

**District I**

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

**District II**

811 S. First St., Artesia, NM 88210  
Phone:(575) 748-1283 Fax:(575) 748-9720

**District III**

1000 Rio Brazos Rd., Aztec, NM 87410  
Phone:(505) 334-6178 Fax:(505) 334-6170

**District IV**

1220 S. St Francis Dr., Santa Fe, NM 87505  
Phone:(505) 476-3470 Fax:(505) 476-3462

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

Form C-101  
August 1, 2011

Permit 374694

**APPLICATION FOR PERMIT TO DRILL, RE-ENTER, DEEPEN, PLUGBACK, OR ADD A ZONE**

1. Operator Name and Address Permian Resources Operating, LLC 300 N. Marienfeld St Ste 1000 Midland, TX 79701		2. OGRID Number 372165
		3. API Number 30-015-55672
4. Property Code 335404	5. Property Name CAVEMAN	6. Well No. 174H

**7. Surface Location**

UL - Lot L	Section 8	Township 22S	Range 27E	Lot Idn L	Feet From 2505	N/S Line S	Feet From 300	E/W Line W	County Eddy
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**8. Proposed Bottom Hole Location**

UL - Lot M	Section 12	Township 22S	Range 26E	Lot Idn M	Feet From 660	N/S Line S	Feet From 100	E/W Line W	County Eddy
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**9. Pool Information**

ESPERANZA;BONESPRING	97755
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**Additional Well Information**

11. Work Type New Well	12. Well Type OIL	13. Cable/Rotary	14. Lease Type State	15. Ground Level Elevation 3102
16. Multiple N	17. Proposed Depth 18437	18. Formation Bone Spring	19. Contractor	20. Spud Date 1/7/2025
Depth to Ground water		Distance from nearest fresh water well		Distance to nearest surface water

☐ We will be using a closed-loop system in lieu of lined pits

**21. Proposed Casing and Cement Program**

Type	Hole Size	Casing Size	Casing Weight/ft	Setting Depth	Sacks of Cement	Estimated TOC
Surf	17.5	13.375	54.5	300	240	0
Int1	12.25	9.625	36	1975	500	0
Prod	8.75	5.5	17	8382	630	1475
Prod	7.875	5.5	17	18437	1400	7632

**Casing/Cement Program: Additional Comments**

DV Tool Contingency Plan Request Anticipated DVT Placement: ~1450' cement Details – Cement volumes will be adjusted accordingly based on DVT Placement. Planned TOC: Surface. Stage 1 (intermediate she to DVT) Lead: 100sx (54.3bbbls) CI C, 11ppg, 3.05 cf/sx cmt (120% excess) Additives: 100% ProLiteCH+5PPS Plexcredit STE+2%SMS+0.1% R-1300+0.25% MagBond+3PPS Gilsonite+0.005GPS TOC: 1450' (DVT) Tail: 255sx (62.2bbl) CI C, 14.8ppg, 1.37cf/sx cmt (30% excess) Additives: +5% Salt+0.25% MagBond+0.005GPS TOC: 1500' Stage 2 (DVT to Surface) Lead: 270 sx (5146.7bbbls) CI C, 11ppg, 3.05 cf/sx cmt (300% excess) Additives: 100% ProLiteCH+5PPS Plexcredit STE+2%SMS+0.1% R-1300+0.25% MagBond+3PPS Gilsonite+0.005GPS TOC: Surface Tail: 165sx (39.1bbl) CI C, 14.8ppg, 1.33cf/sx cmt (40% excess) Additives: +5% Salt+0.25% MagBond+0.005GPS TOC: 1450' (DVT)

**22. Proposed Blowout Prevention Program**

Type	Working Pressure	Test Pressure	Manufacturer
Double Ram	5000	5000	

23. I hereby certify that the information given above is true and complete to the best of my knowledge and belief.  
I further certify I have complied with 19.15.14.9 (A) NMAC ☒ and/or 19.15.14.9 (B) NMAC ☒ if applicable.

**OIL CONSERVATION DIVISION**

Signature:			
Printed Name:	Electronically filed by Stephanie Rabadue	Approved By:	Ward Rikala
Title:	Regulatory Manager	Title:	Petroleum Specialist Supervisor
Email Address:	stephanie.rabadue@permianres.com	Approved Date:	11/6/2024
Date:	10/10/2024	Phone:	432-260-4388
		Expiration Date:	11/6/2026
		Conditions of Approval Attached	

<b>C-102</b>  Submit Electronically Via OCD Permitting	State of New Mexico Energy, Minerals & Natural Resources Department <b>OIL CONSERVATION DIVISION</b>	Revised July 9, 2024	
		Submittal Type:	<input checked="" type="checkbox"/> Initial Submittal
			<input type="checkbox"/> Amended Report
			<input type="checkbox"/> As Drilled

## WELL LOCATION INFORMATION

API Number	Pool Code	Pool Name	Wildcat; Bone Spring
Property Code	Property Name	Well Number	
	<b>CAVEMAN</b>	<b>174H</b>	
OGRID No. <b>372165</b>	Operator Name	Ground Level Elevation	
	<b>PERMIAN RESOURCES OPERATING, LLC</b>	<b>3,102'</b>	
Surface Owner: <input type="checkbox"/> State <input checked="" type="checkbox"/> Fee <input type="checkbox"/> Tribal <input type="checkbox"/> Federal		Mineral Owner: <input type="checkbox"/> State <input checked="" type="checkbox"/> Fee <input type="checkbox"/> Tribal <input type="checkbox"/> Federal	

## Surface Location

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
<b>L</b>	<b>8</b>	<b>22 S</b>	<b>27 E</b>		<b>2,505' FSL</b>	<b>300' FWL</b>	<b>32.406881</b>	<b>-104.219326</b>	<b>EDDY</b>

## Bottom Hole Location

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
<b>M</b>	<b>12</b>	<b>22 S</b>	<b>26 E</b>		<b>660' FSL</b>	<b>100' FWL</b>	<b>32.401706</b>	<b>-104.254726</b>	<b>EDDY</b>

Dedicated Acres 320	Infill or Defining Well	Defining Well API	Overlapping Spacing Unit (Y/N)	Consolidation Code
Order Numbers.			Well setbacks are under Common Ownership: <input type="checkbox"/> Yes <input type="checkbox"/> No	

## Kick Off Point (KOP)

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
<b>L</b>	<b>8</b>	<b>22 S</b>	<b>27 E</b>		<b>2,505' FSL</b>	<b>300' FWL</b>	<b>32.406881</b>	<b>-104.219326</b>	<b>EDDY</b>

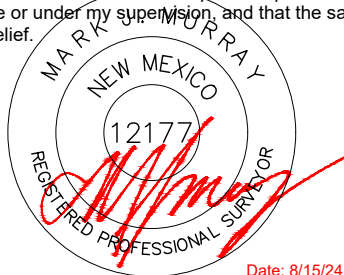
## First Take Point (FTP)

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
<b>P</b>	<b>7</b>	<b>22 S</b>	<b>27 E</b>		<b>660' FSL</b>	<b>100' FEL</b>	<b>32.401801</b>	<b>-104.220598</b>	<b>EDDY</b>

## Last Take Point (LTP)

UL	Section	Township	Range	Lot	Ft. from N/S	Ft. from E/W	Latitude	Longitude	County
<b>M</b>	<b>12</b>	<b>22 S</b>	<b>26 E</b>		<b>660' FSL</b>	<b>100' FWL</b>	<b>32.401706</b>	<b>-104.254726</b>	<b>EDDY</b>

Unitized Area or Area of Uniform Interest	Spacing Unit Type <input type="checkbox"/> Horizontal <input type="checkbox"/> Vertical	Ground Floor Elevation:
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<b>OPERATOR CERTIFICATIONS</b>  I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and, if the well is a vertical or directional well, that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of a working interest or unleased mineral interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.  If this well is a horizontal well, I further certify that this organization has received the consent of at least one lessee or owner of a working interest or unleased mineral interest in each tract (in the target pool or formation) in which any part of the well's completed interval will be located or obtained a compulsory pooling order from the division.		<b>SURVEYOR CERTIFICATIONS</b>  I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.   Date: 8/15/24	
Signature <i>Cassie Evans</i>	Date 9/28/24	Signature and Seal of Professional Surveyor	
Printed Name Cassie Evans	Email Address Cassie.Evans@permianres.com	Certificate Number 12177	Date of Survey 7/27/2024

Note: No allowable will be assigned to this completion until all interests have been consolidated or a non-standard unit has been approved by the division.

This grid represents a standard section. You may superimpose a non-standard section, or larger area, over this grid. Operators must outline the dedicated acreage in a red box, clearly show the well surface location and bottom hole location, if it is directionally drilled, with the dimensions from the section lines in the cardinal directions. If this is a horizontal wellbore show on this plat the location of the First Take Point and Last Take Point, and the point within the Completed interval (other than the First Take Point or Last Take Point) that is closest to any outer boundary of the tract.

CORNER COORDINATES NEW MEXICO EAST - NAD 83	
A	CALCULATED CORNER N:514,529.96' E:565,503.26'
B	CALCULATED CORNER N:514,526.57' E:568,203.80'
C	CALCULATED CORNER N:514,523.18' E:570,904.33'
D	CALCULATED CORNER N:514,539.63' E:573,555.46'
E	CALCULATED CORNER N:514,556.09' E:576,206.59'
F	CALCULATED CORNER N:511,910.96' E:576,220.44'
G	CALCULATED CORNER N:509,265.84' E:576,234.30'
H	CALCULATED CORNER N:509,242.27' E:573,570.94'
I	NAIL
J	CAPPED IRON ROD N:509,234.69' E:568,189.28'
K	CALCULATED CORNER N:509,220.26' E:565,497.19'
L	CALCULATED CORNER N:511,875.11' E:565,500.23'
M	CALCULATED CORNER N:511,870.94' E:570,905.96'

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

Form APD Conditions  
Permit 374694

PERMIT CONDITIONS OF APPROVAL

Operator Name and Address: Permian Resources Operating, LLC [372165] 300 N. Marienfeld St Ste 1000 Midland, TX 79701	API Number: 30-015-55672
	Well: CAVEMAN #174H

OCD Reviewer	Condition
pkautz	Pit construction and closure must satisfy all requirements of operators approved plan.
pkautz	If using a pit for drilling and completion operations, must have an approved pit from prior to spudding the well.
pkautz	File As Drilled C-102 and a directional Survey with C-104 completion packet.
pkautz	Once the well is spud, to prevent ground water contamination through whole or partial conduits from the surface, the operator shall drill without interruption through the fresh water zone or zones and shall immediately set in cement the water protection string.
pkautz	Oil base muds are not to be used until fresh water zones are cased and cemented providing isolation from the oil or diesel. This includes synthetic oils. Oil based mud, drilling fluids and solids must be contained in a steel closed loop system.
pkautz	Cement is required to circulate on both surface and intermediate1 strings of casing.
pkautz	If cement does not circulate on any string, a Cement Bond Log (CBL) is required for that string of casing.

State of New Mexico  
Energy, Minerals and Natural Resources Department

Submit Electronically  
Via E-permitting

Oil Conservation Division  
1220 South St. Francis Dr.  
Santa Fe, NM 87505

## NATURAL GAS MANAGEMENT PLAN

This Natural Gas Management Plan must be submitted with each Application for Permit to Drill (APD) for a new or recompleted well.

### Section 1 – Plan Description

Effective May 25, 2021

**I. Operator:** Permian Resources Operating LLC **OGRID:** 372165 **Date:** 9/24/24

**II. Type:** ☒ Original ☐ Amendment due to ☐ 19.15.27.9.D(6)(a) NMAC ☐ 19.15.27.9.D(6)(b) NMAC ☐ Other.

If Other, please describe: \_\_\_\_\_

**III. Well(s):** Provide the following information for each new or recompleted well or set of wells proposed to be drilled or proposed to be recompleted from a single well pad or connected to a central delivery point.

Well Name	API	ULSTR	Footages	Anticipated Oil BBL/D	Anticipated Gas MCF/D	Anticipated Produced Water BBL/D
Caveman 111H	TBD	E-8-22S-27E	2408' FNL, 483' FWL	544	1859	1870
Caveman 112H	TBD	E-8-22S-27E	2441' FNL, 483' FWL	544	1859	1870
Caveman 113H	TBD	L-8-22S-27E	2472' FSL, 300' FEL	544	1859	1870
Caveman 114H	TBD	L-8-22S-27E	2439' FSL, 300' FWL	544	1859	1870
Caveman 121H	TBD	E-8-22S-27E	2439' FNL, 303' FWL	544	1859	1870
Caveman 122H	TBD	E-8-22S-27E	2505' FNL, 303' FWL	544	1859	1870
Caveman 123H	TBD	L-8-22S-27E	2538' FSL, 301' FWL	544	1859	1870
Caveman 124H	TBD	L-8-22S-27E	2536' FSL, 480' FWL	544	1859	1870
Caveman 132H	TBD	E-8-22S-27E	2538' FNL, 303' FWL	544	1859	1870
Caveman 133H	TBD	E-8-22S-27E	2571' FNL, 302' FWL	544	1859	1870
Caveman 134H	TBD	L-8-22S-27E	2470' FSL, 480' FWL	544	1859	1870
Caveman 171H	TBD	E-8-22S-27E	2406' FNL, 304' FWL	544	1859	1870
Caveman 172H	TBD	E-8-22S-27E	2472' FNL, 303' FWL	544	1859	1870
Caveman 173H	TBD	L-8-22S-27E	2571' FSL, 301' FWL	544	1859	1870
Caveman 174H	TBD	L-8-22S-27E	2505' FSL, 300' FWL	544	1859	1870
Caveman 221H	TBD	E-8-22S-27E	2540' FNL, 482' FWL	544	1859	1870
Caveman 222H	TBD	E-8-22S-27E	2573' FNL, 482' FWL	544	1859	1870
Caveman 223H	TBD	L-8-22S-27E	2569' FSL, 481' FWL	544	1859	1870
Caveman 224H	TBD	L-8-22S-27E	2503' FSL, 480' FWL	544	1859	1870
Caveman 421H	TBD	E-8-22S-27E	2474' FNL, 483' FWL	544	1859	1870
Caveman 423H	TBD	E-8-22S-27E	2507' FNL, 483' FWL	544	1859	1870
Caveman 424H	TBD	L-8-22S-27E	2437' FSL, 480' FEL	544	1859	1870

**IV. Central Delivery Point Name:** Betty/Barney CTB [See 19.15.27.9(D)(1) NMAC]

**V. Anticipated Schedule:** Provide the following information for each new or recompleted well or set of wells proposed to be drilled or proposed to be recompleted from a single well pad or connected to a central delivery point.

Well Name	API	Spud Date	TD Reached Date	Completion Commencement Date	Initial Flow Back Date	First Production Date
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Caveman 111H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 112H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 113H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 114H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 121H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 122H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 123H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 124H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 132H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 133H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 134H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 171H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 172H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 173H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 174H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 221H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 222H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 223H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 224H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 421H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 423H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>
Caveman 424H	TBD	<u>1/21/25</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>	<u>TBD</u>

**VI. Separation Equipment:** ☒ Attach a complete description of how Operator will size separation equipment to optimize gas capture.

**VII. Operational Practices:** ☒ Attach a complete description of the actions Operator will take to comply with the requirements of Subsection A through F of 19.15.27.8 NMAC.

**VIII. Best Management Practices:** ☒ Attach a complete description of Operator's best management practices to minimize venting during active and planned maintenance.

## Section 2 – Enhanced Plan

### EFFECTIVE APRIL 1, 2022

Beginning April 1, 2022, an operator that is not in compliance with its state-wide methane capture requirement for the applicable





### **Section 3 - Certifications**

**Effective May 25, 2021**

Operator certifies that, after reasonable inquiry and based on the available information at the time of submittal:

☐ Operator will be able to connect the well(s) to a natural gas gathering system in the general area with sufficient capacity to transport one hundred percent of the anticipated volume of natural gas produced from the well(s) commencing on the date of first production, taking into account the current and anticipated volumes of produced natural gas from other wells connected to the pipeline gathering system; or

☒ Operator will not be able to connect to a natural gas gathering system in the general area with sufficient capacity to transport one hundred percent of the anticipated volume of natural gas produced from the well(s) commencing on the date of first production, taking into account the current and anticipated volumes of produced natural gas from other wells connected to the pipeline gathering system.

***If Operator checks this box, Operator will select one of the following:***

**Well Shut-In.** ☒ Operator will shut-in and not produce the well until it submits the certification required by Paragraph (4) of Subsection D of 19.15.27.9 NMAC; or

**Venting and Flaring Plan.** ☐ Operator has attached a venting and flaring plan that evaluates and selects one or more of the potential alternative beneficial uses for the natural gas until a natural gas gathering system is available, including:

- (a) power generation on lease;
- (b) power generation for grid;
- (c) compression on lease;
- (d) liquids removal on lease;
- (e) reinjection for underground storage;
- (f) reinjection for temporary storage;
- (g) reinjection for enhanced oil recovery;
- (h) fuel cell production; and
- (i) other alternative beneficial uses approved by the division.

### **Section 4 - Notices**

1. If, at any time after Operator submits this Natural Gas Management Plan and before the well is spud:

(a) Operator becomes aware that the natural gas gathering system it planned to connect the well(s) to has become unavailable or will not have capacity to transport one hundred percent of the production from the well(s), no later than 20 days after becoming aware of such information, Operator shall submit for OCD's approval a new or revised venting and flaring plan containing the information specified in Paragraph (5) of Subsection D of 19.15.27.9 NMAC; or

(b) Operator becomes aware that it has, cumulatively for the year, become out of compliance with its baseline natural gas capture rate or natural gas capture requirement, no later than 20 days after becoming aware of such information, Operator shall submit for OCD's approval a new or revised Natural Gas Management Plan for each well it plans to spud during the next 90 days containing the information specified in Paragraph (2) of Subsection D of 19.15.27.9 NMAC, and shall file an update for each Natural Gas Management Plan until Operator is back in compliance with its baseline natural gas capture rate or natural gas capture requirement.

2. OCD may deny or conditionally approve an APD if Operator does not make a certification, fails to submit an adequate venting and flaring plan which includes alternative beneficial uses for the anticipated volume of natural gas produced, or if OCD determines that Operator will not have adequate natural gas takeaway capacity at the time a well will be spud.



**I certify that, after reasonable inquiry, the statements in and attached to this Natural Gas Management Plan are true and correct to the best of my knowledge and acknowledge that a false statement may be subject to civil and criminal penalties under the Oil and Gas Act.**

Signature: <i>Cassie Evans</i>
Printed Name: Cassie Evans
Title: Regulatory Specialist
E-mail Address: Cassie.Evans@permianres.com
Date: 9/24/24
Phone: 432-313-1732
<b>OIL CONSERVATION DIVISION</b> <b>(Only applicable when submitted as a standalone form)</b>
Approved By:
Title:
Approval Date:
Conditions of Approval:

## Permian Resources Operating, LLC (372165)

**Natural Gas Management Plan Descriptions****VI. Separation Equipment:**

Permian utilizes a production forecast from our Reservoir Engineering team to appropriately size each permanent, 3-phase separator and heater treater utilized for production operations. Our goal is to maintain 5 minutes of retention time in the test vessel and 20 minutes in the heater treater at peak production rates. The gas produced is routed from the separator to the gas sales line.

**VII. Operational Practices:***Drilling*

During Permian's drilling operations it is uncommon for venting or flaring to occur. If flaring is needed due to safety concerns, gas will be routed to a flare and volumes will be estimated.

*Flowback*

During completion/recompletion flowback operations, after separation flowback begins and as soon as it is technically feasible, Permian routes gas through a permanent separator and the controlled facility where the gas is either sold or flared through a high-pressure flare if needed.

*Production*

Per 19.15.27.8.D, Permian's facilities are designed to minimize waste. Our produced gas will only be vented or flared in an emergency or malfunction situation, except as allowed for normal operations noted in 19.15.27.8.D(2) & (4). All gas that is flared is metered. All gas that may be vented will be estimated.

*Performance Standards*

Permian utilizes a production forecast from our Reservoir Engineering team to appropriately size each permanent, 3-phase separator and heater treater utilized for production operations.

All of Permian's permanent storage tanks associated with production operations which are routed to a flare or control device are equipped with an automatic gauging system.

All of Permian's flare stacks, both currently installed and for future installation, are:

- 1) Appropriately sized and designed to ensure proper combustion efficiency.
- 2) Equipped with an automatic ignitor or continuous pilot.
- 3) Anchored and located at least 100 feet from the well and storage tanks.

Permian's field operations and HSE teams have implemented an AVO inspection schedule that adheres to the requirements of 19.15.27.8.E(5).

All of our operations and facilities are designed to minimize waste. We routinely employ the following methods and practices:

- Closed-loop systems
- Enclosed and properly sized tanks

## Permian Resources Operating, LLC (372165)

- Vapor recovery units to maximize recovery of low-pressure gas streams and potential unauthorized emissions
- Low-emitting or electric engines whenever practical
- Combustors and flare stacks in the event of a malfunction or emergency
- Routine facility inspections to identify leaking components, functioning control devices, such as flares and combustors, and repair / replacement of malfunctioning components where applicable

*Measurement or estimation*

Permian measures or estimates the volumes of natural gas vented, flared and/or beneficially used for all of our drilling, completing and producing wells. We utilize accepted industry standards and methodology which can be independently verified. Annual GOR testing is completed on our wells and will be submitted as required by the OCD. None of our equipment is designed to allow diversion around metering elements except during inspection, maintenance and repair operations.

**VIII. Best Management Practices:**

Permian utilizes the following BMPs to minimize venting during active and planned maintenance activities:

- Use a closed-loop process wherever possible during planned maintenance activities, such as blowdowns, liquid removal, and work over operations.
- Employ low-emitting or electric engines for equipment, such as compressors
- Adhere to a strict preventative maintenance program which includes routine facility inspections, identification of component malfunctions, and repairing or replacing components such as hatches, seals, valves, etc. where applicable
- Utilize vapor recovery units (VRU's) to maximize recovery of volumes of low-pressure gas streams and potential unauthorized emissions
- Route low pressure gas and emissions streams to a combustion device to prevent venting where necessary

# **PERMIAN**

## **R E S O U R C E S**

### **NEW MEXICO**

**(SP) EDDY  
CAVEMAN PROJECT  
CAVEMAN 174H**

**OWB**

**Plan: PWP0**

### **Standard Planning Report - Geographic**

**04 September, 2024**

PERMIAN  
RESOURCES

Planning Report - Geographic

Database:	Compass_17	Local Co-ordinate Reference:	Well CAVEMAN 174H
Company:	NEW MEXICO	TVD Reference:	KB @ 3132.0usft
Project:	(SP) EDDY	MD Reference:	KB @ 3132.0usft
Site:	CAVEMAN PROJECT	North Reference:	Grid
Well:	CAVEMAN 174H	Survey Calculation Method:	Minimum Curvature
Wellbore:	OWB		
Design:	PWP0		

Project	(SP) EDDY		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site		CAVEMAN PROJECT			
Site Position:		Northing:	512,055.14 usft	Latitude:	32° 24' 27.558 N
From:	Map	Easting:	576,702.31 usft	Longitude:	104° 13' 7.460 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "		

Well	CAVEMAN 174H					
Well Position	+N/-S	0.0 usft	Northing:	511,773.31 usft	Latitude:	32° 24' 24.771 N
	+E/-W	0.0 usft	Easting:	576,521.55 usft	Longitude:	104° 13' 9.573 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	3,102.0 usft
Grid Convergence:		0.06 °				

Wellbore	OWB				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF200510	12/31/2009	8.06	60.30	48,832.75250750

Design	PWP0			
Audit Notes:				
Version:	Phase:	PROTOTYPE	Tie On Depth:	0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.0	0.0	0.0	260.17

Plan Survey Tool Program	Date	9/4/2024		
Depth From (usft)	Depth To (usft)	Survey (Wellbore)	Tool Name	Remarks
1	0.0	18,437.1 PWP0 (OWB)	MWD	
			OWSG_Rev2_ MWD - Stand	

Plan Sections										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.00	
1,000.0	0.00	0.00	1,000.0	0.0	0.0	0.00	0.00	0.00	0.00	
1,987.3	19.75	191.94	1,967.9	-164.8	-34.8	2.00	2.00	0.00	191.94	
6,581.7	19.75	191.94	6,292.1	-1,683.5	-355.9	0.00	0.00	0.00	0.00	
7,569.0	0.00	0.00	7,260.0	-1,848.4	-390.7	2.00	-2.00	0.00	180.00	
7,631.5	0.00	0.00	7,322.5	-1,848.4	-390.7	0.00	0.00	0.00	0.00	
8,381.5	90.00	269.76	7,800.0	-1,850.4	-868.2	12.00	12.00	-12.03	269.76	
18,437.1	90.00	269.76	7,800.0	-1,892.5	-10,923.6	0.00	0.00	0.00	0.00	BHL-CAVEMAN 174H

# PERMIAN

## RESOURCES

### Planning Report - Geographic

<b>Database:</b>	Compass_17	<b>Local Co-ordinate Reference:</b>	Well CAVEMAN 174H
<b>Company:</b>	NEW MEXICO	<b>TVD Reference:</b>	KB @ 3132.0usft
<b>Project:</b>	(SP) EDDY	<b>MD Reference:</b>	KB @ 3132.0usft
<b>Site:</b>	CAVEMAN PROJECT	<b>North Reference:</b>	Grid
<b>Well:</b>	CAVEMAN 174H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	OWB		
<b>Design:</b>	PWP0		

Planned Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
0.0	0.00	0.00	0.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
100.0	0.00	0.00	100.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
200.0	0.00	0.00	200.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
300.0	0.00	0.00	300.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
400.0	0.00	0.00	400.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
500.0	0.00	0.00	500.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
600.0	0.00	0.00	600.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
700.0	0.00	0.00	700.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
800.0	0.00	0.00	800.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
900.0	0.00	0.00	900.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
1,000.0	0.00	0.00	1,000.0	0.0	0.0	511,773.31	576,521.55	32° 24' 24.771 N	104° 13' 9.573 W
Start Build 2.00									
1,100.0	2.00	191.94	1,100.0	-1.7	-0.4	511,771.60	576,521.19	32° 24' 24.754 N	104° 13' 9.577 W
1,200.0	4.00	191.94	1,199.8	-6.8	-1.4	511,766.48	576,520.11	32° 24' 24.703 N	104° 13' 9.590 W
1,300.0	6.00	191.94	1,299.5	-15.4	-3.2	511,757.96	576,518.31	32° 24' 24.619 N	104° 13' 9.611 W
1,400.0	8.00	191.94	1,398.7	-27.3	-5.8	511,746.03	576,515.79	32° 24' 24.501 N	104° 13' 9.640 W
1,500.0	10.00	191.94	1,497.5	-42.6	-9.0	511,730.73	576,512.55	32° 24' 24.350 N	104° 13' 9.678 W
1,600.0	12.00	191.94	1,595.6	-61.2	-12.9	511,712.06	576,508.61	32° 24' 24.165 N	104° 13' 9.724 W
1,700.0	14.00	191.94	1,693.1	-83.3	-17.6	511,690.05	576,503.95	32° 24' 23.947 N	104° 13' 9.779 W
1,800.0	16.00	191.94	1,789.6	-108.6	-23.0	511,664.73	576,498.60	32° 24' 23.697 N	104° 13' 9.842 W
1,900.0	18.00	191.94	1,885.3	-137.2	-29.0	511,636.13	576,492.56	32° 24' 23.414 N	104° 13' 9.913 W
1,987.3	19.75	191.94	1,967.9	-164.8	-34.8	511,608.49	576,486.71	32° 24' 23.140 N	104° 13' 9.981 W
Start 4594.3 hold at 1987.3 MD									
2,000.0	19.75	191.94	1,979.8	-169.0	-35.7	511,604.30	576,485.83	32° 24' 23.099 N	104° 13' 9.991 W
2,100.0	19.75	191.94	2,073.9	-202.1	-42.7	511,571.25	576,478.84	32° 24' 22.772 N	104° 13' 10.073 W
2,200.0	19.75	191.94	2,168.1	-235.1	-49.7	511,538.19	576,471.85	32° 24' 22.445 N	104° 13' 10.155 W
2,300.0	19.75	191.94	2,262.2	-268.2	-56.7	511,505.14	576,464.87	32° 24' 22.118 N	104° 13' 10.237 W
2,400.0	19.75	191.94	2,356.3	-301.2	-63.7	511,472.08	576,457.88	32° 24' 21.791 N	104° 13' 10.319 W
2,500.0	19.75	191.94	2,450.4	-334.3	-70.7	511,439.02	576,450.89	32° 24' 21.464 N	104° 13' 10.401 W
2,600.0	19.75	191.94	2,544.5	-367.3	-77.6	511,405.97	576,443.90	32° 24' 21.137 N	104° 13' 10.483 W
2,700.0	19.75	191.94	2,638.7	-400.4	-84.6	511,372.91	576,436.92	32° 24' 20.810 N	104° 13' 10.565 W
2,800.0	19.75	191.94	2,732.8	-433.5	-91.6	511,339.86	576,429.93	32° 24' 20.483 N	104° 13' 10.647 W
2,900.0	19.75	191.94	2,826.9	-466.5	-98.6	511,306.80	576,422.94	32° 24' 20.156 N	104° 13' 10.729 W
3,000.0	19.75	191.94	2,921.0	-499.6	-105.6	511,273.74	576,415.95	32° 24' 19.829 N	104° 13' 10.811 W
3,100.0	19.75	191.94	3,015.1	-532.6	-112.6	511,240.69	576,408.97	32° 24' 19.501 N	104° 13' 10.893 W
3,200.0	19.75	191.94	3,109.3	-565.7	-119.6	511,207.63	576,401.98	32° 24' 19.174 N	104° 13' 10.974 W
3,300.0	19.75	191.94	3,203.4	-598.7	-126.6	511,174.57	576,394.99	32° 24' 18.847 N	104° 13' 11.056 W
3,400.0	19.75	191.94	3,297.5	-631.8	-133.5	511,141.52	576,388.00	32° 24' 18.520 N	104° 13' 11.138 W
3,500.0	19.75	191.94	3,391.6	-664.8	-140.5	511,108.46	576,381.02	32° 24' 18.193 N	104° 13' 11.220 W
3,600.0	19.75	191.94	3,485.7	-697.9	-147.5	511,075.41	576,374.03	32° 24' 17.866 N	104° 13' 11.302 W
3,700.0	19.75	191.94	3,579.9	-731.0	-154.5	511,042.35	576,367.04	32° 24' 17.539 N	104° 13' 11.384 W
3,800.0	19.75	191.94	3,674.0	-764.0	-161.5	511,009.29	576,360.05	32° 24' 17.212 N	104° 13' 11.466 W
3,900.0	19.75	191.94	3,768.1	-797.1	-168.5	510,976.24	576,353.07	32° 24' 16.885 N	104° 13' 11.548 W
4,000.0	19.75	191.94	3,862.2	-830.1	-175.5	510,943.18	576,346.08	32° 24' 16.558 N	104° 13' 11.630 W
4,100.0	19.75	191.94	3,956.3	-863.2	-182.5	510,910.13	576,339.09	32° 24' 16.231 N	104° 13' 11.712 W
4,200.0	19.75	191.94	4,050.5	-896.2	-189.4	510,877.07	576,332.10	32° 24' 15.904 N	104° 13' 11.794 W
4,300.0	19.75	191.94	4,144.6	-929.3	-196.4	510,844.01	576,325.12	32° 24' 15.577 N	104° 13' 11.876 W
4,400.0	19.75	191.94	4,238.7	-962.4	-203.4	510,810.96	576,318.13	32° 24' 15.250 N	104° 13' 11.957 W
4,500.0	19.75	191.94	4,332.8	-995.4	-210.4	510,777.90	576,311.14	32° 24' 14.923 N	104° 13' 12.039 W
4,600.0	19.75	191.94	4,426.9	-1,028.5	-217.4	510,744.85	576,304.15	32° 24' 14.596 N	104° 13' 12.121 W
4,700.0	19.75	191.94	4,521.0	-1,061.5	-224.4	510,711.79	576,297.17	32° 24' 14.269 N	104° 13' 12.203 W
4,800.0	19.75	191.94	4,615.2	-1,094.6	-231.4	510,678.73	576,290.18	32° 24' 13.942 N	104° 13' 12.285 W
4,900.0	19.75	191.94	4,709.3	-1,127.6	-238.4	510,645.68	576,283.19	32° 24' 13.615 N	104° 13' 12.367 W
5,000.0	19.75	191.94	4,803.4	-1,160.7	-245.3	510,612.62	576,276.20	32° 24' 13.288 N	104° 13' 12.449 W

# PERMIAN

## RESOURCES

### Planning Report - Geographic

<b>Database:</b>	Compass_17	<b>Local Co-ordinate Reference:</b>	Well CAVEMAN 174H
<b>Company:</b>	NEW MEXICO	<b>TVD Reference:</b>	KB @ 3132.0usft
<b>Project:</b>	(SP) EDDY	<b>MD Reference:</b>	KB @ 3132.0usft
<b>Site:</b>	CAVEMAN PROJECT	<b>North Reference:</b>	Grid
<b>Well:</b>	CAVEMAN 174H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	OWB		
<b>Design:</b>	PWP0		

Planned Survey										
Measured			Vertical			Map	Map			
Depth	Inclination	Azimuth	Depth	+N/-S	+E/-W	Northing	Easting	Latitude	Longitude	
(usft)	(°)	(°)	(usft)	(usft)	(usft)	(usft)	(usft)			
5,100.0	19.75	191.94	4,897.5	-1,193.7	-252.3	510,579.56	576,269.22	32° 24' 12.961 N	104° 13' 12.531 W	
5,200.0	19.75	191.94	4,991.6	-1,226.8	-259.3	510,546.51	576,262.23	32° 24' 12.634 N	104° 13' 12.613 W	
5,300.0	19.75	191.94	5,085.8	-1,259.9	-266.3	510,513.45	576,255.24	32° 24' 12.307 N	104° 13' 12.695 W	
5,400.0	19.75	191.94	5,179.9	-1,292.9	-273.3	510,480.40	576,248.25	32° 24' 11.979 N	104° 13' 12.777 W	
5,500.0	19.75	191.94	5,274.0	-1,326.0	-280.3	510,447.34	576,241.27	32° 24' 11.652 N	104° 13' 12.859 W	
5,600.0	19.75	191.94	5,368.1	-1,359.0	-287.3	510,414.28	576,234.28	32° 24' 11.325 N	104° 13' 12.940 W	
5,700.0	19.75	191.94	5,462.2	-1,392.1	-294.3	510,381.23	576,227.29	32° 24' 10.998 N	104° 13' 13.022 W	
5,800.0	19.75	191.94	5,556.4	-1,425.1	-301.2	510,348.17	576,220.30	32° 24' 10.671 N	104° 13' 13.104 W	
5,900.0	19.75	191.94	5,650.5	-1,458.2	-308.2	510,315.12	576,213.32	32° 24' 10.344 N	104° 13' 13.186 W	
6,000.0	19.75	191.94	5,744.6	-1,491.3	-315.2	510,282.06	576,206.33	32° 24' 10.017 N	104° 13' 13.268 W	
6,100.0	19.75	191.94	5,838.7	-1,524.3	-322.2	510,249.00	576,199.34	32° 24' 9.690 N	104° 13' 13.350 W	
6,200.0	19.75	191.94	5,932.8	-1,557.4	-329.2	510,215.95	576,192.35	32° 24' 9.363 N	104° 13' 13.432 W	
6,300.0	19.75	191.94	6,027.0	-1,590.4	-336.2	510,182.89	576,185.37	32° 24' 9.036 N	104° 13' 13.514 W	
6,400.0	19.75	191.94	6,121.1	-1,623.5	-343.2	510,149.83	576,178.38	32° 24' 8.709 N	104° 13' 13.596 W	
6,500.0	19.75	191.94	6,215.2	-1,656.5	-350.2	510,116.78	576,171.39	32° 24' 8.382 N	104° 13' 13.678 W	
6,581.7	19.75	191.94	6,292.1	-1,683.5	-355.9	510,089.78	576,165.68	32° 24' 8.115 N	104° 13' 13.745 W	
Start Drop -2.00										
6,600.0	19.38	191.94	6,309.3	-1,689.5	-357.1	510,083.78	576,164.42	32° 24' 8.056 N	104° 13' 13.759 W	
6,700.0	17.38	191.94	6,404.2	-1,720.4	-363.7	510,052.93	576,157.89	32° 24' 7.750 N	104° 13' 13.836 W	
6,800.0	15.38	191.94	6,500.2	-1,748.0	-369.5	510,025.34	576,152.06	32° 24' 7.477 N	104° 13' 13.904 W	
6,900.0	13.38	191.94	6,597.0	-1,772.3	-374.6	510,001.04	576,146.93	32° 24' 7.237 N	104° 13' 13.964 W	
7,000.0	11.38	191.94	6,694.7	-1,793.2	-379.1	509,980.06	576,142.49	32° 24' 7.029 N	104° 13' 14.016 W	
7,100.0	9.38	191.94	6,793.1	-1,810.9	-382.8	509,962.43	576,138.77	32° 24' 6.855 N	104° 13' 14.060 W	
7,200.0	7.38	191.94	6,892.0	-1,825.1	-385.8	509,948.17	576,135.75	32° 24' 6.714 N	104° 13' 14.095 W	
7,300.0	5.38	191.94	6,991.4	-1,836.0	-388.1	509,937.30	576,133.45	32° 24' 6.606 N	104° 13' 14.122 W	
7,400.0	3.38	191.94	7,091.1	-1,843.5	-389.7	509,929.83	576,131.87	32° 24' 6.532 N	104° 13' 14.141 W	
7,500.0	1.38	191.94	7,191.0	-1,847.5	-390.5	509,925.77	576,131.01	32° 24' 6.492 N	104° 13' 14.151 W	
7,569.0	0.00	0.00	7,260.0	-1,848.4	-390.7	509,924.95	576,130.84	32° 24' 6.484 N	104° 13' 14.153 W	
Start 62.5 hold at 7569.0 MD										
7,600.0	0.00	0.00	7,291.0	-1,848.4	-390.7	509,924.95	576,130.84	32° 24' 6.484 N	104° 13' 14.153 W	
7,631.5	0.00	0.00	7,322.5	-1,848.4	-390.7	509,924.95	576,130.84	32° 24' 6.484 N	104° 13' 14.153 W	
Start DLS 12.00 TFO 269.76										
7,650.0	2.22	269.76	7,341.0	-1,848.4	-391.1	509,924.95	576,130.49	32° 24' 6.484 N	104° 13' 14.157 W	
7,675.0	5.22	269.76	7,365.9	-1,848.4	-392.7	509,924.94	576,128.87	32° 24' 6.484 N	104° 13' 14.176 W	
7,700.0	8.22	269.76	7,390.7	-1,848.4	-395.6	509,924.93	576,125.94	32° 24' 6.484 N	104° 13' 14.210 W	
7,725.0	11.22	269.76	7,415.4	-1,848.4	-399.8	509,924.91	576,121.72	32° 24' 6.484 N	104° 13' 14.259 W	
7,750.0	14.22	269.76	7,439.8	-1,848.4	-405.3	509,924.89	576,116.22	32° 24' 6.484 N	104° 13' 14.324 W	
7,775.0	17.22	269.76	7,463.8	-1,848.4	-412.1	509,924.86	576,109.45	32° 24' 6.484 N	104° 13' 14.403 W	
7,800.0	20.22	269.76	7,487.5	-1,848.5	-420.1	509,924.83	576,101.43	32° 24' 6.483 N	104° 13' 14.496 W	
7,825.0	23.22	269.76	7,510.7	-1,848.5	-429.4	509,924.79	576,092.18	32° 24' 6.483 N	104° 13' 14.604 W	
7,850.0	26.22	269.76	7,533.4	-1,848.6	-439.8	509,924.75	576,081.73	32° 24' 6.483 N	104° 13' 14.726 W	
7,875.0	29.22	269.76	7,555.6	-1,848.6	-451.4	509,924.70	576,070.10	32° 24' 6.482 N	104° 13' 14.862 W	
7,900.0	32.22	269.76	7,577.0	-1,848.7	-464.2	509,924.64	576,057.34	32° 24' 6.482 N	104° 13' 15.010 W	
7,925.0	35.22	269.76	7,597.8	-1,848.7	-478.1	509,924.59	576,043.46	32° 24' 6.481 N	104° 13' 15.172 W	
7,950.0	38.22	269.76	7,617.9	-1,848.8	-493.0	509,924.52	576,028.52	32° 24' 6.481 N	104° 13' 15.347 W	
7,975.0	41.22	269.76	7,637.1	-1,848.9	-509.0	509,924.46	576,012.54	32° 24' 6.481 N	104° 13' 15.533 W	
8,000.0	44.22	269.76	7,655.5	-1,848.9	-526.0	509,924.38	575,995.59	32° 24' 6.480 N	104° 13' 15.731 W	
8,025.0	47.22	269.76	7,672.9	-1,849.0	-543.9	509,924.31	575,977.69	32° 24' 6.479 N	104° 13' 15.939 W	
8,050.0	50.22	269.76	7,689.4	-1,849.1	-562.6	509,924.23	575,958.91	32° 24' 6.479 N	104° 13' 16.159 W	
8,075.0	53.22	269.76	7,704.9	-1,849.2	-582.3	509,924.15	575,939.29	32° 24' 6.478 N	104° 13' 16.387 W	
8,100.0	56.22	269.76	7,719.3	-1,849.2	-602.7	509,924.06	575,918.88	32° 24' 6.478 N	104° 13' 16.625 W	
8,125.0	59.22	269.76	7,732.7	-1,849.3	-623.8	509,923.97	575,897.75	32° 24' 6.477 N	104° 13' 16.872 W	
8,150.0	62.22	269.76	7,744.9	-1,849.4	-645.6	509,923.88	575,875.95	32° 24' 6.476 N	104° 13' 17.126 W	
8,175.0	65.22	269.76	7,756.0	-1,849.5	-668.0	509,923.79	575,853.53	32° 24' 6.476 N	104° 13' 17.388 W	



# PERMIAN

## RESOURCES

### Planning Report - Geographic

<b>Database:</b>	Compass_17	<b>Local Co-ordinate Reference:</b>	Well CAVEMAN 174H
<b>Company:</b>	NEW MEXICO	<b>TVD Reference:</b>	KB @ 3132.0usft
<b>Project:</b>	(SP) EDDY	<b>MD Reference:</b>	KB @ 3132.0usft
<b>Site:</b>	CAVEMAN PROJECT	<b>North Reference:</b>	Grid
<b>Well:</b>	CAVEMAN 174H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	OWB		
<b>Design:</b>	PWP0		

Planned Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
8,200.0	68.22	269.76	7,765.9	-1,849.6	-691.0	509,923.69	575,830.57	32° 24' 6.475 N	104° 13' 17.656 W	
8,225.0	71.22	269.76	7,774.5	-1,849.7	-714.4	509,923.59	575,807.13	32° 24' 6.474 N	104° 13' 17.929 W	
8,250.0	74.22	269.76	7,782.0	-1,849.8	-738.3	509,923.49	575,783.26	32° 24' 6.473 N	104° 13' 18.207 W	
8,275.0	77.22	269.76	7,788.1	-1,849.9	-762.5	509,923.39	575,759.03	32° 24' 6.473 N	104° 13' 18.490 W	
8,300.0	80.22	269.76	7,793.0	-1,850.0	-787.0	509,923.29	575,734.52	32° 24' 6.472 N	104° 13' 18.776 W	
8,325.0	83.22	269.76	7,796.6	-1,850.1	-811.8	509,923.19	575,709.78	32° 24' 6.471 N	104° 13' 19.064 W	
8,350.0	86.22	269.76	7,798.9	-1,850.2	-836.7	509,923.08	575,684.89	32° 24' 6.470 N	104° 13' 19.355 W	
8,375.0	89.22	269.76	7,799.9	-1,850.3	-861.6	509,922.98	575,659.92	32° 24' 6.470 N	104° 13' 19.646 W	
8,381.5	90.00	269.76	7,800.0	-1,850.4	-868.2	509,922.95	575,653.38	32° 24' 6.469 N	104° 13' 19.722 W	
Start 10055.5 hold at 8381.5 MD										
8,400.0	90.00	269.76	7,800.0	-1,850.4	-886.6	509,922.87	575,634.92	32° 24' 6.469 N	104° 13' 19.938 W	
8,500.0	90.00	269.76	7,800.0	-1,850.9	-986.6	509,922.45	575,534.92	32° 24' 6.466 N	104° 13' 21.104 W	
8,600.0	90.00	269.76	7,800.0	-1,851.3	-1,086.6	509,922.04	575,434.92	32° 24' 6.463 N	104° 13' 22.271 W	
8,700.0	90.00	269.76	7,800.0	-1,851.7	-1,186.6	509,921.62	575,334.92	32° 24' 6.459 N	104° 13' 23.437 W	
8,800.0	90.00	269.76	7,800.0	-1,852.1	-1,286.6	509,921.20	575,234.92	32° 24' 6.456 N	104° 13' 24.604 W	
8,900.0	90.00	269.76	7,800.0	-1,852.5	-1,386.6	509,920.78	575,134.92	32° 24' 6.453 N	104° 13' 25.770 W	
9,000.0	90.00	269.76	7,800.0	-1,853.0	-1,486.6	509,920.36	575,034.92	32° 24' 6.450 N	104° 13' 26.936 W	
9,100.0	90.00	269.76	7,800.0	-1,853.4	-1,586.6	509,919.94	574,934.92	32° 24' 6.447 N	104° 13' 28.103 W	
9,200.0	90.00	269.76	7,800.0	-1,853.8	-1,686.6	509,919.52	574,834.92	32° 24' 6.444 N	104° 13' 29.269 W	
9,300.0	90.00	269.76	7,800.0	-1,854.2	-1,786.6	509,919.10	574,734.93	32° 24' 6.441 N	104° 13' 30.436 W	
9,400.0	90.00	269.76	7,800.0	-1,854.6	-1,886.6	509,918.68	574,634.93	32° 24' 6.437 N	104° 13' 31.602 W	
9,500.0	90.00	269.76	7,800.0	-1,855.0	-1,986.6	509,918.26	574,534.93	32° 24' 6.434 N	104° 13' 32.769 W	
9,600.0	90.00	269.76	7,800.0	-1,855.5	-2,086.6	509,917.84	574,434.93	32° 24' 6.431 N	104° 13' 33.935 W	
9,700.0	90.00	269.76	7,800.0	-1,855.9	-2,186.6	509,917.43	574,334.93	32° 24' 6.428 N	104° 13' 35.102 W	
9,800.0	90.00	269.76	7,800.0	-1,856.3	-2,286.6	509,917.01	574,234.93	32° 24' 6.425 N	104° 13' 36.268 W	
9,900.0	90.00	269.76	7,800.0	-1,856.7	-2,386.6	509,916.59	574,134.93	32° 24' 6.422 N	104° 13' 37.434 W	
10,000.0	90.00	269.76	7,800.0	-1,857.1	-2,486.6	509,916.17	574,034.93	32° 24' 6.418 N	104° 13' 38.601 W	
10,100.0	90.00	269.76	7,800.0	-1,857.6	-2,586.6	509,915.75	573,934.93	32° 24' 6.415 N	104° 13' 39.767 W	
10,200.0	90.00	269.76	7,800.0	-1,858.0	-2,686.6	509,915.33	573,834.93	32° 24' 6.412 N	104° 13' 40.934 W	
10,300.0	90.00	269.76	7,800.0	-1,858.4	-2,786.6	509,914.91	573,734.93	32° 24' 6.409 N	104° 13' 42.100 W	
10,400.0	90.00	269.76	7,800.0	-1,858.8	-2,886.6	509,914.49	573,634.93	32° 24' 6.406 N	104° 13' 43.267 W	
10,500.0	90.00	269.76	7,800.0	-1,859.2	-2,986.6	509,914.07	573,534.94	32° 24' 6.403 N	104° 13' 44.433 W	
10,600.0	90.00	269.76	7,800.0	-1,859.7	-3,086.6	509,913.65	573,434.94	32° 24' 6.399 N	104° 13' 45.600 W	
10,700.0	90.00	269.76	7,800.0	-1,860.1	-3,186.6	509,913.23	573,334.94	32° 24' 6.396 N	104° 13' 46.766 W	
10,800.0	90.00	269.76	7,800.0	-1,860.5	-3,286.6	509,912.82	573,234.94	32° 24' 6.393 N	104° 13' 47.932 W	
10,900.0	90.00	269.76	7,800.0	-1,860.9	-3,386.6	509,912.40	573,134.94	32° 24' 6.390 N	104° 13' 49.099 W	
11,000.0	90.00	269.76	7,800.0	-1,861.3	-3,486.6	509,911.98	573,034.94	32° 24' 6.387 N	104° 13' 50.265 W	
11,100.0	90.00	269.76	7,800.0	-1,861.8	-3,586.6	509,911.56	572,934.94	32° 24' 6.383 N	104° 13' 51.432 W	
11,200.0	90.00	269.76	7,800.0	-1,862.2	-3,686.6	509,911.14	572,834.94	32° 24' 6.380 N	104° 13' 52.598 W	
11,300.0	90.00	269.76	7,800.0	-1,862.6	-3,786.6	509,910.72	572,734.94	32° 24' 6.377 N	104° 13' 53.765 W	
11,400.0	90.00	269.76	7,800.0	-1,863.0	-3,886.6	509,910.30	572,634.94	32° 24' 6.374 N	104° 13' 54.931 W	
11,500.0	90.00	269.76	7,800.0	-1,863.4	-3,986.6	509,909.88	572,534.94	32° 24' 6.371 N	104° 13' 56.097 W	
11,600.0	90.00	269.76	7,800.0	-1,863.8	-4,086.6	509,909.46	572,434.95	32° 24' 6.367 N	104° 13' 57.264 W	
11,700.0	90.00	269.76	7,800.0	-1,864.3	-4,186.6	509,909.04	572,334.95	32° 24' 6.364 N	104° 13' 58.430 W	
11,800.0	90.00	269.76	7,800.0	-1,864.7	-4,286.6	509,908.62	572,234.95	32° 24' 6.361 N	104° 13' 59.597 W	
11,900.0	90.00	269.76	7,800.0	-1,865.1	-4,386.6	509,908.21	572,134.95	32° 24' 6.358 N	104° 14' 0.763 W	
12,000.0	90.00	269.76	7,800.0	-1,865.5	-4,486.6	509,907.79	572,034.95	32° 24' 6.355 N	104° 14' 1.930 W	
12,100.0	90.00	269.76	7,800.0	-1,865.9	-4,586.6	509,907.37	571,934.95	32° 24' 6.351 N	104° 14' 3.096 W	
12,200.0	90.00	269.76	7,800.0	-1,866.4	-4,686.6	509,906.95	571,834.95	32° 24' 6.348 N	104° 14' 4.263 W	
12,300.0	90.00	269.76	7,800.0	-1,866.8	-4,786.6	509,906.53	571,734.95	32° 24' 6.345 N	104° 14' 5.429 W	
12,400.0	90.00	269.76	7,800.0	-1,867.2	-4,886.6	509,906.11	571,634.95	32° 24' 6.342 N	104° 14' 6.595 W	
12,500.0	90.00	269.76	7,800.0	-1,867.6	-4,986.6	509,905.69	571,534.95	32° 24' 6.338 N	104° 14' 7.762 W	
12,600.0	90.00	269.76	7,800.0	-1,868.0	-5,086.6	509,905.27	571,434.95	32° 24' 6.335 N	104° 14' 8.928 W	
12,700.0	90.00	269.76	7,800.0	-1,868.5	-5,186.6	509,904.85	571,334.96	32° 24' 6.332 N	104° 14' 10.095 W	

# PERMIAN

## RESOURCES

### Planning Report - Geographic

<b>Database:</b>	Compass_17	<b>Local Co-ordinate Reference:</b>	Well CAVEMAN 174H
<b>Company:</b>	NEW MEXICO	<b>TVD Reference:</b>	KB @ 3132.0usft
<b>Project:</b>	(SP) EDDY	<b>MD Reference:</b>	KB @ 3132.0usft
<b>Site:</b>	CAVEMAN PROJECT	<b>North Reference:</b>	Grid
<b>Well:</b>	CAVEMAN 174H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	OWB		
<b>Design:</b>	PWP0		

Planned Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude	
12,800.0	90.00	269.76	7,800.0	-1,868.9	-5,286.6	509,904.43	571,234.96	32° 24' 6.329 N	104° 14' 11.261 W	
12,900.0	90.00	269.76	7,800.0	-1,869.3	-5,386.6	509,904.02	571,134.96	32° 24' 6.325 N	104° 14' 12.428 W	
13,000.0	90.00	269.76	7,800.0	-1,869.7	-5,486.6	509,903.60	571,034.96	32° 24' 6.322 N	104° 14' 13.594 W	
13,100.0	90.00	269.76	7,800.0	-1,870.1	-5,586.6	509,903.18	570,934.96	32° 24' 6.319 N	104° 14' 14.761 W	
13,200.0	90.00	269.76	7,800.0	-1,870.6	-5,686.6	509,902.76	570,834.96	32° 24' 6.316 N	104° 14' 15.927 W	
13,300.0	90.00	269.76	7,800.0	-1,871.0	-5,786.6	509,902.34	570,734.96	32° 24' 6.312 N	104° 14' 17.093 W	
13,400.0	90.00	269.76	7,800.0	-1,871.4	-5,886.6	509,901.92	570,634.96	32° 24' 6.309 N	104° 14' 18.260 W	
13,500.0	90.00	269.76	7,800.0	-1,871.8	-5,986.6	509,901.50	570,534.96	32° 24' 6.306 N	104° 14' 19.426 W	
13,600.0	90.00	269.76	7,800.0	-1,872.2	-6,086.6	509,901.08	570,434.96	32° 24' 6.303 N	104° 14' 20.593 W	
13,700.0	90.00	269.76	7,800.0	-1,872.6	-6,186.6	509,900.66	570,334.96	32° 24' 6.299 N	104° 14' 21.759 W	
13,800.0	90.00	269.76	7,800.0	-1,873.1	-6,286.6	509,900.24	570,234.96	32° 24' 6.296 N	104° 14' 22.926 W	
13,900.0	90.00	269.76	7,800.0	-1,873.5	-6,386.6	509,899.82	570,134.97	32° 24' 6.293 N	104° 14' 24.092 W	
14,000.0	90.00	269.76	7,800.0	-1,873.9	-6,486.6	509,899.41	570,034.97	32° 24' 6.289 N	104° 14' 25.259 W	
14,100.0	90.00	269.76	7,800.0	-1,874.3	-6,586.6	509,898.99	569,934.97	32° 24' 6.286 N	104° 14' 26.425 W	
14,200.0	90.00	269.76	7,800.0	-1,874.7	-6,686.6	509,898.57	569,834.97	32° 24' 6.283 N	104° 14' 27.591 W	
14,300.0	90.00	269.76	7,800.0	-1,875.2	-6,786.6	509,898.15	569,734.97	32° 24' 6.280 N	104° 14' 28.758 W	
14,400.0	90.00	269.76	7,800.0	-1,875.6	-6,886.6	509,897.73	569,634.97	32° 24' 6.276 N	104° 14' 29.924 W	
14,500.0	90.00	269.76	7,800.0	-1,876.0	-6,986.6	509,897.31	569,534.97	32° 24' 6.273 N	104° 14' 31.091 W	
14,600.0	90.00	269.76	7,800.0	-1,876.4	-7,086.6	509,896.89	569,434.97	32° 24' 6.270 N	104° 14' 32.257 W	
14,700.0	90.00	269.76	7,800.0	-1,876.8	-7,186.6	509,896.47	569,334.97	32° 24' 6.266 N	104° 14' 33.424 W	
14,800.0	90.00	269.76	7,800.0	-1,877.3	-7,286.6	509,896.05	569,234.97	32° 24' 6.263 N	104° 14' 34.590 W	
14,900.0	90.00	269.76	7,800.0	-1,877.7	-7,386.6	509,895.63	569,134.97	32° 24' 6.260 N	104° 14' 35.757 W	
15,000.0	90.00	269.76	7,800.0	-1,878.1	-7,486.6	509,895.21	569,034.98	32° 24' 6.256 N	104° 14' 36.923 W	
15,100.0	90.00	269.76	7,800.0	-1,878.5	-7,586.6	509,894.80	568,934.98	32° 24' 6.253 N	104° 14' 38.089 W	
15,200.0	90.00	269.76	7,800.0	-1,878.9	-7,686.6	509,894.38	568,834.98	32° 24' 6.250 N	104° 14' 39.256 W	
15,300.0	90.00	269.76	7,800.0	-1,879.4	-7,786.6	509,893.96	568,734.98	32° 24' 6.246 N	104° 14' 40.422 W	
15,400.0	90.00	269.76	7,800.0	-1,879.8	-7,886.6	509,893.54	568,634.98	32° 24' 6.243 N	104° 14' 41.589 W	
15,500.0	90.00	269.76	7,800.0	-1,880.2	-7,986.6	509,893.12	568,534.98	32° 24' 6.240 N	104° 14' 42.755 W	
15,600.0	90.00	269.76	7,800.0	-1,880.6	-8,086.6	509,892.70	568,434.98	32° 24' 6.236 N	104° 14' 43.922 W	
15,700.0	90.00	269.76	7,800.0	-1,881.0	-8,186.6	509,892.28	568,334.98	32° 24' 6.233 N	104° 14' 45.088 W	
15,800.0	90.00	269.76	7,800.0	-1,881.4	-8,286.6	509,891.86	568,234.98	32° 24' 6.230 N	104° 14' 46.255 W	
15,900.0	90.00	269.76	7,800.0	-1,881.9	-8,386.6	509,891.44	568,134.98	32° 24' 6.226 N	104° 14' 47.421 W	
16,000.0	90.00	269.76	7,800.0	-1,882.3	-8,486.6	509,891.02	568,034.98	32° 24' 6.223 N	104° 14' 48.587 W	
16,100.0	90.00	269.76	7,800.0	-1,882.7	-8,586.6	509,890.61	567,934.98	32° 24' 6.220 N	104° 14' 49.754 W	
16,200.0	90.00	269.76	7,800.0	-1,883.1	-8,686.6	509,890.19	567,834.99	32° 24' 6.216 N	104° 14' 50.920 W	
16,300.0	90.00	269.76	7,800.0	-1,883.5	-8,786.6	509,889.77	567,734.99	32° 24' 6.213 N	104° 14' 52.087 W	
16,400.0	90.00	269.76	7,800.0	-1,884.0	-8,886.6	509,889.35	567,634.99	32° 24' 6.210 N	104° 14' 53.253 W	
16,500.0	90.00	269.76	7,800.0	-1,884.4	-8,986.6	509,888.93	567,534.99	32° 24' 6.206 N	104° 14' 54.420 W	
16,600.0	90.00	269.76	7,800.0	-1,884.8	-9,086.6	509,888.51	567,434.99	32° 24' 6.203 N	104° 14' 55.586 W	
16,700.0	90.00	269.76	7,800.0	-1,885.2	-9,186.6	509,888.09	567,334.99	32° 24' 6.200 N	104° 14' 56.752 W	
16,800.0	90.00	269.76	7,800.0	-1,885.6	-9,286.6	509,887.67	567,234.99	32° 24' 6.196 N	104° 14' 57.919 W	
16,900.0	90.00	269.76	7,800.0	-1,886.1	-9,386.6	509,887.25	567,134.99	32° 24' 6.193 N	104° 14' 59.085 W	
17,000.0	90.00	269.76	7,800.0	-1,886.5	-9,486.6	509,886.83	567,034.99	32° 24' 6.189 N	104° 15' 0.252 W	
17,100.0	90.00	269.76	7,800.0	-1,886.9	-9,586.6	509,886.41	566,934.99	32° 24' 6.186 N	104° 15' 1.418 W	
17,200.0	90.00	269.76	7,800.0	-1,887.3	-9,686.6	509,886.00	566,834.99	32° 24' 6.183 N	104° 15' 2.585 W	
17,300.0	90.00	269.76	7,800.0	-1,887.7	-9,786.6	509,885.58	566,735.00	32° 24' 6.179 N	104° 15' 3.751 W	
17,400.0	90.00	269.76	7,800.0	-1,888.2	-9,886.6	509,885.16	566,635.00	32° 24' 6.176 N	104° 15' 4.918 W	
17,500.0	90.00	269.76	7,800.0	-1,888.6	-9,986.6	509,884.74	566,535.00	32° 24' 6.173 N	104° 15' 6.084 W	
17,600.0	90.00	269.76	7,800.0	-1,889.0	-10,086.6	509,884.32	566,435.00	32° 24' 6.169 N	104° 15' 7.250 W	
17,700.0	90.00	269.76	7,800.0	-1,889.4	-10,186.6	509,883.90	566,335.00	32° 24' 6.166 N	104° 15' 8.417 W	
17,800.0	90.00	269.76	7,800.0	-1,889.8	-10,286.6	509,883.48	566,235.00	32° 24' 6.162 N	104° 15' 9.583 W	
17,900.0	90.00	269.76	7,800.0	-1,890.2	-10,386.6	509,883.06	566,135.00	32° 24' 6.159 N	104° 15' 10.750 W	
18,000.0	90.00	269.76	7,800.0	-1,890.7	-10,486.6	509,882.64	566,035.00	32° 24' 6.156 N	104° 15' 11.916 W	
18,100.0	90.00	269.76	7,800.0	-1,891.1	-10,586.6	509,882.22	565,935.00	32° 24' 6.152 N	104° 15' 13.083 W	
18,200.0	90.00	269.76	7,800.0	-1,891.5	-10,686.5	509,881.80	565,835.00	32° 24' 6.149 N	104° 15' 14.249 W	

PERMIAN  
RESOURCES

Planning Report - Geographic

Database:	Compass_17	Local Co-ordinate Reference:	Well CAVEMAN 174H
Company:	NEW MEXICO	TVD Reference:	KB @ 3132.0usft
Project:	(SP) EDDY	MD Reference:	KB @ 3132.0usft
Site:	CAVEMAN PROJECT	North Reference:	Grid
Well:	CAVEMAN 174H	Survey Calculation Method:	Minimum Curvature
Wellbore:	OWB		
Design:	PWP0		

Planned Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
18,300.0	90.00	269.76	7,800.0	-1,891.9	-10,786.5	509,881.39	565,735.00	32° 24' 6.145 N	104° 15' 15.416 W
18,400.0	90.00	269.76	7,800.0	-1,892.3	-10,886.5	509,880.97	565,635.01	32° 24' 6.142 N	104° 15' 16.582 W
18,437.1	90.00	269.76	7,800.0	-1,892.5	-10,923.6	509,880.81	565,597.95	32° 24' 6.141 N	104° 15' 17.014 W
TD at 18437.1									

Design Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
BHL-CAVEMAN 174H	0.00	0.00	7,800.0	-1,892.5	-10,923.6	509,880.81	565,597.95	32° 24' 6.141 N	104° 15' 17.014 W
- plan hits target center									
- Point									
FTP-CAVEMAN 174H	0.00	0.00	7,800.0	-1,848.4	-390.7	509,924.95	576,130.84	32° 24' 6.484 N	104° 13' 14.153 W
- plan misses target center by 197.8usft at 8004.1usft MD (7658.4 TVD, -1848.9 N, -528.8 E)									
- Point									

Plan Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,000.0	1,000.0	0.0	0.0	Start Build 2.00
1,987.3	1,967.9	-164.8	-34.8	Start 4594.3 hold at 1987.3 MD
6,581.7	6,292.1	-1,683.5	-355.9	Start Drop -2.00
7,569.0	7,260.0	-1,848.4	-390.7	Start 62.5 hold at 7569.0 MD
7,631.5	7,322.5	-1,848.4	-390.7	Start DLS 12.00 TFO 269.76
8,381.5	7,800.0	-1,850.4	-868.2	Start 10055.5 hold at 8381.5 MD
18,437.1	7,800.0	-1,892.5	-10,923.6	TD at 18437.1

## Permian Resources - Caveman 174H

## 1. Geologic Formations

Formation	Elevation	TVD	Lithology	Target
Rustler	2857	275	Sandstone	No
Top of Salt	NP	NP	Salt	No
Lamar	1372	1760	Anhydrite/Shale	No
Capitan	2782	350	Anhydrite/Shale	No
Bell Canyon	1082	2050	Limestone	No
Cherry Canyon	272	2860	Limestone	No
Brushy Canyon	-583	3715	Limestone	No
Bone Spring Lime	-2018	5150	Limestone	No
1st Bone Spring Sand	-3209	6341	Sandstone	No
2nd Bone Spring Sand	-3819	6951	Sandstone	No
3rd Bone Spring Sand	-5240	8372	Limestone/Shale	Yes
Wolfcamp	-5531	8663	Sandstone/Limestone/Shale	No
#REF!	#REF!	#REF!	Sandstone/Limestone/Shale	#REF!
#REF!	#REF!	#REF!	Sandstone/Limestone/Shale	#REF!
#REF!	#REF!	#REF!	Shale	#REF!

## 2. Blowout Prevention

BOP installed and tested before drilling which hole?	Size?	Min. Required WP	Type	x	Tested to:
12.25	13-5/8"	5M	Annular	x	2500 psi
			Blind Ram	x	5000 psi
			Pipe Ram	x	
			Double Ram		
			Other*		
8.75	13-5/8"	5M	Annular	x	2500 psi
			Blind Ram	x	5000 psi
			Pipe Ram	x	
			Double Ram		
			Other*		

**Equipment:** BOPE will meet all requirements for above listed system per 43 CFR 3172. BOPE with working pressure ratings in excess of anticipated maximum surface pressure will be utilized for well control from drill out of surface casing to TMD. The system may be upgraded to a higher pressure but still tested to the working pressure listed in the table above. If the system is upgraded all of the components installed will be functional, tested, and will meet all requirements per 43 CFR 3172. The wellhead will be a multibowl speed head allowing for hangoff of intermediate casing of the surface x intermediate annulus without breaking the connection between the BOP & wellhead. A variance is requested to utilize a flexible choke line (flexhose) from the BOP to choke manifold.

**Requesting Variance? YES**

**Variance request: Multibowl Wellhead, Flexhose, Breaktesting, Offline Cementing Variances. Attachments in Section 8.**

**Testing Procedure:** Operator requests to ONLY test broken pressure seals per API Standard 53 and the attachments in Section 8. The BOP test shall be performed before drilling out of the surface casing shoe and will occur at a minimum: a. when initially installed, b. whenever any seal subject to test pressure is broken, c. following related repairs, d. at 21-day intervals. Testing of the ram type preventer(s) and annular type preventer(s) shall be tested per 43 CFR 3172. The BOPE configuration, choke manifold layout, and accumulator system will be in compliance with 43 CFR 3172. Bleed lines will discharge 100' from wellhead in non-H<sub>2</sub>S scenarios and 150' from wellhead in H<sub>2</sub>S scenarios.

**DV Tool Contingency Plan Request |**

Anticipated DVT Placement: ~1450' Cement Details – Cement volumes will be adjusted accordingly based on DVT Placement. Planned TOC: Surface. Stage 1 (Intermediate Shoe to DVT) Lead: 100sx (54.3bbls) CI C, 11ppg, 3.05 cf/sx cmt (120% excess) Additives: 100% ProLiteCH+5PPS Plexcredit

STE+2%SMS+0.1% R-1300+0.25% MagBond+3PPS Gilsonite+0.005GPS TOC: 1450' (DVT) Tail: 255sx (62.2bbl) CI C, 14.8ppg, 1.37cf/sx cmt (30% excess) Additives: +5% Salt+0.25% MagBond+0.005GPS TOC: 1500' Stage 2 (DVT to Surface) Lead: 270sx (5146.7bbls) CI C, 11ppg, 3.05 cf/sx cmt (300% excess) Additives: 100% ProLiteCH+5PPS Plexcredit STE+2%SMS+0.1% R-1300+0.25% MagBond+3PPS Gilsonite+0.005GPS TOC: Surface Tail: 165sx (39.1bbl) CI C, 14.8ppg, 1.33cf/sx cmt (40% excess) Additives: +5% Salt+0.25% MagBond+0.005GPS TOC: 1450' (DVT)

Choke Diagram Attachemnt: 5 M Choke Manifold  
BOP Diagram Attachment: BOP Schematic

### 3. Casing

String	Hole Size	Casing Size	Top	Bottom	Top TVD	Bottom TVD	Length	Grade	Weight	Connection	Collapse SF	Burst SF	Joint SF Type	Joint SF	Body SF Type	Body SF
Surface	17.5	13.375	0	300	0	300	300	J55	54.5	BTC	7.62	###	Dry	7.81	Dry	7.33
Intermediate	12.25	9.625	0	1975	0	1975	1975	J55	36	BTC	2.93	1.66	Dry	3.73	Dry	3.30
Production	8.75	5.5	0	8382	0	7800	8382	P110RY	17	GeoConn	1.84	1.93	Dry	2.35	Dry	2.35
Production	7.875	5.5	8382	18437	7800	7800	10055	P110RY	17	GeoConn	1.84	1.93	Dry	2.35	Dry	2.35
BLM Min Safety Factor											1.125	1		1.6		1.6

Non API casing spec sheets and casing design assumptions attached.

### 4. Cement

String	Lead/Tail	Top MD	Bottom MD	Quantity (sx)	Yield	Density	Cu Ft	Excess %	Cement Type	Additives
Surface	Tail	0	300	240	1.34	14.8	320	50%	Class C	Accelerator
Intermediate	Lead	0	1580	350	2.08	12.7	720	50%	Class C	Salt, Extender, and LCM
Intermediate	Tail	1580	1975	150	1.34	14.8	190	50%	Class C	Accelerator
Production	Lead	1475	7632	630	3.45	10.7	2140	40%	Class H	POZ, Extender, Fluid Loss, Dispersant, Retarder
Production	Tail	7632	18437	1400	1.73	12.5	2420	25%	Class H	POZ, Extender, Fluid Loss, Dispersant, Retarder

### 5. Circulating Medium

**Mud System Type:** Closed

**Will an air or gas system be used:** No

**Describe what will be on location to control well or mitigate other conditions:** Sufficient quantities of mud materials will be on the well site at all times for the purpose of assuring well control and maintaining wellbore integrity. Surface interval will employ fresh water mud. The intermediate hole will utilize a saturated brine fluid to inhibit salt washout. The production hole will employ brine based and oil base fluid to inhibit formation reactivity and of the appropriate density to maintain well control.

**Describe the mud monitoring system utilized:** Centrifuge separation system. Open tank monitoring with EDR will be used for drilling fluids and return volumes. Open tank monitoring will be used for cement and cuttings return volumes. Mud properties will be monitored at least every 24 hours using industry accepted mud check practices.

**Cuttings Volume:** 7950 Cu Ft

**Circulating Medium Table**

Top Depth	Bottom Depth	Mud Type	Min Weight	Max Weight
0	300	Spud Mud	8.6	9.5
300	1975	Salt Saturated	10	10
1975	19038	Oil Based Mud	9	10

6. Test, Logging, Coring

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

Will utilize MWD/LWD from intermediate hole to TD of the well.

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

DIRECTIONAL SURVEY

Coring operation description for the well:

7. Pressure

Anticipated Bottom Hole Pressure	4060	psi
Anticipated Surface Pressure	2340	psi
Anticipated Bottom Hole Temperature	136	°F
Anticipated Abnormal pressure, temp, or geo hazards	No	







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ALL DIMENSIONS APPROXIMATE

CACTUS WELLHEAD LLC		PERMIAN RESOURCES NEW MEXICO	
20" x 13-3/8" x 10-3/4" x 8-5/8" x 5-1/2" MBU-4T-CFL-R-DBLO Sys. With 13-5/8" 10M x 7-1/16" 15M CTH-DBLHPS Tubing Head And 10-3/4" & 7-5/8" & 5-1/2" Fluted Mandrel Casing Hangers	DRAWN	DLE	26OCT23
	APPRV		
	DRAWING NO.	HBE0001038	

### Permian Resources Offline Cementing Procedure Surface & Intermediate Casing

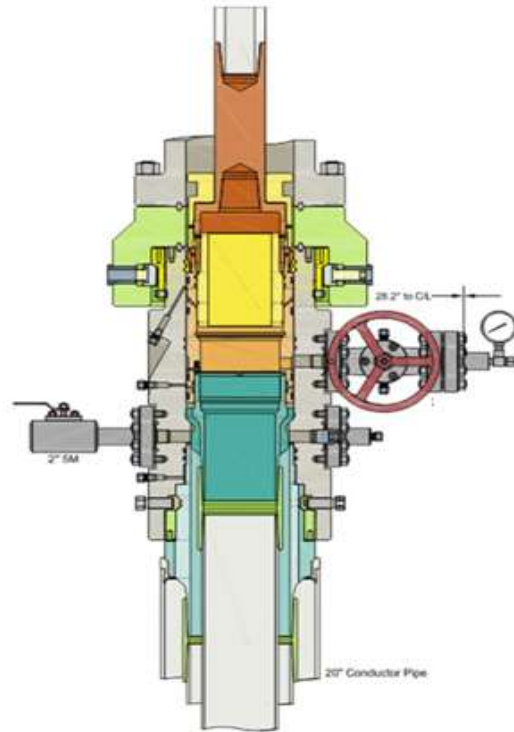
1. Drill hole to Total Depth with Rig and perform wellbore cleanup cycles.
2. Run and casing to Depth.
3. Land casing with mandrel.
4. Circulate 1.5 csg capacity.
5. Flow test – Confirm well is static and floats are holding.
6. Set Annular packoff and pressure test. Test to 5k.
7. Nipple down BOP and install cap flange.
8. Skid rig to next well on pad
9. Remove cap flange (confirm well is static before removal)
  - a) If well is not static use the casing outlet valves to kill well
  - b) Drillers method will be used in well control event
  - c) High pressure return line will be rigged up to lower casing valve and run to choke manifold to control annular pressure
  - d) Kill mud will be circulated once influx is circulated out of hole
  - e) Confirm well is static and remove cap flange to start offline cement operations
10. Install offline cement tool.
11. Rig up cementers.
12. Circulate bottoms up with cement truck
13. Commence planned cement job, take returns through the annulus wellhead valve
14. After plug is bumped confirm floats hold and well is static
15. Rig down cementers and equipment
16. Install night cap with pressure gauge to monitor.



## Intermediate



Run 7 5/8" Casing  
Land Casing on 7 5/8" Mandrel Hanger  
Cement 7 5/8" Casing  
Retrieve Running Tool



Run 9 5/8" Packoff  
Test Upper and Lower Seals  
Engage Lockring  
Retrieve Running Tool







ContiTech Fluid Technology

ContiTech Oil & Marine Corp. # 11535 Brittmoore Park Dr., Houston, TX 77041-6916 USA		<b>Packing list / Delivery note</b>		
CONSIGNEE / Ship-to address:  HELMERICH & PAYNE INT'L DRILLING CO ATTN: FLEX RIG WHSE - B-BAY 210 MAGNOLIA DRIVE GALENA PARK TX 77547		Document No. <b>71461553</b> Document Date 28.01.2022		
Buyer:  HELMERICH & PAYNE INT'L DRILLING CO 1437 SOUTH BOULDER 74119 TULSA		Customer Number 11697 Customer VAT No. Supplier Number Purchase Order No. 740362040 Purchase Order Date 18.01.2022 Sales Order Number 1388153 Sales Order Date 18.01.2022		
Conditions  Incoterms EXW Houston Ex Works		Unloading Point RAN-No.		
		<b>Page 1 of 2</b>		
		Weights (Gross / Net) Total Gross Weight 2,507.000 LB Total Net Weight 2,507.000 LB		
Item	Material/Description	Quantity	Net Weight	Gross Weight
20	Buyer: Jack Peebles E-mail: Jackie.Peebles@hpinc.com Tel: 832-782-6000  Rig/Whse: HOW <b>00RECERTIFY</b> Recert of HP Hoses Serial# 67094 Commodity Code: 3" X 35 FT 10K Choke & Kill Hoses API 16C  End 1: 4 - 1/16" 10Kpsi API Spec 6A Type 6BX Flange End 2: 4 - 1/16" 10Kpsi API Spec 6A Type 6BX Flange c/w BX155 ring groove each end Standard: API Spec 16C - Monogrammed  Working Pressure: 10,000psi Test Pressure: 15,000psi  Inspection & Certification includes: External inspection of the hose & couplings Internal boroscopic inspection of hose liner Hydrostatic pressure test of hose assembly Repair of any external damage to hose body and end connections (limited to minor repairs). Clean & protect end connections Inspection Report Disposal of hose assembly if hose fails inspection and recertification process. Please Flush Hoses before sending them to our Facility.	1 PC	2,507.000 LB	2,507.000 LB

ContiTech Rubber Industrial Kft.  
 H-6728 Szeged Budapesti út 10.  
 P. O. Box 152 Szeged H-6701  
 Phone: (62)566-700, Fax: (62)566-713  
 Tax Number: 11087209-2-06  
 EU Community VAT: HU11087209  
 Registration No.: Cg. 0609-002502  
 Registry Court: Csongrád Megyei Cégbíróság

COMMERZBANK ZRT. (HUF)  
 H-1054 Budapest, Széchenyi rakpart 8.  
 H-1245 Budapest P.O. Box 1070  
 Account No.: 14220108-26830003  
 IBAN: HU83 1422 0108 2683 0003 0000 0000  
 SWIFT: COBA HU HXXX

COMMERZBANK AG Hannover (EUR)  
 30159 Hannover, Theaterstr. 11-12.  
 Account No.: 3 066 156 00  
 Sort Code: 250 400 66  
 BIC: COBADEFF250  
 IBAN: DE41250400660306615600



Record Rotary Hose sleeve number on the CBC Made Hose List!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!



## Hydrostatic Test Certificate

ContiTech

<b>Certificate Number</b> H100122	<b>COM Order Reference</b> 1388153	<b>Customer Name &amp; Address</b> HELMERICH & PAYNE DRILLING CO 1434 SOUTH BOULDER AVE TULSA, OK 74119 USA
<b>Customer Purchase Order No:</b> 740362040		
<b>Project:</b>		
<b>Test Center Address</b> ContiTech Oil & Marine Corp. 11535 Brittmoore Park Drive Houston, TX 77041 USA	<b>Accepted by COM Inspection</b> Signed: Gerson Mejia-Lazo Date: 02/09/22	<b>Accepted by Client Inspection</b>

We certify that the goods detailed hereon have been inspected as described below by our Quality Management System, and to the best of our knowledge are found to conform the requirements of the above referenced purchase order as issued to ContiTech Oil & Marine Corporation.

Item	Part No.	Description	Qty	Serial Number	Work. Press. (psi)	Test Press. (psi)	Test Time (minutes)
20	RECERTIFICATION	3" ID 10K Choke and Kill Hose x 35ft OAL	1	67094	10,000	15,000	60

Record Information	
Start Time	1/27/2022 13:21:21
End Time	1/27/2022 14:38:28
Interval	00:01:00
Number	78
MaxValue	15849
MinValue	-3
AvgValue	14240
RecordName	67094-sh
RecordNumber	199

Gauge Information	
Model	ADT680
SN	21817380014
Range	(0-40000)psi
Unit	psi





## Permian Resources

### Multi-Well Pad Batch Drilling Procedure

Surface Casing - PR intends to Batch set all surface casing to a depth approved in the APD. Surface Holes will be batch drilled by a rig. Appropriate notifications will be made prior to spudding the well, running and cementing casing and prior to skidding to the rig to the next well on pad.

1. Drill Surface hole to Approved Depth with Rig and perform wellbore cleanup cycles. Trip out and rack back drilling BHA.
2. Run and land planned surface casing see Illustration 1-1 Below to depth approved in APD.
3. Set packoff and test to 5k psi
4. Offline Cement
5. Install wellhead with pressure gauge and nightcap. Nightcap is shown on final wellhead Stack up Illustration #2-2.
6. Skid Rig to adjacent well to drill Surface hole.
7. Surface casing test will be performed by the rig in order to allow ample time for Cement to develop 500psi compressive strength. Casing test to 0.22 psi/ft or 1500 psi whichever is greater - not to exceed 70% casing burst.



Illustration 1-1

Intermediate Casing – PR intends to Batch set all intermediate casing strings to a depth approved in the APD. Intermediate Holes will be batch drilled by the rig. Appropriate notifications will be made prior to testing BOPE, and prior to running/cementing all casing strings.

1. Rig will remove the nightcap and install and test BOPE.
2. Test Surface casing per COA WOC timing (.22 psi/ft or 1500 psi whichever is greater) - not to exceed 70% casing burst. Cement must have achieved 500psi compressive strength prior to test.
3. Install wear bushing then drill out surface casing shoe-track plus 20' and conduct FIT to minimum of the MW equivalent anticipated to control the formation pressure to the next casing point.
4. Drill Intermediate hole to approved casing point. Trip out of hole with BHA to run Casing.
5. Remove wear bushing then run and land Intermediate Casing with mandrel hanger in wellhead.
6. Cement casing to surface with floats holding.
7. Washout stack then run wash tool in wellhead and wash hanger and pack-off setting area.
8. Install pack-off and test void to 5,000 psi for 15 minutes. Nightcap shown on final wellhead stack up illustration 2-2 on page 3.
9. Test casing per COA WOC timing (.22 psi/ft or 1500 psi whichever is greater) - not to exceed 70% casing burst. Cement must have achieved 500psi compressive strength prior to test.
10. Install nightcap – skid rig to adjacent well to drill Intermediate hole.

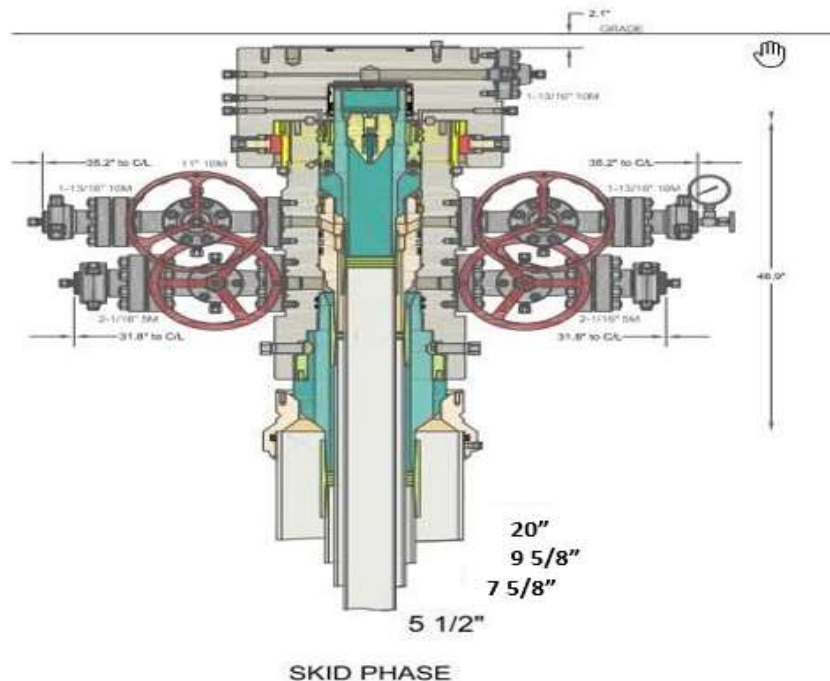


Illustration 2-2

Production Casing – PR intends to Batch set all Production casings with Rig. Appropriate notifications will be made prior Testing BOPE, and prior to running/cementing all casing strings.

1. Drilling Rig will remove the nightcap and install and test BOPE.
2. Install wear bushing then drill Intermediate shoe-track plus 20' and conduct FIT to minimum MW equivalent to control the formation pressure to TD of well.
3. Drill Vertical hole to KOP – Trip out for Curve BHA.
4. Drill Curve, landing in production interval – Trip for Lateral BHA.
5. Drill Lateral / Production hole to Permitted BHL, perform cleanup cycles and trip out to run Production Casing.
6. Remove wear bushing then run Production casing to TD landing casing mandrel in wellhead.
7. Cement Production string with floats holding.
8. Run in with wash tool and wash wellhead area – install pack-off and test void to 5,000psi for 15 minutes.
9. Install BPV in Production mandrel hanger – Nipple down BOPE and install nightcap.
10. Test nightcap void to 5,000 psi for 30 minutes per illustration 2-2
11. Skid rig to adjacent well on pad to drill production hole.

## Permian Resources BOP Break Testing Variance Procedure

Subject: Request for a Variance Allowing break Testing of the Blowout Preventer Equipment (BOPE). Permian Resources requests a variance to ONLY test broken pressure seals on the BOPE and function test BOP when skidding a drilling rig between multiple wells on a pad.

### Background

Title 43 CFR 3172, Drilling Operations, Sections 6.b.9.iv states that the BOP test must be performed whenever any seal subject to test pressure is broken. The current interpretation of the Bureau of Land Management (BLM) requires a complete BOP test and not just a test of the affected component. 43 CFR 3172.13, Variances from minimum standards states, "An operator may request the authorized officer to approve a variance from any of the minimum standards prescribed in [§§ 3172.6](#) through [3172.12](#). All such requests shall be submitted in writing to the appropriate authorized officer and provide information as to the circumstances which warrant approval of the variance(s) requested and the proposed alternative methods by which the related minimum standard(s) are to be satisfied. The authorized officer, after considering all relevant factors, if appropriate, may approve the requested variance(s) if it is determined that the proposed alternative(s) meet or exceed the objectives of the applicable minimum standard(s)." Permian Resources feels the break testing the BOPE is such a situation. Therefore, as per 43 CFR 3172.13, Permian Resources submits this request for the variance.

### Supporting Documentation

The language used in 43 CFR 3172 became effective on December 19, 1988 and has remained the standard for regulating BLM onshore drilling operations for over 30 years. During this time, there have been significant changes in drilling technology. The BLM continues to use the variance request process to allow for the use of modern technology and acceptable engineering practices that have arisen since 43 CFR 3172 was originally released. The Permian Resources drilling rig fleet has many modern upgrades that allow the intact BOP stack to be moved between well slots on a multi-well pad, as well as, wellhead designs that incorporate quick connects facilitating release of the BOP from the wellhead without breaking any BOP stack components apart. These technologies have been used extensively offshore, and other regulators, API, and many operators around the world have endorsed break testing as safe and reliable.

Figure 1: Winch System attached to BOP Stack



Figure 2: BOP Winch System



American Petroleum Institute (API) standards, specification and recommended practices are considered the industry standard and are consistently utilized and referenced by the industry. 43 CFR 3172 recognizes API recommended Practices (RP) 53 in its original development. API Standard 53, Well Control Equipment Systems for Drilling Wells (Fifth Edition, December 2018, Annex C, Table C.4) recognizes break testing as an acceptable practice. Specifically, API Standard 53, Section 5.3.7.1 states "A pressure test of the pressure containing component shall be performed following the disconnection or repair, limited to the affected component." See Table C.4 below for reference.

62

API STANDARD 53

Table C.4—Initial Pressure Testing, Surface BOP Stacks

Component to be Pressure Tested	Pressure Test—Low Pressure <sup>a,c</sup> psig (MPa)	Pressure Test—High Pressure <sup>a,c</sup>	
		Change Out of Component, Elastomer, or Ring Gasket	No Change Out of Component, Elastomer, or Ring Gasket
Annular preventer <sup>b</sup>	250 to 350 (1.72 to 2.41)	RWP of annular preventer	MASP or 70% annular RWP, whichever is lower.
Fixed pipe, variable bore, blind, and BSR preventers <sup>a,c</sup>	250 to 350 (1.72 to 2.41)	RWP of ram preventer or wellhead system, whichever is lower	ITP
Choke and kill line and BOP side outlet valves below ram preventers (both sides)	250 to 350 (1.72 to 2.41)	RWP of side outlet valve or wellhead system, whichever is lower	ITP
Choke manifold—upstream of chokes <sup>a</sup>	250 to 350 (1.72 to 2.41)	RWP of ram preventers or wellhead system, whichever is lower	ITP
Choke manifold—downstream of chokes <sup>a</sup>	250 to 350 (1.72 to 2.41)	RWP of valve(s), line(s), or MASP for the well program, whichever is lower	
Kelly, kelly valves, drill pipe safety valves, IBOPs	250 to 350 (1.72 to 2.41)	MASP for the well program	

<sup>a</sup> Pressure test evaluation periods shall be a minimum of five minutes.

No visible leaks.

The pressure shall remain stable during the evaluation period. The pressure shall not decrease below the intended test pressure.

<sup>b</sup> Annular(s) and VBR(s) shall be pressure tested on the largest and smallest OD drill pipe to be used in well program.

<sup>c</sup> For pad drilling operations, moving from one wellhead to another within the 21 days, pressure testing is required for pressure-containing and pressure-controlling connections when the integrity of a pressure seal is broken.

<sup>d</sup> For surface offshore operations, the ram BOPs shall be pressure tested with the ram locks engaged and the closing and locking pressure vented during the initial test. For land operations, the ram BOPs shall be pressure tested with the ram locks engaged and the closing and locking pressure vented at commissioning and annually.

<sup>e</sup> Adjustable chokes are not required to be full sealing devices. Pressure testing against a closed choke is not required.



The Bureau of Safety and Environmental Enforcement (BSEE), Department of Interior, has also utilized the API standards, specification and best practices in the development of its offshore oil and gas regulations and incorporates them by reference within its regulations.

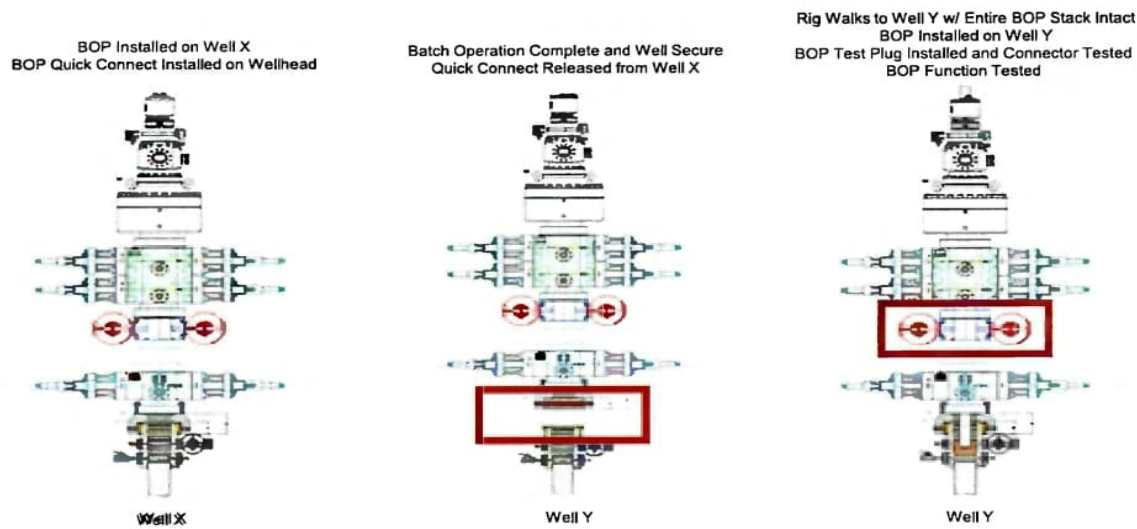
Break testing has been approved by the BLM in the past with other operators based on the detailed information provided in this document.

Permian Resources feels break testing and our current procedures meet the intent of 43 CFR 3172 and often exceed it. There has been no evidence that break testing results in more components failing than seen on full BOP tests. Permian Resources internal standards require complete BOPE tests more often than that of 43 CFR 3172 (every 21 days). In addition to function testing the annular, pipe rams and blind rams after each BOP nipple up, Permian Resources performs a choke drill with the rig crew prior to drilling out every casing shoe. This is additional training for the rig crew that exceeds the requirements of 43 CFR 3172.

#### Procedures

- 1) Permian Resources will use this document for our break testing plan for New Mexico Delaware Basin. The summary below will be referenced in the APD or Sundry Notice and receive approval prior to implementing this variance.
- 2) Permian Resources will perform BOP break testing on multi-wells pads where multiple intermediate sections can be drilled and cased within the 21-day BOP test window.
  - a) A full BOP test will be conducted on the first well on the pad.
  - b) The first intermediate hole section drilled on the pad will be the deepest. All the remaining hole sections will be the same formation depth or shallower.
  - c) A full BOP test will be required if the intermediate hole section being drilled has a MASP over 5M.
  - d) A full BOP test will be required prior to drilling any production hole.
- 3) After performing a complete BOP test on the first well, the intermediate hole section will be drilled and cased, two breaks would be made on the BOP equipment.
  - a) Between the HCV valve and choke line connection
  - b) Between the BOP quick connect and the wellhead
- 4) The BOP is then lifted and removed from the wellhead by a hydraulic system.
- 5) After skidding to the next well, the BOP is moved to the wellhead by the same hydraulic system and installed.
- 6) The connections mentioned in 3a and 3b will then be reconnected.
- 7) Install test plug into the wellhead using test joint or drill pipe.
- 8) A shell test is performed against the upper pipe rams testing the two breaks.
- 9) The shell test will consist of a 250 psi low test and a high test to the value submitted in the APD or Sundry (e.g. 5,000 psi or 10,000psi).
- 10) Function tests will be performed on the following components: lower pipe rams, blind rams, and annular.
- 11) For a multi-well pad the same two breaks on the BOP would be made and on the next wells and steps 4 through 10 would be repeated.
- 12) A second break test would only be done if the intermediate hole section being drilled could not be completed within the 21 day BOP test window.

*Note: Picture below highlights BOP components that will be tested during batch operations*



### Summary

A variance is requested to ONLY test broken pressure seals on the BOP equipment when moving from wellhead to wellhead which is in compliance with API Standard 53. API Standard 53 states, that for pad drilling operations, moving from one wellhead to another within 21 days, pressure testing is required for pressure-containing and pressure-controlling connections when the integrity of a pressure seal is broken.

The BOP will be secured by a hydraulic carrier or cradle. The BLM will be contacted if a Well Control event occurs prior to the commencement of a BOPE Break Testing operation.

Based on public data and the supporting documentation submitted herein to the BLM, we will request permission to ONLY retest broken pressure seals if the following conditions are met:

- 1) After a full BOP test is conducted on the first well on the pad.
- 2) The first intermediate hole section drilled on the pad will be the deepest. All the remaining hole sections will be the same depth or shallower.
- 3) A full BOP test will be required if the intermediate hole section being drilled has a MASP over 5M.
- 4) A full BOP test will be required prior to drilling the production hole.



Only **ONE** test will occur during each break test procedure.

All valves in red including the upper pipe rams will be shut to test the broken connections.  
 \*\* Each valve on choke manifold will alternate being tested against during each rig skid.



The connection between the HCV and kill line connection will **NOT** be broken on each skid and does not need to be retested.

The connection between the BOP stack / BOP Quick Connect and wellhead will be broken, as well as, the connection between the HCV and Choke Line on each skid and will be re-tested each time.

# **PERMIAN**

## **R E S O U R C E S**

### **H<sub>2</sub>S CONTINGENCY PLAN**

**FOR**

**Permian Resources Corporation**

**Caveman 171H, 121H, 172H, 122H, 132H, 133H, 173H, 123H,  
174H, 113H, 114H, 111H, 112H, 421H, 423H, 221H, 222H, 223H,  
124H, 224H, 134H, 424H**

**Eddy County, New Mexico**

**09-27-2024**

**This plan is subject to updating**

Permian Resources Corporation	H <sub>2</sub> S Contingency Plan Caveman 171H, 121H, 172H, 122H, 132H, 133H, 173H, 123H, 174H, 113H, 114H, 111H, 112H, 421H, 423H, 221H, 222H, 223H, 124H, 224H, 134H, 424H	Eddy County, New Mexico
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## II. Appendix B – SO<sub>2</sub> SDS

### **Section 1.0 – Introduction**

#### **I. Purpose**

The purpose of this contingency plan (Plan) is to provide Permian Resources Corporation. (Permian Resources) with an organized plan of action for alerting and protecting Permian Resources employees, the general public, and any potential first responders prior to any intentional release or immediately following the accidental / unintentional release of a potentially hazardous volume / concentration of Hydrogen Sulfide Gas (H<sub>2</sub>S).

#### **II. Scope & Applicability**

This Plan applies to all planned, unplanned, uncontrolled and/or unauthorized releases of hazardous concentrations of H<sub>2</sub>S or any associated hazardous byproducts of combustion, occurring at any Permian Resources owned or operated facilities including but not limited to: wells, flowlines, pipelines, tank batteries, production facilities, SWD facilities, compressor stations, gas processing plants, drilling / completions / workover operations, and any other applicable company owned property.

### **Section 2.0 - Plan Implementation**

#### **I. Activation Requirements**

In accordance with the requirements of Bureau of Land Management Onshore Order #6 and NMAC 19.15.11, this Plan shall be activated in advance of any authorized, planned, unplanned, uncontrolled, or unauthorized release of a hazardous volume / concentration of H<sub>2</sub>S gas, or SO<sub>2</sub>, which could potentially adversely impact the workers, general public or the environment.

#### **II. Emergency Evacuation**

In the event of an unplanned, uncontrolled, or unauthorized release of a hazardous volume / concentration of H<sub>2</sub>S gas, the first priority is to ensure the safety of the workers and general public. Upon discovery and subsequent determination of an applicable release, which cannot be quickly mitigated, immediately by using 911, notify local authorities to begin the process of alerting the general public, evacuate any residents within the Radius of Exposure (ROE), and limit any general public or employee access to any areas within the ROE of the affected facility.

#### **III. Emergency Response Activities**

The purpose of emergency response actions is to take steps to quickly mitigate / stop the ongoing release of the hazardous source of H<sub>2</sub>S. Upon discovery of any hazardous release, immediately notify Permian Resources management to activate the Emergency Response Team (ERT). Once Permian Resources supervision arrives and assesses the situation, a work plan identifying the proper procedures shall be developed to stop the release.

### **Section 3.0 - Potential Hazardous Conditions & Response Actions**

Permian Resources Corporation	H <sub>2</sub> S Contingency Plan Caveman 171H, 121H, 172H, 122H, 132H, 133H, 173H, 123H, 174H, 113H, 114H, 111H, 112H, 421H, 423H, 221H, 222H, 223H, 124H, 224H, 134H, 424H	Eddy County, New Mexico
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During a planned or unplanned release of H<sub>2</sub>S, there are several hazardous conditions that are presented both to employees, the general public, and emergency responders. These specific hazardous conditions are identified in the tables below.

H <sub>2</sub> S OPERATING CONDITIONS – RESPONSE ACTIONS TO CONSIDER		✓
<b>H<sub>2</sub>S CONDITION 1: POTENTIAL DANGER TO LIFE AND HEALTH → WARNING SIGN GREEN</b>		
<b>H<sub>2</sub>S concentration &lt;10 ppm</b> detected by location monitors		<input type="checkbox"/>
<b>General Actions During Condition 1</b>		<input type="checkbox"/>
Notify Site Supervisor / Permian Resources Person-in-Charge (PIC) of any observed increase in ambient H <sub>2</sub> S concentrations		<input type="checkbox"/>
All personnel check safety equipment is in adequate working order & store in accessible location		<input type="checkbox"/>
Sensitize crews with safety meetings.		<input type="checkbox"/>
Limit visitors and non-essential personnel on location		<input type="checkbox"/>
Continuously monitor H <sub>2</sub> S concentrations and check calibration of sensors		<input type="checkbox"/>
Ensure H <sub>2</sub> S scavenger is on location.		<input type="checkbox"/>
<b>H<sub>2</sub>S CONDITION 2: MODERATE DANGER TO LIFE AND HEALTH → WARNING SIGN YELLOW</b>		
<b>H<sub>2</sub>S concentration &gt;10 ppm and &lt; 30 ppm</b> in atmosphere detected by location monitors:		<input type="checkbox"/>
<b>General Actions During Condition 2</b>		<input type="checkbox"/>
Sound H <sub>2</sub> S alarm and/or display yellow flag.		<input type="checkbox"/>
Account for on-site personnel		<input type="checkbox"/>
Upon sounding of an area or personal H <sub>2</sub> S monitor alarm when 10 ppm is reached, proceed to a safe briefing area upwind of the location immediately (see <b>MA-4, Figure 5-1</b> ).		<input type="checkbox"/>
Don proper respiratory protection.		<input type="checkbox"/>
Alert other affected personnel		<input type="checkbox"/>
<b>If trained and safe to do so</b> undertake measures to control source H <sub>2</sub> S discharge and eliminate possible ignition sources. Initiate Emergency Shutdown procedures as deemed necessary to correct or control the specific situation.		<input type="checkbox"/>
Account for on-site personnel at safe briefing area.		<input type="checkbox"/>
Stay in safe briefing area if not working to correct the situation.		<input type="checkbox"/>
Keep Site Supervisor / Permian Resources PIC informed. Notify applicable government agencies ( <b>Appendix A</b> ) If off-site impact; notify any neighbors within Radius of Exposure ( <b>ROE</b> ), <b>Fig 5.11</b>		<input type="checkbox"/>
Continuously monitor H <sub>2</sub> S until readings below 10 ppm.		<input type="checkbox"/>
Evacuated area shall not be re-entered except by trained and authorized personnel utilizing appropriate respiratory protection; or until “all clear” sounded by Permian Resources PIC / Site Supervisor.		

Permian Resources Corporation	H <sub>2</sub> S Contingency Plan Caveman 171H, 121H, 172H, 122H, 132H, 133H, 173H, 123H, 174H, 113H, 114H, 111H, 112H, 421H, 423H, 221H, 222H, 223H, 124H, 224H, 134H, 424H	Eddy County, New Mexico
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<b>H<sub>2</sub>S CONDITION 3: EXTREME DANGER TO LIFE AND HEALTH → WARNING SIGN RED</b>	
> 30 ppm H <sub>2</sub> S concentration in air detected by location monitors: Extreme danger to life	<input type="checkbox"/>
<b>General Actions During Condition 3</b>	<input type="checkbox"/>
Sound H <sub>2</sub> S alarm and/or display red flag.	<input type="checkbox"/>
Account for on-site personnel	<input type="checkbox"/>
Move away from H <sub>2</sub> S source and get out of the affected area.	<input type="checkbox"/>
Proceed to designated safe briefing area; alert other affected personnel.	<input type="checkbox"/>
Account for personnel at safe briefing area.	<input type="checkbox"/>
If trained and safe to do so undertake measures to control source H <sub>2</sub> S discharge and eliminate possible ignition sources. Initiate Emergency Shutdown procedures as deemed necessary to correct or control the specific situation.	<input type="checkbox"/>
Notify vehicles or situation and divert all traffic away from location.	<input type="checkbox"/>
Permian Resources Person-in-Charge will make appropriate community notifications.	<input type="checkbox"/>
Red warning flag must be on display until the situation has been corrected and the Permian Resources Person-in-Charge determines it is safe to resume operations under <b>Condition 1</b> .	<input type="checkbox"/>
Notify management of the condition and action taken. If H <sub>2</sub> S concentration is increasing and steps to correct the situation are not successful – or at any time if well control is questionable – alert all responsible parties for possible activation of the H <sub>2</sub> S Contingency Plan. If well control at the surface is lost, determine if situation warrants igniting the well.	<input type="checkbox"/>
If uncontrolled flow at the surface occurs, the Permian Resources PIC, with approval, if possible, from those coordinating the emergency ( <b>as specified in the site-specific H<sub>2</sub>S Contingency Plan</b> ) are responsible for determining if the situation warrants igniting the flow of the uncontrolled well. This decision should be made only as a last resort and in a situation where it is obvious that human life is in danger and there is no hope of controlling the flow under prevailing conditions.	<input type="checkbox"/>
If the flow is ignited, burning H <sub>2</sub> S will be converted to sulfur dioxide (SO <sub>2</sub> ), which is also highly toxic. Do not assume that area is safe after the flow is ignited. If the well is ignited, evacuation of the area is mandatory, because SO <sub>2</sub> will remain in low-lying places under no-wind conditions.	<input type="checkbox"/>
Keep Site Supervisor / Permian Resources PIC informed. Notify applicable government agencies and local law enforcement ( <b>Appendix A</b> ) If off-site impact; notify any neighbors within the Radius of Exposure ( <b>ROE</b> ), see example in <b>Figure 5-11</b> .	<input type="checkbox"/>
Continuously monitor H <sub>2</sub> S until readings fall below 10 ppm.	<input type="checkbox"/>

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Evacuated area shall not be re-entered except by trained and authorized personnel utilizing appropriate respiratory protection; or until “all clear” sounded by Permian Resources PIC / Site Supervisor.	<input type="checkbox"/>
<b>IF ABOVE ACTIONS CANNOT BE ACCOMPLISHED IN TIME TO PREVENT EXPOSURE TO THE PUBLIC</b>	
Alert public (directly or through appropriate government agencies) who may be subject to potentially harmful exposure levels.	<input type="checkbox"/>
Make recommendations to public officials regarding blocking unauthorized access to the unsafe area and assist as appropriate.	<input type="checkbox"/>
Make recommendations to public officials regarding evacuating the public and assist as appropriate.	<input type="checkbox"/>
Monitor ambient air in the area of exposure (after following abatement measures) to determine when it is safe for re-entry.	<input type="checkbox"/>

#### **Section 4.0 - Notification of H<sub>2</sub>S Release Event**

##### **I. Local & State Law Enforcement**

Prior to the planned / controlled release of a hazardous concentration of H<sub>2</sub>S gas or any associated byproducts of the combustion of H<sub>2</sub>S gas, notify local law enforcement agencies regarding the contents of this plan.

In the event of the discovery of an unplanned/uncontrolled release of a hazardous concentration of H<sub>2</sub>S gas or any associated byproducts of combustion, immediately notify local and/or state law enforcement agencies of the situation and ask for their assistance.

##### **II. General Public**

In the event of a planned or unplanned release of a hazardous concentration of H<sub>2</sub>S gas or any associated byproducts of combustion, notify local law enforcement agencies and ask for their assistance in alerting the general public and limiting access to any public roads that may be impacted by such a release.

##### **III. New Mexico Oil Conservation Division**

The Permian Resources HSE Department will make any applicable notification to the New Mexico OCD regarding any release of a hazardous concentration of H<sub>2</sub>S Gas or any associated byproducts of combustion.

##### **IV. New Mexico Environment Department**

The Permian Resources HSE Department will make any applicable notifications to the NMED regarding any release of a hazardous concentration of H<sub>2</sub>S gas or any associated byproducts of combustion.

##### **V. Bureau of Land Management**

The Permian Resources Regulatory Department will make any applicable notifications to the BLM



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regarding any release of a hazardous concentration of H<sub>2</sub>S gas or any associated byproducts of combustion.

### Section 5.0 - Emergency Contact List

EMERGENCY CONTACT LIST				
PERMIAN RESOURCES CORPORATION.				
POSITION	NAME	OFFICE	CELL	ALT PHONE
<b>Operations</b>				
Operations Superintendent	Rick Lawson		432.530.3188	
TX Operations Superintendent	Josh Graham	432.940.3191	432.940.3191	
NM Operations Superintendent	Manual Mata	432.664.0278	575.408.0216	
Drilling Manager	Jason Fitzgerald	432.315.0146	318.347.3916	
Drilling Engineer	Parker Simmons	432.400.1038	281.536.9813	
Production Manager	Levi Harris	432.219.8568	720.261.4633	
SVP Development Ops	Clayton Smith	720.499.1416	361.215.2494	
SVP Production Ops	Casey McCain	432.695.4239	432.664.6140	
<b>HSE &amp; Regulatory</b>				
H&S Manager	Adam Hicks	720.499.2377	903.426.4556	
Regulatory Manager	Stephanie Rabadue		432.260.4388	
Environmental Manager	Montgomery Floyd	432-315-0123	432-425-8321	
HSE Consultant	Blake Wisdom		918-323-2343	
<b>Local, State, &amp; Federal Agencies</b>				
Eddy County Sheriff		575-887-7551		911
New Mexico State Highway Patrol		505-757-2297		911
Carlsbad Fire / EMS		575-885-3125		911
Carlsbad Memorial Hospital		575-887-4100		
Secorp – Safety Contractor	Ricky Stephens		(325)-262-0707	
New Mexico Oil Conservation Division – District 1 Office – Hobbs, NM.		575-393-6161		
New Mexico Environment Department – District III Office – Hobbs, NM		575-397-6910		
New Mexico Oil Conservation Division – Hobbs, NM	24 Hour Emergency	575-393-6161		
Bureau of Land Management – Carlsbad, NM		575-706-2779		
Eddy County PET Inspector		575-361-2822		
U.S. Fish & Wildlife		502-248-6911		

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## Section 6.0 – Drilling Location Information

### I. Site Safety Information

#### 1. Safe Briefing Area

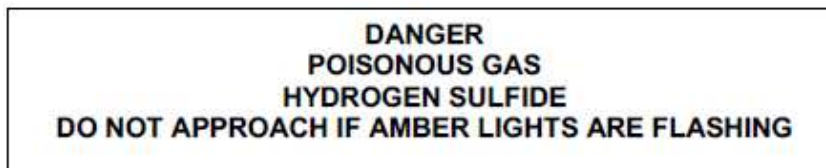
- a. There shall be two areas that will be designated as "SAFE BRIEFING AREAS". If H<sub>2</sub>S is detected in concentrations equal to or in excess of 10 ppm all personnel not assigned emergency duties are to assemble in the designated Safe Briefing area for instructions. These two areas shall be positioned in accessible locations to facilitate the availability of self-contained breathing air devices. The briefing areas shall be positioned no less than 250' from the wellhead and in such locations that at least one briefing area will be up-wind from the well at all times.

#### 2. Wind Indicators

- a. 4 Windssocks will be installed at strategic points on the facility.

#### 3. Danger Signs

- a. A warning sign indicating the possible well conditions will be displayed at the location entrance.



#### 4. H<sub>2</sub>S Detectors and Alarms

- a. Continuous monitoring type H<sub>2</sub>S detectors, capable of sensing a minimum of 5ppm H<sub>2</sub>S in air will be located centrally located at the tanks, heater treater, and combustor. Continuous monitoring type SO<sub>2</sub> detector will also be located at the combustor. The automatic H<sub>2</sub>S alarm/flashing light will be located at the site entrance and in front of tank battery.

#### 5. Safety Trailer

- a. A safety trailer equipped with an emergency cascade breathing air system with 2 ea. Work/escape packs, a stretcher, 2 OSHA approved full body harnesses, and a 20# Class ABC fire extinguisher shall be available at the site in close proximity to the safe briefing area. The cascade system shall be able to be deployed to the drill floor when needed to provide safe breathing air to the workers as needed.

#### 6. Well Control Equipment

- a. The location shall have a flare line to a remote automatic ignitor and back up flare gun, placed 150' from the wellhead.
- b. The location shall be equipped with a remotely operated choke system and a mud gas separator.

#### 7. Mud Program

- a. Company shall have a mud program that contains sufficient weight and additives to control H<sub>2</sub>S.

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8. Metallurgy

- a. All drill strings, casing, tubing, wellhead, BOP, spools, kill lines, choke manifold and lines, and valves shall be suitable for anticipated H<sub>2</sub>S volume and pressure.

9. Communication

- a. The location shall be equipped with a means of effective communication such as a cell phones, intercoms, satellite phones or landlines.

**II. Directions to Location**

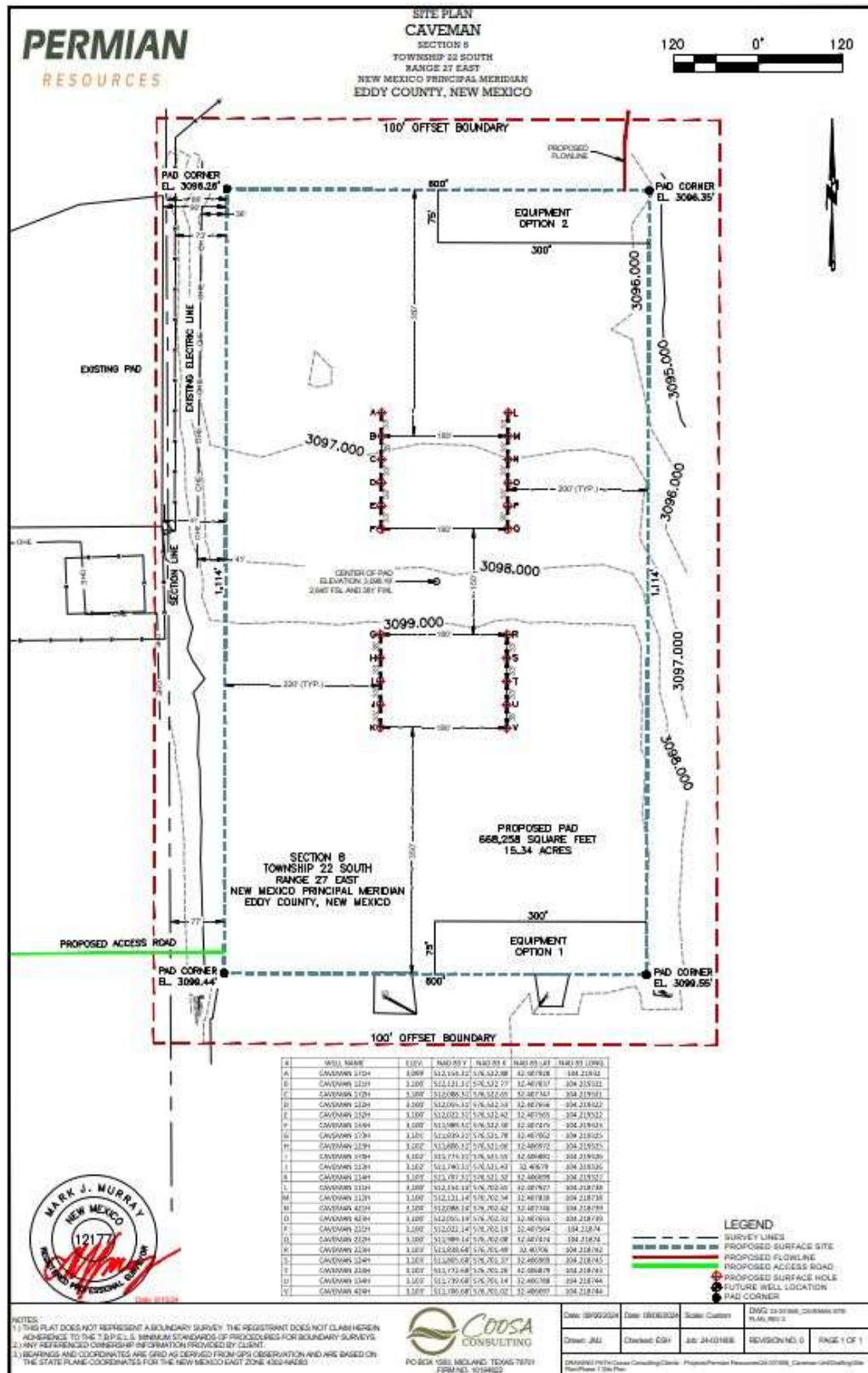
BEGINNING AT THE INTERSECTION OF U.S. HIGHWAY 62 AND GREENE ST IN CARLSBAD, PROCEED SOUTH ON CANAL ST FOR 1.1 MILES THEN TURN LEFT ONTO E FIESTA DR. TRAVEL 0.2 MILES AND TURN LEFT ON PAVED ROAD. TRAVEL 0.3 MILES TO LOCATION AND TURN RIGHT. PROCEED TO LOCATION.

Permian Resources Corporation

H<sub>2</sub>S Contingency Plan  
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Plat of Location



Permian Resources Corporation	H <sub>2</sub> S Contingency Plan Caveman 171H, 121H, 172H, 122H, 132H, 133H, 173H, 123H, 174H, 113H, 114H, 111H, 112H, 421H, 423H, 221H, 222H, 223H, 124H, 224H, 134H, 424H	Eddy County, New Mexico
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1. Routes of Ingress & Egress (MAP)



2. Residences in proximity to the 3000' Radius of Exposure (ROE) (MAP)

There are no residences or public gathering places with the 100 PPM, 300 PPM, or 500 PPM ROE.



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Map of 3000' ROE Perimeter



100 PPM, 300 PPM, & 500 PPM Max ROE under worst case scenario

Enter H <sub>2</sub> S in PPM	1500	
Enter Gas flow in mcf/day (maximum worst case conditions)	2500	
500 ppm radius of exposure (public road)	<u>105</u>	feet
300 ppm radius of exposure	<u>146</u>	feet
100 ppm radius of exposure (public area)	<u>230</u>	feet

- Location NAD 83 GPS Coordinates **Lat: 32.407655, Long: -104.218739**

3. Public Roads in proximity of the Radius of Exposure (ROE)

There are no public roads that would be within the 500 PPM ROE. The closest public road is Industrial Avenue which is 900' from the location.

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## Section 7.0 – Hazard Communication

### I. Physical Characteristics of Hydrogen Sulfide Gas

Hydrogen sulfide (H<sub>2</sub>S) is a colorless, poisonous gas that is soluble in water. It can be present in crude oils, condensates, natural gas and wastewater streams.

H<sub>2</sub>S is heavier than air with a vapor density of 1.189 (air = 1.0); however, H<sub>2</sub>S is most often mixed with other gases. These mixtures of H<sub>2</sub>S and other gases can be heavier or lighter than air. If the H<sub>2</sub>S-containing mixture is heavier, it can collect in low areas such as ditches, ravines, firewalls, and pits; in storage tanks; and in areas of poor ventilation. Please see physical properties in **Table 7.0**.

With H<sub>2</sub>S the sense of smell is rapidly lost allowing lethal concentrations to be accumulated without warning. The toxicity of hydrogen sulfide at varying concentrations is indicated in the **Table 7.1**.

**Warning:** Do not use the mouth-to-mouth method if a victim ingested or inhaled hydrogen sulfide. Give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

**Table 7.0. Physical Properties of H<sub>2</sub>S**

Properties of H <sub>2</sub> S	Description
Vapor Density > 1 = 1.189 Air = 1	<ul style="list-style-type: none"> <li>H<sub>2</sub>S gas is slightly heavier than air, which can cause it to settle in low places and build in concentration.</li> <li>Produced as a mixture with other gases associated with oil and gas production.</li> </ul>
Flammable Range 4.3%-46% 43000 ppm – 460000 ppm	<ul style="list-style-type: none"> <li>H<sub>2</sub>S can be extremely flammable / explosive when these concentrations are reached by volume in air.</li> </ul>

Although H<sub>2</sub>S is primarily a respiratory hazard, it is also flammable and forms an explosive mixture at concentrations of 4.3%–46.0% (40,000ppm – 460,000 ppm) by volume in air.

#### H<sub>2</sub>S can be encountered when:

- Venting and draining equipment.
- Opening equipment (separators, pumps, and tanks).
- Opening piping connections (“line breaking”).
- Gauging and sampling storage tanks.
- Entering confined spaces.
- Working around wastewater pits, skimmers, and treatment facilities.

### II. Human Health Hazards - Toxicological Information



Permian Resources Corporation	H <sub>2</sub> S Contingency Plan Caveman 171H, 121H, 172H, 122H, 132H, 133H, 173H, 123H, 174H, 113H, 114H, 111H, 112H, 421H, 423H, 221H, 222H, 223H, 124H, 224H, 134H, 424H	Eddy County, New Mexico
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**Table 7.1. Hazards & Toxicity**

Concentration (ppm)	Symptoms/Effects
0.00011-0.00033 ppm	Typical background concentrations
0.01-1.5 ppm	Odor threshold (when rotten egg smell is first noticeable to some). Odor becomes more offensive at 3-5 ppm. Above 30 ppm, odor described as sweet or sickeningly sweet.
2-5 ppm	Prolonged exposure may cause nausea, tearing of the eyes, headaches or loss of sleep. Airway problems (bronchial constriction) in some asthma patients.
20 ppm	Possible fatigue, loss of appetite, headache, irritability, poor memory, dizziness.
50-100 ppm	Slight conjunctivitis ("gas eye") and respiratory tract irritation after 1 hour. May cause digestive upset and loss of appetite.
100 ppm	Coughing, eye irritation, loss of smell after 2-15 minutes (olfactory fatigue). Altered breathing, drowsiness after 15-30 minutes. Throat irritation after 1 hour. Gradual increase in severity of symptoms over several hours. Death may occur after 48 hours.
100-150 ppm	Loss of smell (olfactory fatigue or paralysis).
200-300 ppm	Marked conjunctivitis and respiratory tract irritation after 1 hour. Pulmonary edema may occur from prolonged exposure.
500-700 ppm	Staggering, collapse in 5 minutes. Serious damage to the eyes in 30 minutes. Death after 30-60 minutes.
700-1000 ppm	Rapid unconsciousness, "knockdown" or immediate collapse within 1 to 2 breaths, breathing stops, death within minutes.
1000-2000 ppm	Nearly instant death

### III. Environmental Hazards

H<sub>2</sub>S and its associated byproducts from combustion presents a serious environmental hazard. Sulphur

Permian Resources Corporation	H <sub>2</sub> S Contingency Plan Caveman 171H, 121H, 172H, 122H, 132H, 133H, 173H, 123H, 174H, 113H, 114H, 111H, 112H, 421H, 423H, 221H, 222H, 223H, 124H, 224H, 134H, 424H	Eddy County, New Mexico
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Dioxide SO<sub>2</sub> is produced as a constituent of flaring H<sub>2</sub>S Gas and can present hazards associated, which are similar to H<sub>2</sub>S. Although SO<sub>2</sub> is heavier than air, it will be picked up by a breeze and carried downwind at elevated temperatures. Since Sulfur Dioxide is extremely irritating to the eyes and mucous membranes of the upper respiratory tract, it has exceptionally good warning powers in this respect. The following table indicates the toxic nature of the gas. Please see the attached SDS in Appendix B for reference.

SULFUR DIOXIDE TOXICITY		
Concentration		Effects
%SO <sub>2</sub>	PPM	
0.0005	3 to 5	Pungent odor-normally a person can detect SO <sub>2</sub> in this range.
0.0012	12	Throat irritation, coughing, and constriction of the chest tearing and smarting of eyes.
0.15	150	So irritating that it can only be endured for a few minutes.
0.05	500	Causes a sense of suffocation, even with first breath.

### Section 8.0 - Regulatory Information

#### I. OSHA & NIOSH Information

#### II. Table 8.0. OSHA & NIOSH H<sub>2</sub>S Information

PEL, IDLH, TLV	Description
NIOSH PEL 10 PPM	<ul style="list-style-type: none"> <li>PEL is the Permissible Exposure Limit that an employee may be exposed up to 8 hr / day.</li> </ul>
OSHA General Industry Ceiling PEL – 20 PPM	<ul style="list-style-type: none"> <li>The maximum exposure limit, which cannot be exceeded for any length of time.</li> </ul>
IDLH 100 PPM	<ul style="list-style-type: none"> <li>Immediately Dangerous to Life and Health</li> </ul>
Permian Resources PEL 10 PPM	<ul style="list-style-type: none"> <li>Permian Resources Policy Regarding H<sub>2</sub>S for employee safety</li> </ul>

#### III. New Mexico OCD & BLM – H<sub>2</sub>S Concentration Threshold Requirements

New Mexico NMAC 19.15.11 and Onshore Order #6 identify two Radii of Exposure (ROE) that identify potential danger to the public and require additional compliance measures. Permian Resources is required to install safety devices, establish safety procedures and develop a written H<sub>2</sub>S contingency plan for sites where the H<sub>2</sub>S concentrations are as follows.

**Table 8.1. Calculating H<sub>2</sub>S Radius of Exposure**

H <sub>2</sub> S Radius of Exposure	Description	Control and Equipment Requirements
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Permian Resources Corporation	H <sub>2</sub> S Contingency Plan Caveman 171H, 121H, 172H, 122H, 132H, 133H, 173H, 123H, 174H, 113H, 114H, 111H, 112H, 421H, 423H, 221H, 222H, 223H, 124H, 224H, 134H, 424H	Eddy County, New Mexico
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100 ppm	Distance from a release to where the H <sub>2</sub> S concentration in the air will dilute below 100ppm	ROE > 50-ft and includes any part of a "public area" (residence, school, business, etc., or any area that can be expected to be populated). ROE > 3,000-ft
500 ppm	Distance from a release to where the H <sub>2</sub> S concentration in the air will dilute below 500ppm	ROE > 50-ft and includes any part of a public road (public roads are tax supported roads or any road used for public access or use)

### Calculating H<sub>2</sub>S Radius of Exposure

The ROE of an H<sub>2</sub>S release is calculated to determine if a potentially hazardous volume of H<sub>2</sub>S gas at 100 or 500 parts per million (ppm) is within a regulated distance requiring further action. If information about the concentration of H<sub>2</sub>S and the potential gas release volume is known, the location of the Muster Areas will be set, and safety measures will be implemented based on the calculated radius of exposure (ROE). NMAC 19.15.11 – Hydrogen Sulfide Safety defines the ROE as the radius constructed with the gas's point of escape as its center and its length calculated by the following Pasquill-Gifford equations:

To determine the extent of the **100 ppm ROE**:

$$x = [(1.589) (\text{mole fraction H}_2\text{S})(Q)]^{(.6258)}.$$

To determine the extent of the **500 ppm ROE**:

$$x = [(0.4546) (\text{mole fraction H}_2\text{S})(Q)]^{(.6258)}.$$

**Table 8.2. Calculating H<sub>2</sub>S Radius of Exposure**

ROE Variable	Description
X =	ROE in feet
Q =	<b>Max volume of gas released determined to be released in cubic feet per day (ft<sup>3</sup>/d)</b> normalized to standard temperature and pressure, 60°F and 14.65 psia
Mole fraction H <sub>2</sub> S =	Mole fraction of H <sub>2</sub> S in the gaseous mixture released.

The volume used as the escape rate in determining the ROE is specified in the rule as follows:

- The maximum daily volume rate of gas containing H<sub>2</sub>S handled by that system element for which the ROE is calculated.
- For existing gas wells, the current adjusted open-flow rate, or the operator's estimate of the well's capacity to flow against zero back-pressure at the wellhead.

### New Mexico Oil Conservation Division & BLM Site Requirements under NMAC 19.15.11 & Onshore Order #6

- Two cleared areas will be designated as Safe Briefing Areas. During an emergency, personnel will assemble in one of these areas for instructions from the Permian Resources Person-in-Charge.

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Prevailing wind direction should be considered in locating the briefing areas 200' or more on either side of the well head. One area should offset the other at an angle of 45° to 90° with respect to prevailing wind direction to allow for wind shifts during the work period.

- In the event of either an intentional or accidental releases of hydrogen sulfide, safeguards to protect the general public from the harmful effects of hydrogen sulfide must be in place for operations. A summary of the provisions in each of three H<sub>2</sub>S ROE cases is included in **Table 8.3**.
  - **CASE 1** -100 ppm ROE < 50'
  - **CASE 2** - 100 ppm ROE is 50' or greater, but < 3000' and does not penetrate public area.
  - **CASE 3** -100 ppm ROE is 50' or greater and penetrates a public area or 500 ppm ROE includes a public road. Also if 100 ppm ROE > 3000' regardless of public area.

**Table 8.3. NMAC 19.15.11 Compliance Requirements Drilling & Production**

NMAC 19.15.11 & BLM COMPLIANCE REQUIREMENTS - DRILLING & PRODUCTION			
PROVISION	CASE 1	CASE 2	CASE 3
H <sub>2</sub> S Concentration Test	X	X	X
H-9	X	X	X
Training	X	X	X
District Office Notification	X	X	X
Drill Stem Tests Restricted	X*	X*	X
BOP Test	X*	X*	X
Materials		X	X
Warning and Marker		X	X
Security		X	X
Contingency Plan			X
Control and Equipment Safety			X
Monitors		X**	X**
Mud (ph Control or Scavenger)			X*
Wind Indicators		X**	X
Protective Breathing Equipment		X**	X
Choke Manifold, Secondary Remote Control, and Mud-Gas Separator			X
Flare Stacks			X*

### Section 9.0 - Training Requirements

#### Training

The following elements are considered a minimum level of training for personnel assigned to operations who may encounter H<sub>2</sub>S as part of routine or maintenance work.

- The hazards, characteristics, and properties of hydrogen sulfide (H<sub>2</sub>S) and (SO<sub>2</sub>).
- Sources of H<sub>2</sub>S and SO<sub>2</sub>.
- Proper use of H<sub>2</sub>S and SO<sub>2</sub> detection methods used at the workplace.
- Recognition of, and proper response to, the warning signals initiated by H<sub>2</sub>S and SO<sub>2</sub> detection systems in use at the workplace.

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- Symptoms of H<sub>2</sub>S exposure; symptoms of SO<sub>2</sub> exposure
- Rescue techniques and first aid to victims of H<sub>2</sub>S and SO<sub>2</sub> exposure.
- Proper use and maintenance of breathing equipment for working in H<sub>2</sub>S and SO<sub>2</sub> atmospheres, as appropriate theory and hands-on practice, with demonstrated proficiency (29 CFR Part 1910.134).
- Workplace practices and relevant maintenance procedures that have been established to protect personnel from the hazards of H<sub>2</sub>S and SO<sub>2</sub>.
- Wind direction awareness and routes of egress.
- Confined space and enclosed facility entry procedures (if applicable).
- Emergency response procedures that have been developed for the facility or operations.
- Locations and use of safety equipment.
- Locations of safe briefing areas.

***Refresher training will be conducted annually.***

#### ***Section 10.0 - Personal Protective Equipment***

##### **I. Personal H<sub>2</sub>S Monitors**

All personnel engaged in planned or unplanned work activity to mitigate the release of a hazardous concentration of H<sub>2</sub>S shall have on their person a personal H<sub>2</sub>S monitor.

##### **II. Fixed H<sub>2</sub>S Detection and Alarms**

- 4 channel H<sub>2</sub>S monitor
- 4 wireless H<sub>2</sub>S monitors
- H<sub>2</sub>S alarm system (Audible/Red strobe)
- Personal gas monitor for each person on location
- Gas sample tubes

##### **III. Flame Resistant Clothing**

All personnel engaged in planned or unplanned work activity associated with this Plan shall have on the appropriate level of FRC clothing.

##### **IV. Respiratory Protection**

The following respiratory protection equipment shall be available at each drilling location.

- Working cascade system available on rig floor and pit system & 750' of air line hose
- Four (4) breathing air manifolds
- Four (4) 30-minute rescue packs
- Five (5) work/Escape units
- Five (5) escape units
- One (1) filler hose for the work/escape/rescue units

Supplied air (airline or SCBA) respiratory protection against hydrogen sulfide exposure is required in the following situations:

- When routine or maintenance work tasks involve exposure to H<sub>2</sub>S concentrations of 10 ppm or greater.

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- When a fixed location area monitor alarms, and re-entry to the work area is required to complete a job.
- When confined spaces are to be entered without knowledge of H<sub>2</sub>S levels present, or if initial measurements are to be taken of H<sub>2</sub>S levels.
- During rescue of employees suspected of H<sub>2</sub>S overexposure.
- For specific tasks identified with significant exposure potential and outlined in local program guidelines.
- All respiratory equipment for hydrogen sulfide must be of the supplied-air type, equipped with pressure-demand regulators and operated in the pressure-demand mode only. This is the only type of respiratory protection recommended for hydrogen sulfide application. Equipment should be approved by NIOSH/MSHA or other recognized national authority as required. If airline units are used, a five-minute egress bottle should also be carried.
- Gas masks or other air-purifying respirators MUST NEVER BE USED FOR HYDROGEN SULFIDE due to the poor warning properties of the gas.
- Use of respiratory protection should be accompanied by a written respiratory protection program.

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Appendix A  
H<sub>2</sub>S SDS



Hydrogen sulfide

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SECTION 1: Identification

1.1. Product identifier

Product form

:

Substance

Name

:

Hydrogen sulfide

CAS No

:

7783-06-4

Formula

:

H<sub>2</sub>S

Other means of identification

:

Hydrogen sulfide

Product group

:

Core Products

1.2. Recommended use and restrictions on use

Recommended uses and restrictions

:

Industrial use  
Use as directed

1.3. Supplier

Praxair Canada Inc.

1200 – 1 City Centre Drive

Mississauga - Canada L5B 1M2

T 1-905-803-1600 - F 1-905-803-1682

[www.praxair.ca](http://www.praxair.ca)

1.4. Emergency telephone number

Emergency number

:

1-800-363-0042

Call emergency number 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product.

For routine information, contact your supplier or Praxair sales representative.

SECTION 2: Hazard identification

2.1. Classification of the substance or mixture

GHS-CA classification

Flam. Gas 1

H220

Liquefied gas

H280

Acute Tox. 2 (Inhalation: gas)

H330

STOT SE 3

H335

2.2. GHS Label elements, including precautionary statements

GHS-CA labelling

Hazard pictograms









GHS02

GHS04

GHS06

GHS07

Signal word

:

DANGER

Hazard statements

:

EXTREMELY FLAMMABLE GAS

CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED

FATAL IF INHALED

MAY CAUSE RESPIRATORY IRRITATION

MAY FORM EXPLOSIVE MIXTURES WITH AIR

SYMPTOMS MAY BE DELAYED

EXTENDED EXPOSURE TO GAS REDUCES THE ABILITY TO SMELL SULFIDES

Precautionary statements

:

Do not handle until all safety precautions have been read and understood

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking

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Do not breathe gas  
Use and store only outdoors or in a well-ventilated area  
Avoid release to the environment  
Wear protective gloves, protective clothing, eye protection, respiratory protection, and/or face protection  
Leaking gas fire: Do not extinguish, unless leak can be stopped safely  
In case of leakage, eliminate all ignition sources  
Store locked up  
Dispose of contents/container in accordance with container Supplier/owner instructions  
Protect from sunlight when ambient temperature exceeds 52°C (125°F)  
Close valve after each use and when empty  
Do not open valve until connected to equipment prepared for use  
When returning cylinder, install leak tight valve outlet cap or plug  
Do not depend on odour to detect the presence of gas

**2.3. Other hazards**

Other hazards not contributing to the classification : Contact with liquid may cause cold burns/frostbite.

**2.4. Unknown acute toxicity (GHS-CA)**

No data available

**SECTION 3: Composition/information on ingredients**

**3.1. Substances**

Name	CAS No.	% (Vol.)	Common Name (synonyms)
Hydrogen sulfide (Main constituent)	(CAS No) 7783-06-4	100	Hydrogen sulfide (H <sub>2</sub> S) / Hydrogen sulphide / Sulfur hydride / Sulfureted hydrogen / Dihydrogen sulphide / Hydrogensulfide

**3.2. Mixtures**

Not applicable

**SECTION 4: First-aid measures**

**4.1. Description of first aid measures**

First-aid measures after inhalation : Remove to fresh air and keep at rest in a position comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult, trained personnel should give oxygen. Call a physician.

First-aid measures after skin contact : The liquid may cause frostbite. For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). Water temperature should be tolerable to normal skin. Maintain skin warming for at least 15 minutes or until normal coloring and sensation have returned to the affected area. In case of massive exposure, remove clothing while showering with warm water. Seek medical evaluation and treatment as soon as possible.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Contact an ophthalmologist immediately.

First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

**4.2. Most important symptoms and effects (acute and delayed)**

No additional information available

**4.3. Immediate medical attention and special treatment, if necessary**

Other medical advice or treatment : Obtain medical assistance. Treat with corticosteroid spray as soon as possible after inhalation.

**SECTION 5: Fire-fighting measures**

**5.1. Suitable extinguishing media**

Suitable extinguishing media : Carbon dioxide, Dry chemical, Water spray or fog. Use extinguishing media appropriate for surrounding fire.

**5.2. Unsuitable extinguishing media**

No additional information available

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#### 5.3. Specific hazards arising from the hazardous product

Fire hazard	: <b>EXTREMELY FLAMMABLE GAS.</b> If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device.
Explosion hazard	: <b>EXTREMELY FLAMMABLE GAS.</b> Forms explosive mixtures with air and oxidizing agents.
Reactivity	: No reactivity hazard other than the effects described in sub-sections below.
Reactivity in case of fire	: No reactivity hazard other than the effects described in sub-sections below.

#### 5.4. Special protective equipment and precautions for fire-fighters

Firefighting instructions	: <b>DANGER! Toxic, flammable liquefied gas</b>  Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with their provincial and local fire code regulations.
Special protective equipment for fire fighters	: Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Other information	: Containers are equipped with a pressure relief device. (Exceptions may exist where authorized by TC.).

## SECTION 6: Accidental release measures

#### 6.1. Personal precautions, protective equipment and emergency procedures

General measures	: <b>DANGER! Toxic, flammable liquefied gas.</b> Forms explosive mixtures with air and oxidizing agents. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if safe to do so. Reduce vapors with fog or fine water spray, taking care not to spread liquid with water. Shut off flow if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device.
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#### 6.2. Methods and materials for containment and cleaning up

Methods for cleaning up	: Try to stop release. Reduce vapour with fog or fine water spray. Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.
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#### 6.3. Reference to other sections

For further information refer to section 8: Exposure controls/personal protection

## SECTION 7: Handling and storage

#### 7.1. Precautions for safe handling

Precautions for safe handling	: Leak-check system with soapy water; never use a flame  All piped systems and associated equipment must be grounded  Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment  Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g. wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.
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#### 7.2. Conditions for safe storage, including any incompatibilities

##### Storage conditions

: Store only where temperature will not exceed 125°F (52°C). Post "No Smoking/No Open Flames" signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g. NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16

**OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE:** When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

## SECTION 8: Exposure controls/personal protection

### 8.1. Control parameters

Hydrogen sulfide (7783-06-4)		
USA - ACGIH	ACGIH TLV-TWA (ppm)	1 ppm
USA - ACGIH	ACGIH TLV-STEL (ppm)	5 ppm
USA - OSHA	OSHA PEL (Ceiling) (ppm)	20 ppm
Canada (Quebec)	VECD (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
Canada (Quebec)	VECD (ppm)	15 ppm
Canada (Quebec)	VEMP (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
Canada (Quebec)	VEMP (ppm)	10 ppm
Alberta	OEL Ceiling (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
Alberta	OEL Ceiling (ppm)	15 ppm
Alberta	OEL TWA (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
Alberta	OEL TWA (ppm)	10 ppm
British Columbia	OEL Ceiling (ppm)	10 ppm
Manitoba	OEL STEL (ppm)	5 ppm
Manitoba	OEL TWA (ppm)	1 ppm
New Brunswick	OEL STEL (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
New Brunswick	OEL STEL (ppm)	15 ppm
New Brunswick	OEL TWA (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
New Brunswick	OEL TWA (ppm)	10 ppm
Newfoundland & Labrador	OEL STEL (ppm)	5 ppm
Newfoundland & Labrador	OEL TWA (ppm)	1 ppm
Nova Scotia	OEL STEL (ppm)	5 ppm
Nova Scotia	OEL TWA (ppm)	1 ppm
Nunavut	OEL Ceiling (mg/m <sup>3</sup> )	28 mg/m <sup>3</sup>
Nunavut	OEL Ceiling (ppm)	20 ppm
Nunavut	OEL STEL (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
Nunavut	OEL STEL (ppm)	15 ppm
Nunavut	OEL TWA (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
Nunavut	OEL TWA (ppm)	10 ppm
Northwest Territories	OEL STEL (ppm)	15 ppm

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## Hydrogen sulfide

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according to the Hazardous Products Regulation (February 11, 2015)

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Supersedes: 10-15-2013

Hydrogen sulfide (7783-06-4)		
Northwest Territories	OEL TWA (ppm)	10 ppm
Ontario	OEL STEL (ppm)	15 ppm
Ontario	OEL TWA (ppm)	10 ppm
Prince Edward Island	OEL STEL (ppm)	5 ppm
Prince Edward Island	OEL TWA (ppm)	1 ppm
Québec	VECD (mg/m <sup>3</sup> )	21 mg/m <sup>3</sup>
Québec	VECD (ppm)	15 ppm
Québec	VEMP (mg/m <sup>3</sup> )	14 mg/m <sup>3</sup>
Québec	VEMP (ppm)	10 ppm
Saskatchewan	OEL STEL (ppm)	15 ppm
Saskatchewan	OEL TWA (ppm)	10 ppm
Yukon	OEL STEL (mg/m <sup>3</sup> )	27 mg/m <sup>3</sup>
Yukon	OEL STEL (ppm)	15 ppm
Yukon	OEL TWA (mg/m <sup>3</sup> )	15 mg/m <sup>3</sup>
Yukon	OEL TWA (ppm)	10 ppm

#### 8.2. Appropriate engineering controls

Appropriate engineering controls

: Use corrosion-resistant equipment. Use an explosion-proof local exhaust system. Local exhaust and general ventilation must be adequate to meet exposure standards. MECHANICAL (GENERAL): **Inadequate - Use only in a closed system.** Use explosion proof equipment and lighting.

#### 8.3. Individual protection measures/Personal protective equipment

Personal protective equipment

: Safety glasses. Face shield. Gloves.



Hand protection

: Wear work gloves when handling containers. Wear heavy rubber gloves where contact with product may occur.

Eye protection

: Wear goggles and a face shield when transfilling or breaking transfer connections. Select in accordance with the current CSA standard Z94.3, "Industrial Eye and Face Protection", and any provincial regulations, local bylaws or guidelines.

Respiratory protection

: **Respiratory protection:** Use respirable fume respirator or air supplied respirator when working in confined space or where local exhaust or ventilation does not keep exposure below TLV. Select in accordance with provincial regulations, local bylaws or guidelines. Selection should be based on the current CSA standard Z94.4, "Selection, Care, and Use of Respirators." Respirators should also be approved by NIOSH and MSHA. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).

Thermal hazard protection

: Wear cold insulating gloves when transfilling or breaking transfer connections. Standard EN 511 - Cold insulating gloves.

Other information

: **Other protection:** Safety shoes for general handling at customer sites. Metatarsal shoes and cuffless trousers for cylinder handling at packaging and filling plants. Select in accordance with the current CSA standard Z195, "Protective Foot Wear", and any provincial regulations, local bylaws or guidelines. For working with flammable and oxidizing materials, consider the use of flame resistant anti-static safety clothing.

## SECTION 9: Physical and chemical properties

### 9.1. Information on basic physical and chemical properties

Physical state	: Gas
Appearance	: Colorless gas. Colorless liquid at low temperature or under high pressure.
Molecular mass	: 34 g/mol
Colour	: Colourless.
Odour	: Odour can persist. Poor warning properties at low concentrations. Rotten eggs.
Odour threshold	: Odour threshold is subjective and inadequate to warn of overexposure.

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pH	: Not applicable.
pH solution	: No data available
Relative evaporation rate (butylacetate=1)	: No data available
Relative evaporation rate (ether=1)	: Not applicable.
Melting point	: -86 °C
Freezing point	: -82.9 °C
Boiling point	: -60.3 °C
Flash point	: Not applicable.
Critical temperature	: 100.4 °C
Auto-ignition temperature	: 260 °C
Decomposition temperature	: No data available
Vapour pressure	: 1880 kPa
Vapour pressure at 50 °C	: No data available
Critical pressure	: 8940 kPa
Relative vapour density at 20 °C	: >=1
Relative density	: No data available
Relative density of saturated gas/air mixture	: No data available
Density	: No data available
Relative gas density	: 1.2
Solubility	: Water: 3980 mg/l
Log Pow	: Not applicable.
Log Kow	: Not applicable.
Viscosity, kinematic	: Not applicable.
Viscosity, dynamic	: Not applicable.
Viscosity, kinematic (calculated value) (40 °C)	: No data available
Explosive properties	: Not applicable.
Oxidizing properties	: None.
Flammability (solid, gas)	: 4,3 - 46 vol %

#### 9.2. Other information

Gas group	: Liquefied gas
Additional information	: Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level

## SECTION 10: Stability and reactivity

### 10.1. Reactivity

Reactivity	: No reactivity hazard other than the effects described in sub-sections below.
Chemical stability	: Stable under normal conditions.
Possibility of hazardous reactions	: May react violently with oxidants. Can form explosive mixture with air.
Conditions to avoid	: Avoid moisture in installation systems. Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Incompatible materials	: Ammonia. Bases. Bromine pentafluoride. Chlorine trifluoride. chromium trioxide. (and heat). Copper. (powdered). Fluorine. Lead. Lead oxide. Mercury. Nitric acid. Nitrogen trifluoride. nitrogen sulfide. Organic compounds. Oxidizing agents. Oxygen difluoride. Rubber. Sodium. (and moisture). Water.
Hazardous decomposition products	: Thermal decomposition may produce : Sulfur. Hydrogen.

## SECTION 11: Toxicological information

### 11.1. Information on toxicological effects

Acute toxicity (oral)	: Not classified
Acute toxicity (dermal)	: Not classified

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Acute toxicity (inhalation) : Inhalation:gas: FATAL IF INHALED.

Hydrogen sulfide ( 1f )7783-06-4	
LC50 inhalation rat (mg/l)	0.99 mg/l (Exposure time: 1 h)
LC50 inhalation rat (ppm)	356 ppm/4h
ATE CA (gases)	356.00000000 ppmv/4h
ATE CA (vapours)	0.99000000 mg/l/4h
ATE CA (dust,mist)	0.99000000 mg/l/4h

Skin corrosion/irritation : Not classified  
pH: Not applicable.

Serious eye damage/irritation : Not classified  
pH: Not applicable.

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : MAY CAUSE RESPIRATORY IRRITATION.

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

## SECTION 12: Ecological information

### 12.1. Toxicity

Ecology - general : VERY TOXIC TO AQUATIC LIFE.

Hydrogen sulfide (7783-06-4)	
LC50 fish 1	0.0448 mg/l (Exposure time: 96 h - Species: Lepomis macrochirus [flow-through])
LC50 fish 2	0.016 mg/l (Exposure time: 96 h - Species: Pimephales promelas [flow-through])

### 12.2. Persistence and degradability

Hydrogen sulfide (7783-06-4)	
Persistence and degradability	Not applicable for inorganic gases.

### 12.3. Bioaccumulative potential

Hydrogen sulfide (7783-06-4)	
BCF fish 1	(no bioaccumulation expected)
Log Pow	Not applicable.
Log Kow	Not applicable.
Bioaccumulative potential	No data available.

### 12.4. Mobility in soil

Hydrogen sulfide (7783-06-4)	
Mobility in soil	No data available.
Log Pow	Not applicable.
Log Kow	Not applicable.
Ecology - soil	Because of its high volatility, the product is unlikely to cause ground or water pollution.

### 12.5. Other adverse effects

Other adverse effects : May cause pH changes in aqueous ecological systems.

Effect on the ozone layer : None

Effect on global warming : No known effects from this product

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#### SECTION 13: Disposal considerations

##### 13.1. Disposal methods

Waste disposal recommendations : Do not attempt to dispose of residual or unused quantities. Return container to supplier.

#### SECTION 14: Transport information

##### 14.1. Basic shipping description

In accordance with TDG

##### TDG

UN-No. (TDG) : UN1053  
TDG Primary Hazard Classes : 2.3 - Class 2.3 - Toxic Gas.  
TDG Subsidiary Classes : 2.1  
Proper shipping name : HYDROGEN SULPHIDE

ERAP Index : 500  
Explosive Limit and Limited Quantity Index : 0  
Passenger Carrying Ship Index : Forbidden  
Passenger Carrying Road Vehicle or Passenger Carrying Railway Vehicle Index : Forbidden

##### 14.3. Air and sea transport

##### IMDG

UN-No. (IMDG) : 1053  
Proper Shipping Name (IMDG) : HYDROGEN SULPHIDE  
Class (IMDG) : 2 - Gases  
MFAG-No : 117

##### IATA

UN-No. (IATA) : 1053  
Proper Shipping Name (IATA) : Hydrogen sulphide  
Class (IATA) : 2

#### SECTION 15: Regulatory information

##### 15.1. National regulations

##### Hydrogen sulfide (7783-06-4)

Listed on the Canadian DSL (Domestic Substances List)

##### 15.2. International regulations

##### Hydrogen sulfide (7783-06-4)

Listed on the AICS (Australian Inventory of Chemical Substances)  
Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)  
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)  
Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory  
Listed on the Korean ECL (Existing Chemicals List)  
Listed on NZIoC (New Zealand Inventory of Chemicals)  
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)  
Listed on the United States TSCA (Toxic Substances Control Act) inventory  
Listed on INSQ (Mexican national Inventory of Chemical Substances)

#### SECTION 16: Other information

Date of issue : 15/10/1979  
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##### Indication of changes:

Training advice : Users of breathing apparatus must be trained. Ensure operators understand the toxicity hazard. Ensure operators understand the flammability hazard.

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#### Other information

: When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product.

Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair Canada Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair Canada Inc., it is the user's obligation to determine the conditions of safe use of the product. Praxair Canada Inc. SDSs are furnished on sale or delivery by Praxair Canada Inc., or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from [www.praxair.ca](http://www.praxair.ca). If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write Praxair Canada Inc. (Phone: 1-888-257-5149; Address: Praxair Canada Inc, 1 City Centre Drive, Suite 1200, Mississauga, Ontario, L5B 1M2).

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#### NFPA health hazard

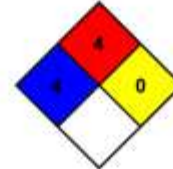
: 4 - Very short exposure could cause death or serious residual injury even though prompt medical attention was given.

#### NFPA fire hazard

: 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.

#### NFPA reactivity

: 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



#### HMIS III Rating

##### Health

: 2 Moderate Hazard - Temporary or minor injury may occur

##### Flammability

: 4 Severe Hazard - Flammable gases, or very volatile flammable liquids with flash points below 73 F, and boiling points below 100 F. Materials may ignite spontaneously with air. (Class IA)

##### Physical

: 2 Moderate Hazard - Materials that are unstable and may undergo violent chemical changes at normal temperature and pressure with low risk for explosion. Materials may react violently with water or form peroxides upon exposure to air.

#### SDS Canada (GHS) - Praxair

*This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.*

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Appendix B  
SO<sub>2</sub> SDS



## Safety Data Sheet

Material Name: SULFUR DIOXIDE

SDS ID: MAT22290

### Section 1 - PRODUCT AND COMPANY IDENTIFICATION

**Material Name**

SULFUR DIOXIDE

**Synonyms**

MTG MSDS 80; SULFUROUS ACID ANHYDRIDE; SULFUROUS OXIDE; SULPHUR DIOXIDE;  
SULFUROUS ANHYDRIDE; FERMENTICIDE LIQUID; SULFUR DIOXIDE(SO<sub>2</sub>); SULFUR OXIDE;  
SULFUR OXIDE(SO<sub>2</sub>)

**Chemical Family**

inorganic, gas

**Product Description**

Classification determined in accordance with Compressed Gas Association standards.

**Product Use**

Industrial and Specialty Gas Applications.

**Restrictions on Use**

None known.

**Details of the supplier of the safety data sheet**

MATHESON TRI-GAS, INC.  
3 Mountainview Road  
Warren, NJ 07059  
General Information: 1-800-416-2505  
Emergency #: 1-800-424-9300 (CHEMTREC)  
Outside the US: 703-527-3887 (Call collect)

### Section 2 - HAZARDS IDENTIFICATION

**Classification in accordance with paragraph (d) of 29 CFR 1910.1200.**

Gases Under Pressure - Liquefied gas  
Acute Toxicity - Inhalation - Gas - Category 3  
Skin Corrosion/Irritation - Category 1B  
Serious Eye Damage/Eye Irritation - Category 1  
Simple Asphyxiant

**GHS Label Elements**

**Symbol(s)**



**Signal Word**

Danger

**Hazard Statement(s)**

Contains gas under pressure; may explode if heated.  
Toxic if inhaled.  
Causes severe skin burns and eye damage.  
May displace oxygen and cause rapid suffocation.

**Precautionary Statement(s)**

**Prevention**

Use only outdoors or in a well-ventilated area.  
Wear protective gloves/protective clothing/eye protection/face protection.



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## Safety Data Sheet

**Material Name: SULFUR DIOXIDE**

**SDS ID: MAT22290**

Wash thoroughly after handling.

Do not breathe dusts or mists.

**Response**

IF INHALED: Remove person to fresh air and keep comfortable for breathing.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.

Continue rinsing.

IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower.

Wash contaminated clothing before reuse.

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

Immediately call a POISON CENTER or doctor.

Specific treatment (see label).

**Storage**

Store in a well-ventilated place. Keep container tightly closed.

Store locked up.

Protect from sunlight.

**Disposal**

Dispose of contents/container in accordance with local/regional/national/international regulations.

**Other Hazards**

Contact with liquified gas may cause frostbite.

### Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

CAS	Component Name	Percent
7446-09-5	Sulfur dioxide	100.0

### Section 4 - FIRST AID MEASURES

**Inhalation**

IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing. Get immediate medical attention.

**Skin**

IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115°F; 41-46°C). If warm water is not available, gently wrap affected parts in blankets. DO NOT induce vomiting. Get immediate medical attention.

**Eyes**

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.

Continue rinsing. Get immediate medical attention.

**Ingestion**

IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Get immediate medical attention.

**Most Important Symptoms/Effects**

**Acute**

Toxic if inhaled, frostbite, suffocation, respiratory tract burns, skin burns, eye burns

**Delayed**

No information on significant adverse effects.

**Indication of any immediate medical attention and special treatment needed**

Treat symptomatically and supportively.

**Note to Physicians**

For inhalation, consider oxygen.

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## Safety Data Sheet

Material Name: SULFUR DIOXIDE

SDS ID: MAT22290

### Section 5 - FIRE FIGHTING MEASURES

#### Extinguishing Media

#### Suitable Extinguishing Media

carbon dioxide, regular dry chemical, Large fires: Use regular foam or flood with fine water spray.

#### Unsuitable Extinguishing Media

None known.

#### Special Hazards Arising from the Chemical

Negligible fire hazard.

#### Hazardous Combustion Products

sulfur oxides

#### Fire Fighting Measures

Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. Keep unnecessary people away, isolate hazard area and deny entry.

#### Special Protective Equipment and Precautions for Firefighters

Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.

### Section 6 - ACCIDENTAL RELEASE MEASURES

#### Personal Precautions, Protective Equipment and Emergency Procedures

Wear personal protective clothing and equipment, see Section 8.

#### Methods and Materials for Containment and Cleaning Up

Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas.

Ventilate closed spaces before entering. Evacuation radius: 150 feet. Stop leak if possible without personal risk.

Reduce vapors with water spray. Do not get water directly on material.

#### Environmental Precautions

Avoid release to the environment.

### Section 7 - HANDLING AND STORAGE

#### Precautions for Safe Handling

Do not get in eyes, on skin, or on clothing. Do not breathe gas, fumes, vapor, or spray. Wash hands thoroughly after handling. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. Contaminated work clothing should not be allowed out of the workplace. Do not eat, drink or smoke when using this product. Keep only in original container. Avoid release to the environment.

#### Conditions for Safe Storage, Including any Incompatibilities

Store in a well-ventilated place. Keep container tightly closed.

Store locked up.

Protect from sunlight.

Store and handle in accordance with all current regulations and standards. Protect from physical damage. Store outside or in a detached building. Keep separated from incompatible substances.

#### Incompatible Materials

bases, combustible materials, halogens, metal carbide, metal oxides, metals, oxidizing materials, peroxides, reducing agents

### Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

#### Component Exposure Limits

Sulfur dioxide	7446-09-5
ACGIH:	0.25 ppm STEL

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## Safety Data Sheet

**Material Name: SULFUR DIOXIDE**

**SDS ID: MAT22290**

NIOSH:	2 ppm TWA ; 5 mg/m <sup>3</sup> TWA
	5 ppm STEL ; 13 mg/m <sup>3</sup> STEL
	100 ppm IDLH
OSHA (US):	5 ppm TWA ; 13 mg/m <sup>3</sup> TWA
Mexico:	0.25 ppm STEL [PPT-CT ]

### ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)

There are no biological limit values for any of this product's components.

### Engineering Controls

Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

### Individual Protection Measures, such as Personal Protective Equipment

#### Eye/face protection

Wear splash resistant safety goggles with a faceshield. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

#### Skin Protection

Wear appropriate chemical resistant clothing. Wear chemical resistant clothing to prevent skin contact.

#### Respiratory Protection

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

#### Glove Recommendations

Wear appropriate chemical resistant gloves.

## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance	colorless gas	Physical State	gas
Odor	irritating odor	Color	colorless
Odor Threshold	3 - 5 ppm	pH	(Acidic in solution )
Melting Point	-73 °C (-99 °F )	Boiling Point	-10 °C (14 °F )
Boiling Point Range	Not available	Freezing point	Not available
Evaporation Rate	>1 (Butyl acetate = 1 )	Flammability (solid, gas)	Not available
Autoignition Temperature	Not available	Flash Point	(Not flammable )
Lower Explosive Limit	Not available	Decomposition temperature	Not available
Upper Explosive Limit	Not available	Vapor Pressure	2432 mmHg @ 20 °C
Vapor Density (air=1)	2.26	Specific Gravity (water=1)	1.462 at -10 °C

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## Safety Data Sheet

Material Name: SULFUR DIOXIDE

SDS ID: MAT22290

Water Solubility	22.8 % (@ 0 °C )	Partition coefficient: n-octanol/water	Not available
Viscosity	Not available	Kinematic viscosity	Not available
Solubility (Other)	Not available	Density	Not available
Physical Form	liquified gas	Molecular Formula	S-O <sub>2</sub>
Molecular Weight	64.06		

**Solvent Solubility****Soluble**

alcohol, acetic acid, sulfuric acid, ether, chloroform, Benzene, sulfuryl chloride, nitrobenzenes, Toluene, acetone

### Section 10 - STABILITY AND REACTIVITY

**Reactivity**

No reactivity hazard is expected.

**Chemical Stability**

Stable at normal temperatures and pressure.

**Possibility of Hazardous Reactions**

Will not polymerize.

**Conditions to Avoid**

Minimize contact with material. Containers may rupture or explode if exposed to heat.

**Incompatible Materials**

bases, combustible materials, halogens, metal carbide, metal oxides, metals, oxidizing materials, peroxides, reducing agents

**Hazardous decomposition products**

oxides of sulfur

### Section 11 - TOXICOLOGICAL INFORMATION

**Information on Likely Routes of Exposure****Inhalation**

Toxic if inhaled. Causes damage to respiratory system, burns, difficulty breathing

**Skin Contact**

skin burns

**Eye Contact**

eye burns

**Ingestion**

burns, nausea, vomiting, diarrhea, stomach pain

**Acute and Chronic Toxicity****Component Analysis - LD50/LC50**

The components of this material have been reviewed in various sources and the following selected endpoints are published:

**Sulfur dioxide (7446-09-5)**

Inhalation LC50 Rat 965 - 1168 ppm 4 h

**Product Toxicity Data****Acute Toxicity Estimate**

No data available.

**Immediate Effects**

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## Safety Data Sheet

**Material Name: SULFUR DIOXIDE**

**SDS ID: MAT22290**

Toxic if inhaled, frostbite, suffocation, respiratory tract burns, skin burns, eye burns

**Delayed Effects**

No information on significant adverse effects.

**Irritation/Corrosivity Data**

respiratory tract burns, skin burns, eye burns

**Respiratory Sensitization**

No data available.

**Dermal Sensitization**

No data available.

**Component Carcinogenicity**

Sulfur dioxide	7446-09-5
ACGIH:	A4 - Not Classifiable as a Human Carcinogen
IARC:	Monograph 54 [1992] (Group 3 (not classifiable))

**Germ Cell Mutagenicity**

No data available.

**Tumorigenic Data**

No data available

**Reproductive Toxicity**

No data available.

**Specific Target Organ Toxicity - Single Exposure**

No target organs identified.

**Specific Target Organ Toxicity - Repeated Exposure**

No target organs identified.

**Aspiration hazard**

Not applicable.

**Medical Conditions Aggravated by Exposure**

respiratory disorders

### Section 12 - ECOLOGICAL INFORMATION

**Component Analysis - Aquatic Toxicity**

No LOLI ecotoxicity data are available for this product's components.

**Persistence and Degradability**

No data available.

**Bioaccumulative Potential**

No data available.

**Mobility**

No data available.

### Section 13 - DISPOSAL CONSIDERATIONS

**Disposal Methods**

Dispose of contents/container in accordance with local/regional/national/international regulations.

**Component Waste Numbers**

The U.S. EPA has not published waste numbers for this product's components.

### Section 14 - TRANSPORT INFORMATION

**US DOT Information:**

Shipping Name: SULFUR DIOXIDE

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**MATHESON**

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**Safety Data Sheet****Material Name: SULFUR DIOXIDE****SDS ID: MAT22290****Hazard Class:** 2.3**UN/NA #:** UN1079**Required Label(s):** 2.3**IMDG Information:****Shipping Name:** SULPHUR DIOXIDE**Hazard Class:** 2.3**UN#:** UN1079**Required Label(s):** 2.3**TDG Information:****Shipping Name:** SULFUR DIOXIDE**Hazard Class:** 2.3**UN#:** UN1079**Required Label(s):** 2.3**International Bulk Chemical Code**

This material does not contain any chemicals required by the IBC Code to be identified as dangerous chemicals in bulk.

**Section 15 - REGULATORY INFORMATION****U.S. Federal Regulations**

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), and/or require an OSHA process safety plan.

<b>Sulfur dioxide</b>	<b>7446-09-5</b>
<b>SARA 302:</b>	500 lb TPQ
<b>OSHA (safety):</b>	1000 lb TQ (Liquid )
<b>SARA 304:</b>	500 lb EPCRA RQ

**SARA Section 311/312 (40 CFR 370 Subparts B and C) reporting categories**

Gas Under Pressure; Acute toxicity; Skin Corrosion/Irritation; Serious Eye Damage/Eye Irritation; Simple Asphyxiant

**U.S. State Regulations**

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA
<b>Sulfur dioxide</b>	<b>7446-09-5</b>	Yes	Yes	Yes	Yes	Yes

**California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)****WARNING**This product can expose you to chemicals including Sulfur dioxide , which is known to the State of California to cause birth defects or other reproductive harm. For more information go to [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).



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**Safety Data Sheet****Material Name: SULFUR DIOXIDE****SDS ID: MAT22290**

Sulfur dioxide	7446-09-5
Repro/Dev. Tox	developmental toxicity , 7/29/2011

**Component Analysis - Inventory****Sulfur dioxide (7446-09-5)**

US	CA	AU	CN	EU	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2
Yes	DSL	Yes	Yes	EIN	Yes	Yes	Yes	No

KR - REACH CCA	MX	NZ	PH	TH-TECI	TW, CN	VN (Draft)
No	Yes	Yes	Yes	Yes	Yes	Yes

**Section 16 - OTHER INFORMATION****NFPA Ratings**

Health: 3 Fire: 0 Instability: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

**Summary of Changes**

SDS update: 02/10/2016

**Key / Legend**

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CA/MA/MN/NJ/PA - California/Massachusetts/Minnesota/New Jersey/Pennsylvania\*; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CFR - Code of Federal Regulations (US); CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EC - European Commission; EEC - European Economic Community; EIN - European Inventory of (Existing Commercial Chemical Substances); EINECS - European Inventory of Existing Commercial Chemical Substances; ENCS - Japan Existing and New Chemical Substance Inventory; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; F - Background (for Venezuela Biological Exposure Indices); IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; ISHL - Japan Industrial Safety and Health Law; IUCLID - International Uniform Chemical Information Database; JP - Japan; Kow - Octanol/water partition coefficient; KR KECI Annex 1 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR KECI Annex 2 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR - Korea; LD50/LC50 - Lethal Dose/ Lethal Concentration; KR REACH CCA - Korea Registration and Evaluation of Chemical Substances Chemical Control Act; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of Lists™ - ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; MX - Mexico; Ne- Non-specific; NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; Nq - Non-quantitative; NSL - Non-Domestic Substance List (Canada); NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PEL - Permissible Exposure Limit; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH - Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; Se - Semi-quantitative; STEL - Short-term Exposure Limit;



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