3 to 15 minutes." H<sub>2</sub>S concentrations at 200 ppm "kills sense of smell rapidly, burns eyes and throat". H<sub>2</sub>S concentrations of 500 ppm cause "dizziness, loss of sense of reason and balance, breathing problems in a few minutes." API RP 55 goes on to state that H<sub>2</sub>S concentrations at 700 ppm can cause unconsciousness quickly. Similarly, the American National Standards Institute (ANSI) Standard No.237.2-1972 regarding hydrogen sulfide indicates the H<sub>2</sub>S exposures in the 500 to 700 ppm range cause "loss of consciousness and possibly death in 30 minutes to one hour."

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