05/24/2019

west virginia department of environmental protection

Office of Oil and Gas
601 57th Street, S.E.
Charleston, WV 25304
(304) 926-0450
fax: (304) 926-0452

Austin Caperton, Cabinet Secretary
www.dep.wv.gov

Tuesday, May 21, 2019
PERMIT MODIFICATION APPROVAL
Horizontal 6A / New Drill

TUG HILL OPERATING, LLC
380 SOUTHPOINTE BLVD
CANONSBURG, PA 15317

Re: Permit Modification Approval for GOUDY 1S-4HM
47-051-02050-00-00

Extending bottom hole location from 12136' to 17232'. Update to lease information.

TUG HILL OPERATING, LLC

The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

If there are any questions, please feel free to contact me at (304) 926- 0450.

James A. Martin
Chief

Operator's Well Number: GOUDY 1S-4HM
Farm Name: PPG INDUSTRIES, INC.
U.S. WELL NUMBER: 47-051-02050-00-00
Horizontal 6A New Drill
Date Modification Issued: 05/21/2019

WW-6B
(04/15)

API NO. 47- 051 - 02050 05/24/2019
OPERATOR WELL NO. Goudy 1S-4HM
Well Pad Name: Goudy

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS
WELL WORK PERMIT APPLICATION

1) Well Operator:	Tug Hill Operating, LLC	494510851	Marshall	Franklin	New Martinsville
		Operator ID	County	District	Quadrangle

2) Operator's Well Number: Goudy 1S-4HM Well Pad Name: Goudy

3) Farm Name/Surface Owner: TH Exploration III, LLC Public Road Access: Wells Hill Road (County Route 2/2)

4) Elevation, current ground: 1242' Elevation, proposed post-construction: 1242'

5) Well Type (a) Gas X Oil _____ Underground Storage _____
Other _____
(b)If Gas Shallow x Deep _____
Horizontal X

3/27/19

6) Existing Pad: Yes or No Yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Expected Pressure(s):
Marcellus is the target formation at a depth of 6382 - 6440' thickness of 58' and anticipated pressure of approx. 3800 psi

8) Proposed Total Vertical Depth: 6,540'

9) Formation at Total Vertical Depth: Onondaga

10) Proposed Total Measured Depth: 17,232'

11) Proposed Horizontal Leg Length: 10,042.19'

12) Approximate Fresh Water Strata Depths: 70', 862'

13) Method to Determine Fresh Water Depths: Use shallow offset wells to determine deepest freshwater. Or determine using predrill tests, testing while drilling or petrophysical evaluation of resistivity.

14) Approximate Saltwater Depths: 2,167'

15) Approximate Coal Seam Depths: Sewickly Coal - 761' and Pittsburgh Coal - 856'

16) Approximate Depth to Possible Void (coal mine, karst, other): None anticipated

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes _____ No X

(a) If Yes, provide Mine Info: Name: _____
Depth: _____
Seam: _____
Owner: _____

API NO. 47- 051 - 02050 05/24/2019
OPERATOR WELL NO. Goudy 1S-4HM
Well Pad Name: Goudy

18) **CASING AND TUBING PROGRAM**

TYPE	Size (in)	New or Used	Grade	Weight per ft. (lb/ft)	FOOTAGE: For Drilling (ft)	INTERVALS: Left in Well (ft)	CEMENT: Fill-up (Cu. Ft.)/CTS
Conductor	30"	NEW	BW	BW	120'	120'	259FT^3(CTS)
Fresh Water	13 3/8"	NEW	H40	48#	970'	970'	1024ft^3(CTS)
Coal	13 3/8"	NEW	H40	48#	970'	970'	1024ft^3(CTS)
Intermediate	9 5/8"	NEW	J55	36#	2,653'	2,653'	879ft^3(CTS)
Production	5 1/2"	NEW	P110	20#	17,232'	17,232'	4401ft^3(CTS)
Tubing	2 3/8"	NEW	N80	4.7#		7,067'	
Liners							

3/27/19

TYPE	Size (in)	Wellbore Diameter (in)	Wall Thickness (in)	Burst Pressure (psi)	Anticipated Max. Internal Pressure (psi)	Cement Type	Cement Yield (cu. ft./k)
Conductor	30"	36"	1.0	2,333	1,866	CLASS A	1.2
Fresh Water	13 3/8"	17 1/2"	.33	1,730	1,384	SEE #24	1.2
Coal	13 3/8"	17 1/2"	.33	1,730	1,384	SEE#24	1.2
Intermediate	9 5/8"	12 1/4"	.352	3,520	2,816	SEE#24	1.19
Production	5 1/2"	8 7/8_8 3/4	.361	12,640	9,000	SEE#24	1.17/1.19
Tubing	2 3/8"		.19	11,200	8,960		
Liners							

PACKERS

Kind:	N/A			
Sizes:	N/A			
Depths Set:	N/A			

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WW-6B
(10/14)

API NO. 47- 051 - 02050 05/24/2019
OPERATOR WELL NO. Goudy 1S-4HM
Well Pad Name: Goudy

3/27/19

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill through the Marcellus and TD Pilot Hole 100' into the Onondaga. Log vertical section and run a solid cement plug back to proposed KOP. Drill curve and lateral per proposed well plan, run and cement production casing. Perform CBL from 60 deg to surface, make cleanout run, and stimulate.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Well to be completed with approximately 25,100,000 lb. proppant and 388,064 bbl of water. Max rate = 80 bpm; max psi = 9,000#.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 11.56 acres

22) Area to be disturbed for well pad only, less access road (acres): 5.81 acres

23) Describe centralizer placement for each casing string:

Will run 3 centralizers on surface casing at equal distance. Intermediate will have 1 centralizer every other joint. Production casing will have one centralizer every other joint in lateral, one centralizer every joint through curve, one centralizer every other joint to surface.

24) Describe all cement additives associated with each cement type:

*See Attachment

25) Proposed borehole conditioning procedures:

Will circulate a minimum of 3 hours at TD, short trip to curve, circulate bottoms up, check for flow, POOH

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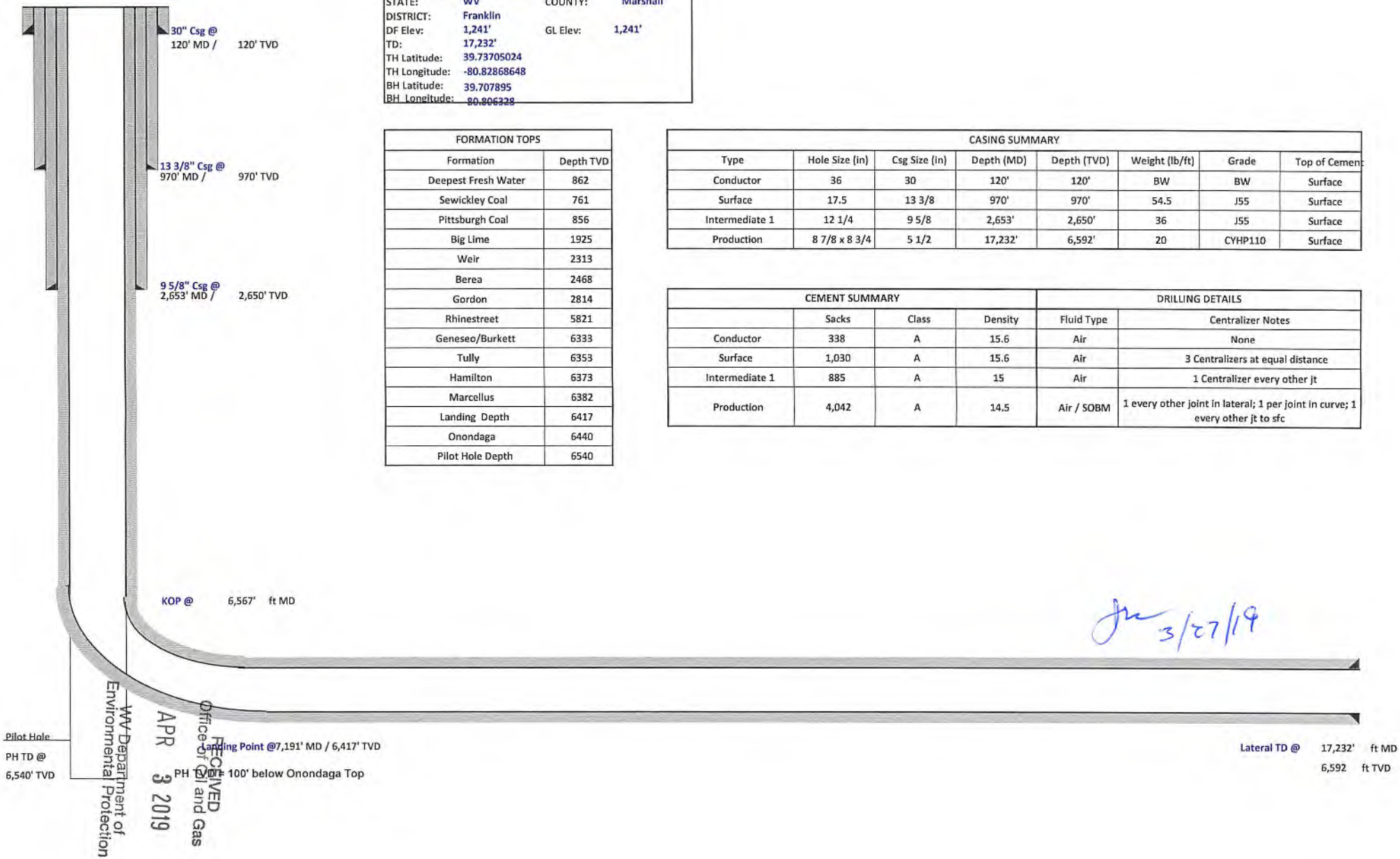
*Note: Attach additional sheets as needed.

TUG HILL OPERATING

WELL NAME:	Goudy 1S-4HM		
STATE:	WV	COUNTY:	Marshall
DISTRICT:	Franklin		
DF Elev:	1,241'	GL Elev:	1,241'
TD:	17,232'		
TH Latitude:	39.73705024		
TH Longitude:	-80.82868648		
BH Latitude:	39.707895		
BH Longitude:	-80.806328		



FORMATION TOPS	
Formation	Depth TVD
Deepest Fresh Water	862
Sewickley Coal	761
Pittsburgh Coal	856
Big Lime	1925
Weir	2313
Berea	2468
Gordon	2814
Rhinestreet	5821
Geneseo/Burkett	6333
Tully	6353
Hamilton	6373
Marcellus	6382
Landing Depth	6417
Onondaga	6440
Pilot Hole Depth	6540

CASING SUMMARY							
Type	Hole Size (in)	Csg Size (in)	Depth (MD)	Depth (TVD)	Weight (lb/ft)	Grade	Top of Cement
Conductor	36	30	120'	120'	BW	BW	Surface
Surface	17.5	13 3/8	970'	970'	54.5	J55	Surface
Intermediate 1	12 1/4	9 5/8	2,653'	2,650'	36	J55	Surface
Production	8 7/8 x 8 3/4	5 1/2	17,232'	6,592'	20	CYHP110	Surface

CEMENT SUMMARY				DRILLING DETAILS	
	Sacks	Class	Density	Fluid Type	Centralizer Notes
Conductor	338	A	15.6	Air	None
Surface	1,030	A	15.6	Air	3 Centralizers at equal distance
Intermediate 1	885	A	15	Air	1 Centralizer every other jt
Production	4,042	A	14.5	Air / SOBM	1 every other joint in lateral; 1 per joint in curve; 1 every other jt to sfc

3/27/19

TUG HILL OPERATING

Tug Hill Operating, LLC Casing and Cement Program

Goudy 1S-4HM

Casing

	String	Grade	Bit Size	Depth (Measured)	Cement Fill Up
Conductor	30"	BW	36"	120'	CTS
Surface	13 3/8"	J55	17 1/2"	970'	CTS
Intermediate	9 5/8"	J55	12 1/4"	2,653'	CTS
Production	5 1/2"	CYHP110	8 7/8 x 8 3/4	17,232'	CTS

Cement

Conductor:	Premium NE-1 + 2% bwoc CaC12 + 46.5% Fresh Water – Conductor Cement mixed at 15.6 ppg, Y=1.2
Surface:	Premium NE-1 + 2% bwoc CaC12 + 46.5% Fresh Water – Surface Cement mixed at 15.6 ppg, Y=1.2
Intermediate:	Premium NE-1 + 1% bwoc CaC12 + 46.5% Fresh Water – Intermediate Cement mixed at 15.6 ppg, Y=1.19
Kick Off Plug:	Class H Cement + 1% CD-32 + .7% Sodium Metasilicate + .1% R-3 + .75 gal/100sk FP-13L - KOP Plug
Production:	50:50 Poz: Premium NE-1 + .1% bwoc ASA-301 + 60lb/sk ASCA-1 + .35% bwoc BA-10A + .25% bwoc MPA-170, 44 lb sack + .5% bwoc R-3 + .75 gals/100sk FP-13L – Production Cement mixed at 15.2ppg, Y = 1.19

TUG HILL OPERATING

Well: Goudy 1S-04HM (K)
Site: Goudy
Project: Marshall County, West Virginia.
Design: rev3

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	Dleg	TFace	VSect	Annotation
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	KOP Begin 1°/100' build
3	800.00	3.00	95.00	799.86	-0.68	7.82	1.00	95.00	4.59	Begin 3.00° tangent
4	2702.74	3.00	95.00	2700.00	-9.36	107.03	0.00	0.00	62.77	Begin 3°/100' build
5	2902.74	9.00	95.00	2898.81	-11.18	127.84	3.00	0.00	74.98	Begin 3°/100' build/turn
6	3805.06	31.29	150.16	3745.77	-224.57	318.27	3.00	69.51	355.73	Begin 31.29° tangent
7	6567.35	31.29	150.16	6106.35	-1468.96	1031.99	0.00	0.00	1790.10	Begin 8°/100' build/turn
8	6801.26	50.00	150.08	6283.04	-1600.49	1107.57	8.00	-0.20	1941.77	Begin 10°/100' build/turn
9	7191.27	89.00	149.98	6417.00	-1910.87	1286.58	10.00	-0.15	2300.04	Begin 89.00° lateral
10	17231.58	89.00	149.98	6592.00	-10603.30	6308.40	0.00	0.00	12337.99	PBHL/TD 17231.58 MD/6592.00 TVD

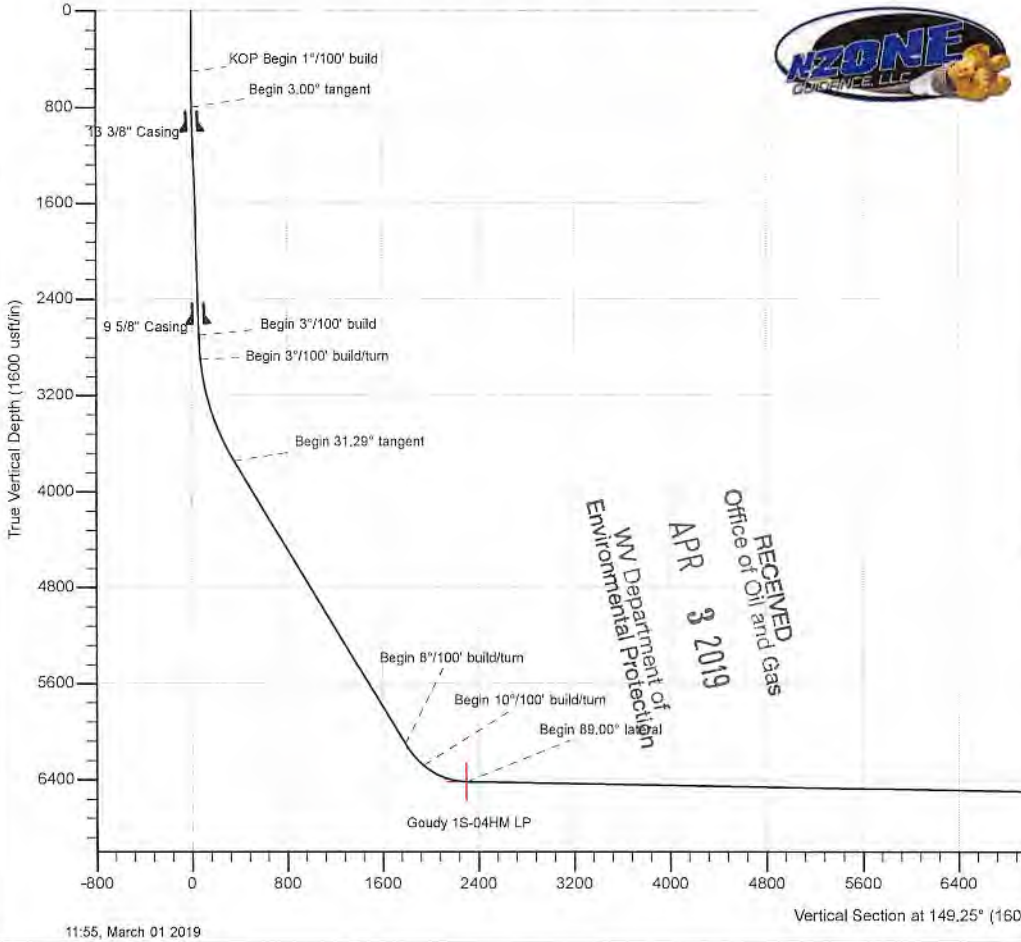
Azimuths to Grid North
True North: -0.11°
Magnetic North: -8.73°

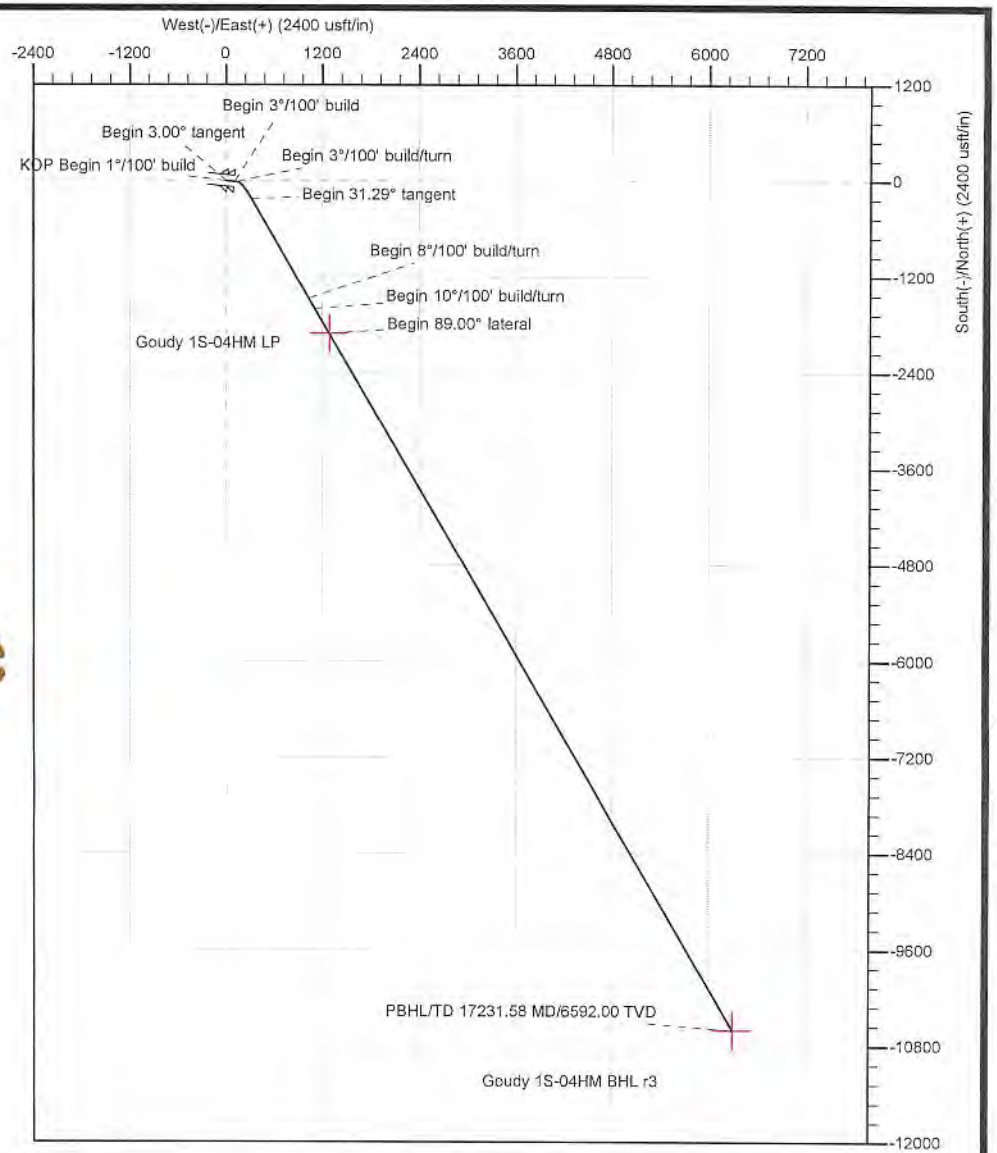
Magnetic Field
Strength: 52058.4snT
Dip Angle: 66.86°
Date: 5/11/2018
Model: IGRF2015

Geodetic System: Universal Transverse Mercator (US Survey Feet)
Datum: NAD83 West Virginia - HARN
Ellipsoid: GRS 1980
Zone: Zone 17N (84 W to 78 W)
System Datum: Mean Sea Level
Depth Reference: GL @ 1241.00usft

Northing	Easting	Latitude	Longitude
14431031.05	1688576.71	39.73705024	-80.82868648

Total Corr (M->G): To convert a Magnetic Direction to a Grid Direction, Subtract 8.73°





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11:55, March 01 2019

TUG HILL OPERATING

Planning Report - Geographic

Database:	DB_Jul2216dt_v14	**Local Co-ordinate Reference:**	Well Goudy 1S-04HM (K)
Company:	Tug Hill Operating LLC	**TVD Reference:**	GL @ 1241.00usft
Project:	Marshall County, West Virginia.	**MD Reference:**	GL @ 1241.00usft
Site:	Goudy	**North Reference:**	Grid
Well:	Goudy 1S-04HM (K)	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev3		

Project	Marshall County, West Virginia.		
Map System:	Universal Transverse Mercator (US Survey Feet)	**System Datum:**	Mean Sea Level
Geo Datum:	NAD83 West Virginia - HARN		
Map Zone:	Zone 17N (84 W to 78 W)		

Site	Goudy				
Site Position:		**Northing:**	14,430,942.40 usft	**Latitude:**	39.73680688
From:	Lat/Long	**Easting:**	1,688,559.77 usft	**Longitude:**	-80.82874732
Position Uncertainty:	0.00 usft	**Slot Radius:**	13-3/16 "	**Grid Convergence:**	0.11 °

Well	Goudy 1S-04HM (K)					
Well Position	**+N/-S**	0.00 usft	**Northing:**	14,431,031.05 usft	**Latitude:**	39.73705024
	+E/-W	0.00 usft	**Easting:**	1,688,576.71 usft	**Longitude:**	-80.82868648
Position Uncertainty		0.00 usft	**Wellhead Elevation:**		**Ground Level:**	1,241.00 usft

Wellbore	Original Hole				
Magnetics	**Model Name**	**Sample Date**	**Declination (°)**	**Dip Angle (°)**	**Field Strength (nT)**
	IGRF2015	5/11/2018	-8.62	66.86	52,058.42689591

Design	rev3				
Audit Notes:					
Version:		**Phase:**	PLAN	**Tie On Depth:**	0.00
Vertical Section:	**Depth From (TVD) (usft)**	**+N/-S (usft)**	**+E/-W (usft)**	**Direction (°)**	
	0.00	0.00	0.00	149.25	

Plan Survey Tool Program **Date** 3/1/2019

	Depth From (usft)	Depth To (usft)	Survey (Wellbore)	Tool Name	Remarks
1	0.00	17,231.58	rev3 (Original Hole)	MWD MWD - Standard	

Database:	DB_Jul2216dt_v14	**Local Co-ordinate Reference:**	Well Goudy 1S-04HM (K)
Company:	Tug Hill Operating LLC	**TVD Reference:**	GL @ 1241.00usft
Project:	Marshall County, West Virginia.	**MD Reference:**	GL @ 1241.00usft
Site:	Goudy	**North Reference:**	Grid
Well:	Goudy 1S-04HM (K)	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev3		

Plan Sections

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00	
800.00	3.00	95.00	799.86	-0.68	7.82	1.00	1.00	0.00	95.00	
2,702.74	3.00	95.00	2,700.00	-9.36	107.03	0.00	0.00	0.00	0.00	
2,902.74	9.00	95.00	2,898.81	-11.18	127.84	3.00	3.00	0.00	0.00	
3,805.06	31.29	150.16	3,745.77	-224.57	318.27	3.00	2.47	6.11	69.51	
6,567.35	31.29	150.16	6,106.35	-1,468.98	1,031.99	0.00	0.00	0.00	0.00	
6,801.26	50.00	150.08	6,283.04	-1,600.49	1,107.57	8.00	8.00	-0.04	-0.20	
7,191.27	89.00	149.98	6,417.00	-1,910.87	1,286.58	10.00	10.00	-0.02	-0.15	
17,231.58	89.00	149.98	6,592.00	-10,603.30	6,308.40	0.00	0.00	0.00	0.00	Goudy 1S-04HM BHL

TUG HILL OPERATING

Planning Report - Geographic

Database:	DB_Jul2216dt_v14	**Local Co-ordinate Reference:**	Well Goudy 1S-04HM (K)
Company:	Tug Hill Operating LLC	**TVD Reference:**	GL @ 1241.00usft
Project:	Marshall County, West Virginia.	**MD Reference:**	GL @ 1241.00usft
Site:	Goudy	**North Reference:**	Grid
Well:	Goudy 1S-04HM (K)	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev3		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
0.00	0.00	0.00	0.00	0.00	0.00	14,431,031.05	1,688,576.71	39.73705024	-80.82868648
100.00	0.00	0.00	100.00	0.00	0.00	14,431,031.05	1,688,576.71	39.73705024	-80.82868648
200.00	0.00	0.00	200.00	0.00	0.00	14,431,031.05	1,688,576.71	39.73705024	-80.82868648
300.00	0.00	0.00	300.00	0.00	0.00	14,431,031.05	1,688,576.71	39.73705024	-80.82868648
400.00	0.00	0.00	400.00	0.00	0.00	14,431,031.05	1,688,576.71	39.73705024	-80.82868648
500.00	0.00	0.00	500.00	0.00	0.00	14,431,031.05	1,688,576.71	39.73705024	-80.82868648
KOP Begin 1°/100' build									
600.00	1.00	95.00	599.99	-0.08	0.87	14,431,030.97	1,688,577.58	39.73705003	-80.82868339
700.00	2.00	95.00	699.96	-0.30	3.48	14,431,030.74	1,688,580.19	39.73704939	-80.82867411
800.00	3.00	95.00	799.86	-0.68	7.82	14,431,030.36	1,688,584.53	39.73704832	-80.82865866
Begin 3.00° tangent									
900.00	3.00	95.00	899.73	-1.14	13.04	14,431,029.91	1,688,589.74	39.73704704	-80.82864012
1,000.00	3.00	95.00	999.59	-1.60	18.25	14,431,029.45	1,688,594.96	39.73704576	-80.82862158
1,100.00	3.00	95.00	1,099.45	-2.05	23.46	14,431,029.00	1,688,600.17	39.73704448	-80.82860303
1,200.00	3.00	95.00	1,199.31	-2.51	28.68	14,431,028.54	1,688,605.39	39.73704320	-80.82858449
1,300.00	3.00	95.00	1,299.18	-2.97	33.89	14,431,028.08	1,688,610.60	39.73704192	-80.82856595
1,400.00	3.00	95.00	1,399.04	-3.42	39.10	14,431,027.63	1,688,615.81	39.73704064	-80.82854740
1,500.00	3.00	95.00	1,498.90	-3.88	44.32	14,431,027.17	1,688,621.03	39.73703936	-80.82852886
1,600.00	3.00	95.00	1,598.77	-4.33	49.53	14,431,026.71	1,688,626.24	39.73703808	-80.82851032
1,700.00	3.00	95.00	1,698.63	-4.79	54.75	14,431,026.26	1,688,631.45	39.73703680	-80.82849178
1,800.00	3.00	95.00	1,798.49	-5.25	59.96	14,431,025.80	1,688,636.67	39.73703552	-80.82847323
1,900.00	3.00	95.00	1,898.36	-5.70	65.17	14,431,025.35	1,688,641.88	39.73703424	-80.82845469
2,000.00	3.00	95.00	1,998.22	-6.16	70.39	14,431,024.89	1,688,647.10	39.73703296	-80.82843615
2,100.00	3.00	95.00	2,098.08	-6.61	75.60	14,431,024.43	1,688,652.31	39.73703168	-80.82841760
2,200.00	3.00	95.00	2,197.94	-7.07	80.81	14,431,023.98	1,688,657.52	39.73703040	-80.82839906
2,300.00	3.00	95.00	2,297.81	-7.53	86.03	14,431,023.52	1,688,662.74	39.73702912	-80.82838052
2,400.00	3.00	95.00	2,397.67	-7.98	91.24	14,431,023.07	1,688,667.95	39.73702784	-80.82836198
2,500.00	3.00	95.00	2,497.53	-8.44	96.45	14,431,022.61	1,688,673.16	39.73702656	-80.82834343
2,600.00	3.00	95.00	2,597.40	-8.89	101.67	14,431,022.15	1,688,678.38	39.73702528	-80.82832489
2,700.00	3.00	95.00	2,697.26	-9.35	106.88	14,431,021.70	1,688,683.59	39.73702400	-80.82830635
2,702.74	3.00	95.00	2,700.00	-9.36	107.03	14,431,021.68	1,688,683.73	39.73702396	-80.82830584
Begin 3°/100' build									
2,800.00	5.92	95.00	2,796.95	-10.02	114.56	14,431,021.03	1,688,691.27	39.73702211	-80.82827905
2,900.00	8.92	95.00	2,896.10	-11.15	127.42	14,431,019.90	1,688,704.12	39.73701896	-80.82823332
2,902.74	9.00	95.00	2,898.81	-11.18	127.84	14,431,019.86	1,688,704.55	39.73701885	-80.82823180
Begin 3°/100' build/turn									
3,000.00	10.38	110.34	2,994.69	-14.89	143.64	14,431,016.15	1,688,720.35	39.73700858	-80.82817562
3,100.00	12.37	121.79	3,092.74	-23.67	161.20	14,431,007.37	1,688,737.91	39.73698438	-80.82811322
3,200.00	14.70	129.90	3,189.96	-37.46	180.05	14,430,993.59	1,688,756.76	39.73694642	-80.82804628
3,300.00	17.24	135.75	3,286.10	-56.22	200.12	14,430,974.83	1,688,776.83	39.73689480	-80.82797499
3,400.00	19.90	140.11	3,380.89	-79.89	221.38	14,430,951.16	1,688,798.09	39.73682967	-80.82789954
3,500.00	22.64	143.47	3,474.07	-108.42	243.75	14,430,922.62	1,688,820.46	39.73675119	-80.82782015
3,600.00	25.44	146.13	3,565.39	-141.73	267.19	14,430,889.32	1,688,843.90	39.73665960	-80.82773702
3,700.00	28.28	148.29	3,654.60	-179.72	291.61	14,430,851.33	1,688,868.32	39.73655514	-80.82765039
3,800.00	31.14	150.08	3,741.45	-222.29	316.97	14,430,808.75	1,688,893.68	39.73643809	-80.82756050
3,805.06	31.29	150.16	3,745.78	-224.57	318.28	14,430,806.48	1,688,894.98	39.73643183	-80.82755586
Begin 31.29° tangent									
3,900.00	31.29	150.16	3,826.91	-267.34	342.81	14,430,763.71	1,688,919.51	39.73631424	-80.82746890
4,000.00	31.29	150.16	3,912.37	-312.39	368.64	14,430,718.66	1,688,945.35	39.73619039	-80.82737730
4,100.00	31.29	150.16	3,997.82	-357.44	394.48	14,430,673.61	1,688,971.19	39.73606653	-80.82728570
4,200.00	31.29	150.16	4,083.28	-402.49	420.32	14,430,628.56	1,688,997.03	39.73594267	-80.82719410
4,300.00	31.29	150.16	4,168.74	-447.54	446.16	14,430,583.51	1,689,022.87	39.73581881	-80.82710250
4,400.00	31.29	150.16	4,254.19	-492.59	471.99	14,430,538.46	1,689,048.70	39.73569495	-80.82701090
4,500.00	31.29	150.16	4,339.65	-537.64	497.83	14,430,493.41	1,689,074.54	39.73557110	-80.82691931

TUG HILL OPERATING

Planning Report - Geographic

Database:	DB_Jul2216dt_v14	**Local Co-ordinate Reference:**	Well Goudy 1S-04HM (K)
Company:	Tug Hill Operating LLC	**TVD Reference:**	GL @ 1241.00usft
Project:	Marshall County, West Virginia	**MD Reference:**	GL @ 1241.00usft
Site:	Goudy	**North Reference:**	Grid
Well:	Goudy 1S-04HM (K)	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev3		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
4,600.00	31.29	150.16	4,425.11	-582.69	523.67	14,430,448.36	1,689,100.38	39.73544724	-80.82682771
4,700.00	31.29	150.16	4,510.56	-627.74	549.51	14,430,403.31	1,689,126.22	39.73532338	-80.82673611
4,800.00	31.29	150.16	4,596.02	-672.79	575.35	14,430,358.26	1,689,152.05	39.73519952	-80.82664451
4,900.00	31.29	150.16	4,681.48	-717.84	601.18	14,430,313.21	1,689,177.89	39.73507566	-80.82655292
5,000.00	31.29	150.16	4,766.93	-762.89	627.02	14,430,268.16	1,689,203.73	39.73495180	-80.82646132
5,100.00	31.29	150.16	4,852.39	-807.94	652.86	14,430,223.11	1,689,229.57	39.73482794	-80.82636972
5,200.00	31.29	150.16	4,937.85	-852.99	678.70	14,430,178.06	1,689,255.41	39.73470409	-80.82627813
5,300.00	31.29	150.16	5,023.31	-898.04	704.54	14,430,133.01	1,689,281.24	39.73458023	-80.82618653
5,400.00	31.29	150.16	5,108.76	-943.09	730.37	14,430,087.96	1,689,307.08	39.73445637	-80.82609494
5,500.00	31.29	150.16	5,194.22	-988.14	756.21	14,430,042.91	1,689,332.92	39.73433251	-80.82600334
5,600.00	31.29	150.16	5,279.68	-1,033.19	782.05	14,429,997.86	1,689,358.76	39.73420865	-80.82591175
5,700.00	31.29	150.16	5,365.13	-1,078.24	807.89	14,429,952.81	1,689,384.60	39.73408479	-80.82582016
5,800.00	31.29	150.16	5,450.59	-1,123.29	833.72	14,429,907.76	1,689,410.43	39.73396093	-80.82572856
5,900.00	31.29	150.16	5,536.05	-1,168.34	859.56	14,429,862.71	1,689,436.27	39.73383707	-80.82563697
6,000.00	31.29	150.16	5,621.50	-1,213.39	885.40	14,429,817.66	1,689,462.11	39.73371321	-80.82554537
6,100.00	31.29	150.16	5,706.96	-1,258.44	911.24	14,429,772.61	1,689,487.95	39.73358935	-80.82545378
6,200.00	31.29	150.16	5,792.42	-1,303.49	937.08	14,429,727.56	1,689,513.78	39.73346549	-80.82536219
6,300.00	31.29	150.16	5,877.88	-1,348.54	962.91	14,429,682.51	1,689,539.62	39.73334163	-80.82527060
6,400.00	31.29	150.16	5,963.33	-1,393.59	988.75	14,429,637.46	1,689,565.46	39.73321777	-80.82517901
6,500.00	31.29	150.16	6,048.79	-1,438.64	1,014.59	14,429,592.41	1,689,591.30	39.73309391	-80.82508741
6,567.35	31.29	150.16	6,106.35	-1,468.98	1,031.99	14,429,562.07	1,689,608.70	39.73301050	-80.82502573
Begin 8°/100' build/turn									
6,600.00	33.90	150.15	6,133.85	-1,484.23	1,040.74	14,429,546.81	1,689,617.45	39.73296856	-80.82499470
6,700.00	41.90	150.11	6,212.70	-1,537.46	1,071.31	14,429,493.59	1,689,648.02	39.73282223	-80.82488633
6,800.00	49.90	150.08	6,282.23	-1,599.66	1,107.09	14,429,431.39	1,689,683.80	39.73265122	-80.82475951
6,801.26	50.00	150.08	6,283.04	-1,600.49	1,107.57	14,429,430.56	1,689,684.28	39.73264892	-80.82475781
Begin 10°/100' build/turn									
6,900.00	59.87	150.05	6,339.70	-1,670.44	1,147.85	14,429,360.60	1,689,724.56	39.73245659	-80.82461501
7,000.00	69.87	150.02	6,382.10	-1,748.78	1,193.01	14,429,282.27	1,689,769.72	39.73224121	-80.82445493
7,100.00	79.87	150.00	6,408.16	-1,832.29	1,241.20	14,429,198.76	1,689,817.91	39.73201162	-80.82428411
7,191.27	89.00	149.98	6,417.00	-1,910.87	1,286.58	14,429,120.18	1,689,863.29	39.73179556	-80.82412324
Begin 89.00° lateral									
7,200.00	89.00	149.98	6,417.15	-1,918.43	1,290.95	14,429,112.62	1,689,867.66	39.73177478	-80.82410777
7,300.00	89.00	149.98	6,418.90	-2,005.00	1,340.97	14,429,026.04	1,689,917.67	39.73153675	-80.82393047
7,400.00	89.00	149.98	6,420.64	-2,091.58	1,390.98	14,428,939.47	1,689,967.69	39.73129872	-80.82375317
7,500.00	89.00	149.98	6,422.38	-2,178.15	1,441.00	14,428,852.89	1,690,017.71	39.73106068	-80.82357587
7,600.00	89.00	149.98	6,424.12	-2,264.73	1,491.02	14,428,766.32	1,690,067.72	39.73082265	-80.82339858
7,700.00	89.00	149.98	6,425.87	-2,351.31	1,541.03	14,428,679.74	1,690,117.74	39.73058462	-80.82322129
7,800.00	89.00	149.98	6,427.61	-2,437.88	1,591.05	14,428,593.17	1,690,167.76	39.73034658	-80.82304399
7,900.00	89.00	149.98	6,429.35	-2,524.46	1,641.07	14,428,506.59	1,690,217.77	39.73010855	-80.82286670
8,000.00	89.00	149.98	6,431.10	-2,611.03	1,691.08	14,428,420.02	1,690,267.79	39.72987052	-80.82268941
8,100.00	89.00	149.98	6,432.84	-2,697.61	1,741.10	14,428,333.44	1,690,317.81	39.72963248	-80.82251212
8,200.00	89.00	149.98	6,434.58	-2,784.18	1,791.12	14,428,246.87	1,690,367.82	39.72939445	-80.82233484
8,300.00	89.00	149.98	6,436.32	-2,870.76	1,841.13	14,428,160.29	1,690,417.84	39.72915641	-80.82215755
8,400.00	89.00	149.98	6,438.07	-2,957.33	1,891.15	14,428,073.72	1,690,467.86	39.72891838	-80.82198026
8,500.00	89.00	149.98	6,439.81	-3,043.91	1,941.17	14,427,987.14	1,690,517.87	39.72868034	-80.82180298
8,600.00	89.00	149.98	6,441.55	-3,130.48	1,991.18	14,427,900.56	1,690,567.89	39.72844230	-80.82162570
8,700.00	89.00	149.98	6,443.30	-3,217.06	2,041.20	14,427,813.99	1,690,617.91	39.72820427	-80.82144842
8,800.00	89.00	149.98	6,445.04	-3,303.63	2,091.22	14,427,727.41	1,690,667.92	39.72796623	-80.82127114
8,900.00	89.00	149.98	6,446.78	-3,390.21	2,141.23	14,427,640.84	1,690,717.94	39.72772819	-80.82109386
9,000.00	89.00	149.98	6,448.53	-3,476.79	2,191.25	14,427,554.26	1,690,767.96	39.72749016	-80.82091658
9,100.00	89.00	149.98	6,450.27	-3,563.36	2,241.26	14,427,467.69	1,690,817.97	39.72725212	-80.82073930
9,200.00	89.00	149.98	6,452.01	-3,649.94	2,291.28	14,427,381.11	1,690,867.99	39.72701408	-80.82056203
9,300.00	89.00	149.98	6,453.75	-3,736.51	2,341.30	14,427,294.54	1,690,918.01	39.72677604	-80.82038475

TUG HILL OPERATING

Planning Report - Geographic

Database:	DB_Jul2216dt_v14	**Local Co-ordinate Reference:**	Well Goudy 1S-04HM (K)
Company:	Tug Hill Operating LLC	**TVD Reference:**	GL @ 1241.00usft
Project:	Marshall County, West Virginia.	**MD Reference:**	GL @ 1241.00usft
Site:	Goudy	**North Reference:**	Grid
Well:	Goudy 1S-04HM (K)	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev3		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
9,400.00	89.00	149.98	6,455.50	-3,823.09	2,391.31	14,427,207.96	1,690,968.02	39.72653801	-80.82020748
9,500.00	89.00	149.98	6,457.24	-3,909.66	2,441.33	14,427,121.39	1,691,018.04	39.72629997	-80.82003021
9,600.00	89.00	149.98	6,458.98	-3,996.24	2,491.35	14,427,034.81	1,691,068.06	39.72606193	-80.81985294
9,700.00	89.00	149.98	6,460.73	-4,082.81	2,541.36	14,426,948.24	1,691,118.07	39.72582389	-80.81967567
9,800.00	89.00	149.98	6,462.47	-4,169.39	2,591.38	14,426,861.66	1,691,168.09	39.72558585	-80.81949840
9,900.00	89.00	149.98	6,464.21	-4,255.96	2,641.40	14,426,775.08	1,691,218.11	39.72534781	-80.81932113
10,000.00	89.00	149.98	6,465.96	-4,342.54	2,691.41	14,426,688.51	1,691,268.12	39.72510977	-80.81914387
10,100.00	89.00	149.98	6,467.70	-4,429.11	2,741.43	14,426,601.93	1,691,318.14	39.72487173	-80.81896660
10,200.00	89.00	149.98	6,469.44	-4,515.69	2,791.45	14,426,515.36	1,691,368.16	39.72463369	-80.81878934
10,300.00	89.00	149.98	6,471.18	-4,602.27	2,841.46	14,426,428.78	1,691,418.17	39.72439565	-80.81861208
10,400.00	89.00	149.98	6,472.93	-4,688.84	2,891.48	14,426,342.21	1,691,468.19	39.72415761	-80.81843482
10,500.00	89.00	149.98	6,474.67	-4,775.42	2,941.50	14,426,255.63	1,691,518.21	39.72391957	-80.81825756
10,600.00	89.00	149.98	6,476.41	-4,861.99	2,991.51	14,426,169.06	1,691,568.22	39.72368153	-80.81808030
10,700.00	89.00	149.98	6,478.16	-4,948.57	3,041.53	14,426,082.48	1,691,618.24	39.72344348	-80.81790304
10,800.00	89.00	149.98	6,479.90	-5,035.14	3,091.55	14,425,995.91	1,691,668.26	39.72320544	-80.81772579
10,900.00	89.00	149.98	6,481.64	-5,121.72	3,141.56	14,425,909.33	1,691,718.27	39.72296740	-80.81754853
11,000.00	89.00	149.98	6,483.39	-5,208.29	3,191.58	14,425,822.75	1,691,768.29	39.72272936	-80.81737128
11,100.00	89.00	149.98	6,485.13	-5,294.87	3,241.60	14,425,736.18	1,691,818.31	39.72249131	-80.81719403
11,200.00	89.00	149.98	6,486.87	-5,381.44	3,291.61	14,425,649.60	1,691,868.32	39.72225327	-80.81701678
11,300.00	89.00	149.98	6,488.61	-5,468.02	3,341.63	14,425,563.03	1,691,918.34	39.72201523	-80.81683953
11,400.00	89.00	149.98	6,490.36	-5,554.60	3,391.65	14,425,476.45	1,691,968.36	39.72177718	-80.81666228
11,500.00	89.00	149.98	6,492.10	-5,641.17	3,441.66	14,425,389.88	1,692,018.37	39.72153914	-80.81648503
11,600.00	89.00	149.98	6,493.84	-5,727.75	3,491.68	14,425,303.30	1,692,068.39	39.72130109	-80.81630779
11,700.00	89.00	149.98	6,495.59	-5,814.32	3,541.70	14,425,216.73	1,692,118.41	39.72106305	-80.81613054
11,800.00	89.00	149.98	6,497.33	-5,900.90	3,591.71	14,425,130.15	1,692,168.42	39.72082501	-80.81595330
11,900.00	89.00	149.98	6,499.07	-5,987.47	3,641.73	14,425,043.58	1,692,218.44	39.72058696	-80.81577605
12,000.00	89.00	149.98	6,500.82	-6,074.05	3,691.75	14,424,957.00	1,692,268.46	39.72034891	-80.81559881
12,100.00	89.00	149.98	6,502.56	-6,160.62	3,741.76	14,424,870.43	1,692,318.47	39.72011087	-80.81542157
12,200.00	89.00	149.98	6,504.30	-6,247.20	3,791.78	14,424,783.85	1,692,368.49	39.71987282	-80.81524433
12,300.00	89.00	149.98	6,506.04	-6,333.77	3,841.80	14,424,697.27	1,692,418.51	39.71963478	-80.81506710
12,400.00	89.00	149.98	6,507.79	-6,420.35	3,891.81	14,424,610.70	1,692,468.52	39.71939673	-80.81488986
12,500.00	89.00	149.98	6,509.53	-6,506.92	3,941.83	14,424,524.12	1,692,518.54	39.71915868	-80.81471263
12,600.00	89.00	149.98	6,511.27	-6,593.50	3,991.85	14,424,437.55	1,692,568.56	39.71892064	-80.81453539
12,700.00	89.00	149.98	6,513.02	-6,680.08	4,041.86	14,424,350.97	1,692,618.57	39.71868259	-80.81435816
12,800.00	89.00	149.98	6,514.76	-6,766.65	4,091.88	14,424,264.40	1,692,668.59	39.71844454	-80.81418093
12,900.00	89.00	149.98	6,516.50	-6,853.23	4,141.90	14,424,177.82	1,692,718.61	39.71820649	-80.81400370
13,000.00	89.00	149.98	6,518.24	-6,939.80	4,191.91	14,424,091.25	1,692,768.62	39.71796845	-80.81382647
13,100.00	89.00	149.98	6,519.99	-7,026.38	4,241.93	14,424,004.67	1,692,818.64	39.71773040	-80.81364924
13,200.00	89.00	149.98	6,521.73	-7,112.95	4,291.95	14,423,918.10	1,692,868.65	39.71749235	-80.81347201
13,300.00	89.00	149.98	6,523.47	-7,199.53	4,341.96	14,423,831.52	1,692,918.67	39.71725430	-80.81329479
13,400.00	89.00	149.98	6,525.22	-7,286.10	4,391.98	14,423,744.95	1,692,968.69	39.71701625	-80.81311756
13,500.00	89.00	149.98	6,526.96	-7,372.68	4,442.00	14,423,658.37	1,693,018.70	39.71677820	-80.81294034
13,600.00	89.00	149.98	6,528.70	-7,459.25	4,492.01	14,423,571.79	1,693,068.72	39.71654015	-80.81276312
13,700.00	89.00	149.98	6,530.45	-7,545.83	4,542.03	14,423,485.22	1,693,118.74	39.71630210	-80.81258590
13,800.00	89.00	149.98	6,532.19	-7,632.40	4,592.05	14,423,398.64	1,693,168.75	39.71606405	-80.81240868
13,900.00	89.00	149.98	6,533.93	-7,718.98	4,642.06	14,423,312.07	1,693,218.77	39.71582600	-80.81223146
14,000.00	89.00	149.98	6,535.67	-7,805.56	4,692.08	14,423,225.49	1,693,268.79	39.71558795	-80.81205424
14,100.00	89.00	149.98	6,537.42	-7,892.13	4,742.10	14,423,138.92	1,693,318.80	39.71534990	-80.81187703
14,200.00	89.00	149.98	6,539.16	-7,978.71	4,792.11	14,423,052.34	1,693,368.82	39.71511184	-80.81169981
14,300.00	89.00	149.98	6,540.90	-8,065.28	4,842.13	14,422,965.77	1,693,418.84	39.71487379	-80.81152260
14,400.00	89.00	149.98	6,542.65	-8,151.86	4,892.15	14,422,879.19	1,693,468.85	39.71463574	-80.81134539
14,500.00	89.00	149.98	6,544.39	-8,238.43	4,942.16	14,422,792.62	1,693,518.87	39.71439769	-80.81116818
14,600.00	89.00	149.98	6,546.13	-8,325.01	4,992.18	14,422,706.04	1,693,568.89	39.71415964	-80.81099097
14,700.00	89.00	149.98	6,547.88	-8,411.58	5,042.20	14,422,619.46	1,693,618.90	39.71392158	-80.81081376
14,800.00	89.00	149.98	6,549.62	-8,498.16	5,092.21	14,422,532.89	1,693,668.92	39.71368353	-80.81063655

TUG HILL OPERATING

Planning Report - Geographic

Database:	DB_Jul2216dt_v14	**Local Co-ordinate Reference:**	Well Goudy 1S-04HM (K)
Company:	Tug Hill Operating LLC	**TVD Reference:**	GL @ 1241.00usft
Project:	Marshall County, West Virginia.	**MD Reference:**	GL @ 1241.00usft
Site:	Goudy	**North Reference:**	Grid
Well:	Goudy 1S-04HM (K)	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev3		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
14,900.00	89.00	149.98	6,551.36	-8,584.73	5,142.23	14,422,446.31	1,693,718.94	39.71344548	-80.81045935
15,000.00	89.00	149.98	6,553.10	-8,671.31	5,192.25	14,422,359.74	1,693,768.95	39.71320742	-80.81028214
15,100.00	89.00	149.98	6,554.85	-8,757.88	5,242.26	14,422,273.16	1,693,818.97	39.71296937	-80.81010494
15,200.00	89.00	149.98	6,556.59	-8,844.46	5,292.28	14,422,186.59	1,693,868.99	39.71273131	-80.80992774
15,300.00	89.00	149.98	6,558.33	-8,931.04	5,342.30	14,422,100.01	1,693,919.00	39.71249326	-80.80975054
15,400.00	89.00	149.98	6,560.08	-9,017.61	5,392.31	14,422,013.44	1,693,969.02	39.71225520	-80.80957334
15,500.00	89.00	149.98	6,561.82	-9,104.19	5,442.33	14,421,926.86	1,694,019.04	39.71201715	-80.80939614
15,600.00	89.00	149.98	6,563.56	-9,190.76	5,492.34	14,421,840.29	1,694,069.05	39.71177909	-80.80921894
15,700.00	89.00	149.98	6,565.31	-9,277.34	5,542.36	14,421,753.71	1,694,119.07	39.71154104	-80.80904174
15,800.00	89.00	149.98	6,567.05	-9,363.91	5,592.38	14,421,667.14	1,694,169.09	39.71130298	-80.80886455
15,900.00	89.00	149.98	6,568.79	-9,450.49	5,642.39	14,421,580.56	1,694,219.10	39.71106493	-80.80868735
16,000.00	89.00	149.98	6,570.53	-9,537.06	5,692.41	14,421,493.98	1,694,269.12	39.71082687	-80.80851016
16,100.00	89.00	149.98	6,572.28	-9,623.64	5,742.43	14,421,407.41	1,694,319.14	39.71058881	-80.80833297
16,200.00	89.00	149.98	6,574.02	-9,710.21	5,792.44	14,421,320.83	1,694,369.15	39.71035076	-80.80815578
16,300.00	89.00	149.98	6,575.76	-9,796.79	5,842.46	14,421,234.26	1,694,419.17	39.71011270	-80.80797859
16,400.00	89.00	149.98	6,577.51	-9,883.37	5,892.48	14,421,147.68	1,694,469.19	39.70987464	-80.80780140
16,500.00	89.00	149.98	6,579.25	-9,969.94	5,942.49	14,421,061.11	1,694,519.20	39.70963658	-80.80762422
16,600.00	89.00	149.98	6,580.99	-10,056.52	5,992.51	14,420,974.53	1,694,569.22	39.70939852	-80.80744703
16,700.00	89.00	149.98	6,582.73	-10,143.09	6,042.53	14,420,887.96	1,694,619.24	39.70916047	-80.80726985
16,800.00	89.00	149.98	6,584.48	-10,229.67	6,092.54	14,420,801.38	1,694,669.25	39.70892241	-80.80709266
16,900.00	89.00	149.98	6,586.22	-10,316.24	6,142.56	14,420,714.81	1,694,719.27	39.70868435	-80.80691548
17,000.00	89.00	149.98	6,587.96	-10,402.82	6,192.58	14,420,628.23	1,694,769.29	39.70844629	-80.80673830
17,100.00	89.00	149.98	6,589.71	-10,489.39	6,242.59	14,420,541.66	1,694,819.30	39.70820823	-80.80656112
17,200.00	89.00	149.98	6,591.45	-10,575.97	6,292.61	14,420,455.08	1,694,869.32	39.70797017	-80.80638395
17,231.58	89.00	149.98	6,592.00	-10,603.30	6,308.40	14,420,427.74	1,694,885.11	39.70789500	-80.80632800
PBHL/TD 17231.58 MD/6592.00 TVD									

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Goudy 1S-04HM LP - plan hits target center - Point	0.00	0.00	6,417.00	-1,910.87	1,286.58	14,429,120.18	1,689,863.29	39.73179556	-80.82412325
Goudy 1S-04HM BHL r3 - plan hits target center - Point	0.00	0.00	6,592.00	-10,603.30	6,308.40	14,420,427.74	1,694,885.11	39.70789500	-80.80632800

Casing Points

Measured Depth (usft)	Vertical Depth (usft)	Name	Casing Diameter (")	Hole Diameter (")
1,000.41	1,000.00	13 3/8" Casing	13-3/8	17
2,602.61	2,600.00	9 5/8" Casing	9-5/8	12-1/4

Database:	DB_Jul2216dt_v14	**Local Co-ordinate Reference:**	Well Goudy 1S-04HM (K)
Company:	Tug Hill Operating LLC	**TVD Reference:**	GL @ 1241.00usft
Project:	Marshall County, West Virginia.	**MD Reference:**	GL @ 1241.00usft
Site:	Goudy	**North Reference:**	Grid
Well:	Goudy 1S-04HM (K)	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Original Hole		
Design:	rev3		

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates +N/-S (usft)	Local Coordinates +E/-W (usft)	Comment
500.00	500.00	0.00	0.00	KOP Begin 1°/100' build
800.00	799.86	-0.68	7.82	Begin 3.00° tangent
2,702.74	2,700.00	-9.36	107.03	Begin 3°/100' build
2,902.74	2,898.81	-11.18	127.84	Begin 3°/100' build/turn
3,805.06	3,745.78	-224.57	318.28	Begin 31.29° tangent
6,567.35	6,106.35	-1,468.98	1,031.99	Begin 8°/100' build/turn
6,801.26	6,283.04	-1,600.49	1,107.57	Begin 10°/100' build/turn
7,191.27	6,417.00	-1,910.87	1,286.58	Begin 89.00° lateral
17,231.58	6,592.00	-10,603.30	6,308.40	PBHL/TD 17231.58 MD/6592.00 TVD

05/24/2019

Well Site Safety Plan

Tug Hill Operating, LLC

3/27/19

Well Name:Goudy 1S-4HM

Pad Location: Goudy Pad

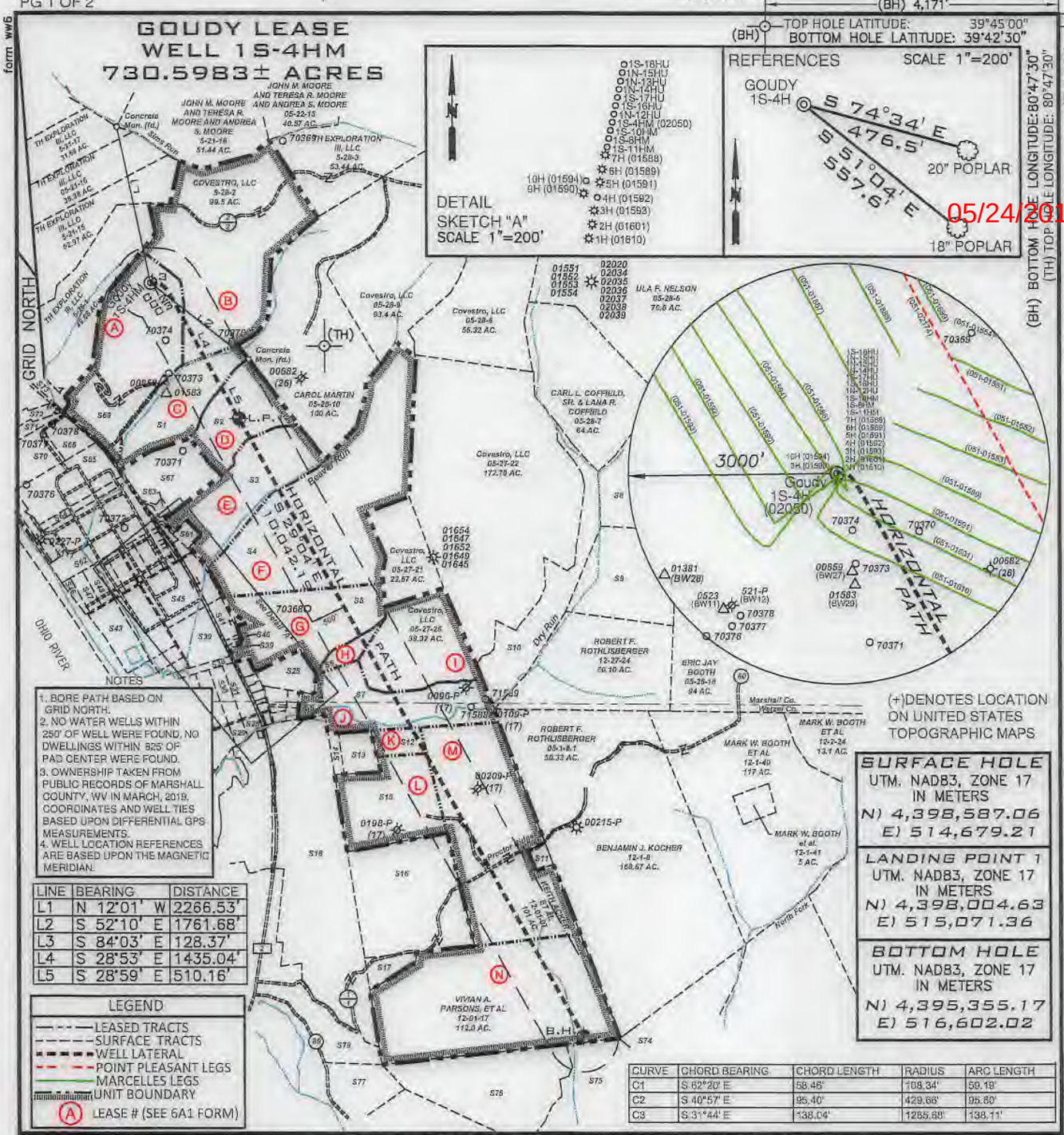
Marshall County, West Virginia

UTM (meters), NAD83, Zone 17:
Northing: 4,398,587.06
Easting: 514,679.21

Updated: March 2019

form ww6

GOUDY LEASE
WELL 1S-4HM
730.5983± ACRES



NOTES

1. BORE PATH BASED ON GRID NORTH.
2. NO WATER WELLS WITHIN 250' OF WELL WERE FOUND, NO DWELLINGS WITHIN 625' OF PAD CENTER WERE FOUND.
3. OWNERSHIP TAKEN FROM PUBLIC RECORDS OF MARSHALL COUNTY, WV IN MARCH, 2019. COORDINATES AND WELL TIES BASED UPON DIFFERENTIAL GPS MEASUREMENTS.
4. WELL LOCATION REFERENCES ARE BASED UPON THE MAGNETIC MERIDIAN.

LINE	BEARING	DISTANCE
L1	N 12°01' W	2266.53'
L2	S 52°10' E	1761.68'
L3	S 84°03' E	128.37'
L4	S 28°53' E	1435.04'
L5	S 28°59' E	510.16'

LEGEND
- LEASED TRACTS
- SURFACE TRACTS
- WELL LATERAL
- POINT PLEASANT LEGS
- MARCELLES LEGS
- UNIT BOUNDARY
- (A) LEASE # (SEE 6A1 FORM)

CURVE	CHORD BEARING	CHORD LENGTH	RADIUS	ARC LENGTH
C1	S 62°20' E	58.46'	108.34'	59.19'
C2	S 40°57' E	95.40'	429.66'	95.60'
C3	S 31°44' E	138.04'	1265.66'	138.11'

SURFACE HOLE
UTM, NAD83, ZONE 17
IN METERS
N) 4,398,587.06
E) 514,679.21

LANDING POINT 1
UTM, NAD83, ZONE 17
IN METERS
N) 4,398,004.63
E) 515,071.36

BOTTOM HOLE
UTM, NAD83, ZONE 17
IN METERS
N) 4,395,355.17
E) 516,602.02

FILE NUMBER

DRAWING NUMBER GOUDY_1S-4HM_REV 3

SCALE 1" = 2000'

MINIMUM DEGREE OF ACCURACY 1/200

PROVEN SOURCE OF ELEVATION SUBMETER MAPPING
GRADE GPS

I, THE UNDERSIGNED, HEREBY CERTIFY THAT THIS PLAT IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF AND SHOWS ALL THE INFORMATION REQUIRED BY LAW AND THE RULES ISSUED AND PRESCRIBED BY THE DEPARTMENT OF ENVIRONMENTAL PROTECTION

P.S. 708 David L Jackson

DAVID JACKSON LICENSED NO. 708 STATE OF WEST VIRGINIA PROFESSIONAL SURVEYOR

SEAL

JACKSON SURVEYING INC.
P.O. Box 1460
Clarksburg, WV 26302
304-623-5851

STATE OF WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

3/27/19

WVDEP
OFFICE OF OIL & GAS
601 57TH STREET, SE
CHARLESTON, WV 25304

DATE: MARCH 25, 2019

OPERATORS WELL NO. GOUDY 1S-4HM

API WELL NO.
47 – 051 – 02050
STATE COUNTY PERMIT

WELL TYPE: OIL ___ GAS X LIQUID INJECTION ___ WASTE DISPOSAL ___
(IF "GAS") PRODUCTION X STORAGE ___ DEEP ___ SHALLOW X

LOCATION ELEVATION 1239.4' WATERSHED (HUC 10) FRENCH CREEK – OHIO RIVER

DISTRICT FRANKLIN COUNTY MARSHALL

QUADRANGLE NEW MARTINSVILLE 7.5' LEASE NUMBER SEE WW-6A1 FORM

SURFACE OWNER TH EXPLORATION III, LLC. ACREAGE 70.0

OIL & GAS ROYALTY OWNER TH EXPLORATION III, LLC. LEASE ACREAGE 70.0

PROPOSED WORK: DRILL X CONVERT ___ DRILL DEEPER ___ REDRILL ___ FRACTURE OR STIMULATE X PLUG OFF OLD FORMATION ___

PERFORATE NEW FORMATION ___ OTHER PHYSICAL CHANGE (SPECIFY) ___

PLUG & ABANDON ___ CLEAN OUT & REPLUG ___

TARGET FORMATION MARCELLUS ESTIMATED DEPTH TVD 6,540' TMD: 17,232'

WELL OPERATOR TUG HILL OPERATING, LLC DESIGNATED AGENT DIANNA STAMPER CT CORPORATION SYSTEM

ADDRESS 1320 SOUTH UNIVERSITY DRIVE, SUITE 500 FORT WORTH, TX 76107 ADDRESS 5400 D BIG TYLER ROAD CHARLESTON, WV 25313

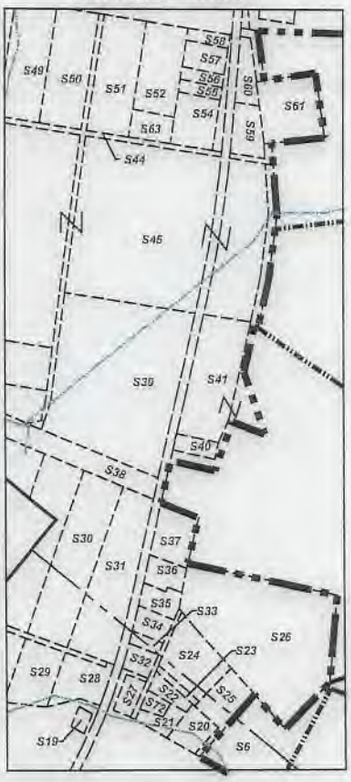
COUNTY NAME PERMIT

form WW6

PG 2 OF 2

GOUDY LEASE
WELL 1S-4HM
730.5983± ACRES

Detail "A"
SCALE 1"=1000'



Number	TAX MAP -PARCEL	SURFACE OWNER	ACRES
S1 C	05-28-12	TH Exploration III, LLC	20.226
S2 D	05-28-11	Carol A. Martin	24.681
S3 E	05-27-19	Covestro, LLC	33.786
S4 F	05-27-20	Covestro LLC	93.027
S5 G	05-27-20.1	Appalachian Power Co.	43.973
S6 H	05-27-27	James Andrew & Karen Lynne Richmond	8.9353
S7 J	05-27-25	James Andrew & Karen Lynne Richmond	41.35
S8	05-26-4.5	Eric Jay Booth	74.382
S9	05-26-19	Eric Jay Booth & Karrel S. Booth	50.0
S10	05-27-23	Robert F. Rothlisberger	35.77
S11	12-01-7.1	Harry Wayman Estate	2.0
S12 K	12-01-04	Robert F. Rothlisberger	6.0
S13	12-01-03	Charles D. & Edith Feenerty Harrison	7.8
S14	12-01-02	James Andrew & Karen Lynne Richmond	2.7
S15 L	12-01-05	Irvin L. Hoyt, Jr. & David L. Hoyt	36.8
S16	12-01-06	Mona Parsons, et al	52.75
S17	12-01-16	Vivian A. Parsons, et al	5.125
S18	12-01-01	Covestro, LLC	135.0
S19	12-01-1.7	Colombia Gas Transmission, Corp.	0.15
S20	12-23-15	Paul E. & Donna Jo Cain	0.70
S21	12-23-15.1	Robert F. Rothlisberger	0.47
S22	12-23-13	Paul E. & Donna Jo Cain	0.38
S23	05-27-27.2	Paul E. Cain, et ux	0.1767
S24	05-27-27.1	Donald P. Cain	1.645
S25	05-27-27.3	Paul E. Cain, et ux	1.018
S26	05-27-28	Covestro, LLC	8.0
S27	12-23-12	Paul E. & Donna Jo Cain	0.37
S28	12-23-11	Covestro, LLC	1.25
S29	12-23-10	Covestro, LLC	1.28
S30	12-23-05	Covestro, LLC	3.69
S31	05-27-40	Covestro, LLC	3.36
S32	12-23-06	Covestro, LLC	0.34
S33	12-27-44	Covestro, LLC	0.21
S34	05-27-43	Covestro, LLC	0.63
S35	05-27-42	Covestro, LLC	0.52
S36	05-27-42.1	Covestro, LLC	0.52
S37	05-27-41	Martha Jean Arrick	0.99
S38	05-27-31.2	Appalachian Power Co.	3.33
S39	05-27-31	Covestro, LLC	16.1
S40	05-27-30	Covestro, LLC	0.371
S41	05-27-31.1	Covestro, LLC	3.0
S42	05-27-32.2	Covestro, LLC	3.95
S43	05-27-29	Covestro, LLC	9.0
S44	05-27-45	Covestro, LLC	0.3627
S45	05-27-32	Covestro, LLC	33.53
S46	05-27-03	Covestro, LLC	1.27
S47	05-27-04	Covestro, LLC	2.52
S48	05-27-05	Covestro, LLC	2.52
S49	05-27-06	Covestro, LLC	2.52
S50	05-27-07	Covestro, LLC	2.52
S51	05-27-08	Covestro, LLC	2.52
S52	05-27-09	Covestro, LLC	1.87
S53	05-27-10	Covestro, LLC	0.52
S54	05-27-12	Covestro, LLC	1.0
S55	05-27-13	Covestro, LLC	0.34
S56	05-27-14	Covestro, LLC	0.25
S57	05-27-15	Covestro, LLC	0.47
S58	05-27-16	Covestro, LLC	0.23
S59	05-27-18	Covestro, LLC	0.97
S60	05-27-17	Covestro, LLC	0.88
S61	05-27-19.3	Cemetery	2.0
S62	05-27-02	Covestro, LLC	28.099
S63	05-27-19.2	Wheeling Electric Co.	0.922
S64	05-28-12.2	Covestro, LLC	3.1
S65	05-28-12.3	Covestro, LLC	18.784
S66	05-28-13.1	Air Products & Chemicals, Inc	5.522
S67	05-27-19.1	Covestro, LLC	21.267
S68	05-27-11	Covestro, LLC	0.03
S69 A	05-28-13	TH Exploration III, LLC	70.0
S70	05-28-13.2	Covestro, LLC	11.02
S71	05-28-1.1	Covestro, LLC	5.2217
S72	05-28-1.4	Eagle Natrium, LLC	11.69
S73	05-31-3.1	Eagle Natrium, LLC	98.613
S74	12-01-19	Steven J. & Susan L. Hafer	36.5
S75	12-01-28	Steven J. & Susan L. Hafer	88.39
S76	12-01-18	Travis Darrell Blake & Angela Dawn Mitchell	48.4
S77	12-01-15.3	Daniel L. & Vickie L. Williams	7.0
S78	12-01-1.1	W.V.D.O.H.	10.59

05/24/2019

DAVID JACKSON
LICENSED
NO. 708
STATE OF
WEST VIRGINIA
PROFESSIONAL SURVEYOR

P.S. 708 David L Jackson

TUG HILL OPERATING

OPERATOR'S
WELL #: Goudy 1S-4HM
DISTRICT: Franklin
COUNTY: Marshall
STATE: WV

WELL PLAT
PAGE 2 OF 2
DATE: 3/25/2018

4705102050 05/24/2019

WW-6A1
(5/13)

Operator's Well No. Goudy 1S-4HM

INFORMATION SUPPLIED UNDER WEST VIRGINIA CODE
Chapter 22, Article 6A, Section 5(a)(5)
IN LIEU OF FILING LEASE(S) AND OTHER CONTINUING CONTRACT(S)

Under the oath required to make the verification on page 1 of this Notice and Application, I depose and say that I am the person who signed the Notice and Application for the Applicant, and that –

(1) the tract of land is the same tract described in this Application, partly or wholly depicted in the accompanying plat, and described in the Construction and Reclamation Plan;

(2) the parties and recordation data (if recorded) for lease(s) or other continuing contract(s) by which the Applicant claims the right to extract, produce or market the oil or gas are as follows:

Lease Name or Number	Grantor, Lessor, etc.	Grantee, Lessee, etc.	Royalty	Book/Page

*See attached pages

RECEIVED
Office of Oil and Gas
APR 3 2019
WV Department of
Environmental Protection

Acknowledgement of Possible Permitting/Approval
In Addition to the Office of Oil and Gas

The permit applicant for the proposed well work addressed in this application hereby acknowledges the possibility of the need for permits and/or approvals from local, state, or federal entities in addition to the DEP, Office of Oil and Gas, including but not limited to the following:

- WV Division of Water and Waste Management
- WV Division of Natural Resources WV Division of Highways
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- County Floodplain Coordinator

The applicant further acknowledges that any Office of Oil and Gas permit in no way overrides, replaces, or nullifies the need for other permits/approvals that may be necessary and further affirms that all needed permits/approvals should be acquired from the appropriate authority before the affected activity is initiated.

Well Operator: Tug Hill Operating, LLC
By: Amy L. Miller
Its: Permitting Specialist - Appalachia Region

WW-6A1 Supplement

Operator's Well No. Goudy 1S - 4HM

Lease ID	Parcel	Tags	Grantor, Lessor, Etc.	Grantee, Lessee, Etc.	Royalty	Deed Book/Page		Assignment	Assignment	Assignment	Assignment	Assignment	Assignment	Assignment	Assignment	Assignment
10*14300	5-28-13	A	PPG INDUSTRIES, INC.	GASTAR EXPLORATION USA, INC.	1/8+	725	123	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 24/332	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14498	5-28-2	B	BAYER MATERIALSCIENCE LLC	GASTAR EXPLORATION USA INC	1/8+	757	340	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14300	5-28-12	C	PPG INDUSTRIES, INC.	GASTAR EXPLORATION USA, INC.	1/8+	725	123	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 24/332	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14658	5-28-12	C	THOMAS WILLIAM ABERSOLD	GASTAR EXPLORATION USA, INC.	1/8+	775	314	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 28/499	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14659	5-28-12	C	JUDITH LEE ABERSOLD	GASTAR EXPLORATION USA INC	1/8+	781	609	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 28/499	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14565	5-28-11	D	HARRY LEE GOUDY	CENTRAL MICHIGAN EXPLORATION LLC	1/8+	670	59	N/A	N/A	N/A	N/A	N/A	Central Michigan Exploration LLC to Stone Energy Corporation: 21/288 & 21/356	Stone Energy Corporation to Gastar Exploration USA Inc & Atinum Marcellus I LLC: 27/160	Gastar Exploration USA Inc merged into Gastar Exploration Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14493	5-27-19	E	BETTY JEAN NEELY	GASTAR EXPLORATION USA, INC	1/8+	748	468	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14494	5-27-19	E	MARY LOU WILSON	GASTAR EXPLORATION USA, INC	1/8+	748	471	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9

WW-6A1 Supplement

Operator's Well No. Goudy 1S - 4HM

Lease ID	Parcel	Tags	Grantor, Lessor, Etc.	Grantee, Lessee, Etc.	Royalty	Deed Book/Page		Assignment	Assignment	Assignment	Assignment	Assignment	Assignment	Assignment	Assignment	Assignment
10*14495	5-27-19	E	PATRICIA HARTMAN	GASTAR EXPLORATION USA, INC	1/8+	752	197	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14496	5-27-19	E	STEPHANIE L HALL	GASTAR EXPLORATION USA	1/8+	752	215	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14497	5-27-19	E	CAROL DEEN GARDNER	GASTAR EXPLORATION USA INC	1/8+	752	212	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14498	5-27-19	E	BAYER MATERIALSCIENCE LLC	GASTAR EXPLORATION USA INC	1/8+	757	340	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*22926	5-27-19	E	COVESTRO LLC	TH EXPLORATION LLC	1/8+	976	27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*14493	5-27-20	F	BETTY JEAN NEELY	GASTAR EXPLORATION USA, INC	1/8+	748	468	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14494	5-27-20	F	MARY LOU WILSON	GASTAR EXPLORATION USA, INC	1/8+	748	471	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14495	5-27-20	F	PATRICIA HARTMAN	GASTAR EXPLORATION USA, INC	1/8+	752	197	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14496	5-27-20	F	STEPHANIE L HALL	GASTAR EXPLORATION USA	1/8+	752	215	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14497	5-27-20	F	CAROL DEEN GARDNER	GASTAR EXPLORATION USA INC	1/8+	752	212	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9

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10*14498	5-27-20	F	BAYER MATERIALSCIENCE LLC	GASTAR EXPLORATION USA INC	1/8+	757	340	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*22926	5-27-20	F	COVESTRO LLC	TH EXPLORATION LLC	1/8+	976	27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*14493	5-27-20.1	G	BETTY JEAN NEELY	GASTAR EXPLORATION USA, INC	1/8+	748	468	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14494	5-27-20.1	G	MARY LOU WILSON	GASTAR EXPLORATION USA, INC	1/8+	748	471	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14495	5-27-20.1	G	PATRICIA HARTMAN	GASTAR EXPLORATION USA, INC	1/8+	752	197	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14496	5-27-20.1	G	STEPHANIE L HALL	GASTAR EXPLORATION USA	1/8+	752	215	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14497	5-27-20.1	G	CAROL DEEN GARDNER	GASTAR EXPLORATION USA INC	1/8+	752	212	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14499	5-27-20.1	G	UNION CARBIDE CORPORATION	GASTAR EXPLORATION USA INC	1/8+	815	221	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14505	5-27-27	H	JAMES ANDREW RICHMOND	GASTAR EXPLORATION USA INC	1/8+	752	447	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*14498	5-27-26	I	BAYER MATERIALSCIENCE LLC	GASTAR EXPLORATION USA INC	1/8+	757	340	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9

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10*22926	5-27-26	I	COVESTRO LLC	TH EXPLORATION LLC	1/8+	976	27	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*14505	5-27-25	J	JAMES ANDREW RICHMOND	GASTAR EXPLORATION USA INC	1/8+	752	447	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 26/639	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 21/41	Gastar Exploration Inc to TH Exploration II LLC: 36/9
10*23502	12-1-4	K	ROBERT F ROTHLISBERGER	TH EXPLORATION LLC	1/8+	210A	801	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*15075	12-1-5	L	BARBARA P MAZER	GASTAR EXPLORATION USA INC	1/8+	129A	693	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 135A/284	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 13/270	Gastar Exploration Inc to TH Exploration II LLC: 173A/431
10*15076	12-1-5	L	EDWARD PENNINGTON	GASTAR EXPLORATION USA INC	1/8+	130A	979	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 135A/284	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 13/270	Gastar Exploration Inc to TH Exploration II LLC: 173A/431
10*15079	12-1-5	L	JAMES K. HALL	GASTAR EXPLORATION USA INC	1/8+	132A	704	N/A	N/A	N/A	N/A	N/A	N/A	Gastar Exploration USA Inc to Atinum Marcellus I LLC: 135A/284	Merger of Gastar Exploration Inc and Gastar Exploration USA Inc: 13/270	Gastar Exploration Inc to TH Exploration II LLC: 173A/431
10*18122	12-1-5	L	ANNE L HALL AND RICHARD S WURST	TH EXPLORATION LLC	1/8+	187A	626	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*18175	12-1-5	L	STONE HILL MINERALS HOLDINGS LLC	TH EXPLORATION LLC	1/8+	188A	791	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*18177	12-1-5	L	STONE HILL MINERALS HOLDINGS LLC	TH EXPLORATION LLC	1/8+	188A	793	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*18233	12-1-5	L	SUSAN G HALL	TH EXPLORATION LLC	1/8+	188A	429	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*18286	12-1-5	L	ELIZABETH H HALL	TH EXPLORATION LLC	1/8+	188A	431	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*19511	12-1-7	M	CORT D ACKER	TH EXPLORATION LLC	1/8+	195A	168	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*24538	12-1-7	M	BRC MINERALS, LP	BRC WORKING INTEREST COMPANY LLC	1/8+	103A	320	BRC Working Interest Company LLC to Chesapeake Appalachia LLC: 103A/470	Chesapeake Appalachia LLC to Statoil USA Onshore Properties Inc: 120A/109	Chesapeake Appalachia LLC to SWN Production Company: 157A/540	Statoil USA Onshore Properties Inc to SWN Exchange Titleholder LLC: 158A/801	SWN Exchange Titleholder LLC merged with and into SWN Production Company LLC: 13/296	SWN Production Company LLC to Antero Exchange Properties LLC: 177A/533	Statoil USA Onshore Properties Inc to Antero Exchange Properties LLC: 177A/738	Antero Exchange Properties LLC merged with and into Antero Resources Corporation: 13/311	Antero Resources Corporation to TH Exploration LLC: 218A/755
10*25450	12-1-17	N	MURIEL MILLER	TH EXPLORATION LLC	1/8+	222A	465	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*22580	12-1-17	N	JAMES H PARSONS JR	TH EXPLORATION LLC	1/8+	209A	265	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*23524	12-1-17	N	HAMMETT LAND & MINERALS LLC	TH EXPLORATION LLC	1/8+	210A	807	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*23525	12-1-17	N	HAMMETT LAND & MINERALS LLC	TH EXPLORATION LLC	1/8+	210A	809	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*23906	12-1-17	N	JOHN M PARSONS & ANTOINETTE L COSTANTINO	TH EXPLORATION LLC	1/8+	214A	675	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*24090	12-1-17	N	VIVIAN A PARSONS	TH EXPLORATION LLC	1/8+	216A	371	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*24317	12-1-17	N	ROY C PARSONS	TH EXPLORATION LLC	1/8+	218A	480	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10*25644	12-1-17	N	JOHN P SNYDER	TH EXPLORATION LLC	1/8+	222A	434	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

COPY 05/24/2019

AFFIDAVIT

STATE OF TEXAS §
§ SS
COUNTY OF TARRANT §

On this 18th day of October, 2016, before me, the undersigned authority, personally appeared David D. Kalish ("Affiant") who being first duly sworn under oath, deposes and saith:

1. TH Exploration, LLC, TH Exploration II, LLC and TH Exploration III, LLC are wholly owned subsidiaries of THQ Appalachia I, LLC.
2. Tug Hill Operating, LLC provides oil and gas operations services to THQ Appalachia I, LLC under an Operating Services Agreement dated July 23, 2014.
3. David D. Kalish, the Affiant, is the Vice President of Tug Hill Operating, LLC, THQ Appalachia I, LLC, TH Exploration, LLC, TH Exploration II, LLC and TH Exploration III, LLC, and;
3. Tug Hill Operating, LLC is authorized to operate and maintain the assets owned by THQ Appalachia I, LLC, including, as referenced above, TH Exploration, LLC, TH Exploration II, LLC, and TH Exploration III, LLC, including oil and gas leases, wells, pipelines, surface facilities, and other all other assets that support the business of THQ Appalachia I, LLC, and;
4. Specifically, Tug Hill Operating, LLC is authorized to submit and obtain well work permits and carry out all activities pursuant to such work permits for assets owned by TH Exploration, LLC, TH Exploration II, LLC, TH Exploration III, LLC.

FURTHER, AFFIANT SAITH NOT.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this 18th day of October, 2016.

David D. Kalish
Affiant: David D. Kalish

Jan Pest
MARSHALL County 03:44:28 PM
Instrument No 1416299
Date Recorded 10/19/2016
Document Type MIS
Pages Recorded 1
Book-Page 28-62
Recording Fee $5.00
Additional $6.00

JURAT

STATE OF TEXAS §
§ SS
COUNTY OF TARRANT §

Sworn and subscribed to (or affirmed) before me on this, the 18th day of October, 2016, by David D. Kalish.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

ROBIN BOCK
Notary Public, State of Texas
Comm. Expires 10-05-2020
Notary ID 129153360

My Commission Expires: 10-05-2020
Signature/Notary Public: Robin Bock
Name/Notary Public (Print): Robin Bock

Jan Pest
MARSHALL County 01:22:38 PM
Instrument No 1403489
Date Recorded 04/27/2016
Document Type ASN
Pages Recorded 77
Book-Page 36-9
Recording Fee $77.00
Additional $13.00

05/24/2019

WHEN RECORDED RETURN TO:
TH Exploration II, LLC
1320 South University Drive, Suite 500
Fort Worth, Texas 76107
Attn: David Kalish

Execution Version

ASSIGNMENT AND BILL OF SALE

STATE OF WV §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF MARSHALL §

THIS ASSIGNMENT AND BILL OF SALE (this "*Assignment*"), dated April 7, 2016, but effective as of 7:00 A.M. Houston time on January 1, 2016 (the "*Effective Time*"), is between Gastar Exploration Inc., a Delaware corporation, whose address is 1331 Lamar Street, Suite 650 Houston, Texas 77010 ("*Assignor*"), and TH Exploration II, LLC, a Texas limited liability company, whose address is 1320 South University Drive, Suite 500, Fort Worth, Texas 76107 ("*Assignee*"). Assignor and Assignee are each, individually, referred to herein as a "*Party*" and, collectively, as the "*Parties*".

Capitalized terms used but not defined herein shall have the respective meanings set forth in that certain Purchase and Sale Agreement (the "*Purchase Agreement*"), dated as of February 19, 2016, by and between Assignor and Assignee (as successor-in-interest).

Section 1. Assignment. The conveyance and assignment herein shall be deemed effective as of the Effective Time.

For Ten Dollars ($10.00) and other good and valuable consideration (the receipt and sufficiency of which are hereby acknowledged), Assignor does hereby forever GRANT, BARGAIN, SELL, CONVEY, ASSIGN, TRANSFER, SET OVER AND DELIVER unto Assignee, all of Assignor's right, title and interest in and to the following interests and properties (such right, title and interest described in *subsections (a)* through *(b)* of this Section 1, less and except the Excluded Assets, collectively, the "*Conveyed Interests*"):

(a) all oil, gas and/or mineral leases of Assignor, together with any and all other right, title and interest of Assignor in and to the leasehold estates created thereby, including subleases, royalties, overriding royalties, net profits interest, carried interests or similar rights or interests in such leases, and together with all rights, privileges, benefits and powers conferred upon Assignor with respect to the use and occupation of the lands covered thereby that may be necessary, convenient or incidental to the possession and enjoyment of such leases, located in Marshall, Wetzel, Doddridge, Harrison, Lewis, Marion, and Monongalia Counties, West Virginia and Greene, Butler, Fayette, Somerset, and Clearfield Counties, Pennsylvania, including those described on Exhibit A—Part 1 attached hereto (subject to any reservations, limitations or depth restrictions described on Exhibit A—Part 1), (Assignor's interest in such leases and other right, title and interest as so limited, the "*Leases*");

(b) all rights and interests in, under or derived from all unitization agreements in effect with respect to any of the Leases and the units created thereby, including those described

DPS LAND SERVICES-CORP-TIM SCHULTZ
6000 TOWN CENTER BLVD STE 145
CANONSBURG, PA 15317-5841

WHEN RECORDED RETURN TO:
TH Exploration II, LLC
1320 South University Drive, Suite 500
Fort Worth, Texas 76107
Attn: David Kalish

Execution Version

ASSIGNMENT AND BILL OF SALE

STATE OF WV §
§ KNOW ALL MEN BY THESE PRESENTS:
COUNTY OF WETZEL §

THIS ASSIGNMENT AND BILL OF SALE (this "***Assignment***"), dated April 7, 2016, but effective as of 7:00 A.M. Houston time on January 1, 2016 (the "***Effective Time***"), is between Gastar Exploration Inc., a Delaware corporation, whose address is 1331 Lamar Street, Suite 650 Houston, Texas 77010 ("***Assignor***"), and TH Exploration II, LLC, a Texas limited liability company, whose address is 1320 South University Drive, Suite 500, Fort Worth, Texas 76107 ("***Assignee***"). Assignor and Assignee are each, individually, referred to herein as a "***Party***" and, collectively, as the "***Parties***".

Capitalized terms used but not defined herein shall have the respective meanings set forth in that certain Purchase and Sale Agreement (the "***Purchase Agreement***"), dated as of February 19, 2016, by and between Assignor and Assignee (as successor-in-interest).

Section 1. Assignment. The conveyance and assignment herein shall be deemed effective as of the Effective Time.

For Ten Dollars ($10.00) and other good and valuable consideration (the receipt and sufficiency of which are hereby acknowledged), Assignor does hereby forever GRANT, BARGAIN, SELL, CONVEY, ASSIGN, TRANSFER, SET OVER AND DELIVER unto Assignee, all of Assignor's right, title and interest in and to the following interests and properties (such right, title and interest described in *subsections (a)* through *(k)* of this Section 1, less and except the Excluded Assets, collectively, the "***Conveyed Interests***"):

(a) all oil, gas and/or mineral leases of Assignor, together with any and all other right, title and interest of Assignor in and to the leasehold estates created thereby, including subleases, royalties, overriding royalties, net profits interest, carried interests or similar rights or interests in such leases, and together with all rights, privileges, benefits and powers conferred upon Assignor with respect to the use and occupation of the lands covered thereby that may be necessary, convenient or incidental to the possession and enjoyment of such leases, located in Marshall, Wetzel, Doddridge, Harrison, Lewis, Marion, and Monongalia Counties, West Virginia and Greene, Butler, Fayette, Somerset, and Clearfield Counties, Pennsylvania, including those described on Exhibit A—Part 1 attached hereto (subject to any reservations, limitations or depth restrictions described on Exhibit A—Part 1), (Assignor's interest in such leases and other right, title and interest as so limited, the "***Leases***");

DPS
6000 TOWN CENTER BLVD STE 145
CANONSBURG PA 15317-5870

Wetzel County
Carol S Haught, Clerk
Instrument 260482
12/11/2018 @ 01:23:35 PM
OIL AND GAS
Book 218A @ Page 755
Pages Recorded 6
Recording Cost $ 12.00

PARTIAL ASSIGNMENT AND CONVEYANCE OF OIL AND GAS LEASE

STATE OF WEST VIRGINIA)
) §
COUNTY OF WETZEL)

This Partial Assignment and Conveyance of Oil and Gas Leases (this "**Assignment**"), dated effective as of December 7, 2018 at 7:00 a.m. Central Time (the "**Effective Time**"), is made by **Antero Resources Corporation**, a Delaware corporation, whose address is 1615 Wynkoop Street, Denver, CO 80202 ("**Assignor**"), to **TH Exploration, LLC**, a Texas limited liability company, whose address is 1320 S. University Drive, Suite 500, Fort Worth, TX 76107 ("**Assignee**"). Assignor and Assignee are sometimes referred to herein together as the "**Parties**" and individually as a "**Party.**"

WHEREAS, Assignor owns an undivided working interest in the Leases (as defined below).

WHEREAS, Assignor desires to assign to Assignee, and Assignee desires to accept such assignment of, the Leasehold Rights (as defined below), as more particularly described in this Assignment.

NOW, THEREFORE, for and in consideration of Ten Dollars ($10.00) and other valuable consideration, the receipt and sufficiency of which is hereby acknowledged:

Assignor does hereby GRANT, BARGAIN, TRANSFER, ASSIGN and CONVEY to Assignee 100% of Assignor's right, title and interest in and to the oil and gas leases described in more detail on Exhibit A, less and except those certain portions, if any, retained by Assignor as described on Exhibit A, (such oil and gas leases, the "**Leases**", and 100% of Assignor's collective right, title and interest in and to the Leases less an except those portions, if any, retained by Assignor, the "**Leasehold Rights**").

This Assignment is further made subject to the following:

1. **Assignment Subject to Trade Agreement.** This Assignment is made in accordance with and is subject to the terms, covenants and conditions contained in that certain Trade Agreement, dated October 12, 2018 by and between Assignor and Assignee (as the same may be amended from time to time, the "**Trade Agreement**"). In the event of a conflict between the provisions of the Trade Agreement and this Assignment, the provisions of the Trade Agreement shall control. The execution and delivery of this Assignment by Assignor, and the execution and acceptance of this Assignment by Assignee, shall not operate to release or impair any surviving rights or obligations of Assignor or Assignee under the Trade Agreement. Capitalized terms used but not otherwise defined in this Assignment shall have the respective meanings given to such terms in the Trade Agreement.

2. **Assumption of Liabilities.** Subject to the terms of the Trade Agreement, effective as of the Effective Time, Assignee hereby acknowledges, assumes, and agrees to assume, pay, perform, fulfill and discharge the Tug Hill Assumed Liabilities.

3. **Special Warranty of Title.** Assignor (a) hereby warrants, and shall defend, title to the Leasehold Rights unto Assignee and its successors in interest against every person whomsoever lawfully claiming, or to claim the same or any part thereof by, through or under Assignor or its Affiliates, but not otherwise, subject to the Permitted Encumbrances and (b) hereby subrogates Assignee to all covenants and warranties of title by third persons (other than Assignor and its Affiliates) heretofore given or made to Assignor or its predecessors in title or Affiliates in respect of any of the Leasehold Rights.

Operator's Well No. Goudy 1S-4HM

Area of Review

Sources of information to Support 35CSR8 - 5.11: 9.3 et seq.

Description of process to identify potential pathways for well communication during hydraulic fracturing activities.

Data Sources Reviewed:

1. IHS Well Data service: Public nationwide data service that pulls directly from State agency Oil and Gas databases

2. Farm Maps

3. Topo Maps: Recent and older (contact WVGES)

4. Check with DPS

Contacted Devin Ducoeur 724-705-0444, dducoeur@dpslandservices.com DPS GIS (05/24/2018) to have him make maps of the wellbores with his information. DPS utilizes WVGES maps for their mapping seems it as the best publicly available. See attached map he provided.

Request maps for:

1. Wellbore with IHS All Wells Layer

2. Map with Farm lines overlain and any well spots identified on Farm Maps

3. More recent (1970s vintage) topos and older topos

Discussion with Phil Dinterman WVGES GIS Department (7/15/2016)

- WVGES has plotted every well spot they have access to and are aware of with that contains a coordinate. 30000, 70000, and 90000 series wells are available via the WVGES online map. Some locations aren't great due to vintage and manipulation of maps through time
- 30000 series – any well drilled prior to 1929 – APIs were not assigned to original wells
- 70000 series – Well spots pulled from old Farm line maps that the WVGES has access to
- 90000 series – Any sources that the WVGES has access that shows a well spot but has no additional supporting information. DEP does not have 90000 series on their maps.
- There can be duplication between wells in the 3 series
- Phil indicated that other Operators are providing a screenshot of the WVGES map with their planned well and using that for permits

Permit well - Goudy 1S-4HM

Wells within 500' Buffer

Note: Well spots depicted on Area of Review map (page 3) are derived from State held coordinates. The spots may differ from those depicted on the Well Plat because the Plat locations represent actual field surveyed locations. Please refer to the Plat for surveyed well spots

API Number	Operator Name	Total Depth	Perforated Fms	Producing zones not perforated	Is this well "known or reasonably expected to penetrate a depth that could be within the range of Fracture propagation"? 1000' is max limit I would assign to wells that might be within in range of fracture propagation	Comments
4705101588	Tug Hill Operating	6401' TVD 12660' MD	Marcellus	Unknown	Yes, existing Marcellus producer. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	Producing Marcellus horizontal well. A field survey was conducted to locate this well and it was found producing at the location shown on the well plat.
4705101589	Tug Hill Operating	6461' TVD 12725' MD	Marcellus	Unknown	Yes, existing Marcellus producer. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	Producing Marcellus horizontal well. A field survey was conducted to locate this well and it was found producing at the location shown on the well plat.
4705101590	Tug Hill Operating	6395' TVD 13141' MD	Marcellus	Unknown	Yes, existing Marcellus producer. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	Producing Marcellus horizontal well. A field survey was conducted to locate this well and it was found producing at the location shown on the well plat.
4705101591	Tug Hill Operating	6458' TVD 12330' MD	Marcellus	Unknown	Yes, existing Marcellus producer. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	Producing Marcellus horizontal well. A field survey was conducted to locate this well and it was found producing at the location shown on the well plat.
4705101593	Tug Hill Operating	6413' TVD 13178' MD	Marcellus	Unknown	Yes, existing Marcellus producer. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	Producing Marcellus horizontal well. A field survey was conducted to locate this well and it was found producing at the location shown on the well plat.
4705101601	Tug Hill Operating	6456' TVD 13145' MD	Marcellus	Unknown	Yes, existing Marcellus producer. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	Producing Marcellus horizontal well. A field survey was conducted to locate this well and it was found producing at the location shown on the well plat.
4705101610	Tug Hill Operating	6480' TVD 13447' MD	Marcellus	Unknown	Yes, existing Marcellus producer. Proper casing and cement should prevent migration of fluids from new wellbore to existing wellbore	Producing Marcellus horizontal well. A field survey was conducted to locate this well and it was found producing at the location shown on the well plat.
4705170374	Unknown	Unknown	Unknown	Unknown	Uknown but unlikley. The well likley represents an old shallow well that is too shallow to be effected by fracturing in the planned Marcellus well.	State records are incomplete
4705170370	Unknown	Unknown	Unknown	Unknown	Uknown but unlikley. The well likley represents an old shallow well that is too shallow to be effected by	State records are incomplete
4705170368	Unknown	Unknown	Unknown	Unknown	Uknown but unlikley. The well likley represents an old shallow well that is too shallow to be effected by	State records are incomplete

WV Geological & Economic Survey:

Well: County = 51 Permit = 01588

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705101588	Marshall	1588	Franklin	New Martinsville	New Martinsville	39.738526	-80.82272	514575.5	4398563.3

Bottom Hole Location Information:

API	EP	FLAG	UTME	UTMN	LON_DD	LAT_DD
4705101588	1	As Drilled	513629.9	4400291.3	-80.840897	39.752423
4705101588	1	As Proposed	513632.2	4400279.6	-80.840871	39.752318

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
4705101588	5/5/2013	Dvtd Orgnl Loc	Completed	PPG Industries Inc	7H		Goudy	WV16-0076-001/WV16-0096-006	PPG Industries Inc et al	Gastar Exploration USA, Inc.	6400	Marcellus Sh	

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_AFT	NGL_BEF
4705101588	5/5/2013	4/19/2013	1238	Ground Level		Marcellus Sh	Marcellus Sh	Development Well	Development Well	Oil and Gas	Rotary	Fractured		12660	12660			1699		260	

Pay/Show/Water Information:

API	CMP_DT	ACTIVITY	PRODUCT	SECTION	DEPTH_TOP	FM_TOP	DEPTH_BOT	FM_BOT	G_BEF	G_AFT	O_BEF	O_AFT	WATER_QNTY
4705101588	5/5/2013	Water	Fresh Water	Vertical			1155	Pennsylvanian System					
4705101588	5/5/2013	Water	Salt Water	Vertical			1670	3rd Salt Sand					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	6895	Marcellus Sh	7130	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	7217	Marcellus Sh	7425	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	7484	Marcellus Sh	7706	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	7823	Marcellus Sh	7996	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	8069	Marcellus Sh	8229	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	8311	Marcellus Sh	8507	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	8591	Marcellus Sh	8810	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	8921	Marcellus Sh	9104	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	9177	Marcellus Sh	9368	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	9421	Marcellus Sh	9662	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	9725	Marcellus Sh	9895	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	9964	Marcellus Sh	10165	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	10227	Marcellus Sh	10412	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	10507	Marcellus Sh	10722	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	10777	Marcellus Sh	10975	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	11057	Marcellus Sh	11249	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	11335	Marcellus Sh	11504	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	11602	Marcellus Sh	11764	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	11866	Marcellus Sh	12065	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	12141	Marcellus Sh	12331	Marcellus Sh					
4705101588	5/5/2013	Pay	Oil & Gas	Deviated	12404	Marcellus Sh	12464	Marcellus Sh					

Production Gas Information: (Volumes in Mcf)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_GAS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101588	Gastar Exploration Inc.	2015	196,640	0	0	0	16,274	26,229	21,862	19,716	24,566	22,968	22,603	22,156	19,227
4705101588	Tug Hill Operating, LLC	2016	246,137	23,367	21,686	21,468	21,499	21,766	19,968	20,414	20,037	19,880	19,201	18,171	18,685
4705101588	Tug Hill Operating, LLC	2017	184,869	17,520	16,286	18,404	18,395	16,640	16,130	15,606	16,479	15,485	13,023	0	0

Production Oil Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_OIL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101588	Gastar Exploration Inc.	2015	15,344	0	0	0	2,325	2,686	2,029	1,320	1,609	1,550	1,263	1,269	1,195
4705101588	Tug Hill Operating, LLC	2016	0												
4705101588	Tug Hill Operating, LLC	2017	8,264	992	920	1,004	778	884	701	777	787	700	718		

Production NGL Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_NGL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101588	Gastar Exploration Inc.	2015	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101588	Tug Hill Operating, LLC	2016	13,585	1,249	1,260	1,047	1,326	1,296	992	1,076	1,083	979	997	1,067	1,186
4705101588	Tug Hill Operating, LLC	2017	0												

Production Water Information: (Volumes in Gallons)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_WTR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101588	Tug Hill Operating, LLC	2016	1,791	20	27	40	200	213	196	203	207	191	173	157	142
4705101588	Tug Hill Operating, LLC	2017	1,631	163	163	173	186	176	175	193	168	137	92	0	0

Stratigraphy Information:

API	SUFFIX	FM	FM_QUALITY	DEPTH_TOP	DEPTH_QUALITY	THICKNESS	THICKNESS_QUALITY	ELEV	DATUM
4705101588	Dvtd Orgnl Loc	Sewickley coal	Well Record	1000	Reasonable	10	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Pittsburgh coal	Well Record	1220	Reasonable	10	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	3rd Salt Sand	Well Record	1685	Reasonable	55	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Maxton	Well Record	1827	Reasonable	33	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Big Lime	Well Record	1883	Reasonable	75	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Big Injun (Price&eq)	Well Record	1958	Reasonable	258	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Weir	Well Record	2216	Reasonable	239	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Berea Ss	Well Record	2455	Reasonable	240	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Gordon	Well Record	3030	Reasonable	40	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Warren	Well Record	3520	Reasonable	30	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Brallier	Well Record	3550	Reasonable	1463	Calcble Pick	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Java Fm	Well Record	5013	Reasonable	219	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Java: Pipe Creek	Well Record	5232	Reasonable	200	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Rhinestreet Sh	Well Record	5853	Reasonable	294	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Cashaqua Sh	Well Record	6147	Reasonable	85	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Middlesex Sh	Well Record	6232	Reasonable	24	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	West River Sh	Well Record	6256	Reasonable	67	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Geneseo Sh	Well Record	6323	Reasonable	24	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Tully Ls	Well Record	6347	Reasonable	31	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Hamilton	Well Record	6378	Reasonable	9	Reasonable	1238	Ground Level
4705101588	Dvtd Orgnl Loc	Marcellus Sh	Well Record	6387	Reasonable			1238	Ground Level

WV Geological & Economic Survey:

Well: County = 51 Permit = 01589

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705101589	Marshall	1589	Franklin	New Martinsville	New Martinsville	39.736862	-80.828733	514676.2	4398556.2

Bottom Hole Location Information:

API	EP	FLAG	UTME	UTMN	LON_DD	LAT_DD
4705101589	1	As Proposed	516596.6	4397948	-80.806802	39.730266

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
4705101589	7/20/2013	Dvtd Orgnl Loc	Completed	PPG Industries Inc	8H		Goudy	WV16-0096-001/-002/-003/-004/-005/-006	PPG Industries Inc et al	Gastar Exploration USA, Inc.	6400	Marcellus Sh	

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_AFT	NGL_BEF
4705101589	7/20/2013	1/4/2013	1238	Ground Level	Cameron-Garner	Marcellus Sh	Marcellus Sh	Development Well	Development Well	Oil and Gas	Rotary	Acid+Frac	6461	12725	12725			2441		261	

Comment: 7/20/2013 Additional Lease Nos: WV16-0076-001/WV16-0115-000/WV16-0013-000/WV16-0127-001/-002/-003

Pay/Show/Water Information:

API	CMP_DT	ACTIVITY	PRODUCT	SECTION	DEPTH_TOP	FM_TOP	DEPTH_BOT	FM_BOT	G_BEF	G_AFT	O_BEF	O_AFT	WATER_QNTY
4705101589	7/20/2013	Water	Fresh Water	Vertical			1266						
4705101589	7/20/2013	Water	Salt Water	Vertical			1670	Mississippian					
4705101589	7/20/2013	Pay	Oil & Gas	Vertical	6410	Marcellus Sh	6461	Marcellus Sh					
4705101589	7/20/2013	Pay	Oil & Gas	Deviated	6694	Marcellus Sh	12725	Marcellus Sh					

Production Gas Information: (Volumes in Mcf)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_GAS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101589	Gastar Exploration USA, Inc.	2013	266,299	0	0	0	0	0	0	0	41,664	66,616	56,069	50,584	50,366
4705101589	Gastar Exploration USA, Inc.	2014	350,344	46,730	37,617	40,713	9,650	36,872	33,137	29,239	36,737	31,502	20,182	21,160	20,335
4705101589	Gastar Exploration Inc.	2015	216,764	0	0	26,260	16,138	25,316	26,293	26,842	26,369	23,846	17,663	14,798	17,244
4705101589	Tug Hill Operating, LLC	2016	288,549	27,971	27,147	24,632	26,640	26,213	23,900	23,818	23,342	22,126	22,045	20,612	20,296
4705101589	Tug Hill Operating, LLC	2017	205,343	20,051	17,519	19,141	18,459	17,606	16,379	16,404	17,427	15,944	17,049	13,593	16,370

Production Oil Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_OIL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101589	Gastar Exploration USA, Inc.	2013	16,782	0	0	0	0	0	0	0	3,590	3,910	3,020	2,787	2,455
4705101589	Gastar Exploration USA, Inc.	2014	17,783	2,628	2,162	2,182	383	1,392	1,355	960	1,719	1,607	1,239	1,261	1,164
4705101589	Gastar Exploration Inc.	2015	8,030	0	0	929	481	1,032	1,181	1,015	882	852	684	466	607
4705101589	Tug Hill Operating, LLC	2016	0												
4705101589	Tug Hill Operating, LLC	2017	4,251	465	346	367	300	392	298	299	333	337	334	414	385

Production NGL Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_NGL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101589	Gastar Exploration USA, Inc.	2013	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101589	Gastar Exploration USA, Inc.	2014	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101589	Gastar Exploration Inc.	2015	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101589	Tug Hill Operating, LLC	2016	6,617	868	630	619	676	636	463	512	506	455	434	478	529
4705101589	Tug Hill Operating, LLC	2017	0												

Production Water Information: (Volumes in Gallons)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_WTR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101589	Tug Hill Operating, LLC	2016	3,092	22	35	87	267	242	229	222	224	207	184	175	234
4705101589	Tug Hill Operating, LLC	2017	2,040	263	326	341	223	120	128	129	116	93	106	65	96

Stratigraphy Information:

API	SUFFIX	FM	FM_QUALITY	DEPTH_TOP	DEPTH_QUALITY	THICKNESS	THICKNESS_QUALITY	ELEV	DATUM
4705101589	Dvtd Orgnl Loc	Sewickley coal	Well Record	1000	Reasonable	10	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Pittsburgh coal	Well Record	1220	Reasonable	10	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	3rd Salt Sand	Well Record	1685	Reasonable	55	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Maxton	Well Record	1827	Reasonable	33	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Big Lime	Well Record	1883	Reasonable	75	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Big Injun (Price&eq)	Well Record	1958	Reasonable	258	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Weir	Well Record	2216	Reasonable	239	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Berea Ss	Well Record	2455	Reasonable	240	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Gordon	Well Record	3030	Reasonable	40	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Warren	Well Record	3520	Reasonable	30	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Brallier	Well Record	3550	Reasonable	1463	Calcble Pick	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Java Fm	Well Record	5013	Reasonable	219	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Java: Pipe Creek	Well Record	5232	Reasonable	200	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Rhinestreet Sh	Well Record	5853	Reasonable	294	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Cashaqua Sh	Well Record	6147	Reasonable	85	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Middlesex Sh	Well Record	6232	Reasonable	24	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	West River Sh	Well Record	6256	Reasonable	67	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Geneseo Sh	Well Record	6323	Reasonable	24	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Tully Ls	Well Record	6347	Reasonable	31	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Hamilton	Well Record	6378	Reasonable	9	Reasonable	1238	Ground Level
4705101589	Dvtd Orgnl Loc	Marcellus Sh	Well Record	6387	Reasonable			1238	Ground Level

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APR 3 2019

WV Department of
Environmental Protection

WV Geological & Economic Survey

Well: County = 51 Permit = 01590

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705101590	Marshall	1590	Franklin	New Martinsville	New Martinsville	39.736755	-80.82983	514667	4398886.4

Bottom Hole Location Information:

API	EP	FLAG	UTME	UTMN	LON_DD	LAT_DD
4705101590	1	As Drilled	513420.7	4400187.8	-80.843319	39.751021
4705101590	1	As Proposed	513426	4400185.4	-80.843287	39.751121

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
4705101590	4/13/2015	Dvlpmt Drlg Loc	Completed	PPG Industries Inc	9H		Gouby	WV16-0078-001	PPG Industries Inc	Gastar Exploration USA Inc	6400	Marcellus Sh	

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT
4705101590	4/13/2015	4/19/2013	1239	Ground Level	Cameron-Garner	Marcellus Sh	Marcellus Sh	Development Well	Development Well	Oil and Gas	Rotary	Fractured	6395	13141	13141	5988		1462

Comment: 4/13/2015 KOP 5988'

Pay/Show/Water Information:

API	CMP_DT	ACTIVITY	PRODUCT	SECTION	DEPTH_TOP	FM_TOP	DEPTH_BOT	FM_BOT	G_BEF	G_AFT	O_BEF	O_AFT	WATER_QNTY
4705101590	4/13/2015	Water	Fresh Water	Vertical			1150	Pennsylvanian System					
4705101590	4/13/2015	Water	Salt Water	Vertical			1572	Salt Sands (undiff)					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	7650	Marcellus Sh	7793	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	7828	Marcellus Sh	7969	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	8100	Marcellus Sh	8519	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	8567	Marcellus Sh	8675	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	8717	Marcellus Sh	8840	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	9042	Marcellus Sh	9093	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	9244	Marcellus Sh	9457	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	9485	Marcellus Sh	9677	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	9733	Marcellus Sh	9947	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	10090	Marcellus Sh	10206	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	10270	Marcellus Sh	10483	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	10542	Marcellus Sh	10662	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	10809	Marcellus Sh	10960	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	11049	Marcellus Sh	11257	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	11385	Marcellus Sh	11545	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	11646	Marcellus Sh	11762	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	11921	Marcellus Sh	12035	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	12146	Marcellus Sh	12367	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	12425	Marcellus Sh	12740	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	12606	Marcellus Sh	12694	Marcellus Sh					
4705101590	4/13/2015	Pay	Oil & Gas	Deviated	12934	Marcellus Sh	12989	Marcellus Sh					

Production Gas Information: (Volumes in Mcf)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_GAS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101590	Gastar Exploration Inc	2015	326,012	0	0	52,966	29,979	36,041	27,352	29,456	24,996	27,267	25,606	23,985	22,960
4705101590	Tug Hill Operating, LLC	2016	300,963	29,307	25,897	25,509	25,962	25,303	25,261	25,169	24,697	23,276	22,265	22,107	22,601
4705101590	Tug Hill Operating, LLC	2017	201,705	21,514	19,649	20,811	19,393	16,575	18,913	19,153	19,650	19,452	19,367	4,656	42

Production Oil Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_OIL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101590	Gastar Exploration Inc	2015	24,673	0	0	6,670	2,537	3,671	2,411	2,160	1,924	1,945	1,614	1,160	1,905
4705101590	Tug Hill Operating, LLC	2016	0												
4705101590	Tug Hill Operating, LLC	2017	7,009	908	645	660	752	806	619	672	574	675	266	68	

Production NGL Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_NGL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101590	Gastar Exploration Inc	2015	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101590	Tug Hill Operating, LLC	2016	14,512	1,684	1,404	1,491	1,200	1,299	1,085	1,113	1,120	965	985	1,007	1,065
4705101590	Tug Hill Operating, LLC	2017	0												

Production Water Information: (Volumes in Gallons)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_WTR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101590	Tug Hill Operating, LLC	2016	5,086	357	222	285	557	521	615	600	423	449	447	434	418
4705101590	Tug Hill Operating, LLC	2017	5,368	386	350	391	365	382	363	334	793	551	1,042	242	0

Stratigraphy Information:

API	SUFFIX	FM	FM_QUALITY	DEPTH_TOP	DEPTH_QUALITY	THICKNESS	THICKNESS_QUALITY	ELEV	DATUM
4705101590	Dvlpmt Drlg Loc	Sewickley coal	Well Record	1000	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Pittsburgh coal	Well Record	1222	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	2nd Salt Sand	Well Record	1685	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Maxton	Well Record	1827	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Big Lime	Well Record	1893	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Big Injun (Price&eq)	Well Record	1963	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Weir	Well Record	2215	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Berea Ss	Well Record	2468	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Gordon	Well Record	3020	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Warren	Well Record	3620	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Brallier	Well Record	3550	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Java Fm	Well Record	5013	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Rhinestreet Sh	Well Record	5853	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Cashaqua Sh	Well Record	6147	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Middlesex Sh	Well Record	6232	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	West River Sh	Well Record	6256	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Geneseo Sh	Well Record	6323	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Tully Ls	Well Record	6347	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Hamilton	Well Record	6378	Reasonable			1238	Ground Level
4705101590	Dvlpmt Drlg Loc	Marcellus Sh	Well Record	6387	Reasonable			1238	Ground Level

WV Geological & Economic Survey

Well: County = 51 Permit = 01591

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705101591	Marshall	1591	Franklin	New Martinsville	New Martinsville	39.736709	-80.829754	514673.1	4398881.4

Bottom Hole Location Information:

API	EP	FLAG	UTME	UTMN	LON_DD	LAT_DD
4705101591	1	As Proposed	516656.9	4397727.8	-80.805644	39.726172

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
4705101591	7/23/2013	Dvlpmt Drlg Loc	Completed	PPG Industries Inc	5H		Gouby	[illegible]	PPG Industries Inc	Gastar Exploration USA Inc	6400	Marcellus Sh	

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_AFT	NGL_BEF
4705101591	7/23/2013	1/16/2013	1239	Ground Level	Cameron-Garner	Marcellus Sh	Marcellus Sh	Development Well	Development Well	Oil and Gas	Rotary	Acid+Frac	6455	12320	12320			2079		351	

Comment: 7/23/2013 Additional Lease Numbers:WV16-0095-004/WV16-0095-005/WV16-0078-001/WV16-0095-001/WV16-0095-002

Pay/Show/Water Information:

API	CMP_DT	ACTIVITY	PRODUCT	SECTION	DEPTH_TOP	FM_TOP	DEPTH_BOT	FM_BOT	G_BEF	G_AFT	O_BEF	O_AFT	WATER_QNTY
4705101591	7/23/2013	Water	Fresh Water	Vertical			1206						
4705101591	7/23/2013	Water	Salt Water	Vertical			1673	Mississippian					
4705101591	7/23/2013	Pay	Oil & Gas	Vertical	6401	Marcellus Sh	6458	Marcellus Sh					
4705101591	7/23/2013	Pay	Oil & Gas	Deviated	6631	Marcellus Sh	12002	Marcellus Sh					

Production Gas Information: (Volumes in Mcf)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_GAS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101591	Gastar Exploration USA, Inc	2013	230,289	0	0	0	0	0	0	0	44,315	50,770	46,667	41,604	40,413
4705101591	Gastar Exploration USA, Inc	2014	235,957	33,202	21,464	31,800	6,739	29,045	28,002	25,177	28,926	24,602	16,798	14,943	16,159
4705101591	Gastar Exploration Inc	2015	190,812	0	0	21,606	10,822	21,694	21,646	20,012	21,612	20,036	15,063	12,691	14,868
4705101591	Tug Hill Operating, LLC	2016	245,801	23,807	23,126	20,897	20,909	20,303	20,358	20,264	16,594	16,652	15,779	17,559	17,259
4705101591	Tug Hill Operating, LLC	2017	174,577	17,292	16,119	16,304	15,130	15,295	15,261	15,673	14,654	13,403	[illegible]	11,579	12,975

Production Oil Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_OIL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101591	Gastar Exploration USA, Inc	2013	14,295	0	0	0	0	0	0	0	3,671	2,480	2,584	2,287	3,123
4705101591	Gastar Exploration USA, Inc	2014	13,972	1,843	1,208	1,884	254	1,125	1,148	791	1,867	1,172	871	594	697
4705101591	Gastar Exploration Inc	2015	5,840	0	0	791	364	979	1,205	865	721	726	498	404	517
4705101591	Tug Hill Operating, LLC	2016	0												
4705101591	Tug Hill Operating, LLC	2017	2,520	387	294	312	285	328	282	264	283	207	234	265	337

Production NGL Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_NGL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101591	Gastar Exploration USA, Inc	2013	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101591	Gastar Exploration USA, Inc	2014	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101591	Gastar Exploration Inc	2015	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101591	Tug Hill Operating, LLC	2016	5,807	721	687	527	578	540	412	466	420	367	369	407	449
4705101591	Tug Hill Operating, LLC	2017	0												

Production Water Information: (Volumes in Gallons)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_WTR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101591	Tug Hill Operating, LLC	2016	1,792	19	38	45	219	205	185	158	191	175	187	149	199
4705101591	Tug Hill Operating, LLC	2017	1,720	241	278	221	199	101	124	115	99	78	88	85	73

Stratigraphy Information:

API	SUFFIX	FM	FM_QUALITY	DEPTH_TOP	DEPTH_QUALITY	THICKNESS	THICKNESS_QUALITY	ELEV	DATUM
4705101591	Dvlpmt Drlg Loc	Sewickley coal	Well Record	1000	Reasonable	10	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Pittsburgh coal	Well Record	1220	Reasonable	10	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	2nd Salt Sand	Well Record	1585	Reasonable	55	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Maxton	Well Record	1827	Reasonable	55	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Big Lime	Well Record	1893	Reasonable	75	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Big Injun (Price&eq)	Well Record	1958	Reasonable	255	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Weir	Well Record	2216	Reasonable	250	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Berea Ss	Well Record	2468	Reasonable	240	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Gordon	Well Record	3020	Reasonable	40	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Warren	Well Record	3620	Reasonable	90	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Brallier	Well Record	3550	Reasonable	1460	Qstnble Pick	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Java Fm	Well Record	5013	Reasonable	219	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Java: Pipe Creek	Well Record	5232	Reasonable	200	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Rhinestreet Sh	Well Record	5853	Reasonable	294	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Cashaqua Sh	Well Record	6147	Reasonable	55	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Middlesex Sh	Well Record	6202	Reasonable	24	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	West River Sh	Well Record	6256	Reasonable	67	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Geneseo Sh	Well Record	6323	Reasonable	24	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Tully Ls	Well Record	6347	Reasonable	31	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Hamilton	Well Record	6378	Reasonable	9	Reasonable	1228	Ground Level
4705101591	Dvlpmt Drlg Loc	Marcellus Sh	Well Record	6387	Reasonable			1228	Ground Level

05/24/2019

WV Geological & Economic Survey

Well: County = 51 Permit = 01593

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
[illegible]	Marshall	1593	Franklin	New Martinsville	New Martinsville	[illegible]	[illegible]	[illegible]	[illegible]

Bottom Hole Location Information:

API	EP	FLAG	UTME	UTMN	LON_DD	LAT_DD
[illegible]	1	As Drilled	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	As Proposed	[illegible]	[illegible]	[illegible]	[illegible]

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
[illegible]	4/11/2015	Drld Orgnl Loc	Completed	PPG Industries Inc	[illegible]		Goudy	[illegible]	PPG Industries Inc	Gastar Exploration USA Inc	[illegible]	Marcellus Sh	

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_AFT
[illegible]	4/11/2015	[illegible]	[illegible]	Ground Level	Cameron-Garner	Marcellus Sh	Marcellus Sh	Development Well	Development Well	Oil and Gas	Rotary	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		

Comment: 4/11/2015 KOP [illegible]

Pay/Show/Water Information:

API	CMP_DT	ACTIVITY	PRODUCT	SECTION	DEPTH_TOP	FM_TOP	DEPTH_BOT	FM_BOT	G_BEF	G_AFT	O_BEF	O_AFT	WATER_QNTY
[illegible]	4/11/2015	Water	Fresh Water	Vertical			1185	Pennsylvanian System					
[illegible]	4/11/2015	Water	Salt Water	Vertical			[illegible]	Salt Sands (undiff)					
[illegible]	4/11/2015	Pay	Oil & Gas	Deviated	[illegible]	Marcellus Sh	[illegible]	Marcellus Sh					

Production Gas Information: (Volumes in Mcf)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_GAS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
[illegible]	Gastar Exploration Inc	2015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Tug Hill Operating LLC	2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Tug Hill Operating LLC	2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Production Oil Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_OIL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
[illegible]	Gastar Exploration Inc	2015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Tug Hill Operating LLC	2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Tug Hill Operating LLC	2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Production NGL Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_NGL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
[illegible]	Gastar Exploration Inc	2015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Tug Hill Operating LLC	2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Tug Hill Operating LLC	2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Production Water Information: (Volumes in Gallons)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_WTR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
[illegible]	Tug Hill Operating LLC	2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Tug Hill Operating LLC	2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Stratigraphy Information

API	SUFFIX	FM	FM_QUALITY	DEPTH_TOP	DEPTH_QUALITY	THICKNESS	THICKNESS_QUALITY	ELEV	DATUM
[illegible]	Drld Orgnl Loc	Sewickley coal	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Pittsburgh coal	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	3rd Salt Sand	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Maxton	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Big Lime	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Big Injun (Price&eq)	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Weir	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Berea Ss	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Gordon	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Warren	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Benson	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Java Fm	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Java, Pipe Creek	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Rhinestreet Sh	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Cashaqua Sh	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Middlesex Sh	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	West River Sh	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Geneseo Sh	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Tully Ls	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Hamilton	Well Record	[illegible]	Reasonable			[illegible]	Ground Level
[illegible]	Drld Orgnl Loc	Marcellus Sh	Well Record	[illegible]	Reasonable			[illegible]	Ground Level

WV Geological & Economic Survey

Well: County = 51 Permit = 01601

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705101601	Marshall	1601	Franklin	New Martinsville	New Martinsville	[illegible]	[illegible]	[illegible]	[illegible]

Bottom Hole Location Information:

API	EP	FLAG	UTME	UTMN	LON_DD	LAT_DD
4705101601	1	As Proposed	[illegible]	[illegible]	[illegible]	[illegible]

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
4705101601	7/27/2013	Drld Orgnl Loc	Completed	PPG Industries Inc	[illegible]		Goudy	[illegible]	PPG Industries Inc	Gastar Exploration USA Inc	[illegible]	Marcellus Sh	

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_AFT	NGL_BEF
4705101601	7/27/2013	[illegible]	[illegible]	Ground Level	Cameron-Garner	Marcellus Sh	Marcellus Sh	Development Well	Development Well	Oil and Gas	Rotary	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	

Comment: 7/27/2013 Additional Lease Numbers:WV16-0127-001/WV16-0095-003/WV16-0095-004/WV16-0095-005/WV16-0076-001/WV16-0095-001/WV16-0095-002

Pay/Show/Water Information:

API	CMP_DT	ACTIVITY	PRODUCT	SECTION	DEPTH_TOP	FM_TOP	DEPTH_BOT	FM_BOT	G_BEF	G_AFT	O_BEF	O_AFT	WATER_QNTY
4705101601	7/27/2013	Water	Fresh Water	Vertical			[illegible]						
4705101601	7/27/2013	Water	Salt Water	Vertical			[illegible]	Mississippian					
4705101601	7/27/2013	Pay	Oil & Gas	Vertical	[illegible]	Marcellus Sh	[illegible]	Marcellus Sh					
4705101601	7/27/2013	Pay	Oil & Gas	Deviated	[illegible]	Marcellus Sh	[illegible]	Marcellus Sh					

Production Gas Information: (Volumes in Mcf)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_GAS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101601	Gastar Exploration USA, Inc	2013	[illegible]	0	0	0	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Gastar Exploration USA, Inc	2014	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Gastar Exploration Inc	2015	[illegible]	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Tug Hill Operating LLC	2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Tug Hill Operating LLC	2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Production Oil Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_OIL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101601	Gastar Exploration USA, Inc	2013	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Gastar Exploration USA, Inc	2014	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Gastar Exploration Inc	2015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Tug Hill Operating LLC	2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Tug Hill Operating LLC	2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Production NGL Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_NGL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101601	Gastar Exploration USA, Inc	2013	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Gastar Exploration USA, Inc	2014	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Gastar Exploration Inc	2015	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Tug Hill Operating LLC	2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Tug Hill Operating LLC	2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Production Water Information: (Volumes in Gallons)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_WTR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101601	Tug Hill Operating LLC	2016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4705101601	Tug Hill Operating LLC	2017	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Stratigraphy Information

API	SUFFIX	FM	FM_QUALITY	DEPTH_TOP	DEPTH_QUALITY	THICKNESS	THICKNESS_QUALITY	ELEV	DATUM
4705101601	Drld Orgnl Loc	Sewickley coal	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Pittsburgh coal	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	3rd Salt Sand	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Maxton	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Big Lime	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Big Injun (Price&eq)	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Weir	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Berea Ss	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Gordon	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Warren	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Benson	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Java Fm	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Java, Pipe Creek	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Rhinestreet Sh	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Cashaqua Sh	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Middlesex Sh	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	West River Sh	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Geneseo Sh	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Tully Ls	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Hamilton	Well Record	[illegible]	Reasonable	[illegible]	Reasonable	[illegible]	Ground Level
4705101601	Drld Orgnl Loc	Marcellus Sh	Well Record	[illegible]	Reasonable			[illegible]	Ground Level

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WV Geological & Economic Survey:

Well: County = 51 Permit = 01610

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705101610	Marshall	1610	Franklin	New Martinsville	New Martinsville	39.736593	-80.8265	514559.6	4398526.3

Bottom Hole Location Information:

API	EP	FLAG	UTME	UTMN	LON_DD	LAT_DD
4705101610	1	As Drilled	516577.1	4397457.9	-80.806566	39.726841
4705101610	1	As Proposed	516577.1	4397457.9	-80.806566	39.726842

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_
4705101610	8/29/2013	Dvtd Orgnl Loc	Completed	PPG Industries Inc	1H		Gouzy	WV16-0128-001/WV16-0095-008/WV16-0116-000	PPG Industries Inc et al	Gastar Exploration USA, Inc.	6400	Marcellus Sh	

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_AFT	NGL_BEF
4705101610	8/29/2013	2/15/2013	1236	Ground Level	Cameron	Marcellus Sh	Marcellus Sh	Development Well	Development Well	Oil and Gas	Rotary	AcidFrac	6460	13447	13447			2522		273	

Comment: 8/29/2013 Additional Lease Numbers:WV16-0127-001/WV16-0095-003/WV16-0095-004/WV16-0095-005/WV16-0076-001/WV16-0095-001/WV16-0095-002

Pay/Show/Water Information:

API	CMP_DT	ACTIVITY	PRODUCT	SECTION	DEPTH_TOP	FM_TOP	DEPTH_BOT	FM_BOT	G_BEF	G_AFT	O_BEF	O_AFT	WATER_QNTY
4705101610	8/29/2013	Water	Fresh Water	Vertical			1255						
4705101610	8/29/2013	Water	Salt Water	Vertical			1670	Mississippian					
4705101610	8/29/2013	Pay	Oil & Gas	Vertical	6399	Marcellus Sh	6490	Marcellus Sh					
4705101610	8/29/2013	Pay	Oil & Gas	Deviated	6627	Marcellus Sh	13447	Marcellus Sh					

Production Gas Information: (Volumes in Mcf)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_GAS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101610	Gastar Exploration USA, Inc.	2013	273,796	0	0	0	0	0	0	0	38,887	74,674	55,440	52,166	52,630
4705101610	Gastar Exploration USA, Inc.	2014	372,898	48,204	43,158	42,712	6,111	40,972	33,605	27,071	36,870	29,791	22,343	21,372	21,789
4705101610	Gastar Exploration Inc.	2015	234,693	0	0	29,119	16,642	17,224	16,241	37,724	26,613	28,339	25,971	25,816	24,095
4705101610	Tug Hill Operating, LLC	2016	313,836	30,617	28,775	28,337	25,375	26,455	27,941	26,163	26,049	26,551	24,840	22,917	22,610
4705101610	Tug Hill Operating, LLC	2017	227,807	21,141	19,273	21,007	19,009	19,967	17,951	18,129	20,009	18,285	18,858	17,352	16,621

Production Oil Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_OIL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101610	Gastar Exploration USA, Inc.	2013	15,086	0	0	0	0	0	0	0	3,369	4,242	3,041	2,874	2,570
4705101610	Gastar Exploration USA, Inc.	2014	15,616	2,665	2,420	2,257	230	1,597	1,371	889	1,716	1,425	1,374	1,264	1,247
4705101610	Gastar Exploration Inc.	2015	8,080	0	0	1,250	604	871	964	1,011	820	792	693	601	685
4705101610	Tug Hill Operating, LLC	2016	0												
4705101610	Tug Hill Operating, LLC	2017	5,591	625	571	617	462	536	412	359	375	335	400	445	445

Production NGL Information: (Volumes in Bbl) ** some operators may have reported NGL under Oil

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_NGL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101610	Gastar Exploration USA, Inc.	2013	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101610	Gastar Exploration USA, Inc.	2014	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101610	Gastar Exploration Inc.	2015	0	0	0	0	0	0	0	0	0	0	0	0	0
4705101610	Tug Hill Operating, LLC	2016	7,876	670	630	683	769	817	618	421	676	633	571	628	729
4705101610	Tug Hill Operating, LLC	2017	0												

Production Water Information: (Volumes in Gallons)

API	PRODUCING_OPERATOR	PRD_YEAR	ANN_WTR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DCM
4705101610	Tug Hill Operating, LLC	2016	2,196	100	65	186	216	216	235	274	211	204	177	169	146
4705101610	Tug Hill Operating, LLC	2017	1,944	132	112	126	167	155	139	244	275	218	193	64	125

Stratigraphy Information:

API	SUFFIX	FM	FM_QUALITY	DEPTH_TOP	DEPTH_QUALITY	THICKNESS	THICKNESS_QUALITY	ELEV	DATUM
4705101610	Dvtd Orgnl Loc	Sewickley coal	Well Record	1000	Reasonable	10	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Pittsburgh coal	Well Record	1220	Reasonable	10	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	3rd Salt Sand	Well Record	1605	Reasonable	55	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Maxton	Well Record	1827	Reasonable	33	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Big Lime	Well Record	1883	Reasonable	75	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Big Injun (Price&ec)	Well Record	1958	Reasonable	258	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Weir	Well Record	2216	Reasonable	239	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Berea Ss	Well Record	2455	Reasonable	240	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Gordon	Well Record	3030	Reasonable	40	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Warren	Well Record	3620	Reasonable	30	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Brallier	Well Record	3650	Reasonable	1463	Calculated Pick	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Java Fm	Well Record	5013	Reasonable	219	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Java: Pipe Creek	Well Record	5232	Reasonable	200	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Rhinestreet Sh	Well Record	5853	Reasonable	294	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Cashaqua Sh	Well Record	6147	Reasonable	85	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Middlesex Sh	Well Record	6232	Reasonable	24	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	West River Sh	Well Record	6256	Reasonable	67	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Geneseo Sh	Well Record	6323	Reasonable	24	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Tully Ls	Well Record	6347	Reasonable	31	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Hamilton	Well Record	6378	Reasonable	9	Reasonable	1238	Ground Level
4705101610	Dvtd Orgnl Loc	Marcellus Sh	Well Record	6387	Reasonable			1238	Ground Level

WV Geological & Economic Survey:

Well: County = 51 Permit = 70374

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705170374	Marshall	70374	Franklin	New Martinsville	New Martinsville	39.724637	-80.827892	514747.8	4396341.6

There is no Bottom Hole Location data for this well

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
4705170374	-/-/-	Unknown	Prdtv Map	J J Fronapfel						--------- unknown ---------			

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_AFT
4705170374	-/-/-	-/-/-						unclassified	unclassified	not available	unknown	unknown								

There is no Pay data for this well

There is no Production Gas data for this well

There is no Production Oil data for this well ** some operators may have reported NGL under Oil

There is no Production NGL data for this well ** some operators may have reported NGL under Oil

There is no Production Water data for this well

There is no Stratigraphy data for this well

There is no Wireline (E-Log) data for this well

There is no Plugging data for this well

There is no Sample data for this well

WV Geological & Economic Survey:

Well: County = 51 Permit = 70370

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705170370	Marshall	70370	Franklin	New Martinsville	New Martinsville	39.724827	-80.824613	516037.2	4396342.2

There is no Bottom Hole Location data for this well

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
4705170370	-/-/-	Unknown	Prdtv Map	B G Gouzy						Pittsburgh Pl			

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_
4705170370	-/-/-	-/-/-						unclassified	unclassified	not available	unknown	unknown								

There is no Pay data for this well

There is no Production Gas data for this well

There is no Production Oil data for this well ** some operators may have reported NGL under Oil

There is no Production NGL data for this well ** some operators may have reported NGL under Oil

There is no Production Water data for this well

There is no Stratigraphy data for this well

There is no Wireline (E-Log) data for this well

There is no Plugging data for this well

There is no Sample data for this well

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WV Geological & Economic Survey:

Well: County = 51 Permit = 70368

Location Information: View Map

API	COUNTY	PERMIT	TAX_DISTRICT	QUAD_75	QUAD_15	LAT_DD	LON_DD	UTME	UTMN
4705170368	Marshall	70368	Franklin	New Martinsville	New Martinsville	39.724533	-80.820673	516377.2	4397199.1

There is no Bottom Hole Location data for this well

Owner Information:

API	CMP_DT	SUFFIX	STATUS	SURFACE_OWNER	WELL_NUM	CO_NUM	LEASE	LEASE_NUM	MINERAL_OWN	OPERATOR_AT_COMPLETION	PROP_VD	PROP_TRGT_FM	TFM_EST_PR
4705170368	-/-/-	unknown	Proty Map	W Dougherty	1					Fagert, C			

Completion Information:

API	CMP_DT	SPUD_DT	ELEV	DATUM	FIELD	DEEPEST_FM	DEEPEST_FMT	INITIAL_CLASS	FINAL_CLASS	TYPE	RIG	CMP_MTHD	TVD	TMD	NEW_FTG	KOD	G_BEF	G_AFT	O_BEF	O_A
4705170368	-/-/-	-/-/-						unclassified	unclassified	not available	unknown	unknown								

There is no Pay data for this well

There is no Production Gas data for this well

There is no Production Oil data for this well ** some operators may have reported NGL under Oil

There is no Production NGL data for this well ** some operators may have reported NGL under Oil

There is no Production Water data for this well

There is no Stratigraphy data for this well

There is no Wireline (E-Log) data for this well

There is no Plugging data for this well

There is no Sample data for this well

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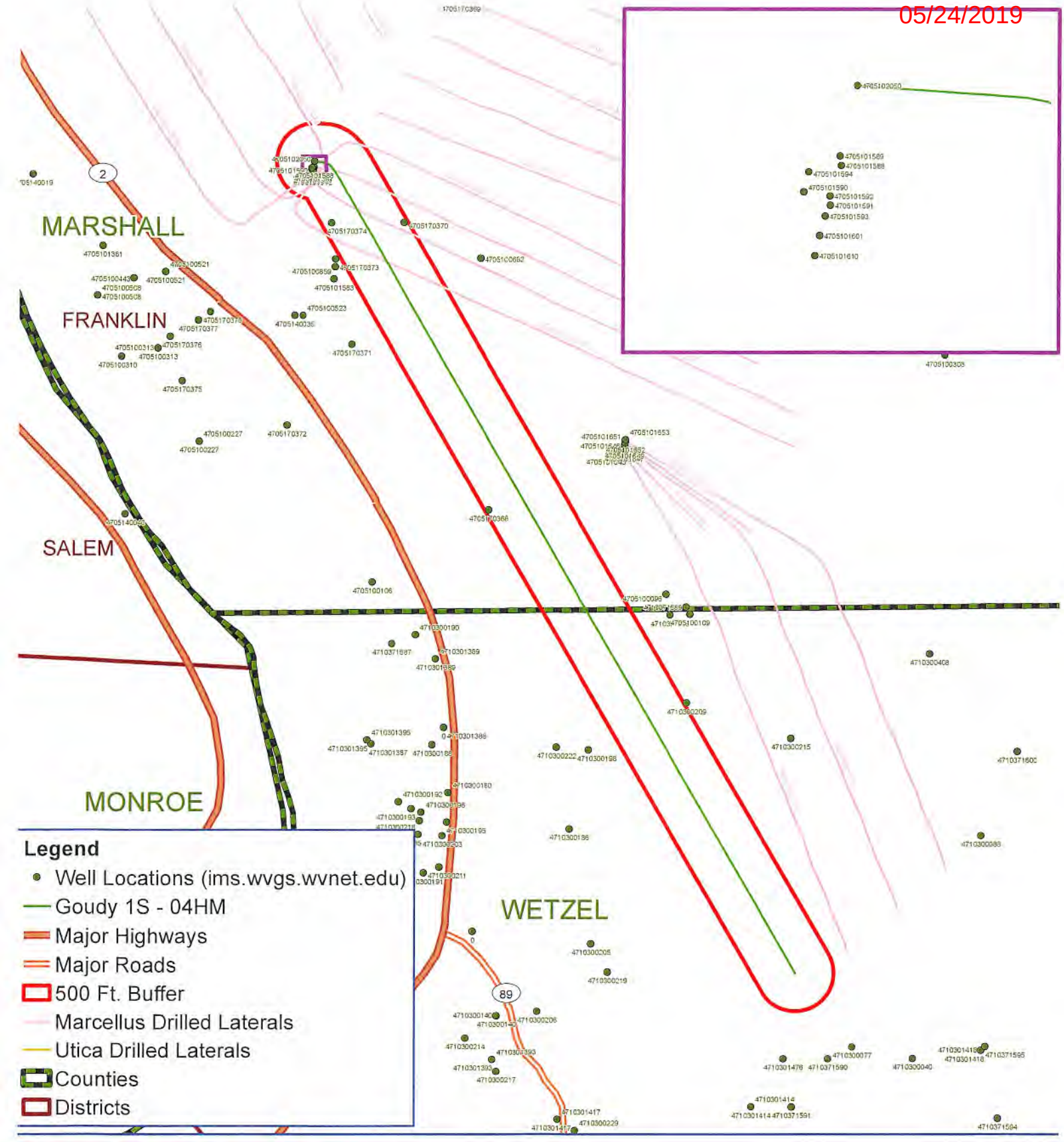
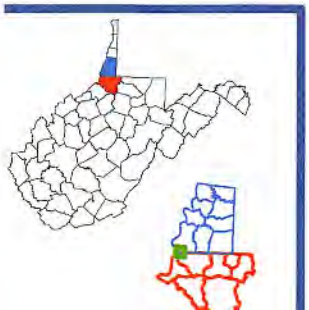
05/24/2019





Goudy 1S - 04HM
Franklin District
Marshall County, WV

0 650 1,300 2,600 Feet

N
W
S

Map Prepared by:

05/24/2019

TUG HILL

March 29, 2019

WVDEP Office of Oil & Gas
Attn: Laura Adkins
601 5th Street, SE
Charleston, WV 25304-2345

VIA: Fed-Ex

RE: Permit Application Modification Request for Goudy 1S-4HM (API # 47-051-02050)

Dear Laura:

Tug Hill Operating, LLC would like to submit the enclosed permit modification request to our approved permit for the Goudy 1S-4HM. We recently secured leases that allow us to extend the bottom hole for this well.

Please find the following enclosed revisions for extending the bottom hole location of the well:

- Revised WW-6B with inspector signature
- Revised WW-6A1
- Revised Mylar Well Plat
- Revised Site Safety Plan
- Revised Area of Review for Communication Purposes

If you have any questions or concerns, please feel free to call me at 304-376-0111. Thank you for your consideration in this matter.

Sincerely,

Amy L. Miller
Permitting Specialist – Appalachia

Alm
Enclosures

RECEIVED
Office of Oil and Gas
APR 3 2019
WV Department of
Environmental Protection

380 SOUTHPOINTE BLVD, PLAZA II, SUITE 200, CANONSBURG, PA 15317 T 724.749.8388 F 724.338.2030

05/24/2019

TUG HILL OPERATING

Well Site Safety Plan

Tug Hill Operating, LLC

3/27/19

Well Name:Goudy 1S-4HM

Pad Location: Goudy Pad

Marshall County, West Virginia

UTM (meters), NAD83, Zone 17:
Northing: 4,398,587.06
Easting: 514,679.21

Updated: March 2019

CONTENTS

PURPOSE AND APPROVAL

Purpose

The West Virginia Department of Environmental Protection (WVDEP) Office of Oil and Gas has established minimum requirements for Well Site Safety Plans (WSSPs) which are required to be submitted with each well site application. This WSSP has been developed pursuant to Title 35, Series 8 – Rules Governing Horizontal Well Development, legislative rule of the West Virginia Department of Environmental Protection Office of Oil and Gas. This plan overviews the equipment, procedures, training, and documentation to respond to emergencies that threaten human health and safety and/or may adversely affect the surrounding environment at Tug-Hill Operating's well site. For purposes of this plan, the term "well site" refers to any site associated with oil and gas exploration or production.

Approved Well Site Safety Plans

Approved WSSPs should be maintained and available at the well site at all times. Copies should also be provided to the local emergency planning committee representing the emergency planning district in which the well work will occur or alternatively to the county office of emergency services. These copies should be provided at least seven days prior to the commencement of well work or site preparation work that involves any disturbance of land.

The WSSP, once approved, may only be modified by the West Virginia Department of Environmental Protection Office of Oil and Gas.

Submittal to Local Emergency Services

Tug-Hill Operating, LLC plans to forward a complete copy of this WSSP to Mr. Tom Hart thart@marshallcountywv.org of the Marshall County EMS seven (7) days prior to any location disturbance.

SECTION 1

CONTACTS, SCHEDULES AND MEETINGS

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

May 2018

1.1 Pre-Spud Safety Meeting

Safety meetings should be held on-site weekly, at a minimum, and specifically prior to the beginning of drilling (pre-spud meeting) operations. Personnel involved in the operation (Tug-Hill, drilling company, H_2S safety personnel, other personnel deemed necessary) shall be included in the safety meetings. The District Oil and Gas Inspector shall be notified forty-eight (48) hours prior to the pre-spud meeting so that they, or their designated representative, can attend the meeting.

Typically, the Tug-Hill On-Site Supervisor will conduct these meeting with Tug-Hill personnel participating as needed. A record of personnel in attendance at these meetings should be documented using the form found in Appendix A. These records may be maintained onsite or in a readily accessible off site location.

1.2 Safety Meeting Schedule and Visitor Log

Safety meetings should be conducted as follows:

- Pre-Drilling (Pre-Spud)
- Pre-Completion
- Pre-Workover
- Post Accident / Near Miss
- As-Needed
- Prior to drilling potentially higher pressure zones (Oriskany and below)

All visitors and contractors are required to sign in and out when entering or leaving the worksite during drilling, completion and work-over activities. This personnel and visitor log will be used for accountability should an incident occur and accountability be conducted after an evacuation. A copy of this log is provided in Appendix A. This log must be maintained on site at all times by the Tug-Hill On-Site Supervisor.

1.3 Emergency Response

In the event that external emergency responders are required, well site personnel shall immediately contact Marshall County Dispatch by dialing 911. County Dispatch will alert the appropriate emergency response agencies depending on the nature and extent of the emergency.

In all cases, well site personnel shall not perform duties/functions in which they have not been trained to perform. Additionally, well site personnel shall not perform response efforts that may put themselves or others in a situation that threatens human health and safety.

1.4 H_2S Notification

The emergency alarm will be an audible or visual type for purposes of alerting personnel that are on location. If elevated levels of H_2S are detected, Tug Hill will immediately implement the

Emergency Response Plan which will provide for site control and evacuation as needed. The site will be secured and only trained emergency response personnel will be permitted to enter the site.

If H_2S is detected and confirmed, Tug Hill will notify the local Oil and Gas Inspector and Deputy Chief of Oil & Gas via telephone.

1.5 Telephone Contact List

Tug-Hill's Emergency Notification List and Reference Sheet is included in Appendix A. The list includes contact information for local emergency response, Tug-Hill management personnel and contractor personnel. Also included in the list is contact information for emergency notification such as spill response and accident hotlines. Schools and public facilities within a one (1) mile radius are also included. This list will be posted at the well site.

Resident location and contact information can be found in Section 2 (Maps and Diagrams).

SECTION 2

MAPS AND DIAGRAMS

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

May 2018

2.1 Driving Directions to Site

Blake Well Site

From the intersection of OH Rt. 7 and WV Rt. 2 near New Martinsville, WV. Travel North on WV Rt.2 for 6.1 mi. Turn Right onto Co Rt. 2/2 (Wells Hill Rd). Follow Co Rt. 2/2 for 0.9 mi. The site entrance will be on the Right (East) side of the road. Well pad road entrance Lat: 39.73919098, Long: -80.82854678.

2.2 Site Location Maps

2.2.1 Plan View Map

Exhibit 1A thru 1B provide the plan view mapping of the well location with flare lines, prevailing wind direction, muster point, access road, and pits identified.

2.2.2 Topographic Map – Resident Information

Exhibit 2 provides a one (1) mile radius topographic map with UTM NAD 83 coordinates of the site location, site entrance, and intersection of access road. Resident locations within the one mile radius are identified along with corresponding telephone contact information in Exhibit 2a.

Exhibit 3 provides a 1,500 feet radius topographic map with UTM NAD 83 coordinates of the site location. There are no resident locations identified as being within the 1,500 feet radius location.

2.2.3 Well Plat

The Well Plat provided in Exhibit 4 outlines and identifies the acreage included in the drilling unit as well as the surface and mineral ownership and that of adjacent properties. Streets, roads and nearby geographic permanent land subdivisions are labeled. The perpendicular distance from the surface and target are noted.

2.3 Evacuation Plan: Policy and Procedures

2.3.1 Identification of Evacuation Protocols

Most situations can be managed; however, a well control event at a level 2 or 3 will cause the well site to be the evacuated. If the well event is such that a blowout occurs, all personnel are expected to evacuate the site and meet at the pre-determined muster point usually at the entrance to the location. A secondary muster point will be identified for each site based on environmental surroundings and atmospheric conditions. After accounting for all personnel, the next steps will be to follow the guidelines from “Well Control ERP”.

A fire which may occur of incipient nature can be handled by local personnel. If the fire escalates beyond incipient, personnel will be notified to evacuate the area, notify and await first responders.

Although unlikely, potential HSE hazards could arise due to: equipment malfunction/failure (e.g., perforating gun not firing properly, a radioactive source being exposed), an H2S release in an area where H2S is present, a major incident in which severe injury or loss of life occurs, or a situation where the onsite representative deems it necessary to evacuate the site.

As stated initially, all evacuations require that personnel proceed to the muster point to be accounted for.

2.3.2 Chain of Command Evacuation Declarations

Tug-Hill will follow the protocol established through National Incident Management System (NIMS). The National Incident Management System (NIMS) is a systematic, proactive approach to guide departments and agencies at all levels of government, nongovernmental organizations, and the private sector to work together seamlessly and manage incidents involving all threats and hazards—regardless of cause, size, location, or complexity—in order to reduce loss of life, property and harm to the environment per FEMA. The highest ranking competent person on location will assume the role of Incident Commander until they are relieved. In some cases, that person may be a contractor or service company representative who will begin managing the incident until a Tug-Hill representative relieves them. If a company employee is on site at the time of an accident, that person shall act as Incident Commander unless otherwise instructed.

All individuals remaining behind to shut down critical systems or utilities must be capable of recognizing when to abandon the operation or task and evacuate themselves. The systems to be shut down will be dependent on the operations being performed and will be decided upon after notification of an emergency evacuation by the Person In Charge or the designated Incident Commander.

2.3.3 Action Expectations

For most all locations, excluding the field office, the expectations are for personnel to evacuate the site until further notice. Each situation is different and the need for service companies to remain on site will be dependent on their service and capabilities. The requirement for the personnel of the service companies to remain will be a decision made on location by the Incident Commander.

The field office will be evacuated if the emergency cannot be handled by local personnel. The only exception will be in the event of severe weather where a tornado warning has been issued, in which case, they will shelter in place until the warning has been lifted. As a reminder, a **tornado watch** indicates that the conditions are favorable for a tornado to form. A **tornado warning** means that a tornado has been spotted or indicated by weather radar and there is imminent danger to life and property.

2.3.4 Initial Response Actions

Initial response actions are those taken by personnel immediately upon becoming aware of an emergency incident. Timely implementation of these initial steps is of the utmost importance because they can greatly affect the overall response operation.

It is important to note that these actions are intended only as guidelines. The appropriate response to a particular incident may vary depending on the nature and severity of the incident and on other factors that are not readily addressed. Note that without exception, personnel and public safety is first priority.

The person functioning as Incident Commander during the initial response period has the authority to take the steps necessary to control the situation and must not be constrained by these general guidelines.

The **Initial Response Actions Acting Supervisor** should at a minimum;

- Ensure Personnel and Public Safety
- Activate the appropriate alarms and operations shutdowns as necessary
- Make appropriate notifications (See Emergency Notification List and Reference Sheet)
- Activate response resources
- Monitor and manage the emergency situation
- Assist responding agencies as necessary

2.3.5 Assisting Others in Evacuation

All personnel performing work shall be fit for duty. In the event of an emergency evacuation, all hazardous areas are to be avoided and any injured individual requiring assistance must be assisted provided that the assist does not place those assisting in immediate danger to health or life. If an injured individual requires assistance to evacuate that would place the rescuer in immediate danger to health and life, personnel should first evacuate themselves as necessary, assess the situation, don any necessary protective equipment, and provide rescue if the are trained and capable.

2.3.6 Muster Points

Accounting for all employees following an evacuation is critical. Confusion in the assembly areas can lead to delays in rescuing anyone trapped or unnecessary and dangerous search-and-rescue operations. To ensure the fastest, most accurate accounting of personnel, accountability will be conducted at the muster point. Supervisors will be responsible for assuring that their personnel are accounted for. Anyone missing will require a review of where that individual last was seen. Caution must be taken when someone leaves the location and no one is aware of it.

There is to be a sign in/sign out accountability form at each location for drilling, completions, and work-over operations. This form should be used as a tool to formally conduct an accountability assessment. See Managing Visitors & Accountability below.

The muster points are typically at the entrance to the location and unless otherwise stated, will be where everyone will need to assemble. Under unique conditions , a secondary muster point

may be designated. This information will be communicated to those working on location at time of arrival to the worksite when changes occur.

2.3.7 Managing Visitors & Accountability

All visitors and contractors are required to sign in when entering the worksite during drilling, completion and work-over activities. This list will be used for accountability should an incident occur and accountability be conducted after an evacuation.

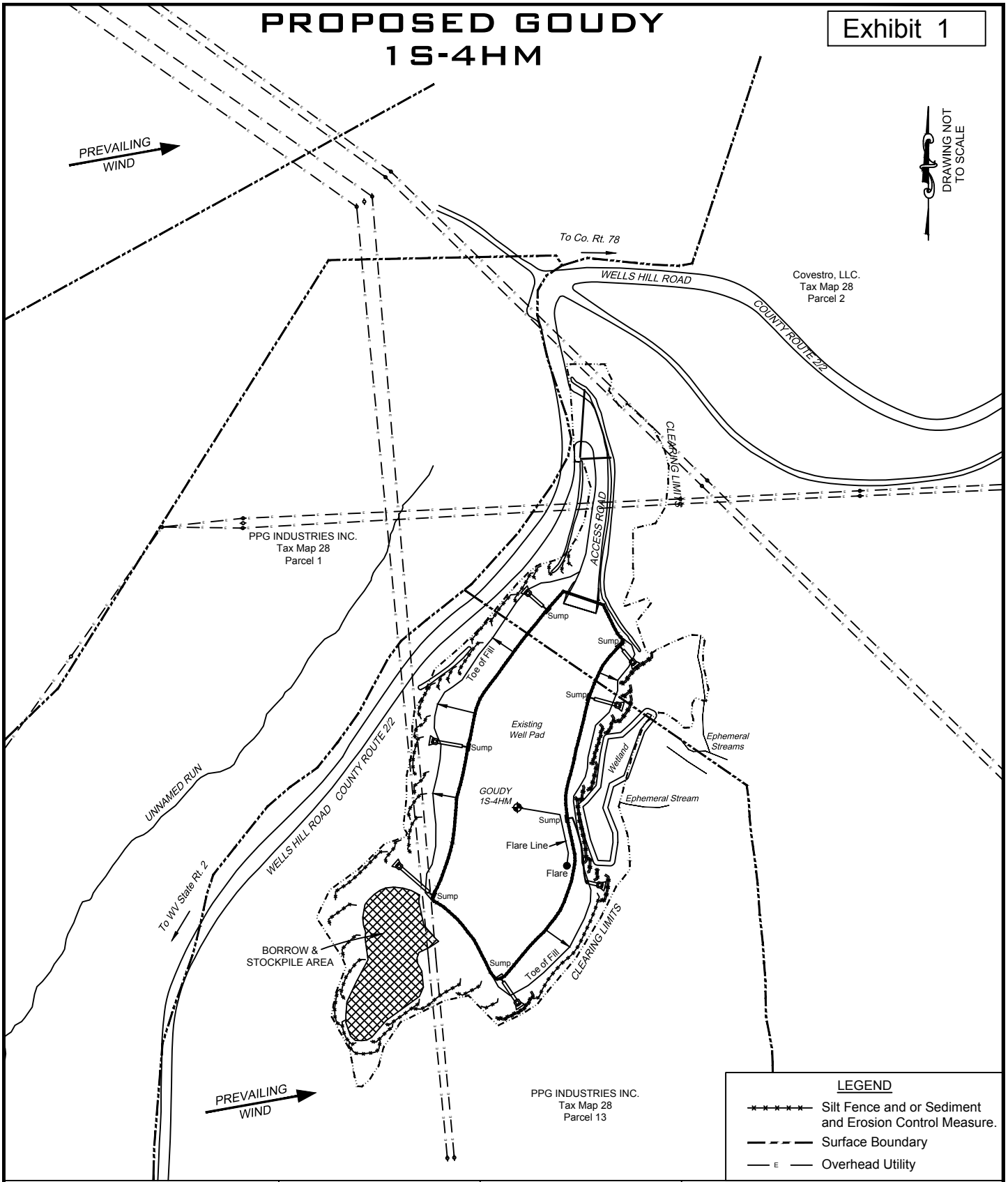
For production facilities where employees or service company individuals are performing work alone, the employee should ensure that their supervisors or peers are aware of their routes and any changes to those routes that may occur.

All personnel are reminded that outsiders other than emergency services will not be allowed in Company facilities during the time of an emergency, and that no statements will be issued to the media or other interested parties except by designated Company Management. Be courteous with media representatives anddirect them to the designated Company spokesman.

05/24/2019

PROPOSED GOUDY 1S-4HM

Exhibit 1



Jackson Surveying Inc.
677 W. Main St.
Clarksburg, Wv 26301
Phone: 304-623-5851

TOPO SECTION:		OPERATOR:	
NEW MARTINSVILLE 7.5'		PREPARED FOR: TUG HILL OPERATING, LLC 380 SOUTHPOINTE BLVD SUITE 200 CANONSBURG,PA 15317	
COUNTY	DISTRICT		
MARSHALL	FRANKLIN		
DRAWN BY	JOB NO.	DATE	SCALE
J.A.H	494510851	03-25-2019	NONE

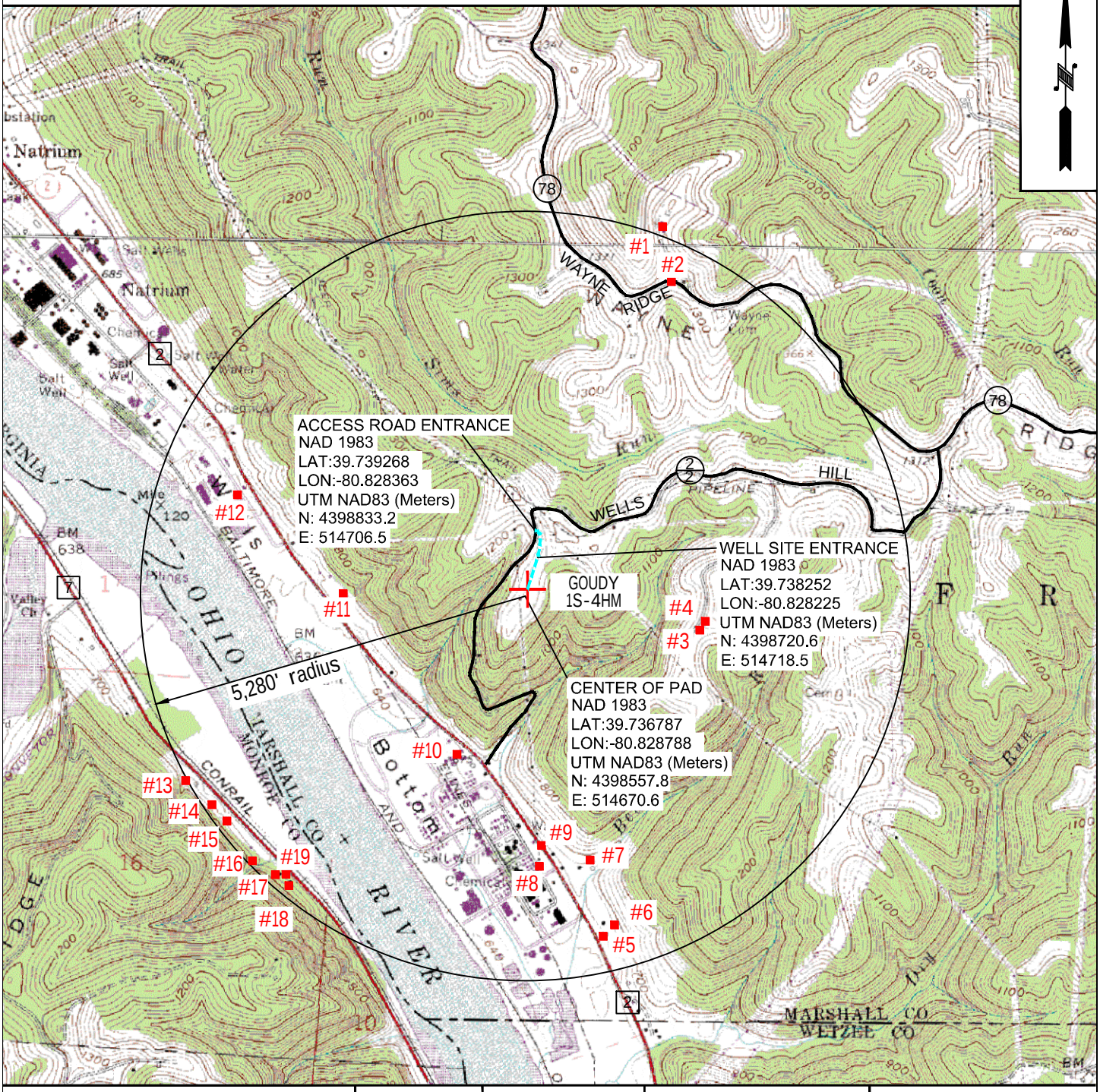
TUG HILL OPERATING

05/24/2019

EXHIBIT 2

PROPOSED GOUDY 1S-4HM

There are Twelve (12) residences, Seven (7) businesses, no churches, no schools, and no emergency facilities within 5,280'.



TUG HILL OPERATING	OPERATOR: 494510851	TOPO SECTION: NEW MARTINSVILLE 7.5'	LEASE NAME: GOUDY
	TUG HILL OPERATING, LLC 380 SOUTHPOINTE BLVD SUITE 200 CANONSBURG,PA 15317	SCALE: 1" = 2000'	DATE: DATE: 03/25/2019

Exhibit 2A

Tug Hill Operating, LLC
380 Southpointe Blvd, Suite 200
Canonsburg, PA 15137

RESIDENCES WITHIN 1 MILE OF GOUDY WELL PAD

Well: Goudy 1S-4HM
District: Franklin
County: Marshall
State: WV

There appears to be Twelve (12) residences, Seven (7) businesses, no churches, no schools, and no emergency facilities within 1 mile (5,280 feet) of the center of well pad for the above referenced well location.

Topo spot #1 TM 22 Par. 18 Edward R. Yoho Jr. 304-639-0576 (C) 304-455-1950 (H) 1711 Wayne Ridge Ln. (246 Wayne Ridge Ln.) Proctor, WV 26055	Topo spot #2 (Unoccupied) TM 22 Par. 14 CNX Land Resources Inc. c/o Nicholas J. Deiuliis CNX Phone 412-429-6416 1000 Consol Energy Dr. Canonsburg, PA 15317	Topo spot #3 (House) TM 28 Par. 10 Carol Martin 304-384-3277 (C) 304-455-6990 (H) 8724 Proctor Creek Rd. (502 Crazy Lane) Proctor, WV 26055
Topo spot #4 (Trailer) TM 28 Par. 10 Carol Martin 304-384-3277 (C) 304-455-6990 (H) 8724 Proctor Creek Rd. (502 Crazy Lane) Proctor, WV 26055	Topo spot #5 (Barn-Maintenance-Business) TM 27 Par. 31.1 Covestro LLC 304-455-4400 17595 Energy Rd. Proctor, WV 26055	Topo spot #6 (Old Trailer) TM 27 Par. 20.1 Appalachian Power Co. 1-800-956-4237 PO Box 16428 Columbus, OH 43216
Topo spot #7 (Business) TM 27 Par. 19 Covestro, LLC. leasing to Bayer Employees Federal Credit Union 304-455-4029 1 Covestro Circle Pittsburgh, PA 15205	Topo spot #8 (Business) TM 27 Par. 12 Covestro, LLC 304-455-4400 17595 Energy Rd. Proctor, WV 26055	Topo spot #9 (Unknown Building-Business) TM 27 Par. 17 Covestro, LLC 304-455-4400 17595 Energy Rd. Proctor, WV 26055
Topo spot #10 (Business) TM 28 Par. 13.1 Air Products & Chemicals Inc. 724-285-1764 300 Schaffner Rd. Butler, PA 16001	Topo spot #11 TM 21 Par. 15.2 Frank P. Lautar Est. (Garage, Closed-Business) 1500 Ninth St. Moundsville, WV 26041	Topo Spot #12 TM 21 Par. 8 PPG Industries, Inc. leasing to Mcjunkin Red Man (Store-Business) 304-455-1184 1 PPG PL Pittsburgh, PA 15272

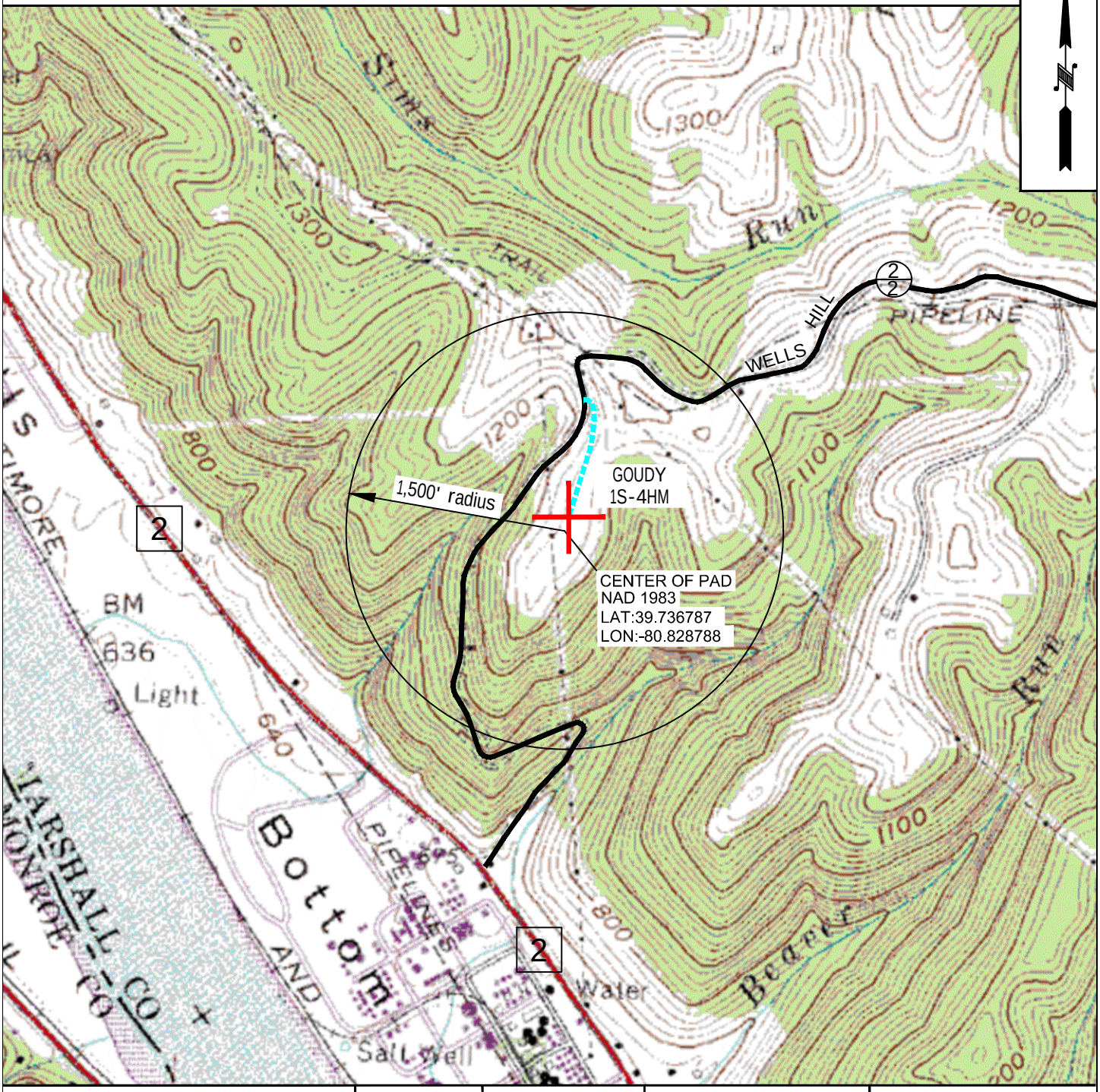
Topo spot #13 Section 16 Par. 180310070000 Dempsey & Joan Reed 740-483-1061 44693 State Route 7 Clarington, OH 43915	Topo Spot #14 Section 16 Par. 1803100600000 Ethel Bier 740-483-9224 44597 State Route 7 (44625- Trailer) Clarington, OH 43915	Topo Spot #15 (House) Section 16 Par. 1803100600000 Ethel Bier 740-483-9224 44597 State Route 7 Clarington, OH 43915
Topo Spot #16 (House) Section 16 Par. 180310130000 Shannon Baters 740-483-1648 44493 State Route 7 Clarington, OH 43915	Topo Spot #17 Section 16 Par. 18031014000 William & Sandra Hall 740-483-1648 44447 State Route 7 Clarington, OH 43915	Topo Spot #18 Section 16 Par. 180310150000 Brian Litman 740-483-1416 44455 State Route 7 (44495) Clarington, OH 43915
Topo Spot #19 Section 16 Par. 180310160000 Brian Litman 740-483-1416 44455 State Route 7 Clarington, OH 43915		

05/24/2019

EXHIBIT 3

PROPOSED
GOUDY 1S-4HM

THERE APPEAR TO BE NO (0) RESIDENCES WITHIN 1,500'.



TUG HILL OPERATING	OPERATOR: 494510851	TOPO SECTION: NEW MARTINSVILLE 7.5'	LEASE NAME: GOUDY
TUG HILL OPERATING, LLC 380 SOUTHPOINTE BLVD SUITE 200 CANONSBURG, PA 15317		SCALE: 1" = 1000'	DATE: DATE: 03/25/2019

SECTION 3

WELL WORK

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

Updated March 2019

This attached Plan will be reviewed with all employees on the work site prior to beginning their work, Any required changes will be inserted into this Plan and made part of the Plan after being approved by the WVOOG

3.1 Documentation

A safety training attendance sheet must be completed for all Tug-Hill required training. Originals will be submitted to the EH&S Department and copies of the attendance sheets shall be on-site to serve as documentation of training.

3.2 Plan Assimilation and Dissemination

Tug-Hill, or their designee, shall be responsible for providing a copy of this plan to the local emergency planning committee (LEPC) or county emergency services (CES) office within at least 7 days from land disturbance or well work. A LEPC or CES representative will sign a receipt documenting this

A copy of this plan will be made available in the following locations;

- In an onsite mailbox
- In the onsite drilling, completion specialist, or workover office
- WV DEP Office of Oil and Gas
- LEPC or CES
- Field Office

3.3 Personal Protective Equipment (PPE)

At a minimum, all personnel on site shall wear the following;

- Hardhat
- Safety glasses with side shields
- Hard toe boots
- Flame Resistant Clothing (FRC)

Additional PPE may be required based on unique job hazards such as:

- Gloves
- High visibility vest
- Hearing protection

Additional PPE may be assigned dependent on the site conditions sand shall be the discretion of the onsite specialist and the Environmental and Safety Department. All additional PPE requirements be communicated to all personnel.

3.4 Drilling

1. Hold Pre-Spud meeting to review pertinent data
2. MIRU Drilling Rig.
3. Install Riser.
4. Drill surface or mine string to required depth
    a. Mine string must be no more than 100’ deeper than mine void
    b. Surface casing must be set at least 50’ and no more than 150’ below the deepest know freshwater bearing zone.
5. POOH and Run casing to planned depth, utilizing centralizers per requirements.
6. Cement per regulation
7. WOC
8. MIRU WL, run CBL, RD WL
9. Pressure test csg
10. If required, drill, case, and cement freshwater protective zone as follows:
    a. TIH and drill to regulated TD
    b. POOH and run csg utilizing centralizers per requirements
    c. Cement per regulation
    d. Pressure test csg
    e. WOC
    f. MIRU WL, run CBL, RD WL
11. Install and test WH per manufacturer spec
12. NU and Test BOPs
13. TIH and drill out to planned intermediate csg depth
14. POOH and run csg to planned depth utilizing centralizers per requirements
15. Cement intermediate csg per regulation
16. Pressure test csg
17. WOC
18. MIRU WL, run CBL, RD WL
19. TIH, drill shoe, and perform FIT
20. Drill remaining vertical, curve, and lateral according to directional plan
21. POOH and run csg utilizing centralizers per plan
22. Cement production casing per regulation
23. WOC
24. ND BOP and install tubing head.
25. Test tubing head to manufacturer spec
26. Cap well and RDMO Drilling Rig

3.5 Stimulation

1. Hold pre-job meeting to review pertinent data
2. MIRU WL, run CBL, RD WL
3. Install frac valve and flow cross; pressure test per manufacturer spec
4. Perform MIT
5. Initiate 1st stage communication by utilizing TCP or toe sleeve
6. MIRU pressure pumping equipment and associated services.
7. Complete well with multi stage stimulation per plan
8. Set kill plug after last stage
9. Lubricate in BPV and set in B section.
10. SI well and RD stimulation equipment

3.6 Cleanout

1. MIRU CT or WO Rig with Snubbing Unit
2. MIRU Flowback equipment
3. NU BOP
4. Lubricate out BPV
5. TIH and D/O kill plug, frac plugs, sleeves, and any other restrictions to TD
6. POOH and RD CT or WO Rig and Snubbing Unit
7. Turn well over to flowback crew and flow well per plan
8. Lubricate in BPV, remove frac valve and flowcross
9. Install production tree
10. Lubricate out BPV and turn over to production

SECTION 4

CHEMICAL INVENTORY AND SAFETY DATA SHEETS (SDS)

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

Updated March 2019

4.1 Safety Data Sheets (SDS):

SDS for all materials and chemicals on-site will be maintained and readily available at the well site. Copies of these SDS will be kept in the Tug Hill On-site Offices, or be available on-line and be the responsibility of the Tug Hill On-site Specialist. An electronic copy of the Anticipated SDS will be submitted to the Department as well. SDS sheets have been included in Appendix B.

4.2 Mud Information

Mud Usage	
Mix Mud Amount	2000 - 3500 bbls
Mud Weights	8.5 – 14 ppg

There will be one induction style mud hopper on location for mixing the fluid. Below table contains the inventory of on-site materials for mixing mud.

Chemical and Unit Size	Product Function	No. of Units
CALCIUM CHLORIDE PWD 97%, 50 LB BAG	Osmotic Inhibition	351
NEXT-BASE eC, 1 GAL BULK	Base Fluid	19110
MIL-BAR 410,BULK CWT	Weighting Agent	2200
CARBO GEL II, 50 LB BAG	Viscosity	32
CARBO-TEC, 55 GAL DRUM	Primary Emulsifier	15
NEXT-MUL HT, 55 GAL DRUM	Secondary Emulsifier	4
MIL-LIME, 50 LB BAG	Excess Lime	97
NEXT-FLC, 50 LB BAG	HTHP Fluid Loss	32
NEXT-DRILL eC, 1 BBL BULK	Purchased Mud	0
SODA ASH, 50 LB BAG	Hardness Buffer	15
MIL-PAC R, 50 LB BAG	Filtration Control	15
MIL-CARB TM, 50 LB BAG	LCM	50
MIL-CARB 5, 50 LB BAG	LCM	50
MIL-CARB 150, 50 LB BAG	LCM	50
MIL-CARB 450, 50 LB BAG	LCM	48
CHEK-LOSS, 25 LB BAG	LCM	70
Potassium Chloride (KCL), 50 LB BAG	Shale Inhibitor	500
CLAY-TROL, 55 GAL DRUM	Shale Inhibitor	8
HD FOAM, 250 GAL TOTE	Drill Soap	3
W.O. DEFOAM, 5 GAL Bucket	Defoamer	64
ALUMINUM SULFATE, 250 GAL TOTE	Inorganic Coagulant	2
MAGNAFLOC 24, 50 LB BAG	Flocculant	10
MAGNAFLOC 351, 50 LB BAG	Flocculant	10

05/24/2019

SECTION 5

BLOW-OUT PREVENTER (BOP) AND WELL CONTROL

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

Updated March 2019

5.1 BOP Equipment

The following is a list of BOP equipment with types, sizes and ratings to be utilized and available during the drill, completion, and work-over of the well.

5M System**

- Annular preventer
- Pipe ram, blind ram, and if conditions warrant as specified by the authorized officer, another pipe ram shall also be required.
- A second pipe ram preventer shall be used with a tapered drill string.
- Drilling spool, or blow out preventer with 2 side outlets (choke side shall be a 3 inch minimum diameter, kill side shall be at least 2 inch diameter).
- 3 inch diameter choke line.
- Kill line (2 inch minimum).
- 2 chokes with 1 remotely controlled rig floor.
- 2 kill line valves and a check valve (2 inch minimum).
- Upper kelly cock valve with handle available.
- When the expected pressures approach working pressure of the system, 1 remote kill line tested to stack pressure (which shall run to the outer edge of the substructure and be unobstructed).
- Lower kelly cock valve with handle available.
- Safety valve(s) and subs to fit all drill string connections in use.
- All BOP equipment connections subject to well pressure shall be flanged, welded, or clamped.
- Fill-up line above the uppermost preventer.

If repair or replacement of the BOP equipment is required after testing, this work shall be performed prior to drilling out the casing shoe.

When the BOP equipment cannot function to secure the hole, the hole shall be secured using cement, retrievable packer, or a bridge plug packer, bridge plug, or other acceptable approved method to assure safe well conditions.

Minimum Standards for Choke Manifold Equipment

I. Choke lines shall be straight lines unless turns use tee blocks or are targeted with running tees and are anchored to prevent whip and reduce vibration.
II. Choke manifold equipment configuration shall be functionally equivalent to the appropriate pressure ratings. The actual configuration of the chokes may vary.

All valves (except chokes) in the kill line choke manifold, and choke line shall be a type that does not restrict the flow (full opening) and that allows a straight through flow.

Pressure gauges in the well control system shall be a type designed for drilling fluid service.

**These are typical design features for 5M systems, however the actual field equipment may vary.

5M and higher system accumulator shall have sufficient capacity to open the hydraulically controlled gate valve (if so equipped) and close all rams plus the annular preventer (for 3 ram systems add a 50 percent safety factor to compensate for any fluid loss in the control system for preventers) and retain a minimum pressure of 200 psi above precharge on the closing manifold without use of the closing units pumps. The fluid reservoir capacity shall be double the usable fluid volume of the accumulator system capacity and the fluid level of the reservoir shall be maintained at the manufacturer's recommendations. Two independent sources of power shall be available for powering the closing unit pumps. Sufficient nitrogen bottles are suitable as a backup power source only and shall be recharged when the pressure falls below manufacturer's specifications.

Accumulator Precharge Pressure Test

This test shall be conducted prior to connecting the closing unit to the BOP stack and at least once every six (6) months. The accumulator pressure shall be corrected if the measured precharge pressure is found to be above or below the maximum or minimum limit specified below (only nitrogen gas may be used to precharge):

Accumulator Working Pressure Rating	Minimum Acceptable Operating Pressure	Desired Precharge Pressure	Maximum Acceptable Precharge Pressure	Minimum Acceptable Precharge Pressure
1,500 psi	1,500 psi	750 psi	800 psi	700 psi
2,000 psi	2,000 psi	1,000 psi	1,100 psi	900 psi
3,000 psi	3,000 psi	1,000 psi	1,100 psi	900 psi

Power Availability

Power for the closing unit pumps shall be available to the unit at all times so that the pumps shall automatically start when the closing valve manifold pressure has decreased to the pre-set level.

Accumulator Pump Capacity

Each BOP closing unit shall be equipped with sufficient number and sizes of pumps so that, with the accumulator system isolated from service, the pump shall be capable of opening the hydraulically-operated gate valve (if equipped), plus closing the annual preventer on the smallest size drill pipe to be used within 2 minutes, and obtain a minimum of 200 psi above specified accumulator precharge pressure.

Locking Devices

A manual locking device (i.e. hand wheels) or automatic locking devices shall be installed on all systems of 2M or greater. A valve shall be installed in the closing line as close as possible to the annular preventer to act as a locking device. This valve shall be maintained in the open position and shall be closed when the power source for the accumulator system is inoperative.

Remote Controls

Remote controls shall be readily accessible to the driller. Remote controls for all 3M or greater systems shall be capable of closing all preventers. Remote controls for 5M or greater systems shall be capable of both opening and closing all preventers. Master controls shall be at the accumulator and shall be capable of opening and closing all preventers and the choke line valve (if equipped). No remote control for a 2M system is required.

5.2 Procedure and Schedule for Testing BOP Equipment

Well Control Equipment Testing

I. All function and pressure tests shall be performed for thirty (30) minutes. Annular preventers should be tested to seventy percent (70%) of the rated capacity and ram preventers should be tested to eighty percent (80%) of the rated capacity.
II. The procedure and schedule for testing the BOP stack as follows: for the bottom and horizontal wellbore drilling phase, the BOP equipment shall be function tested upon initial installation, weekly, and after each bit trip unless otherwise authorized by the Office as part of a well work permit. It shall be pressure tested upon initial installation and every twenty-one (21) days thereafter. All pressure tests shall be performed for thirty (30) minutes. Annular preventers should be tested to seventy percent (70%) of the rated capacity and ram preventers should be tested to eighty percent (80%) of the rated capacity.
III. Valves shall be tested from working pressure side during BOP equipment tests with all downstream valves open.
IV. When testing the kill line valve(s), the check valve shall be held open or the ball removed.
V. Annular preventers shall be functionally operated at least weekly.
VI. Pipe and blind rams shall be activated each trip, however this function need not be performed more than once a day.
VII. A BOP equipment pit level drill (exercise) shall be conducted weekly for each drilling crew.
VIII. Pressure tests shall apply to all related well control equipment.
IX. All of the above described tests and/or drill shall be recorded in the drilling log.
X. For intermediate wellbore drilling phase, the BOP equipment will be pressure and function tested upon initial installation.

XI. For the bottom and horizontal wellbore drilling phase, the BOP equipment will be pressure and function tested upon initial installation, weekly, and after each bit trip.

5.3 BOP Installation Schedule

The BOP will be installed after running surface casing as well as after running intermediate casing. BOP equipment shall be installed on the innermost string of casing after the surface casing.

5.4 Well Control Training

All Tug-Hill On-Site Supervisors and drilling staff working on this well will be International Association of Drilling Contractors (IADC) trained and certified. A trained person will be present during the drilling operations. Training certificates will be available at the drilling location. The list of trained personnel is provided in Appendix C.

5.5 Drilling Records

The Tug-Hill On-Site Supervisor will maintain detailed records of significant drilling events such as lost circulation, hydrogen sulfide gas, fluid entry, kicks, and abnormal pressures.

This Well Site Safety Plan requires the Tug-Hill On-Site Supervisor to notify the district oil and gas inspector or the designated Office of Oil and Gas representative in the event of the presence of hydrogen sulfide gas at a concentration of ten part per million (10 ppm), any blow-out, or a significant kick.

5.6 Schematic and Description of the Rig Layout and Wellhead Assembly

Over the life of a well, the wellhead system may be exposed to many different load conditions. During the well design process, wellhead fatigue risks are assessed based on operational and environmental conditions expected during both the construction and long-term production phases. See Exhibit 1 for schematic of the proposed drilling rig and Exhibit 2 for diagram of the wellhead assembly.

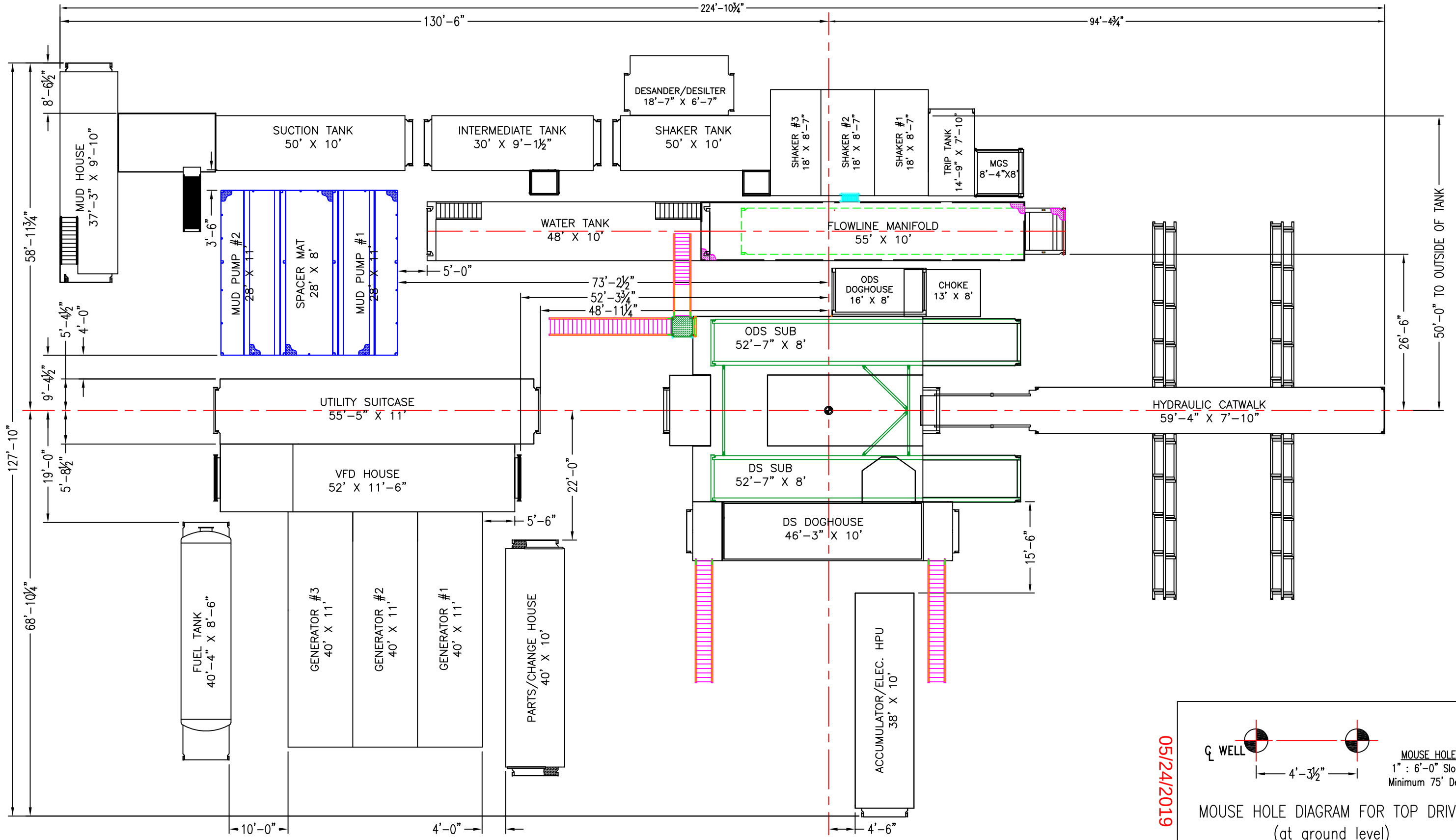
5.7 Kill Procedures

Once a kick is detected a prompt shut in of the well is essential. The exact shut in method will be dictated by the operation being performed at the time of the kick, available equipment, as well as other extenuating circumstance. The following types of kill operations may be performed to bring the well back under control. The different methods listed below are recognized by the IADC.

Kill Procedures:

I. Drillers Method
II. Wait and Weight Method
III. Circulate and Weight Method
IV. Concurrent Method
V. Reverse Circulation Method
VI. Dynamic Kill Method
VII. Bullheading Method
VIII. Volumetric Method

Exhibit B (Blank Well Killsheet) contains a calculation guide used to determine the correct kill procedure.



05/24/2019

MOUSE HOLE
1" : 6'-0" Slope
Minimum 75' Deep

MOUSE HOLE DIAGRAM FOR TOP DRIVE
(at ground level)

NOMAC DRILLING

Rig Layout

Rig 80

REV	DESCRIPTION	BY & DATE	APP & DATE
02	UPDATED MP MATS	JNN 7JULY14	
03	SIMPLIFIED GRAPHICS	BAG 2/23/15	
04	CORRECTED VFD LABEL	LCH 5/28/15	

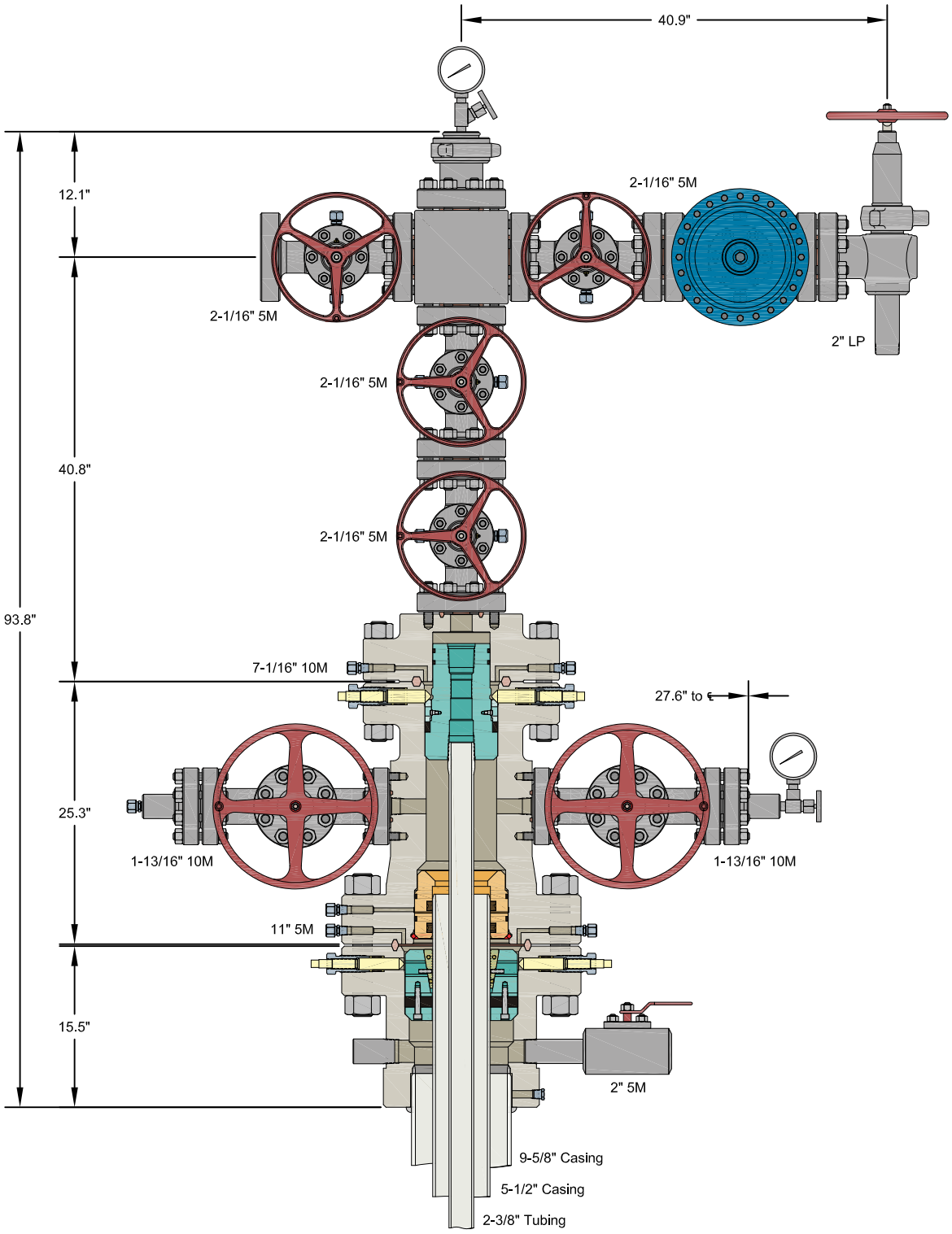
GEN. NOTES:

JOB	10-00134
REV	04
SHT	1 OF 2
DWN	L HEITHOLD 5/29/14
APP	

GE Oil & Gas

05/24/2019

EXHIBIT 2



MARCELLUS SHALE

9-5/8" x 5-1/2" x 2-3/8" 5M Conventional Wellhead Assembly, With T-EBS-F Tubing Head, T-EN Tubing Hanger and A5PEN Adapter Flange

DRAWN	JGR	14OCT11
APPRV	VJK	14OCT11

FOR REFERENCE ONLY

DRAWING NO. AE20931

Exhibit 3

05/24/2019

Prerecorded Data

Original mud weight = _____ lbm/gal
Slow pump rate = _____ spm at _____ psi
Drillpipe volume = _____ bbl
Annulus volume = _____ bbl
Pump output = _____ bbl/strokes

$$\text{Drillpipe strokes} = \frac{\text{Drillpipe volume (bbl)}}{\text{Pump output (bbl/stroke)}}$$

$$= \frac{\text{bbl}}{\text{bbl/stroke}}$$

= _____ strokes

Kick Data

P_{SIDP} = _____ psi
P_{SIC} = _____ psi
Pit gain = _____ bbl
True vertical depth = _____ ft

Kill Mud Data

$$\text{Mud weight increase} = \frac{P_{SIDP} \times 19.23}{Depth} = \text{lbm/gal}$$

Kill mud weight = original weight + increase = _____ lbm/gal + _____ lbm/gal = _____ lbm/gal

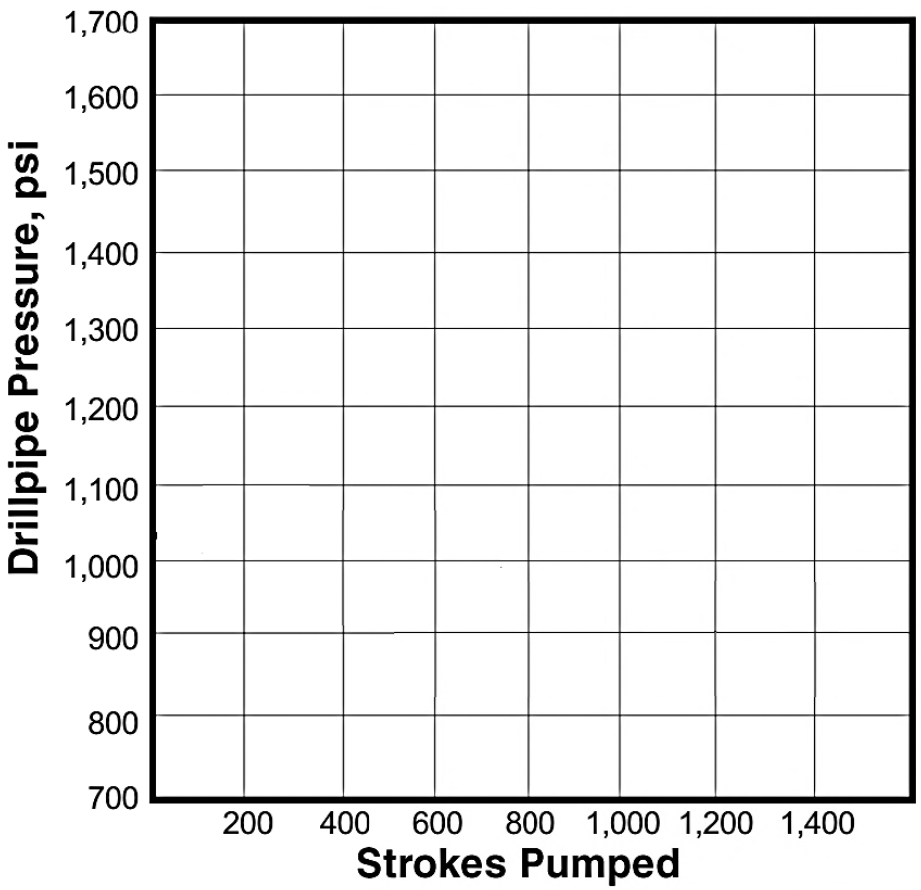
Pump Pressure

Initial drillpipe pressure = P_{SIDP} + slow pump pressure

$$\text{Final drillpipe pressure} = \frac{\text{Kill mud weight} \times \text{slow pump pressure}}{\text{Original mud weight}}$$

$$= \frac{\text{lbm/gal} \times \quad \text{psi}}{\text{lbm/gal}}$$

= _____ psi



Final Drillpipe Pressure, psi

Pressure profile

Strokes	Pressure, psi

05/24/2019

SECTION 6

HYDROGEN SULFIDE (H_2S)

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

Updated March 2019

6.1 Monitoring

The equipment and method used for the monitoring, detection and warning of the presence of hydrogen sulfide during drilling, completions and work-over operations will be portable electronic gas detectors. These detectors will typically be located near the well bore on the drilling rig, mud pits, or on the drillers stand. Personnel involved with drilling operation may utilize personal gas monitors.

6.2 Training

Personnel involved in drilling operations will be trained in H_2S in drilling operations to a minimum of awareness level. Additional training will be given to the Tug-Hill On-Site Supervisor both in H_2S and emergency response procedures related specifically to air toxins. The aforementioned training will be completed prior to spudding the well. These records may be kept separate from this plan.

6.3 H_2S Notification and Control

The emergency alarm will be audible or visual type which will be detectable by all personnel on location. If dangerous levels of H_2S are detected, Tug Hill will immediately implement the Emergency Response Plan which will provide for site control and evacuation as needed. The site will be secured such that access is allowed only for trained emergency response personnel.

If H_2S is detected and confirmed, notification via telephone will be made to the local oil and gas inspector and deputy chief.

6.4 Public Notification and Protection Zones

In an emergency which requires the notification of residents and emergency personnel that may be affected during drilling, such as release of H_2S, flaring etc., the emergency response plan will be immediately implemented. This plan specifies the roles and responsibilities of onsite personnel in case of emergency and addresses emergency notification of potentially affected residents and public emergency response personnel.

When the emergency alarm is activated the on-site personnel will muster for a headcount by the On-Scene Incident Commander (OSIC) which is usually the Tug-Hill On-Site Supervisor. After initial assessment of the situation, the OSIC will notify the public emergency response agency from which direction will be taken. If the agency directs, on-site personnel will notify all local impacted residents of the incident by dispatching workers to each potentially affected residence. If the public emergency responder does not direct this notification to be made by the operator, then the public response agency will be responsible for this notification.

Protection zones will be established and maintained on the nature, extent and severity of the event. These protection zones will be based on those safe distances outlined in the applicable portions of Exhibit 1 (excerpt from the DOT Emergency Response Guidebook).

6.5 Personal Protective Equipment (PPE)

The following personal protection equipment (PPE) will be available and in use on the drilling location:

- Fire Retardant Clothing (FRC)
- Hardhats
- Safety glasses/goggles and face shields
- Safety shoes
- Hearing protection
- Dust masks
- Chemical resistant work gloves

PPE will be maintained in such quantities to adequately outfit well site personnel and site visitors.

In the event other hazards are identified or present during the drilling operations, the Tug-Hill On-Site Supervisor or contractor will attempt to eliminate the hazard, and if not practical, respond to the hazard as appropriate (e.g., additional PPE). In the event H_2S is detected, a hazard assessment will be performed for exposure along with risk mitigation.

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- **EXTREMELY FLAMMABLE.**
- Will be easily ignited by heat, sparks or flames.
- Will form explosive mixtures with air.
- Vapors from liquefied gas are initially heavier than air and spread along ground.

CAUTION: Hydrogen (UN1049), Deuterium (UN1957), Hydrogen, refrigerated liquid (UN1966) and Methane (UN1971) are lighter than air and will rise. Hydrogen and Deuterium fires are difficult to detect since they burn with an invisible flame. Use an alternate method of detection (thermal camera, broom handle, etc.)

- Vapors may travel to source of ignition and flash back.
- Cylinders exposed to fire may vent and release flammable gas through pressure relief devices.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

HEALTH

- Vapors may cause dizziness or asphyxiation without warning.
- Some may be irritating if inhaled at high concentrations.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire may produce irritating and/or toxic gases.

PUBLIC SAFETY

- **CALL EMERGENCY RESPONSE Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.
- Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 800 meters (1/2 mile).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

EMERGENCY RESPONSE

FIRE

- **DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.**

CAUTION: Hydrogen (UN1049), Deuterium (UN1957) and Hydrogen, refrigerated liquid (UN1966) burn with an invisible flame. Hydrogen and Methane mixture, compressed (UN2034) may burn with an invisible flame.

Small Fire

- Dry chemical or CO_2.

Large Fire

- Water spray or fog.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.
- Do not direct water at spill or source of leak.
- Prevent spreading of vapors through sewers, ventilation systems and confined areas.
- Isolate area until gas has dispersed.

CAUTION: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning.

FIRST AID

- Move victim to fresh air.
- Call 911 or emergency medical service.
- Give artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- Clothing frozen to the skin should be thawed before being removed.
- In case of contact with liquefied gas, thaw frosted parts with lukewarm water.
- In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

05/24/2019

SECTION 7 WELL

FLARING

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Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

Updated March 2019

7.1 Flaring

Well flaring occurs during drilling and testing of gas wells. This practice is used to determine the types of fluids the well can produce, the pressure and flow rates of gas, and other characteristics of the underground reservoir. The pressure, flow and composition of the gas will be determined before it can be safely handled by the pipelines and processing plants. Also, additional flaring during under balanced drilling operations is performed to manage gas that comes to the surface. This process can speed up drilling and help to reduce potential damage to the producing formation by the drilling fluids. Prior to commencement of flaring operations, Tug-Hill will contact the Marshall County DEP field inspector and the local county EMS.

The flare duration should not exceed the maximum time requirements required to complete drilling operations. In Section 2 of this plan, Exhibit 1 is a plan view map indicating the proposed flare and flare line location. Prevailing wind direction is also shown.

7.2 Flaring Activities

- **Size, Construction and length of Flare Line**
  - The flare line will be a 4” diameter steel line that extends a minimum of 50’ from the well. The line will be anchored to the surface of the ground by cross pinning it in place using metal stakes at multiple points along the line.

- **Flare Lighting System**
  - The system for lighting the flare will be an automatic flare igniter using a solar collection panel and battery charging system. A secondary igniter will be installed as a backup in the event flaring is required or needed. The Drilling Supervisor shall notify the local fire department prior to lighting the flare or as soon as possible thereafter.

- **Flare Safe Distance**
  - The flare line discharge will be located no less than fifty (50) feet from the wellhead and shall be positioned downwind of the drilling rig and trailers in terms of the prevailing wind direction. The flare system shall have an effective method for ignition. Flammable material beyond the end of the flare will be cleared to a minimum distance of 50 feet.

SECTION 8

COLLISION AVOIDANCE

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

Updated March 2019

8.1 Collision Avoidance

Collision avoidance is managed by utilizing gyro tools, downhole steering tools (MWD/EM), and anti-collision software by engineers. Every well planned to be drilled has a surface plot diagram, 2-D plot diagram, and a pad plot diagram prepared. (Plots attached under "Collision Avoidance Diagrams") North seeking gyro tools, MWD/EM tools, and anti-collision processes are utilized to mitigate the risk of downhole collisions. Anti-collision processes include confirmation of gyro accuracy, evaluation of anti-collision software (Compass, Longbow, or equivalent program), and 2-D/3-D model plotting. It is Tug Hill's standard operating procedure (SOP) for the on-site supervisor of Tug-Hill and the directional drilling company supervisor to confirm the orientation of the directional tools and ensure that the tools are orientated consistent with the directional motor's high side. When anti-collision is a risk and directional assemblies are required to navigate utilizing a gyro tool, it is Tug Hill's SOP to use the Gyro company's muleshoe to ensure the accuracy of the gyro seat in the muleshoe. In addition, when using this muleshoe, it is Tug Hill's SOP to have the Tug Hill's on-site supervisor, directional drilling company supervisor, and gyro company supervisor confirm the alignment and orientation of the tool and ensure that the tools are orientated consistent with the directional motor's high side. This ensures the azimuthal direction is correct when steering the well.

Each well will have directional surveys recorded for the entirety of the wellbore. These surveys will be monitored in real-time and used in conjunction with anti-collision software to ensure that all anti-collision risks are effectively mitigated. At the end of each hole, the third party directional company will certify that the surveys taken are true and accurate. If multiple surface holes are to be drilled off of the same pad, or if the active well is planned within 300' of an existing wellbore, survey frequency over the at-risk interval will be increased and surveys will be recorded at a minimum of 30' intervals or until risk of collision is mitigated. If, at any time an active wellbore comes within 14 feet or a SF of 2.0 from an existing wellbore, survey frequency will be increased and actively monitored until the wells are clear of potential collision. If spatial separation of less than 5' or a SF of less than 1.1 are encountered, an email notification will be sent by the Tug Hill onsite supervisor to the appropriate state inspector. In the event that a wellbore collision cannot be avoided, Tug Hill will properly secure each well and evaluate the most prudent plan forward while communicating plans to the state inspector.

<u>Vertical Section:</u>

- Each hole is drilled to KOP by either the top-hole rig or bottom hole rig. While drilling, directional surveys are taken at the appropriate intervals to ensure that the appropriate SFs and separation distances are maintained. A SF of 1.5 or greater will be obtained as early in the directional plan as is practical and maintained for the duration of the vertical.
- A combination of MWD and gyro surveys are used to determine the wellbore's position.
- Due to wellhead spacing on the surface, anti-collision risks are elevated and

require constant monitoring. In order to mitigate this risk, nudges or tangents are drilled in order to maintain the appropriate spatial separation and SFs.

Curve Section:

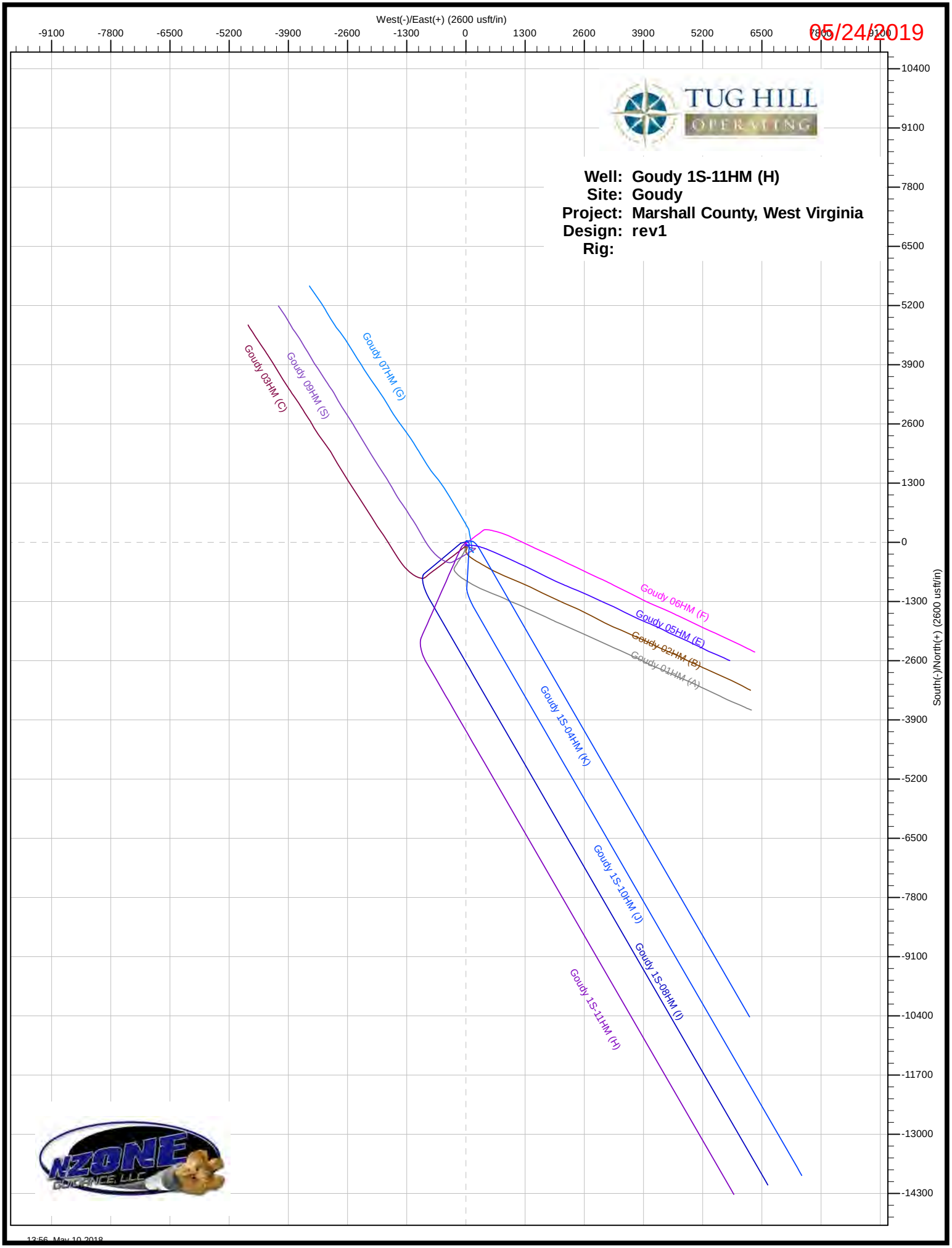
- Each hole is drilled from KOP to the landing point by the bottom hole rig. While drilling, directional surveys are taken at the appropriate intervals to ensure that the appropriate SFs and separation distances are maintained.
- MWD surveys are generally used to determine the wellbore's position as the curve is drilled.
- Anti-collision risks decrease in this section, but directional surveys are taken at a high frequency to ensure that the well is drilled in accordance with the prescribed directional plan.

Horizontal Section:

- Each hole is drilled from the landing point to TD by the bottom hole rig. While drilling, directional surveys are taken at the appropriate intervals to ensure that the appropriate SFs and separation distances are maintained.
- MWD surveys are generally used to determine the wellbore's position as the lateral is drilled.
- Anti-collision risks are minimal or eliminated in this section, and directional surveys are taken to ensure that the well is drilled in accordance with the permitted well path.

Both the onsite supervisor and the drilling engineer for the active well will be responsible for actively monitoring anti-collision risks and communicating any necessary updates to the appropriate state inspector.

See Exhibit 1 for attached Spider Map with site specific details and information pertaining to collision avoidance.


West(-)/East(+) (2600 usft/in)
-9100
-7800
-6500
-5200
-3900
-2600
-1300
0
1300
2600
3900
5200
6500
7800
9100
05/24/2019
TUG HILL
OPERATING
Well: Goudy 1S-11HM (H)
Site: Goudy
Project: Marshall County, West Virginia
Design: rev1
Rig:
Goudy 03HM (C)
Goudy 09HM (S)
Goudy 07HM (G)
Goudy 06HM (F)
Goudy 05HM (E)
Goudy 02HM (B)
Goudy 01HM (A)
Goudy 1S-04HM (K)
Goudy 1S-10HM (J)
Goudy 1S-08HM (I)
Goudy 1S-11HM (H)
South(-)/North(+) (2600 usft/in)
10400
9100
7800
6500
5200
3900
2600
1300
0
-1300
-2600
-3900
-5200
-6500
-7800
-9100
-10400
-11700
-13000
-14300
NZONE
DILIGENCE, LLC
12:56, May 10 2018

APPENDIX A

CONTACTS, SCHEDULES, AND MEETINGS REFERENCE MATERIAL

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

Updated March 2019

05/24/2019

TUG HILL OPERATING

PRE-SPUD MEETING

WELL NAME:	DATE:
LOCATION:	TIME:
O&G INSPECTOR NOTIFIED 48 HOURS PRIOR TO MEETING Y/N	WHEN:

COMPANY/ AGENCY	NAME	POSITION	SIGNATURE

Well Site Weekly Safety Meeting

Topic(s)

Leader:

Date:

Location:

Name	Company Name	Signature	Name	Company Name	Signature

Location Sign-In Sheet 05/24/2019

Name _

By signing this log, I confirm that I have received and understand Tug-Hill's EHS Contractor Orientation Guidelines and agree to adhere to Federal, State, local, site specific as well as my employer's Safety, Health and Environmental policies and regulations for the location upon which I am entering.

Date	Name	Company	Purpose of Visit	Time In	Time Out

05/24/2019

EMERGENCY NOTIFCATION LIST AND REFERENCE SHEET

Well Name: Goudy 1S-4HM
Location: Marshall County, West Virginia
UTM Coordinates: Northing: 4,398,587.06, Easting: 514,679.21,
Zone: 17

EMERGENCY ASSISTANCE / ADVISORY NOTIFICATIONS	INSTRUCTIONS	MAIN NUMBER	ALTERNATE NUMBER
Marshall County EMS - Ambulance - Police - Fire	SAT phone users may need to call alternate number	911	Marshall County 304-843-1500

COUNTY	SHERIFF	MEDICAL LOCATION	NUMBER
Marshall County	304-843-1500	Reynolds Memorial Hospital - Moundsville, WV	304-598-4000
		EZCARE Walk-In Medical Center - New Martinsville, WV	304-398-4949 M-F 8:30-7:00, S 9:00-5:00

AGENCY	CONTACT	MAIN NUMBER	ALTERNATE NUMBER
West Virginia DEP	24 Hour Notification – Spill Hotline	800-642-3074	304-926-0450
WVDEP – Office of Oil & Gas – Chief	James Martin	304-926-0499 Ext. 1654	James.a.martin@wv.gov
WVDEP – Inspector Supervisor	Joe McCourt	304-380-2467	Joseph.a.mccourt@wv.gov
WVDEP – Field Inspector – Marshall County	Jim Nicholson	304-552-3874	James.i.nicholson@wv.gov
WVDEP – Field Inspector – Wetzel County	Derek Haught	304-206-7613	Derek.m.haught@wv.gov
National Response Center	24 Hour Notification	800-424-8802	202-267-2675
OSHA	24 Hour Notification	800-321-6742	
Well Control	Wild Well Control	281-784-4700	
One Call		811	800-245-4848
Poison Control		800-222-1222	
Spill Response	Miller Environmental	304-905-8260 Wheeling	304-292-8655 Morgantown
Spill Response	To Be Determined	-	-

05/24/2019

EMERGENCY NOTIFCATION LIST AND REFERENCE SHEET

Well Name: Goudy 1S-4HM
Location: Marshall County, West Virginia
UTM Coordinates: Northing: 4,398,587.06, Easting: 514,679.21,
Zone: 17

TUG-HILL OPERATING	CONTACT NAME	OFFICE NUMBER	CELLULAR NUMBER
24 Hour Emergency		**800-921-9745**	
New Martinsville, WV	Steve Weigle	682-404-6233	682-404-6233
New Martinsville, WV	Jeff Walker	682-404-6244	682-404-6244
Fort Worth, Texas	David Patterson	817-632-5200	620-304-1031
Fort Worth, Texas	Sean Gasser	817-632-5250	-

CONTRACTOR(S)	CONTACT NAME	OFFICE NUMBER	CELLULAR NUMBER
To Be Determined	To Be Determined	-	-
To Be Determined	To Be Determined	-	-
To Be Determined	To Be Determined	-	-
To Be Determined	To Be Determined	-	-

05/24/2019

APPENDIX B

SAFETY DATA SHEET(S)

Well Site Safety Plan

Well Name: Goudy 1S-4HM
Marshall County, West Virginia

Tug Hill Operating, LLC
380 Southpointe Blvd., Suite 200
Canonsburg, PA

Updated March 2019

BASF
The Chemical Company

Safety Data Sheet
ALCOMER® 24

1. Product and Company Identification

Company
BASF CORPORATION
100 Park Avenue
Florham Park, NJ 07932, USA

24 Hour Emergency Response Information
CHEMTREC: 1-800-424-9300
BASF HOTLINE: 1-800-832-HELP (4357)

2. Hazards Identification

Emergency overview

May cause mild eye and skin irritation based on a component of this product.
Use with local exhaust ventilation.
Avoid dust formation.
Wear protective clothing.
Caution - Slippery when wet!

State of matter: solid
Colour: off-white
Odour: odourless

Potential health effects

Primary routes of exposure:
Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Chronic toxicity:

Carcinogenicity: None of the components in this product at concentrations greater than 0.1% are listed by IARC; NTP, OSHA or ACGIH as a carcinogen.

Reproductive toxicity: No data for product. No effects anticipated

Teratogenicity: No data available concerning teratogenic effects.

Genotoxicity: The chemical structure does not suggest a specific alert for such an effect.

Signs and symptoms of overexposure:
The most important known symptoms and effects are described in the labelling (see section 2) and/or in section 11., Further important symptoms and effects are so far not known.

3. Composition / Information on Ingredients

This product is not regarded as hazardous under current OSHA Hazard Communication standard; CFR 29 Part 1910.1200.

4. First-Aid Measures

General advice:
Remove contaminated clothing.

If inhaled:
If difficulties occur after dust has been inhaled, remove to fresh air and seek medical attention.

If on skin:
Wash thoroughly with soap and water.

If irritation develops, seek medical attention.

If in eyes:
Wash affected eyes for at least 15 minutes under running water with eyelids held open.

Seek medical attention.

If swallowed:
Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required.

Note to physician

Treatment:	Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

Flash point:		not applicable
Flammability:	not highly flammable	
Self-ignition temperature:		not self-igniting

Suitable extinguishing media:
dry powder, foam

Unsuitable extinguishing media for safety reasons:
water jet, carbon dioxide

Additional information:
If water is used, restrict pedestrian and vehicular traffic in areas where slip hazard may exist.

Hazards during fire-fighting:
carbon oxides, nitrogen oxides
The substances/groups of substances mentioned can be released in case of fire. Very slippery when wet.

Protective equipment for fire-fighting:
Wear a self-contained breathing apparatus.

Further information:
The degree of risk is governed by the burning substance and the fire conditions. Contaminated extinguishing water must be disposed of in accordance with official regulations.

6. Accidental release measures

Personal precautions:
Use personal protective clothing.

Environmental precautions:
Do not discharge into drains/surface waters/groundwater.

Cleanup:
Spilled product which becomes wet or spilled aqueous solution create a hazard because of their slippery nature.
Avoid raising dust.
For small amounts: Pick up with suitable appliance and dispose of.
For large amounts: Contain with dust binding material and dispose of.

7. Handling and Storage

Handling

General advice:
Breathing must be protected when large quantities are decanted without local exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice. Forms slippery surfaces with water.

Storage

General advice:
Store in unopened original containers in a cool and dry place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

8. Exposure Controls and Personal Protection

Personal protective equipment

Respiratory protection:
Wear a NIOSH-certified (or equivalent) organic vapour/particulate respirator.

Hand protection:
Chemical resistant protective gloves

Eye protection:
Safety glasses with side-shields.

General safety and hygiene measures:
Wear protective clothing as necessary to minimize contact. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Form:	beads	
Odour:	odourless	
Colour:	off-white	
pH value:	5 - 7	(10 g/l)
Melting point:		The substance / product decomposes therefore not determined.
Boiling point:		not applicable
Density:	0.75 g/cm3	
Bulk density:	564 kg/m3	
% volatiles:		not determined

Solubility in water:	Forms a viscous solution.
Other Information:	If necessary, information on other physical and chemical parameters is indicated in this section.

10. Stability and Reactivity

Conditions to avoid:
Avoid extreme temperatures. Avoid humidity.

Substances to avoid:
strong acids, strong bases, strong oxidizing agents

Hazardous reactions:
The product is not a dust explosion risk as supplied; however the build-up of fine dust can lead to a risk of dust explosions.
Stable under normal conditions.
No hazardous reactions known.

Decomposition products:
No hazardous decomposition products if stored and handled as prescribed/indicated.

Corrosion to metals:
No corrosive effect on metal.

Oxidizing properties:
not fire-propagating

11. Toxicological information

Acute toxicity

Oral:
Type of value: LD50
Species: rat
Value: > 2,000 mg/kg (OECD Guideline 401)

Irritation / corrosion

Skin:
Species: rabbit
Result: non-irritant
Method: OECD Guideline 404

Eye:
Species: rabbit
Result: non-irritant

Other Information:

The product has not been tested. The statements on toxicology have been derived from products of a similar structure and composition.

12. Ecological Information

Fish

Acute:
static

Oncorhynchus mykiss/LC50 (96 h): > 100 mg/l
(under static conditions in the presence of 10 mg/L humic acid)

Aquatic invertebrates

Acute:
Daphnia magna/LC50 (48 h): > 100 mg/l

Degradability / Persistence
Biological / Abiological Degradation

Information on: Anionic polyacrylamide

Evaluation: *Not readily biodegradable (by OECD criteria).*

Environmental mobility:

Information on: Anionic polyacrylamide
Assessment transport between environmental compartments:
Adsorption to solid soil phase is expected.

Other adverse effects:

The product has not been tested. The statements on ecotoxicology have been derived from products of a similar structure and composition.

13. Disposal considerations

Waste disposal of substance:
Must be disposed of or incinerated in accordance with local regulations.

Container disposal:
Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

RCRA:
Not a hazardous waste under RCRA (40 CFR 261).

14. Transport Information

Land transport
USDOT

Not classified as a dangerous good under transport regulations

Sea transport
IMDG

Not classified as a dangerous good under transport regulations

Air transport
IATA/ICAO

Not classified as a dangerous good under transport regulations

15. Regulatory Information

VOC content:

not determined

Federal Regulations

Registration status:
Chemical TSCA, US released / listed

OSHA hazard category: This material is classified as not hazardous under OSHA regulations.;

EPCRA 311/312 (Hazard categories): Not hazardous;

16. Other Information

NFPA Hazard codes:
Health : 1 Fire: 1 Reactivity: 0 Special: -

HMIS III rating
Health: 1 Flammability: 1 Physical hazard: 0

NFPA and HMIS use a numbering scale ranging from 0 to 4 to indicate the degree of hazard. A value of zero means that the substance possesses essentially no hazard; a rating of four indicates extreme danger. Although similar, the two rating systems are intended for different purposes, and use different criteria. The NFPA system was developed to provide an on-the-spot alert to the hazards of a material, and their severity, to emergency responders. The HMIS system was designed to communicate workplace hazard information to employees who handle hazardous chemicals.

We support worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

MSDS Prepared by:
BASF NA Product Regulations
msds@basf.com
MSDS Prepared on: 2012/10/22

END OF DATA SHEET

Safety Data Sheet
ALCOMER 80

1. Product and Company Identification

Company
BASF CORPORATION
100 Park Avenue
Florham Park, NJ 07932, USA

24 Hour Emergency Response Information
CHEMTREC: 1-800-424-9300
BASF HOTLINE: 1-800-832-HELP (4357)

2. Hazards Identification

Emergency overview

Caution - Slippery when wet!
May cause mild eye and skin irritation based on a component of this product.
Use with local exhaust ventilation.
Avoid dust formation.
Wear protective clothing.

State of matter: solid
Colour: off-white
Odour: odourless

Potential health effects

Primary routes of exposure:
Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Chronic toxicity:

Carcinogenicity: None of the components in this product at concentrations greater than 0.1% are listed by IARC; NTP, OSHA or ACGIH as a carcinogen.

Reproductive toxicity: No data available concerning reproduction toxicity.

Teratogenicity: No data available concerning teratogenic effects.

Genotoxicity: No data was available concerning mutagenic activity.

Signs and symptoms of overexposure:
No significant symptoms are expected due to the non-classification of the product.

3. Composition / Information on Ingredients

This product is not regarded as hazardous under current OSHA Hazard Communication standard; CFR 29 Part 1910.1200.

4. First-Aid Measures

General advice:
Remove contaminated clothing.

If inhaled:
If difficulties occur after dust has been inhaled, remove to fresh air and seek medical attention.

If on skin:
Wash thoroughly with soap and water.

If irritation develops, seek medical attention.

If in eyes:
Wash affected eyes for at least 15 minutes under running water with eyelids held open.

Seek medical attention.

If swallowed:
Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required.

Note to physician

Treatment:	Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

Flash point:		not applicable
Autoignition:	350 °C	
Self-ignition temperature:		not self-igniting

Suitable extinguishing media:
dry powder, foam

Unsuitable extinguishing media for safety reasons:
water jet

Additional information:
If water is used, restrict pedestrian and vehicular traffic in areas where slip hazard may exist.

Hazards during fire-fighting:
carbon oxides, nitrogen oxides
The substances/groups of substances mentioned can be released in case of fire. Very slippery when wet.

Protective equipment for fire-fighting:
Wear a self-contained breathing apparatus.

Further information:
The degree of risk is governed by the burning substance and the fire conditions. Contaminated extinguishing water must be disposed of in accordance with official regulations.

6. Accidental release measures

Personal precautions:
Use personal protective clothing.

Environmental precautions:
Do not discharge into drains/surface waters/groundwater.

Cleanup:
Spilled product which becomes wet or spilled aqueous solution create a hazard because of their slippery nature.
Avoid raising dust.
For small amounts: Pick up with suitable appliance and dispose of.
For large amounts: Contain with dust binding material and dispose of.

7. Handling and Storage

Handling

General advice:
Breathing must be protected when large quantities are decanted without local exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice. Forms slippery surfaces with water.

Storage

General advice:
Store in unopened original containers in a cool and dry place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

8. Exposure Controls and Personal Protection

Personal protective equipment

Respiratory protection:
Wear a NIOSH-certified (or equivalent) organic vapour/particulate respirator.

Hand protection:
Chemical resistant protective gloves

Eye protection:
Safety glasses with side-shields.

General safety and hygiene measures:
Wear protective clothing as necessary to minimize contact. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Form:	powder	
Odour:	odourless	
Colour:	off-white	
Melting point:		The substance / product decomposes therefore not determined.
Bulk density:	approx. 800 kg/m3	
% volatiles:		not determined
Solubility in water:		Forms a viscous solution.
Other Information:	If necessary, information on other physical and chemical parameters is indicated in this section.	

10. Stability and Reactivity

Conditions to avoid:
Avoid extreme temperatures. Avoid humidity.

Substances to avoid:
strong acids, strong bases, strong oxidizing agents

Hazardous reactions:
The product is not a dust explosion risk as supplied; however the build-up of fine dust can lead to a risk of dust explosions.
Stable under normal conditions.
No hazardous reactions known.

Decomposition products:
No hazardous decomposition products if stored and handled as prescribed/indicated.

Corrosion to metals:
No corrosive effect on metal.

Oxidizing properties:
not fire-propagating

11. Toxicological information

Acute toxicity

Oral:
Type of value: LD50
Species: rat
Value: > 2,000 mg/kg (OECD Guideline 401)

Irritation / corrosion

Skin:
Species: rabbit
Result: non-irritant
Method: OECD Guideline 404

Eye:
Species: rabbit
Result: non-irritant

Sensitization:

Result: Non-sensitizing.

Other Information:

The product has not been tested. The statements on toxicology have been derived from products of a similar structure and composition.

12. Ecological Information

Fish

Acute:

static
Oncorhynchus mykiss/LC50 (96 h): > 100 mg/l
(under static conditions in the presence of 10 mg/L humic acid)
Oncorhynchus mykiss/LC50 (96 h): = 3,500 ppm

Aquatic invertebrates

Acute:
shrimp/LC50 (48 h): > 100 mg/l

Degradability / Persistence
Biological / Abiological Degradation

Information on: Polyacrylamide

Evaluation: *Not readily biodegradable (by OECD criteria).*

Environmental mobility:

Information on: Polyacrylamide
Assessment transport between environmental compartments:
Adsorption to solid soil phase is expected.

Other adverse effects:

The product has not been tested. The statements on ecotoxicology have been derived from products of a similar structure and composition.

13. Disposal considerations

Waste disposal of substance:
Must be disposed of or incinerated in accordance with local regulations.

Container disposal:
Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

RCRA:
Not a hazardous waste under RCRA (40 CFR 261).

14. Transport Information

Land transport
USDOT

Not classified as a dangerous good under transport regulations

Sea transport
IMDG

Not classified as a dangerous good under transport regulations

Air transport
IATA/ICAO

Not classified as a dangerous good under transport regulations

15. Regulatory Information

VOC content:

not determined

Federal Regulations

Registration status:
Chemical TSCA, US released / listed

OSHA hazard category: This material is classified as not hazardous under OSHA regulations.;

EPCRA 311/312 (Hazard categories): Not hazardous;

State regulations

CA Prop. 65:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

16. Other Information

NFPA Hazard codes:
Health : 0 Fire: 1 Reactivity: 0 Special:

HMIS III rating
Health: 0 Flammability: 1 Physical hazard: 0

NFPA and HMIS use a numbering scale ranging from 0 to 4 to indicate the degree of hazard. A value of zero means that the substance possesses essentially no hazard; a rating of four indicates extreme danger. Although similar, the two rating systems are intended for different purposes, and use different criteria. The NFPA system was developed to provide an on-the-spot alert to the hazards of a material, and their severity, to emergency responders. The HMIS system was designed to communicate workplace hazard information to employees who handle hazardous chemicals.

We support worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

MSDS Prepared by:
BASF NA Product Regulations
msds@basf.com
MSDS Prepared on: 2012/10/17

INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE. FURTHER, YOU EXPRESSLY UNDERSTAND AND AGREE THAT THE DESCRIPTIONS, DESIGNS, DATA, AND INFORMATION FURNISHED BY OUR COMPANY HEREUNDER ARE GIVEN GRATIS AND WE ASSUME NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK.
Due to the merger of CIBA and BASF Group all Material Safety Data Sheets have been reassessed on the basis of consolidated information. This may have resulted in changes of the Material Safety Data Sheets. In case you have questions concerning such changes please contact us at the address mentioned in Section I.

END OF DATA SHEET

Aluminum sulfate, liquid

MSDS No. 011
1/5/2011

Material Safety Data Sheet

Section 1 - Chemical Product and Company Identification

Product/Chemical Name:	Aluminum sulfate, solution
Chemical Formula:	$Al_2(SO_4)_3 \bullet 14(H_2O)$
CAS Number:	10043-01-3
General Use:	Water Treatment Chemical
Emergency Contact:	**800-424-9300** Chemtrec

Manufacturer:
Delta Chemical Corporation
2601 Cannery Avenue
Baltimore, MD 21226-1595
Phone 410-354-0100 (7:00am 5:00pm)
FAX 410-354-1021

HMIS

H	1
F	0
R	0

PPE†
†Sec. 11

Section 2 - Composition / Information on Ingredients

Ingredient Name	CAS Number	% wt
Aluminum sulfate	10043-01-3	27.8
Water	7732-18-5	72.2

	OSHA PEL		ACGIH TLV		NIOSH REL		NIOSH
Ingredient	**TWA**	**STEL**	**TWA**	**STEL**	**TWA**	**STEL**	**IDLH**
Aluminum sulfate	2 mg/m^3 *as aluminum*	none estab.	2 mg/m^3 *as aluminum*	none estab.	2 mg/m^3 *as aluminum*	none estab.	none estab.

Section 3 - Emergency Overview

Description: Clear, amber or light green liquid. pH ±2.1. Not volatile. Not flammable.
Hazards: Harmful by ingestion and in contact with skin. Irritating to eyes, respiratory system and skin. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Section 4 - First Aid Procedures

Inhalation:	(mist or spray) Remove from exposure, seek medical treatment if any symptoms occur.
Eye Contact:	Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention.
Skin Contact:	Remove contaminated clothing and wash contaminated skin with water.
Ingestion:	Do not induce vomiting, drink milk or water and immediately seek medical attention.

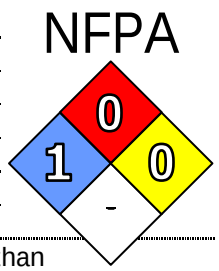
After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 5 - Physical and Chemical Properties

Physical State:	Liquid	**Water Solubility:**	Complete
Appearance:	colorless, clear amber or light green	**Boiling Point:**	109° C/228° F
		Freezing/Melting Point:	-13° C/9° F
Odor:	Negligible odor	**Viscosity:**	25 cps @ 20°C/68° F
Vapor Pressure:	NA	**Vapor Density (Air=1):**	NA
Specific Gravity (H_2O=1, at 15.5°C/60 °F):	1.33	**% VOC:**	0.0
pH:	2.1 ± 0.5		

Section 6 - Fire-Fighting Measures

Flash Point:	NA
Burning Rate:	NA
Autoignition Temperature:	NA
LEL:	NA
UEL:	NA
Flammability Classification:	Not flammable
Extinguishing Media:	NA
Unusual Fire or Explosion Hazards:	If evaporated to dryness and exposed to temperatures greater than 1400°F, aluminum sulfate will decompose generating toxic and corrosive gas.
Hazardous Combustion Products:	See Section 7.
Fire-Fighting Instructions:	Do not release runoff from fire control methods to sewers or waterways.



Section 7 - Stability and Reactivity

Stability:	Stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization:	Hazardous polymerization cannot occur.
Chemical Incompatibilities:	Alkalies and water-reactive materials.
Conditions to Avoid:	N/A
Hazardous Decomposition Products:	Thermal oxidative decomposition of Aluminum Sulfate occurs at temperatures greater than 1400°F and can produce sulfur oxides.

Section 8 - Health Hazard Information

Primary Entry Routes:	Ingestion.
Target Organs:	N/A
Acute Effects:	No unusual.
Eye:	Irritating to eyes.
Skin:	Irritating to skin.
Ingestion:	Harmful if swallowed.
Carcinogenicity:	IARC, NTP, and OSHA do not list Aluminum Sulfate, Liquid as a carcinogen.
Medical Conditions Aggravated by Long-Term Exposure:	None reported.
Chronic Effects:	IARC, NTP, and OSHA list no evidence showing that any of the ingredients cause cancer or affect reproduction.

Section 9 - Spill, Leak, and Disposal Procedures

Spill /Leak Procedures:	Spill procedures are dictated by site wastewater flow controls and will vary from site to site. General procedures are provided in this document, but authorization for any wastewater discharge must be obtained prior to the discharge.
Small Spills:	If directed to an industrial sewer, wash down with large volumes of water. Spills can be neutralized and absorbed with soda ash or lime, but neutralization will release carbon dioxide, which can generate a breathing hazard.
Large Spills:	For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways. Pump residue into storage containers or neutralize with lime or soda ash. Neutralization will release carbon dioxide, which can generate a breathing hazard.
Cleanup:	Wash or neutralize impacted areas after liquid removal to remove residues.

Regulatory Requirements:	Follow applicable OSHA regulations (29 CFR 1910.120). Aluminum sulfate has a reportable quantity under CERCLA.
Disposal:	Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
Container Cleaning and Disposal:	Rinse with water, dispose of containers in accordance with State and local regulations.

Section 10 - Exposure Controls / Personal Protection

Ventilation:	Under normal conditions, liquid alum will not generate mists or vapors. No special ventilation is recommended.
Respiratory Protection:	Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear an MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or non-routine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.
Protective Clothing/Equipment:	Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.
Safety Stations:	Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.
Contaminated Equipment:	Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.
Comments:	Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Special Precautions and Comments

Handling Precautions:	Ensure that all containers are labeled in accordance with OSHA regulations. Avoid skin and eye contact. Wear appropriate protective clothing. Aluminum sulfate delivered in tank trucks may exceed 45° C (113° F).

Section 11 - Regulatory Data

RCRA Hazardous Waste Number:	D002 (Corrosive) if the pH is <2 D002 under §261.22(a)(2) due to the rate of corrosion of steel
CERCLA Hazardous Substance (40 CFR 302.4):	listed CWA, Sec. 311 (b)(4)
CERCLA Reportable Quantity (RQ):	5,000 lbs (2,270 kg) as $Al_2(SO_4)_3$ 17,900 lbs (8,120 kg) as a 27.8% solution
SARA 311/312 Codes:	immediate (acute) health hazard
SARA Toxic Chemical (40 CFR 372.65):	Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355):	Not listed
OSHA Regulations:	
Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A):	Not listed
OSHA Specifically Regulated Substance (29CFR 1910.):	Not listed
State Regulations:	Delta Chemical Corporation has not investigated state specific requirements.

Section 12 - DOT Transportation Data (49 CFR 172.101)

Proper Shipping Name:	UN3264, Corrosive, liquid, acidic, inorganic, n.o.s., (Aluminum sulfate) 8, III, RQ		
Shipping Symbols:	G	**Packaging Authorizations**	
Hazard Class:	8	**a) Exceptions:**	173.154
DOT No.:	UN3264	**b) Non-bulk Packaging:**	173.203
Packing Group:	III	**c) Bulk Packaging:**	173.241
Label:	Class 8	**Quantity Limitations**	
Special Provisions (172.102):	IB3 , T7 , TP1 , TP28	**a) Passenger, Aircraft, or Railcar:**	5 L
		b) Cargo Aircraft Only:	60 L
2004 Emergency Response Guidebook:	Guide 154	**Vessel Stowage Requirements**	
		a) Vessel Stowage:	A
		b) Other:	40

Prepared By: Craig Owen

Revision Notes: 1/5/11 – Periodic review.. 1/18/10 - Proper shipping name revised. 10/26/07 – Temperature statement added to Section 12. 10/1/04, 6/2/06, – Format revised. 3/9/04 – PEL updated, proper shipping name added. 10/16/03 – Transportation data updated.

Disclaimer: The information presented herein is believed to be accurate and reliable, but is given without guaranty or warranty, expressed or implied. The user should not assume that all safety measures are indicated so that other measures may not be required. The user is responsible for assuring that the product and equipment are used in a safe manner that complies with all appropriate legal standards and regulations.

MATERIAL SAFETY DATA SHEET

ALUMINUM STEARATE

Drilling Fluids

1. Product and Company Identification

Material name ALUMINUM STEARATE

Applications Defoaming Agent

Supplier Baker Hughes Drilling Fluids
2001 Rankin Rd.
Houston, TX 77073
Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
Aluminum stearate	300-92-5	100

3. Hazards Identification

Emergency overview Product may form explosive dust/air mixtures if high concentration of product dust is suspended in air. Contact with this material can cause irritation to the skin, eyes and mucous membranes. Prolonged exposure may cause chronic effects.

Potential health effects

Eyes Contact with eyes may cause irritation.

Skin Health injuries are not known or expected under normal use.

Inhalation Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Ingestion No significant adverse effects are expected upon ingestion of the product.

Target organs Eyes. Respiratory system.

Chronic effects May cause delayed lung damage. Cyanosis.

4. First Aid Measures

First aid procedures

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Wash off skin with soap and water. Get medical attention if irritation develops or persists.

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Ingestion Give several glasses of water. If ingestion of a large amount does occur, seek medical attention.

Notes to physician Symptoms may be delayed.

General advice If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties Dusts at sufficient concentrations can form explosive mixtures with air.

Extinguishing media

Suitable extinguishing media Dry chemical, CO2, water spray or alcohol resistant foam. Addition of water or foam to the fire may cause frothing.

Protection of firefighters

Protective equipment for firefighters Move containers from fire area if you can do it without risk. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental Release Measures

Personal precautions Remove all sources of ignition. Do not touch or walk through spilled material. Keep people away from and upwind of spill/leak. Avoid inhalation of dust from the spilled material.

Evacuation procedures Stay upwind. Keep out of low areas.

Environmental precautions Prevent further leakage or spillage if safe to do so. Hose down gases, fumes and/or dust with water. Do not flush into surface water or sanitary sewer system.

Methods for containment	Prevent entry into waterways, sewers, basements or confined areas. Stop the flow of material, if this is without risk.
Methods for cleaning up	Avoid dust formation. Reduce airborne dust and prevent scattering by moistening with water. Sweep up or gather material and place in appropriate container for disposal.

7. Handling and Storage

Handling	Avoid contact with skin and eyes. Wash hands after handling and before eating. Handle and open container with care.
Storage	Use care in handling/storage. Keep away from heat, sparks, and flame. Keep tightly closed in a dry, cool and well-ventilated place.

8. Exposure Controls / Personal Protection

Exposure limits

ACGIH

Material	CAS #	TWA	STEL	Ceiling
ALUMINUM STEARATE	300-92-5	10 mg/m3		

Engineering controls	Provide adequate local exhaust ventilation to maintain worker exposure below exposure limits.

Personal protective equipment

Eye protection	Wear dust goggles. Eye wash fountain and emergency showers are recommended.
Hand protection	Neoprene or rubber gloves.
Skin and body protection	Use of protective coveralls and long sleeves is recommended. Use of an impervious apron is recommended. Use of impervious boots is recommended.
Respiratory protection	Use a particulate filter respirator for particulate concentrations exceeding the Occupational Exposure Limit.
General hygeine considerations	Use good industrial hygiene practices in handling this material. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Powder. White to off-white.
Odor	Slight.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	Not available
Melting point	293 °F (145 °C)
Freezing point	Not available
Boiling point	Not available
Flash point	> 662 °F (> 350 °C) Cleveland Open Cup
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	1.01
Relative density	0.8 - 1
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available
Bulk density	800 kg/m3

10. Chemical Stability & Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Dust may form explosive mixture in air.

Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Carbon oxides. Irritating and/or toxic fumes and gases may be emitted upon the products decomposition.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Carcinogenicity

ACGIH - Threshold Limit Values - Carcinogens

Aluminum stearate	300-92-5	A4 - Not Classifiable as a Human Carcinogen

12. Ecological Information

Not available

13. Disposal Considerations

Disposal instructions	Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical	Yes
CERCLA (Superfund) reportable quantity	None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	Yes
Food and Drug Administration (FDA)	Indirect food additive

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other Information

05/24/2019

HMIS® ratings	Health: 1* Flammability:1 Physical hazard: 0 Personal protection: E
NFPA ratings	Health: 0 Flammability: 1 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
EU preparer	Melanie Thatcher - Tel +44 (0)1224 721597
US preparer	Cheryl Hood - Tel +1 713-625-4888
Issue date	28-Apr-2008
Supercedes date	08-19-2005
MSDS sections updated	Product and Company Identification: Synonyms First Aid Measures: Skin contact Fire Fighting Measures: Fire & Explosion Properties Exposure Controls / Personal Protection: Hand protection Exposure Controls / Personal Protection: Eye protection Exposure Controls / Personal Protection: Hygiene measures Physical & Chemical Properties: Physical & Chemical Properties Physical & Chemical Properties: Solubility Chemical Stability & Reactivity Information: Incompatibility Chemical Stability & Reactivity Information: Hazardous decomposition products

MATERIAL SAFETY DATA SHEET

AMPLI-FOAM™

Drilling Fluids

1. Product and Company Identification

Material name	AMPLI-FOAM™
Chemical name	Surfactant
Applications	Foaming Agent
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
PROPAN-2-OL	67-63-0	10 - 20
Non-hazardous and other components below reportable levels		80 - 90

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

3. Hazards Identification

Emergency overview Flammable/Combustible Material. May be ignited by heat, sparks or flames. Harmful in contact with eyes.

Potential health effects

Eyes Contact may irritate or burn eyes. Eye contact may result in corneal injury.

Skin Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis (rash).

Inhalation Prolonged inhalation may be harmful. Intentional misuse by concentrating and inhaling the product can be harmful or fatal.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Chronic effects Prolonged skin contact may defat the skin and produce dermatitis. Conjunctiva.

Signs and symptoms Shortness of breath. Defatting of the skin. Irritation. Conjunctivitis.

4. First Aid Measures

First aid procedures

Eye contact Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately.

Skin contact Remove and isolate contaminated clothing and shoes. Wash off skin with soap and water. Get medical attention. Thoroughly wash (or discard) clothing and shoes before reuse.

Inhalation Move to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Call a physician if symptoms develop or persist.

Ingestion Do not induce vomiting. Have victim rinse mouth thoroughly with water. If ingestion of a large amount does occur, seek medical attention.

General advice Call a physician if symptoms develop or persist. If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Hazardous combustion products Decomposition of this product may yield oxides of sulfur and nitrogen. Carbon monoxide and carbon dioxide.

Extinguishing media

Suitable extinguishing media Water spray, fog or alcohol resistant foam.

Protection of firefighters

Protective equipment for firefighters Move containers from fire area if you can do it without risk. Cool containers with flooding quantities of water until well after fire is out. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental Release Measures

Personal precautions	Do not touch or walk through spilled material. Keep people away from and upwind of spill/leak.
Evacuation procedures	Keep unnecessary personnel away. Ventilate closed spaces before entering. Stay upwind. Keep out of low areas.
Environmental precautions	Do not contaminate surface water. Do not let product enter drains.
Methods for containment	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Prevent entry into waterways, sewers, basements or confined areas. Stop the flow of material, if this is without risk.
Methods for cleaning up	Large Spills: Dike far ahead of liquid spill for later disposal. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly.

7. Handling and Storage

Handling	Handle and open container with care. Avoid contact with skin and eyes. Do not handle or store near an open flame, heat or other sources of ignition. Ensure all equipment is electrically grounded before beginning transfer operations. Wash hands after handling and before eating.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure Controls / Personal Protection

Exposure limits

ACGIH

Components	CAS #	TWA	STEL	Ceiling
PROPAN-2-OL	67-63-0	200 ppm	400 ppm	

OSHA

Components	CAS #	TWA	STEL	Ceiling
PROPAN-2-OL	67-63-0	400 ppm		

Engineering controls	Provide adequate local exhaust ventilation to maintain worker exposure below exposure limits.
Personal protective equipment	
Eye protection	Wear chemical goggles.
Hand protection	Protective gloves.
Skin and body protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Respiratory protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. No personal respiratory protective equipment normally required.
General hygeine considerations	When using do not smoke. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Appearance / Color / Form	Clear. Light yellow. Liquid.
Odor	Alcoholic.
Clarity	Not available
Odor threshold	Not available
Physical state	Liquid
pH	7 - 8
Melting point	-130 °F (-90 °C) estimated
Freezing point	Not available
Boiling point	181.4 °F (82.5 °C) estimated
Flash point	80.6 °F (27 °C) Pensky-Martens Closed Cup
Evaporation rate	Not available

Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	1.01
Relative density	1.01 g/cm3
Solubility	Soluble in water
Octanol/H2O coeff	Not available
Auto-ignition temperature	750.2 °F (399 °C) estimated
Decomposition temperature	Not available
VOC (Weight %)	15.22 % estimated

10. Chemical Stability & Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Heat, flames and sparks.
Incompatible materials	This product may react with oxidizing agents.
Hazardous decomposition products	Upon decomposition, product emits acrid dense smoke with carbon dioxide, carbon monoxide, trace oxides of nitrogen and sulfur, and water.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

PROPAN-2-OL	67-63-0	Inhalation LC50 Rat: 72.6 mg/L/4H; Oral LD50 Rat:4396 mg/kg; Dermal LD50 Rat:12800 mg/kg; Dermal LD50 Rabbit:12870 mg/kg

Local effects Components of the product may be absorbed into the body through the skin. Irritating to eyes and skin. Risk of serious damage to eyes.

Carcinogenicity Not expected to be hazardous by OSHA criteria.

ACGIH - Threshold Limit Values - Carcinogens

PROPAN-2-OL	67-63-0	A4 - Not Classifiable as a Human Carcinogen

12. Ecological Information

Ecotoxicity Components of this product are hazardous to aquatic life.

Environmental effects

Ecotoxicity - Freshwater Algae Data

PROPAN-2-OL	67-63-0	96 Hr EC50 Scenedesmus subspicatus: >1000 mg/L; 72 Hr EC50 Scenedesmus subspicatus: >1000 mg/L

Ecotoxicity - Freshwater Fish Species Data

PROPAN-2-OL	67-63-0	96 Hr LC50 Pimephales promelas: 9640 mg/L [flow-through]; 96 Hr LC50 Pimephales promelas: 94900 mg/L [flow-through] (29 days old); 96 Hr LC50 Pimephales promelas: 61200 mg/L [flow-through] (31 days old)

Ecotoxicity - Microtox Data

PROPAN-2-OL	67-63-0	5 min EC50 Photobacterium phosphoreum: 35390 mg/L

Ecotoxicity - Water Flea Data

PROPAN-2-OL	67-63-0	48 Hr EC50 Daphnia magna: 13299 mg/L

13. Disposal Considerations

Disposal instructions If discarded, this product is considered a RCRA ignitable waste, D001. Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Proper shipping name	Flammable liquids, n.o.s. (ISOPROPYL ALCOHOL)
Hazard class	3
UN number	UN1993
Packing group	III
Special provisions	B1, B52, IB3, T4, TP1, TP29
Packaging exceptions	150
Packaging non bulk	203
Packaging bulk	242
ERG number	128

IATA

Proper shipping name	Flammable liquid, n.o.s. (ISOPROPYL ALCOHOL)
Hazard class	3
UN number	1993
Packing group	III

IMDG

Proper shipping name	FLAMMABLE LIQUID, N.O.S. (ISOPROPYL ALCOHOL)
Hazard class	3
Subsidiary hazard class	•
UN number	1993
Packing group	III

15. Regulatory Information

US federal regulations All components are on the U.S. EPA TSCA Inventory List.

FEMA (Flavor and Extract Manufacturers Association) - FEMA Numbers

PROPAN-2-OL	67-63-0	2929

U.S. - CERCLA/SARA - Section 313 - Emission Reporting

PROPAN-2-OL	67-63-0	1.0 % de minimis concentration (only if manufactured by the strong acid process, nc supplier notification)

U.S. - FDA - Color Additives Conditionally Approved for Use in Foods

PROPAN-2-OL	67-63-0	21 CFR 73.1

U.S. - FDA - Direct Food Additives

PROPAN-2-OL	67-63-0	21 CFR 172.515, 21 CFR 173.240, 21 CFR 173.340

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical	Yes

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - Yes Fire Hazard - Yes Pressure Hazard - No Reactivity Hazard - No

Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

Regulations The product does not need to be labelled in accordance with EC directives or respective national laws.

State regulations

U.S. - Massachusetts - Right To Know List

PROPAN-2-OL	67-63-0	Present

U.S. - New Jersey - Right to Know Hazardous Substance List

PROPAN-2-OL	67-63-0	sn 1076; sn 2381 (strong-acid process manufacture)

U.S. - Pennsylvania - RTK (Right to Know) List

PROPAN-2-OL	67-63-0	Environmental hazard

16. Other Information

HMIS® ratings
Health: 1*
Flammability:2
Physical hazard: 0
Personal protection: G

NFPA ratings
Health: 1
Flammability: 2
Instability: 0

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

US preparer Cheryl Hood - Tel +1 713-625-4888

Issue date 24-Jun-2008

Supercedes date 10-06-2005

MSDS sections updated This document has undergone significant changes and should be reviewed in its entirety.

MATERIAL SAFETY DATA SHEET

05/24/2019

CLAY-TROL®

Drilling Fluids

1. Product and Company Identification

Material name	**CLAY-TROL®**
Chemical description	Amine Acid Complex
Applications	Shale Stabilizer
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

3. Hazards Identification

Emergency overview	Irritating to eyes, respiratory system and skin.
Potential health effects	
Eyes	Contact with eyes may cause irritation.
Skin	This product may cause irritation to the skin.
Inhalation	Prolonged or excessive inhalation may cause respiratory tract irritation.
Ingestion	Health injuries are not known or expected under normal use.

4. First Aid Measures

First aid procedures	
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.
Skin contact	Remove contaminated clothing. Wash off skin with soap and water. Get medical attention if irritation develops or persists.
Inhalation	Remove to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.
Ingestion	Have victim rinse mouth thoroughly with water. If ingestion of a large amount does occur, seek medical attention.
General advice	If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Hazardous combustion products	None known.
Extinguishing media	
Suitable extinguishing media	Dry chemical, CO2, water spray or regular foam.
Protection of firefighters	
Protective equipment for firefighters	Move containers from fire area if you can do it without risk. Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away. Remove all sources of ignition. Do not touch or walk through spilled material.
Environmental precautions	Prevent further leakage or spillage if safe to do so. Do not flush into surface water or sanitary sewer system.
Methods for cleaning up	Large Spills: Dike far ahead of liquid spill for later disposal. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly.

7. Handling and Storage

Handling	Handle and open container with care. Do not get this material in contact with skin or eyes. Wash hands after handling and before eating.
Storage	Keep away from heat, sparks, and flame. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure Controls / Personal Protection

Engineering controls	Good general ventilation should be sufficient to control airborne levels.
Personal protective equipment	
Eye / face protection	Wear chemical goggles.
Hand protection	Protective gloves.
Skin protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Respiratory protection	No personal respiratory protective equipment normally required.
General hygeine considerations	Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Clear. Amber. Liquid.
Odor	Mild.
Clarity	Not available
Odor threshold	Not available
Physical state	Liquid
pH	Not available
Melting point	Not available
Freezing point	Not available
Boiling point	Not available
Flash point	> 300 °F (> 148.9 °C)
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	1.06
Relative density	Not available
Solubility	Soluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	Upon decomposition, this product may yield gaseous nitrogen oxides, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Not available

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life.

13. Disposal Considerations

05/24/2019

Disposal instructions Dispose in accordance with all applicable regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
CERCLA/SARA Hazardous Substances - Not applicable.

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (CCS)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations The product does not need to be labelled in accordance with EC directives or respective national laws.

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

HMIS® ratings Health: 0
Flammability:0
Physical hazard: 0
Personal protection: C

NFPA ratings Health: 0
Flammability: 0
Instability: 0

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EU preparer	Melanie Thatcher - Tel +44 (0)1224 721597
US preparer	Cheryl Hood - (713)625-4888
Issue date	18-Sep-2006
Supercedes date	09-18-2006

MATERIAL SAFETY DATA SHEET

Drilling Fluids

1. Product and Company Identification

Material name	**POTASSIUM CHLORIDE**
Chemical description	Inorganic salt
Synonym(s)	POTASSIUM CHLORIDE (KCL)
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

3. Hazards Identification

Emergency overview	Product dust may be irritating to eyes, skin and respiratory system.
Potential health effects	
Eyes	Irritating to eyes.
Skin	Irritating to skin.
Inhalation	Inhalation of dusts may cause respiratory irritation.
Ingestion	May cause dizziness, incoordination, headache, nausea, and vomiting. Ingestion of large amounts may produce kidney or bladder damage.
Chronic effects	Prolonged skin contact may defat the skin and produce dermatitis.

4. First Aid Measures

First aid procedures	
Eye contact	Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.
Skin contact	Remove contaminated clothing. Wash off with soap and water. Get medical attention if irritation develops or persists. Wash clothing separately before reuse.
Inhalation	Remove to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.
Ingestion	Immediately give large quantities of water to drink. If ingestion of a large amount does occur, seek medical attention.
Notes to physician	Treat symptomatically.

5. Fire Fighting Measures

Extinguishing media	
Suitable extinguishing media	Use extinguishing agent suitable for type of surrounding fire.

6. Accidental Release Measures

Personal precautions	Wear appropriate protective equipment and clothing during clean-up.
Environmental precautions	Do not flush into surface water or sanitary sewer system.
Methods for cleaning up	Vacuum or sweep up material and place in a disposal container.

7. Handling and Storage

Handling	Handle and open container with care. Avoid dust formation.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure Controls / Personal Protection

Engineering controls	Ensure adequate ventilation, especially in confined areas.
Personal protective equipment	
Eye / face protection	Wear dust goggles. Avoid contact with eyes.
Skin protection	Use of protective coveralls and long sleeves is recommended. Rubber or plastic boots.

Respiratory protection	In case of insufficient ventilation wear suitable respiratory equipment. No personal respiratory protective equipment normally required.
General hygeine considerations	Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Appearance / Color / Form	Crystalline. White. Solid.
Odor	None.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	5.4 - 8.6 (5% soln.)
Melting point	1422 °F (772.2 °C)
Freezing point	Not available
Boiling point	2572 °F (1411.1 °C)
Flash point	Not available
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	2.3827
Relative density	1.984 g/cm3
Solubility	Soluble
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available
Molecular weight	74.5500
Molecular formula	KCl

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.
Incompatible materials	This product may react with metals, halogens.
Hazardous decomposition products	Carbon dioxide, carbon monoxide, oxides of sulphur and nitrogen. Upon combustion, oxides of chlorine may be released.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Acute effects	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.
Local effects	Irritating to eyes, respiratory system and skin.
Chronic effects	Repeated or prolonged skin contact may cause skin irritation and/or dermatitis and sensitization of susceptible persons.

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life.

13. Disposal Considerations

Disposal instructions	Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations. Dispose in accordance with all applicable regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

05/24/2019

15. Regulatory Information

US federal regulations

This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
CERCLA/SARA Hazardous Substances - Not applicable.

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical	No

CERCLA (Superfund) reportable quantity	None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	No
Food and Drug Administration (FDA)	Total food additive GRAS food additive

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations	The product does not need to be labelled in accordance with EC directives or respective national laws.
State regulations	This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

HMIS ratings	Health: 1 Flammability: 0 Physical hazard: 0 Personal protection: C
NFPA ratings	Health: 0 Flammability: 0 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
EU preparer	Melanie Thatcher
US preparer	Cheryl Hood
Issue date	05-12-2005

Material Safety Data Sheet
Product 2077

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	Product 2077
Product use	Corrosion Inhibitor
Manufacturer	CorsiTech P.O. Box 27727 Houston, TX 77227-7727 USA
Telephone	1-800-477-5353 (CorsiTech)
In case of emergency	1-800-424-9300 (CHEMTREC) 1-703-527-3887 (CHEMTREC - International)

2. HAZARDS IDENTIFICATION

Physical state	liquid
Color	yellow.
Odor	pungent.
Emergency overview	Not considered to be flammable.

Potential health effects

Inhalation	Over-exposure by inhalation may cause respiratory irritation.
Ingestion	Ingestion may cause gastrointestinal irritation and diarrhea.
Skin	Prolonged or repeated contact with skin or mucous membrane may result in irritation symptoms, such as redness, blistering, dermatitis etc.
Eyes	Contact may cause eye irritation.
Chronic effects	No known significant effects or critical hazards.

See toxicological information (section 11)

3. COMPOSITION/INFORMATION ON INGREDIENTS

Name	CAS no.	Weight %
Ethylene Glycol	107-21-1	5 - 10

4. FIRST AID MEASURES

Eye contact	Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.
Skin contact	Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.
Inhalation	Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention if symptoms occur.
Ingestion	Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention if symptoms occur.

Protection of first-aiders	No action shall be taken involving any personal risk or without suitable training.
Notes to physician	No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5. FIRE-FIGHTING MEASURES

Flash point	> 200 °F (> 93.3 °C), Pensky-Martens. Closed cup
Flammability of the product	In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable	Use an extinguishing agent suitable for the surrounding fire.
Special exposure hazards	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
Hazardous combustion products	carbon dioxide, carbon monoxide
Special protective equipment for fire-fighters	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.
Special remarks on fire hazards	Not available.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment (see section 8).
Environmental precautions	Avoid contact of spilled material with soil and prevent runoff entering surface waterways. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods for cleaning up

Small spill	Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
Large spill	Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Note: see section 1 for emergency contact information and section 13 for waste disposal.

7. HANDLING AND STORAGE

Handling	Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking.
Storage	Store in accordance with local regulations. Keep container in a well-ventilated area. Store in the original container or an approved alternative made from a compatible material. Keep tightly closed when not in use. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Personal protection

Hands	Use chemical-resistant, impervious gloves.
Eyes	Safety eyewear should be used when there is a likelihood of exposure.
Body	Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory	If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Occupational exposure limits

Component	Source	Type	PPM	MG/M3	Notes
Ethylene Glycol					
	NIOSH REL				
	ACGIH TLV	CEIL		100 mg/m3	

Engineering measures	No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants. If this product contains ingredients with exposure limits, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure below any recommended or statutory limits.
Hygiene measures	Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Wash contaminated clothing before reusing. Emergency baths, showers, or other equipment appropriate for the potential level of exposure should be located close to the workstation location.
Environmental exposure controls	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	liquid
Color	yellow.
Odor	pungent.
Odor threshold	Not available.
Boiling/condensation point	Not available.
Pour point	0 °F (-17.8 °C)
Flash point	> 200 °F (> 93.3 °C), Pensky-Martens. Closed cup
Flammable limits	Lower: Not available. Upper: Not available.
Auto-ignition temperature	Not available.
pH	7.0 - 8.0, Method (neat)
Evaporation rate	Not available.
Solubility	Water
Vapor density	Not available.
Relative density	1.4011 - 1.4311 @ 60 °F (15.6 °C)

Vapor pressure	Not available.
Viscosity	Dynamic: 5 - 25 cPs @ 75 °F (23.9 °C)
Octanol/water partition coefficient (LogPow)	Not available.

Note: Typical values only - not to be interpreted as sales specifications

10. STABILITY AND REACTIVITY

Stability	The product is stable.
Hazardous polymerization	Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	No specific data.
Materials to avoid	No specific data.
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Substance	Test type	Species	Dose
Ethylene Glycol			
	LD50 Oral	Rat	4,700 mg/kg
	LD50 Oral	Mouse	5,500 mg/kg
	LD50 Oral	Guinea pig	6,610 mg/kg
	LC50 Inhalation	Rat	> 200 mg/l

Irritation/Corrosion

Not available.

Carcinogenicity

None of the components are listed.

12. ECOLOGICAL INFORMATION

Environmental effects	No known significant effects or critical hazards.
Other adverse effects	None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal	The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations. Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14. TRANSPORT INFORMATION

Refer to the bill of lading or container label for DOT or other transportation hazard classification. Additionally, be

aware that shipping descriptions may vary based on mode of transport, shipment volume or weight, container size or type, and/or origin and destination. Consult your company's Hazardous Materials / Dangerous Goods expert or your legal counsel for information specific to your situation.

15. REGULATORY INFORMATION

HCS Classification

Component	Classification
Ethylene Glycol	Harmful., Occupational exposure limits

U.S. Federal regulations

CERCLA: Hazardous substances - Reportable quantity:

Substance	Reportable quantity
Ethylene Glycol	5000 lbs

Product Reportable quantity	Substance
82,508 lb, 6,998 gal US	Ethylene Glycol

Product spills equal to or exceeding the threshold above trigger the reporting requirements under CERCLA for the listed hazardous substance. Report the spill or release to the National Response Center (NRC) at (800) 424-8802.

SARA Title III Section 302 Extremely hazardous substances (40 CFR Part 355):
None of the components are listed.

SARA 311/312 MSDS distribution - chemical inventory - hazard identification:
Not applicable.

SARA 313 - Supplier notification

Component	CAS no.	Weight %
Ethylene Glycol	107-21-1	5 - 10

Clean Water Act (CWA) 307:
None of the components are listed.

Clean Water Act (CWA) 311:
None of the components are listed.

Clean Air Act (CAA) 112 accidental release prevention:
None of the components are listed.

Clean Air Act (CAA) 112 regulated flammable substances:
None of the components are listed.

Clean Air Act (CAA) 112 regulated toxic substances:
None of the components are listed.

State regulations

Massachusetts Substances: The following components are listed: Ethylene Glycol.

New Jersey Hazardous Substances: The following components are listed: Ethylene Glycol.

Pennsylvania RTK Hazardous Substances: The following components are listed: Ethylene Glycol.

California Prop. 65

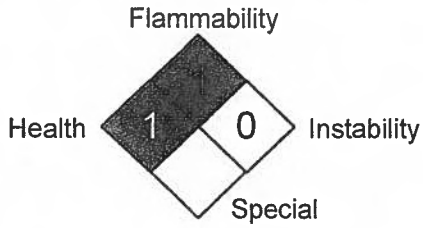
Not available.

International regulations

United States inventory (TSCA 8b):	All components are listed or exempted.
Canada inventory (DSL):	At least one component is not listed in DSL but all such components are listed in NDSL.

16. OTHER INFORMATION

National Fire Protection Association (U.S.A.):



Prepared by	Product Stewardship (1-281-431-2561)
Date of issue	07/09/2010
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Disclaimer

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

MATERIAL SAFETY DATA SHEET

05/24/2019

SODA ASH

Drilling Fluids

1. Product and Company Identification

Material name	**SODA ASH**
Chemical name	Sodium carbonate
Applications	Alkalinity Control Agent
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

3. Hazards Identification

Emergency overview	May cause severe irritation or burns to the eyes, skin, gastrointestinal tract, and respiratory system.
Potential health effects	
Eyes	Contact can cause moderate to severe irritation and possible injury to the eyes. Eye contact may result in corneal injury.
Skin	Contact causes severe skin irritation and possible burns.
Inhalation	Harmful if inhaled. Dusts of this product may cause irritation of the nose, throat, and respiratory tract. Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.
Ingestion	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.
Chronic effects	Prolonged or repeated inhalation may cause nosebleeds, nasal congestion, erosion of the teeth, perforation of the nasal septum, chest pain and bronchitis.

4. First Aid Measures

First aid procedures	
Eye contact	Rinse immediately with plenty of water, also under the eyelids. Get medical attention if irritation develops or persists.
Skin contact	Wash off immediately with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists. Remove and isolate contaminated clothing and shoes. Launder contaminated clothing before reuse.
Inhalation	Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Call a physician if symptoms develop or persist.
Ingestion	DO NOT INDUCE VOMITING. Give victim water or milk. Get medical attention immediately.
Notes to physician	Treat symptomatically.
General advice	If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Extinguishing media	
Suitable extinguishing media	Use extinguishing agent suitable for type of surrounding fire. Dry chemical, CO2, water spray or regular foam.
Protection of firefighters	
Protective equipment for firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Move containers from fire area if you can do it without risk. Cool containers with flooding quantities of water until well after fire is out.

6. Accidental Release Measures

Personal precautions	Wear appropriate protective equipment and clothing during clean-up. For recommended protective clothing and equipment, see section 8 "Exposure Controls and Personal Protection".

Evacuation procedures	Keep unnecessary personnel away.
Environmental precautions	Do not contaminate surface water. Prevent further leakage or spillage if safe to do so.
Methods for containment	Stop the flow of material, if this is without risk.
Methods for cleaning up	Sweep up or vacuum up spillage and collect in suitable container for disposal. Avoid the generation of dusts during clean-up. Ventilate the contaminated area.

7. Handling and Storage

Handling	Wash hands after handling and before eating. Do not get this material in your eyes, on your skin, or on your clothing. Remove and wash contaminated clothing before re-use. Do not ingest. Avoid dust formation.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure Controls / Personal Protection

Exposure guidelines	NUISANCE DUST: Exposure limit for respirable dust is 4 mg/m3 (8hr TWA) Exposure limit for inhalable dust is 10 mg/m3 (8hr TWA)
Engineering controls	Good general ventilation should be sufficient to control airborne levels.
Personal protective equipment	
Eye / face protection	Wear dust goggles.
Skin protection	Use of protective coveralls and long sleeves is recommended. Rubber or plastic boots.
Hand protection	Protective gloves.
Respiratory protection	In case of insufficient ventilation wear suitable respiratory equipment. Half mask with a particle filter P2 (EN 143).
General hygeine considerations	Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Appearance / Color / Form	Powder. White. Solid.
Odor	None.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	7 - 9 11.5 , conc:1% (aqueous solution)
Melting point	Not available
Freezing point	Not available
Boiling point	752 °F (400 °C)
Flash point	Not applicable
Evaporation rate	1
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	0 HPa at 20 °C
Vapor density	Not available
Specific gravity	2.8823
Relative density	2.4 g/cm3
Solubility	Soluble in water.
Octanol/H2O coeff	1.7
Auto-ignition temperature	Not available
Decomposition temperature	752 °F (400 °C)
Percent volatile	5 % in water
Molecular weight	105.99 g/mol
Molecular formula	Na2.CO3

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.

Incompatible materials	Ammonia + silver nitrate, 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, sulfuric acid, sodium sulfide + water, lithium, phosphorus pentoxide, fluorine, and hydrogen peroxide. Corrosive to steel.
Hazardous decomposition products	At thermal decomposition temperatures, carbon monoxide and carbon dioxide. Sodium oxides.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Carcinogenicity	Did not cause cancer in long-term animal studies.

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life.
Persistence / degradability	Expected to be slow, but will ultimately degrade in the aquatic environment.
Bioaccumulation / accumulation	Not expected to bioaccumulate.
Partition coefficient	1.7
Mobility in environmental media	This product will disperse readily in bodies of water or in wet soil.

13. Disposal Considerations

Disposal instructions	Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical	No
CERCLA (Superfund) reportable quantity	None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	No
Food and Drug Administration (FDA)	Total food additive GRAS food additive

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other Information

HMIS ratings
Health: 1
Flammability: 0
Physical hazard: 0
Personal protection: E

NFPA ratings
Health: 0
Flammability: 0
Instability: 0

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release

EU preparer
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Issue date
08-19-2005

MATERIAL SAFETY DATA SHEET

W.O.™ DEFOAM

Drilling Fluids

1. Product and Company Identification

Material name W.O.™ DEFOAM

Applications Alcohol-Based Defoamer

Supplier Baker Hughes Drilling Fluids
2001 Rankin Rd.
Houston, TX 77073
Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
2-ETHYL-3-PROPYLACROLEIN	645-62-5	< 5
POTASSIUM HYDROXIDE	1310-58-3	< 3
Non-hazardous and other components below reportable levels		> 90

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

3. Hazards Identification

Emergency overview Causes skin and eye burns. Irritating to respiratory system.

Potential health effects

Routes of exposure Inhalation. Skin contact. Eye contact.

Eyes High concentration of product vapors can cause severe irritation of eyes. Contact with liquid may produce severe eye irritation, causing severe conjunctiva irritation, corneal defects and possibly permanent loss of vision.

Skin This product may be severely irritating to the skin. Prolonged skin contact may defat the skin and produce dermatitis.

Inhalation Inhalation of vapors or mists of the product may be irritating to the respiratory system.

Ingestion Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Ingestion of this product may result in central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision.

Target organs Eyes. Respiratory system. Skin.

Chronic effects May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. Prolonged skin contact may defat the skin and produce dermatitis.

Signs and symptoms Irritating to eyes, respiratory system and skin. Shortness of breath. Conjunctivitis.

4. First Aid Measures

First aid procedures

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately.

Skin contact Remove and isolate contaminated clothing and shoes. Wash off with soap and plenty of water. Get medical attention.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.

Ingestion Immediately give plenty of water (if possible charcoal slurry). DO NOT INDUCE VOMITING. If material is ingested, immediately contact a physician or poison control center.

General advice Keep victim warm. In case of shortness of breath, give oxygen. In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media Carbon dioxide (CO2). Dry chemical powder. Alcohol foam.

Protection of firefighters

Specific hazards arising from the chemical	Fire may produce irritating, corrosive and/or toxic gases.
Protective equipment for firefighters	Move containers from fire area if you can do it without risk. Firefighters should wear full protective clothing including self contained breathing apparatus. Cool containers with flooding quantities of water until well after fire is out.

6. Accidental Release Measures

Personal precautions	Keep people away from and upwind of spill/leak. Remove all sources of ignition. Ventilate enclosed areas. Do not touch or walk through spilled material.
Environmental precautions	Prevent further leakage or spillage if safe to do so. Do not contaminate water.
Methods for containment	Stop the flow of material, if this is without risk. Prevent entry into waterways, sewers, basements or confined areas.
Methods for cleaning up	Large Spills: Dike far ahead of liquid spill for later disposal. Soak up with inert absorbent material and dispose of as hazardous waste. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly. Never return spills in original containers for re-use.

7. Handling and Storage

Handling	Do not get this material in your eyes, on your skin, or on your clothing. Do not breathe gas/fumes/vapor/spray. Wash hands after handling and before eating.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Do not handle or store near an open flame, heat or other sources of ignition. Store away from strong oxidizers. Keep this material away from food, drink and animal feed.

8. Exposure Controls / Personal Protection

Exposure guidelines

ACGIH - Threshold Limits Values - Ceilings (TLV-C)

POTASSIUM HYDROXIDE	1310-58-3	2 Mg/m3 Ceiling

ACGIH - Threshold Limits Values - TLV Basis - Critical Effects

POTASSIUM HYDROXIDE	1310-58-3	irritation; corrosion

Engineering controls	Provide local and general exhaust ventilation to effectively remove and prevent buildup of any vapors or mists generated from the handling of this product.

Personal protective equipment

Eye / face protection	Wear chemical goggles.
Skin protection	Use of protective coveralls and long sleeves is recommended. Wear appropriate chemical resistant gloves. Use of an impervious apron is recommended.
Hand protection	Impervious butyl rubber gloves.
Respiratory protection	If ventilation is not sufficient to effectively prevent buildup of aerosols or vapors, appropriate NIOSH/MSHA respiratory protection must be provided.
General hygeine considerations	Handle in accordance with good industrial hygiene and safety practice. Keep away from food and drink. Avoid contact with the skin and the eyes. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Clear. Amber. Liquid.
Odor	Pungent.
Clarity	Not available
Odor threshold	Not available
Physical state	Liquid
pH	Not available
Melting point	Not available
Freezing point	Not available
Boiling point	> 214 °F (> 101.1 °C)
Flash point	> 214 °F (> 101.1 °C) Pensky-Martens Closed Cup
Evaporation rate	Not available

Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	0.911
Relative density	17.069 estimated
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available
VOC (Weight %)	0.97 % estimated

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Heat, flames and sparks.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	At thermal decomposition temperatures, carbon monoxide and carbon dioxide.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

2-ETHYL-3-PROPYLACROLEIN	645-62-5	Oral LD50 Rat: 3 g/kg
POTASSIUM HYDROXIDE	1310-58-3	Oral LD50 Rat: 214 mg/kg

Local effects Irritating to eyes, respiratory system and skin.

12. Ecological Information

Ecotoxicity Not available.

Environmental effects Harmful to aquatic life.

Ecotoxicity - Freshwater Fish Species Data

POTASSIUM HYDROXIDE	1310-58-3	24 Hr LC50 mosquito fish: 80.0 mg/L

13. Disposal Considerations

Disposal instructions Dispose in accordance with all applicable regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

FDA - Food Additives Generally Recognized as Safe (GRAS)

POTASSIUM HYDROXIDE	1310-58-3	21 CFR 184.1631

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical	Yes
CERCLA (Superfund) reportable quantity	POTASSIUM HYDROXIDE: 1000

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations The product is classified and labelled in accordance with EC directives or respective national laws.

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

Massachusetts - Right To Know List

2-ETHYL-3-PROPYLACROLEIN	645-62-5	Present
POTASSIUM HYDROXIDE	1310-58-3	Present

New Jersey - Right to Know Hazardous Substance List

POTASSIUM HYDROXIDE	1310-58-3	sn 1571

Pennsylvania - RTK (Right to Know) List

2-ETHYL-3-PROPYLACROLEIN	645-62-5	Present
POTASSIUM HYDROXIDE	1310-58-3	Environmental hazard

16. Other Information

HMIS ratings	Health: 3* Flammability: 1 Physical hazard: 0 Personal protection: H
NFPA ratings	Health: 2 Flammability: 1 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
US preparer	Cheryl Hood - (713)625-4888
Issue date	01-10-2006

MATERIAL SAFETY DATA SHEET

XAN-PLEX D

Drilling Fluids

1. Product and Company Identification

Material name	**XAN-PLEX D**
Chemical name	Polysaccharide Polymer
Chemical description	Drilling Fluid Viscosifier
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

3. Hazards Identification

Emergency overview	Health injuries are not known or expected under normal use.
OSHA regulatory status	This product is considered not hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Eyes	This product may cause slight irritation to the eyes.
Skin	Substance may cause slight skin irritation. Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis (rash).
Inhalation	Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.
Ingestion	Health injuries are not known or expected under normal use.

4. First Aid Measures

First aid procedures	
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.
Skin contact	Remove contaminated clothing. Wash off with soap and water. Wash clothing separately before reuse. Get medical attention if irritation develops or persists.
Inhalation	If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.
Ingestion	Have victim rinse mouth thoroughly with water. If ingestion of a large amount does occur, seek medical attention.
General advice	If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties	Dusts at sufficient concentrations can form explosive mixtures with air. Water may create slip hazard with product.
Hazardous combustion products	Carbon monoxide and carbon dioxide.
Extinguishing media	
Suitable extinguishing media	Dry chemical, CO2, water spray or alcohol resistant foam.
Protection of firefighters	
Protective equipment for firefighters	Firefighters should wear full protective clothing including self contained breathing apparatus.

6. Accidental Release Measures

Personal precautions	Do not touch or walk through spilled material. Surfaces may become slippery after spillage. Keep people away from and upwind of spill/leak.
Evacuation procedures	Stay upwind. Keep out of low areas.
Environmental precautions	Prevent further leakage or spillage if safe to do so.

Methods for containment	Prevent entry into waterways, sewers, basements or confined areas. Stop the flow of material, if this is without risk.
Methods for cleaning up	Sweep up or gather material and place in appropriate container for disposal. Avoid dust formation.

7. Handling and Storage

Handling	Avoid contact with skin and eyes. Handle and open container with care.
Storage	Keep tightly closed in a dry, cool and well-ventilated place. Keep away from heat, sparks, and flame.

8. Exposure Controls / Personal Protection

Exposure guidelines	Nuisance Particulates: OSHA PEL 15 mg/m3 (total dust) - 8-hr. TWA 5 mg/m3 (respirable dust) - 8-hr. TWA
Engineering controls	Provide adequate local exhaust ventilation to maintain worker exposure below exposure limits.
Personal protective equipment	
Eye / face protection	Safety glasses with side-shields.
Skin protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Hand protection	Protective gloves.
Respiratory protection	If airborne concentrations are above the applicable exposure limits, use NIOSH approved respiratory protection.
General hygeine considerations	Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Powder. White to tan. Solid.
Odor	Slight.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	Not available
Melting point	Not available
Freezing point	Not available
Boiling point	Not available
Flash point	Not available
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	Not available
Relative density	0.8 - 1 g/cc
Solubility	Soluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available
Bulk density	800 kg/m3

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Heat. Exposure to moisture.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	At thermal decomposition temperatures, carbon monoxide and carbon dioxide.

Possibility of hazardous reactions Will not occur.

11. Toxicological Information

Acute effects LD50/oral/rat =>5000 mg/kg

Chronic effects Repeated or prolonged skin contact may cause skin irritation and/or dermatitis and sensitization of susceptible persons.

12. Ecological Information

Ecotoxicity This material is not expected to be harmful to aquatic life.

Aquatic toxicity Oncorhynchus mykiss (rainbow trout) 96 hr LC50 = 490 mg/l
Daphnia magna 48 hr LC50 = 980 mg/l
Mysidopsis bahia 96 hr LC50 = >500000 Ppm SPP

13. Disposal Considerations

Disposal instructions Dispose in accordance with all applicable regulations. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations The product does not need to be labelled in accordance with EC directives or respective national laws.

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

HMIS ratings
Health: 1
Flammability: 0
Physical hazard: 0
Personal protection: C

NFPA ratings
Health: 0
Flammability: 0
Instability: 0

Disclaimer The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

US preparer Cheryl Hood - (713)625-4888

Issue date 09-01-2005

MATERIAL SAFETY DATA SHEET

05/24/2019

BAKER HUGHES
Drilling Fluids

XANVIS

1. Product and Company Identification

Material name	**XANVIS**
Applications	VISCOSIFIER FOR WATER-BASED MUDS
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

Composition comments	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

3. Hazards Identification

Emergency overview	Product dust may be irritating to eyes, skin and respiratory system. Prolonged or repeated skin contact may cause skin irritation or allergic skin sensitization reaction. Product may form explosive dust/air mixtures if high concentration of product dust is suspended in air. Static charges created by dust generation in or near flammable vapors may cause flash fire. Surfaces subject to spills may become slippery.
OSHA regulatory status	This product is considered not hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Eyes	Dust or powder may irritate eye tissue.
Skin	Prolonged or excessive skin contact with this product may cause mild skin irritation. May aggravate existing allergic and hypersensitive skin conditions.
Inhalation	Dusts of this product may cause irritation of the nose, throat, and respiratory tract.
Ingestion	Ingestion of large amounts may produce gastrointestinal disturbances including irritation, nausea, and diarrhea.

4. First Aid Measures

First aid procedures	
Eye contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention if irritation develops or persists.
Skin contact	Remove contaminated clothing. Wash off skin with soap and water. Get medical attention if irritation develops or persists. Launder contaminated clothing before reuse.
Inhalation	Remove to fresh air. Call a physician if symptoms develop or persist.
Ingestion	Drink 1 or 2 glasses of water. Do not induce vomiting. If ingestion of a large amount does occur, seek medical attention.
General advice	If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties	Dusts at sufficient concentrations can form explosive mixtures with air.
Hazardous combustion products	Carbon monoxide, carbon dioxide, various hydrocarbon fragments as well as thick smoke.
Extinguishing media	
Suitable extinguishing media	Dry chemical, CO2, water spray or regular foam. Do not use water jet.
Protection of firefighters	
Protective equipment for firefighters	Firefighters should wear full protective clothing including self contained breathing apparatus.

6. Accidental Release Measures

Personal precautions	Surfaces may become slippery after spillage. Wear appropriate protective equipment and clothing during clean-up. For recommended protective clothing and equipment, see section 8 "Exposure Controls and Personal Protection".
Evacuation procedures	Keep unnecessary personnel away.

Environmental precautions	Do not contaminate surface water. Prevent further leakage or spillage if safe to do so.
Methods for cleaning up	Sweep up or vacuum up spillage and collect in suitable container for disposal. Avoid the generation of dusts during clean-up.

7. Handling and Storage

Handling	Do not handle or store near an open flame, heat or other sources of ignition. Handle and open container with care. Avoid dust formation. Dust can form an explosive mixture in air.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat, sparks, and flame.

8. Exposure Controls / Personal Protection

Exposure guidelines	ACGIH TLV 10 mg/m3 (inhalable) 8-hr TWA 3 mg/m3 (respirable 8-hr TWA
Engineering controls	Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.
Personal protective equipment	
Eye / face protection	Wear dust goggles.
Skin protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Hand protection	Neoprene gloves.
Respiratory protection	Use the indicated respiratory protection if the occupational exposure limit is exceeded and/or in case of product release (dust) . Wear respirator with dust filter.
General hygeine considerations	Wash hands before breaks and immediately after handling the product. When using do not smoke.

9. Physical and Chemical Properties

Appearance / Color / Form	White. Solid. Powder.
Odor	Slight.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	Not available
Melting point	Not available
Freezing point	Not available
Boiling point	Not available
Flash point	Not applicable
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	Not available
Relative density	Not available
Solubility	Soluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Exposure to moisture.
Incompatible materials	None known.
Hazardous decomposition products	None known.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Carcinogenicity Not listed by ACGIH, IARC, NIOSH, NTP OR OSHA.

12. Ecological Information

Ecotoxicity This material is not expected to be harmful to aquatic life.

Persistence / degradability Expected to be slow, but will ultimately degrade in the aquatic environment.

Bioaccumulation / accumulation Not expected to bioaccumulate.

Mobility in environmental media This product will disperse readily in bodies of water or in wet soil.

13. Disposal Considerations

Disposal instructions Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
CERCLA/SARA Hazardous Substances - Not applicable.

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Food and Drug Administration (FDA)
Total food additive
Direct food additive

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations	The product does not need to be labelled in accordance with EC directives or respective national laws.
State regulations	This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

16. Other Information

HMIS ratings	Health: 0 Flammability: 0 Physical hazard: 0 Personal protection: E
NFPA ratings	Health: 0 Flammability: 0 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
EU preparer	Melanie Thatcher - Tel +44 (0)1224 721597
US preparer	Cheryl Hood - (713)625-4888
Issue date	01-21-2006

MATERIAL SAFETY DATA SHEET

05/24/2019

BAKER HUGHES
Drilling Fluids

X-CIDE® 102

1. Product and Company Identification

Material name **X-CIDE® 102**

Applications Biocide

Supplier Baker Hughes Drilling Fluids
2001 Rankin Rd.
Houston, TX 77073
Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
GLUTARALDEHYDE	111-30-8	10 - 30
Non-hazardous and other components below reportable levels		60 - 80

3. Hazards Identification

Emergency overview CORROSIVE
Irritating to eyes, respiratory system and skin. May cause sensitization by inhalation and skin contact.

Potential health effects

Routes of exposure Inhalation. Skin contact. Eye contact.

Eyes Corrosive to the eyes and may cause severe damage including blindness.

Skin May cause burns. May cause sensitization by skin contact. Corrosive after repeated contact with skin and mucous membranes.

Inhalation Can cause severe respiratory irritation. Inhaled corrosive substances can lead to a toxic edema of the lungs.

Ingestion Do not ingest. Ingestion may produce burns to the lips, oral cavity, upper airway, esophagus and possibly the digestive tract.

Target organs Eyes. Respiratory system. Skin.

Chronic effects May cause delayed lung damage. Repeated exposure may lead to respiratory sensitization reactions, producing an asthma-like condition.

4. First Aid Measures

First aid procedures

Eye contact Immediately flush eyes with plenty of water for at least 20 minutes. Get medical attention immediately.

Skin contact Remove and isolate contaminated clothing and shoes. Wash off with soap and plenty of water. Immediately flush skin with running water for at least 20 minutes. Get medical attention if irritation develops or persists.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.

Ingestion Have victim rinse mouth thoroughly with water. Do not induce vomiting without medical advice. If material is ingested, immediately contact a physician or poison control center.

General advice Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire Fighting Measures

Hazardous combustion products Carbon monoxide and carbon dioxide.

Extinguishing media

Suitable extinguishing media Dry chemical, foam, carbon dioxide.

Protection of firefighters

Protective equipment for firefighters Move containers from fire area if you can do it without risk. Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask. Cool containers with flooding quantities of water until well after fire is out. Water runoff can cause environmental damage.

6. Accidental Release Measures

Personal precautions
Ensure adequate ventilation. Do not touch or walk through spilled material. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Keep people away from and upwind of spill/leak.

Methods for containment
Prevent entry into waterways, sewers, basements or confined areas. Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.

Methods for cleaning up
Large Spills: Dike far ahead of liquid spill for later disposal. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly.

Never return spills in original containers for re-use.

7. Handling and Storage

Handling
Do not breathe gas/fumes/vapor/spray. Do not get this material in your eyes, on your skin, or on your clothing. Do not handle or store near an open flame, heat or other sources of ignition. Do not empty into drains.

Storage
Use care in handling/storage. Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat, sparks, and flame. Keep this material away from food, drink and animal feed.

8. Exposure Controls / Personal Protection

Exposure guidelines

ACGIH - Threshold Limits Values - Ceilings (TLV-C)

GLUTARALDEHYDE	111-30-8	0.05 Ppm Ceiling (activated and inactivated)

ACGIH - Threshold Limits Values - TLV Basis - Critical Effects

GLUTARALDEHYDE	111-30-8	irritation; sensitization (activated and inactivated)

Engineering controls
Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Personal protective equipment

Eye / face protection
Wear chemical goggles and face shield.

Skin protection
Use of protective coveralls and long sleeves is recommended. Use of an impervious apron is recommended. Use of impervious boots is recommended.

Hand protection
Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374.

Respiratory protection
When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

General hygeine considerations
Keep away from food and drink. When using do not smoke. Avoid contact with the skin and the eyes. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Clear. Colorless. Liquid.
Odor	Fruity.
Clarity	Not available
Odor threshold	Not available
Physical state	Liquid
pH	3.1 - 4.5 Neat - without dilution
Melting point	Not available
Freezing point	Not available
Boiling point	Not available
Flash point	> 212 °F (> 100 °C) Closed Cup
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	27.9 - 34.1 Mm Hg @38°C
Vapor density	> 1
Specific gravity	1.05 - 1.062 @ 16°C

Relative density	8.75 - 8.85 lbs/gal @ 16°C
Solubility	Soluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	437 °F (225 °C) estimated
Decomposition temperature	Not available
Pour point	19.4 °F (-6.7 °C)

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Direct sources of heat.
Incompatible materials	Strong acids, alkalies and oxidizing agents.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Acute effects

Acute LD50: 330 mg/kg, Rat, Oral
Acute LC50: 4267 mg/l/4h, Rat, Inhalation

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

GLUTARALDEHYDE	111-30-8	Inhalation LC50 Rat: 0.1 mg/L/4H; Oral LD50 Rat: 66 mg/kg; Dermal LD50 Rat: >2000 mg/kg; Dermal LD50 Rabbit: 560 µL/kg

Sensitization

ACGIH - Threshold Limits Values - Sensitization (SEN) Notations

GLUTARALDEHYDE	111-30-8	Sensitizer

Local effects

Risk of serious damage to eyes. Inhaled corrosive substances can lead to a toxic oedema of the lungs. May cause sensitization by skin contact.

Chronic effects

Prolonged exposure may cause chronic effects.

Carcinogenicity

ACGIH - Threshold Limits Values - Carcinogens

GLUTARALDEHYDE	111-30-8	A4 - Not Classifiable as a Human Carcinogen (activated and inactivated)

12. Ecological Information

Ecotoxicity

Components of this product have been identified as having potential environmental concerns.

Environmental effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Ecotoxicity - Microtox Data

GLUTARALDEHYDE	111-30-8	5 Min EC50 Photobacterium phosphoreum: 76.0 mg/L

13. Disposal Considerations

Disposal instructions

Do not allow this material to drain into sewers/water supplies. Dispose in accordance with all applicable regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

FDA - Direct Food Additives

GLUTARALDEHYDE	111-30-8	21 CFR 172.230, 21 CFR 173.320, 21 CFR 173.357

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical	Yes
CERCLA (Superfund) reportable quantity	None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations The product is classified and labelled in accordance with EC directives or respective national laws.

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

Massachusetts - Right To Know List

GLUTARALDEHYDE	111-30-8	Present

New Jersey - Right to Know Hazardous Substance List

GLUTARALDEHYDE	111-30-8	sn 0960

Pennsylvania - RTK (Right to Know) List

GLUTARALDEHYDE	111-30-8	Present

16. Other Information

HMIS ratings	Health: 3* Flammability: 1 Physical hazard: 0 Personal protection: H
NFPA ratings	Health: 3 Flammability: 1 Instability: 0
US preparer	Cheryl Hood - (713)625-4888
Issue date	04-21-2006

05/24/2019

SAFETY DATA SHEET
CALCIUM CHLORIDE (ALL GRADES)

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

PRODUCT NAME: CALCIUM CHLORIDE (ALL GRADES)

APPLICATIONS: Oil well completion fluid additive.

SUPPLIER:
M-I Drilling Fluids UK Ltd,
Pocra Quay,
Footdee,
Aberdeen. AB11 5DQ
Tel: 44 (0)1224 - 584336
Fax: 44 (0)1224 - 576119

EMERGENCY TELEPHONES: 001 281 561 1600 (USA)

2. COMPOSITION/INFORMATION ON INGREDIENTS

NAME	CAS No.:	EINECS Nr.:	CLASSIFICATION	CONTENT
CALCIUM CHLORIDE	10043-52-4		Xi R-36/38	

The Full Text for all R-Phrases are Displayed in Section 16

COMPOSITION COMMENTS: This product is classified as an irritant according to the EU Directives.

3. HAZARDS IDENTIFICATION

Irritating to eyes and skin.

4. FIRST AID MEASURES

INHALATION: General first aid, rest, warmth and fresh air. Get medical attention if any discomfort continues.

INGESTION: Rinse mouth thoroughly with water. Victims who are not unconscious should drink large quantities of milk or water, or self induce vomiting (e.g. by sticking own finger into the throat). Get medical attention if any discomfort continues.

SKIN: Promptly wash contaminated skin with soap or mild detergent and water. Promptly remove clothing if soaked through and wash as above. Get medical attention if irritation persists after washing.

EYES: Promptly wash eyes with plenty of water while lifting the eye lids. Continue to rinse for at least 15 minutes and get medical attention.

05/24/2019

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use extinguishing media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES: NOTE! Use air-supplied respirators to protect against gases\fumes.

HAZARDOUS COMBUSTION PRODUCTS: Fire or high temperatures create: Toxic gases/vapors/fumes of: Chlorine.

6. ACCIDENTAL RELEASE MEASURES

SPILL CLEANUP METHODS: Avoid generation and spreading of dust. Collect and reclaim or dispose in sealed containers in licensed waste. Flush with plenty of water to clean spillage area.

7. HANDLING AND STORAGE

USAGE PRECAUTIONS: Avoid spilling, skin and eye contact. Avoid handling which leads to dust formation.

STORAGE PRECAUTIONS: Keep in cool, dry, ventilated storage and closed containers. Keep in original container.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

INGREDIENT NAME:	CAS No.:	STD	LT EXP 8 Hrs	ST EXP 15 Min
CALCIUM CHLORIDE	10043-52-4		No std.	No std.

INGREDIENT COMMENTS: NUI = Nuisance Dust. OES TWA 4mg/m3 respirable dust, 10mg/m3 total dust.

PROTECTIVE EQUIPMENT:

VENTILATION: Provide sufficient ventilation for operations causing dust formation.

RESPIRATORS: D, Dust mask/respirator. Dust filter P2 (for fine dust).

PROTECTIVE GLOVES: Use suitable protective gloves if risk of skin contact. Use protective gloves made of: Impermeable material. Rubber, neoprene or PVC.

EYE PROTECTION: Wear dust resistant safety goggles where there is danger of eye contact.

OTHER PROTECTION: Wear appropriate clothing to prevent repeated or prolonged skin contact. Provide eyewash station.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Granular. Crystals. Pellets. Flakes. Powder, dust.

COLOUR: White. to Grey.

05/24/2019

ODOUR/TASTE:	Odourless or no characteristic odour.		
MOL. WEIGHT:	111		
BOILING POINT (°C, interval):	> 1600	**Pressure:**	
MELT./FREEZ. POINT (°C, interval):	772		
DENSITY/SPECIFIC GRAVITY (g/ml):	2.1 - 2.5	**Temperature (°C):**	20
BULK DENSITY:	800 kg/m3		
pH-VALUE, DILUTED SOLUTION:	9 - 10.5	**Concentration %M:**	100 g/l
SOLUBILITY DESCRIPTION:	Very soluble in water.		
SOLUBILITY VALUE (g/100g H2O 20°C):	75		

10. STABILITY AND REACTIVITY

STABILITY:	Normally stable.
CONDITIONS TO AVOID:	Avoid contact with water. Hygroscopic.
MATERIALS TO AVOID:	Bases,alkalies (inorganic).

11. TOXICOLOGICAL INFORMATION

TOXIC DOSE - LD 50:	1000 mg/kg (oral-rbt)
INHALATION:	May cause irritation to the respiratory system.
INGESTION:	May cause discomfort if swallowed. May cause stomach pain or vomiting.
SKIN:	Powder may irritate skin. Prolonged or repeated exposure may cause severe irritation.
EYES:	Irritation of eyes and mucous membranes. Particles in the eyes may cause irritation and smarting.

12. ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION:	Little danger to the environment. This material is a naturally occurring mineral. OSPAR have defined this chemical as PLONOR. Contact M-I's Environmental Affairs Department for ecological information.

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHODS:	Recover and reclaim or recycle, if practical. Dispose of in accordance with Local Authority requirements.

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14. TRANSPORT INFORMATION

ROAD TRANSPORT NOTES: Not Classified

RAIL TRANSPORT NOTES: Not Classified.

SEA TRANSPORT NOTES: Not Classified.

AIR TRANSPORT NOTES: Not Classified.

15. REGULATORY INFORMATION

LABEL FOR SUPPLY:

RISK PHRASES: R-36/38 Irritating to eyes and skin.

SAFETY PHRASES: S-22 Do not breathe dust.
S-24/25 Avoid contact with skin and eyes.
S-36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

16. OTHER INFORMATION

USER NOTES: HMIS Health - 1 HMIS Flammability - 0 HMIS Physical Hazard - 1

INFORMATION SOURCES: Sax's Dangerous Properties of Industrial Materials, 9th ed., Lewis, R.J. Sr., (ed.), VNR, New York, New York, (1997). Material Safety Data Sheet, Misc. manufacturers.

ISSUED BY: Sarah Glover

PRINTING DATE: 2003-01-17

R-PHRASES (Full Text): R-36/38 Irritating to eyes and skin.

DISCLAIMER: MSDS furnished independent of product sale. While every effort has been made to accurately describe this product, some of the data are obtained from sources beyond our direct supervision. We cannot make any assertions as to its reliability or completeness; therefore, user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Additional information will be furnished upon request to assist the user; however, no warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

MATERIAL SAFETY DATA SHEET

05/24/2019

CARBO-GEL® II

Drilling Fluids

1. Product and Company Identification

Material name	**CARBO-GEL® II**
Chemical description	Organophilic Clay
Applications	Viscosifier
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
CRYSTALLINE SILICA, QUARTZ	14808-60-7	< 5
Non-hazardous and other components below reportable levels		> 90

3. Hazards Identification

Emergency overview Product dust may be irritating to eyes, skin and respiratory system. Prolonged exposure may cause chronic effects.

Potential health effects

- **Eyes** Contact with eyes may cause irritation.
- **Skin** May cause skin irritation and/or dermatitis.
- **Inhalation** Inhalation of dusts may cause respiratory irritation. Prolonged inhalation may be harmful.
- **Ingestion** Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Target organs Eyes. Lungs. Respiratory system.

Chronic effects Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material. Prolonged skin contact may defat the skin and produce dermatitis.

4. First Aid Measures

First aid procedures

- **Eye contact** Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention if irritation develops or persists.
- **Skin contact** Remove and isolate contaminated clothing and shoes. Wash off skin with soap and water. Get medical attention if irritation develops or persists.
- **Inhalation** Move to fresh air. Oxygen or artificial respiration if needed. Get medical attention immediately.
- **Ingestion** Have victim rinse mouth thoroughly with water. If ingestion of a large amount does occur, seek medical attention.

General advice Keep victim warm. Keep victim under observation. In case of shortness of breath, give oxygen. If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Hazardous combustion products Non-combustible, substance itself does not burn.

Extinguishing media

- **Suitable extinguishing media** Use any media suitable for the surrounding fires.

Protection of firefighters

- **Protective equipment for firefighters** Firefighters should wear full protective clothing including self contained breathing apparatus.

6. Accidental Release Measures

Evacuation procedures Stay upwind. Keep out of low areas. Keep unnecessary personnel away. Ventilate closed spaces before entering.

Methods for containment	Stop the flow of material, if this is without risk. Prevent entry into waterways, sewers, basements or confined areas.
Methods for cleaning up	Sweep up or gather material and place in appropriate container for disposal. Avoid dust formation. After removal flush contaminated area thoroughly with water. Do not flush to sewer.

7. Handling and Storage

Handling	Do not breathe dust from this material. Minimize dust generation and accumulation. Do not get this material in your eyes, on your skin, or on your clothing. Handle and open container with care.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Keep this material away from food, drink and animal feed. Use care in handling/storage.

8. Exposure Controls / Personal Protection

Exposure guidelines

ACGIH - Threshold Limits Values - Time Weighted Averages (TLV-TWA)

CRYSTALLINE SILICA, QUARTZ	14808-60-7	0.05 Mg/m3 TWA (respirable fraction)

ACGIH - Threshold Limits Values - TLV Basis - Critical Effects

CRYSTALLINE SILICA, QUARTZ	14808-60-7	silicosis; lung function; lung fibrosis; cancer

Engineering controls	Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Personal protective equipment

Eye / face protection	Wear dust goggles.
Skin protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Hand protection	Protective gloves.
Respiratory protection	If airborne concentrations are above the applicable exposure limits, use NIOSH approved respiratory protection.
General hygeine considerations	Keep away from food and drink. Avoid contact with the skin and the eyes. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Appearance / Color / Form	Powder. Off-white. Solid.
Odor	Odourless.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	Not available
Melting point	2930 °F (1610 °C) estimated
Freezing point	Not available
Boiling point	Not available
Flash point	Not Applicable
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	1.7
Relative density	Not available
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.

Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	None known.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Oral LD50 Rat: 500 mg/kg

Chronic effects Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material.

Carcinogenicity Contains material which may cause cancer. Risk of cancer depends on duration and level of exposure.

ACGIH - Threshold Limits Values - Carcinogens

CRYSTALLINE SILICA, QUARTZ	14808-60-7	A2 - Suspected Human Carcinogen

NTP (National Toxicology Program) - Report on Carcinogens - Known Carcinogens

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Known Carcinogen

12. Ecological Information

Ecotoxicity This material is not expected to be harmful to aquatic life.

Environmental effects Ecological injuries are not known or expected under normal use.

13. Disposal Considerations

Disposal instructions Dispose in accordance with all applicable regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations

NTP (National Toxicology Program) - Report on Carcinogens - Known Carcinogens

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Known Carcinogen

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical	No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations

IARC - Group 1 (Carcinogenic to Humans)

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Monograph 68, 1997 (Listed under Crystalline silica, inhaled in the form of quartz or cristobalite from occupational sources)

State regulations

California - Proposition 65 - Carcinogens List

CRYSTALLINE SILICA, QUARTZ	14808-60-7	carcinogen, initial date 10/1/88 (airborne particles of respirable size)

Massachusetts - Right To Know List

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Carcinogen; Extraordinarily hazardous

New Jersey - Right to Know Hazardous Substance List

CRYSTALLINE SILICA, QUARTZ	14808-60-7	sn 1660

Pennsylvania - RTK (Right to Know) List

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Present (includes dust)

16. Other Information

HMIS ratings
Health: 1*
Flammability: 0
Physical hazard: 0
Personal protection: E

NFPA ratings
Health: 1
Flammability: 0
Instability: 0

US preparer
Cheryl Hood - (713)625-4888

Issue date
08-07-2006

MATERIAL SAFETY DATA SHEET

CARBO-TEC®

Drilling Fluids

1. Product and Company Identification

Material name CARBO-TEC®

Applications High Temperature Emulsifier for Oil-Base Muds

Supplier Baker Hughes Drilling Fluids
2001 Rankin Rd.
Houston, TX 77073
Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
DISTILLATES (PETROLEUM), STRAIGHT-RUN MIDDLE	64741-44-2	20
Non-hazardous and other components below reportable levels		> 60

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

3. Hazards Identification

Potential health effects

Eyes Contact with eyes may cause irritation.

Skin This product may cause irritation to the skin.

Inhalation Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting.

Ingestion May cause dizziness, incoordination, headache, nausea, and vomiting.

4. First Aid Measures

First aid procedures

Eye contact Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Wash off skin with soap and water. Remove and isolate contaminated clothing and shoes. Wash clothing separately before reuse. Get medical attention if irritation develops or persists.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.

Ingestion Have victim rinse mouth thoroughly with water. Get medical attention immediately.

General advice If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Hazardous combustion products Fire may produce irritating, corrosive and/or toxic gases.

Extinguishing media

Suitable extinguishing media Dry chemical, foam, carbon dioxide. Do not use a solid water stream as it may scatter and spread fire.

Protection of firefighters

Protective equipment for firefighters Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask. Move containers from fire area if you can do it without risk.

6. Accidental Release Measures

Personal precautions Keep people away from and upwind of spill/leak. Ventilate closed spaces before entering. Do not touch or walk through spilled material.

Methods for containment Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Stop the flow of material, if this is without risk. Prevent entry into waterways, sewers, basements or confined areas.

Methods for cleaning up	Large Spills: Dike far ahead of liquid spill for later disposal. Soak up with inert absorbent material and dispose of as hazardous waste. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly.

7. Handling and Storage

Handling	Do not handle or store near an open flame, heat or other sources of ignition. Handle and open container with care. Do not breathe gas/fumes/vapor/spray. Do not get this material in your eyes, on your skin, or on your clothing. Wash hands after handling and before eating.
Storage	Keep away from heat, sparks, and flame. Keep containers tightly closed in a dry, cool and well-ventilated place. Use care in handling/storage.

8. Exposure Controls / Personal Protection

Engineering controls	Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.
Personal protective equipment	
Eye / face protection	Wear chemical goggles. Face-shield.
Skin protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Hand protection	Rubber gloves. or Neoprene gloves.
Respiratory protection	No personal respiratory protective equipment normally required.
General hygeine considerations	When using do not smoke. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Viscous. Dark brown. Liquid.
Odor	Petroleum.
Clarity	Not available
Odor threshold	Not available
Physical state	Liquid
pH	Not available
Melting point	Not available
Freezing point	Not available
Boiling point	399.2 °F (204.4 °C) estimated
Flash point	275 °F (135 °C) estimated
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	0.8 HPa estimated
Vapor density	Not available
Specific gravity	0.96
Relative density	4.225 estimated
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Direct sources of heat.
Incompatible materials	This product may react with strong alkalies. Strong oxidizing agents.
Hazardous decomposition products	Upon decomposition this product emits acrid dense smoke with carbon dioxide, carbon monoxide, water and other products of combustion.

11. Toxicological Information

05/24/2019

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

DISTILLATES (PETROLEUM), STRAIGHT-RUN MIDDLE	64741-44-2	Inhalation LC50 Rat: 1.72 mg/L/4H; Oral LD50 Rat: 5000 mg/kg; Dermal LD50 Rabbit: >2000 mg/kg

Local effects Irritating to eyes, respiratory system and skin.

Chronic effects Repeated or prolonged skin contact may cause skin irritation and/or dermatitis and sensitization of susceptible persons.

12. Ecological Information

Persistence / degradability According to the results of tests of biodegradability this product is considered as being readily biodegradable.

13. Disposal Considerations

Disposal instructions Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations. Do not dispose of waste into sewer.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations	The product is classified and labelled in accordance with EC directives or respective national laws.
State regulations	This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

New Jersey - Right to Know Hazardous Substance List

DISTILLATES (PETROLEUM), STRAIGHT-RUN MIDDLE	64741-44-2	sn 2452

16. Other Information

HMIS ratings	Health: 0 Flammability: 1 Physical hazard: 0 Personal protection: D
NFPA ratings	Health: 0 Flammability: 1 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
US preparer	Cheryl Hood - (713)625-4888
Issue date	05-11-2006

MATERIAL SAFETY DATA SHEET

05/24/2019

CARBO-TEC® S

Drilling Fluids

1. Product and Company Identification

Material name	**CARBO-TEC® S**
Chemical description	Unsaturated Polymerized Fatty Acid
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

3. Hazards Identification

Emergency overview	Health injuries are not known or expected under normal use.
Potential health effects	
Eyes	This product may cause slight irritation to the eyes.
Skin	Substance may cause slight skin irritation.
Inhalation	Health injuries are not known or expected under normal use.
Ingestion	Not a likely route of entry.

4. First Aid Measures

First aid procedures	
Eye contact	Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.
Skin contact	Remove and isolate contaminated clothing and shoes. Wash off skin with soap and water. Wash clothing separately before reuse. Get medical attention if irritation develops or persists.
Inhalation	Remove to fresh air. Call a physician if symptoms develop or persist.
Ingestion	No need for first aid is anticipated if material is swallowed.
General advice	If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Extinguishing media	
Suitable extinguishing media	Dry chemical, carbon dioxide. Foam. Water spray or fog.
Protection of firefighters	
Protective equipment for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

6. Accidental Release Measures

Methods for containment	Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
Methods for cleaning up	Large Spills: Dike far ahead of liquid spill for later disposal. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly.

7. Handling and Storage

Handling	Handle and open container with care. Wash hands after handling and before eating.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure Controls / Personal Protection

Engineering controls	Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

Eye protection	Wear safety glasses; chemical goggles (if splashing is possible). Eye wash fountain is recommended.
Hand protection	Impervious gloves.
Skin and body protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Respiratory protection	No personal respiratory protective equipment normally required.
General hygeine considerations	Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Viscous. Amber. Liquid.
Odor	Fatty acid.
Clarity	Not available
Odor threshold	Not available
Physical state	Liquid
pH	Not available
Melting point	Not available
Freezing point	Not available
Boiling point	572 - 644 °F (300 - 340 °C) @ 0.5 mm Hg
Flash point	Not available
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	< 0.001 mm Hg @20 C°
Vapor density	Not available
Specific gravity	0.95 @25 C°
Relative density	Not available
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available

10. Chemical Stability & Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	None known.
Incompatible materials	None known.
Hazardous decomposition products	Carbon oxides.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Not available

12. Ecological Information

Aquatic toxicity	EC50/72h/algae =>1000 mg/l LC50/96h/Fathead minnows =>1000 mg/l EC50/48h/daphnia =1000 mg/l
Persistence / degradability	According to the results of tests of biodegradability this product is not readily biodegradable.
Persistence / degradability	According to the results of tests of biodegradability this product is not readily biodegradable. Aerobic biodegradation: - Ready percent degradation: 6 %, 28 days, OECD 301B

13. Disposal Considerations

Disposal instructions

Dispose in accordance with all applicable regulations. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other Information

HMIS® ratings

Health: 1
Flammability:0
Physical hazard: 0
Personal protection: C

NFPA ratings

Health: 1
Flammability: 1
Instability: 0

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

EU preparer Melanie Thatcher - Tel +44 (0)1224 721597

US preparer	Cheryl Hood - (713)625-4888
Issue date	11-Jul-2007
Supercedes date	03-22-2006
MSDS sections updated	Ecological Information: Aquatic toxicity

05/24/2019

MATERIAL SAFETY DATA SHEET

05/24/2019

CARBO-TROL®

Drilling Fluids

1. Product and Company Identification

Material name	CARBO-TROL®
Chemical description	Organic Polymer/Bridging Agent Blend
Applications	Filtration Control Agent
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
CALCIUM CARBONATE	1317-65-3	15 - 25
CRYSTALLINE SILICA, QUARTZ	14808-60-7	1 - 5
ASPHALT	8052-42-4	> 70

3. Hazards Identification

Emergency overview Product may form explosive dust/air mixtures if high concentration of product dust is suspended in air. Product dust may be irritating to eyes, skin and respiratory system. Prolonged exposure may cause chronic effects.

Potential health effects

- **Eyes** Dust or powder may irritate eye tissue.
- **Skin** Dust or powder may irritate the skin.
- **Inhalation** Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting. Prolonged inhalation may be harmful.
- **Ingestion** Ingestion can cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Chronic effects Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material.

4. First Aid Measures

First aid procedures

- **Eye contact** Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately.
- **Skin contact** Remove and isolate contaminated clothing and shoes. Wash off with soap and water. Get medical attention if irritation develops or persists. Wash clothing separately before reuse.
- **Inhalation** Move to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.
- **Ingestion** If swallowed, do NOT induce vomiting. Give several glasses of water. Get medical attention immediately.

Notes to physician Keep victim under observation. Symptoms may be delayed.

General advice Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties Dusts at sufficient concentrations can form explosive mixtures with air.

Hazardous combustion products Carbon monoxide, carbon dioxide, various hydrocarbon fragments as well as thick smoke.

Extinguishing media

- **Suitable extinguishing media** Dry chemical, carbon dioxide. Addition of water or foam to the fire may cause frothing.

Protection of firefighters

Protective equipment for firefighters	Move containers from fire area if you can do it without risk. Do not scatter spilled material with high pressure water streams. Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

6. Accidental Release Measures

Personal precautions	Keep people away from and upwind of spill/leak. Do not touch or walk through spilled material. Ventilate closed spaces before entering. Remove all sources of ignition. Keep out of low areas.
Environmental precautions	Prevent further leakage or spillage if safe to do so. Do not contaminate surface water.
Methods for containment	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Prevent entry into waterways, sewers, basements or confined areas.
Methods for cleaning up	Sweep up or gather material and place in appropriate container for disposal. Avoid dust formation. After removal flush contaminated area thoroughly with water.

7. Handling and Storage

Handling	Keep away from sources of ignition - No smoking. All equipment used when handling the product must be grounded. Do not breathe gas/fumes/vapor/spray. Wear personal protective equipment. Avoid prolonged exposure.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure Controls / Personal Protection

Exposure limits

ACGIH

Components	CAS #	TWA	STEL	Ceiling
ASPHALT	8052-42-4	0.5 mg/m3		
CRYSTALLINE SILICA, QUARTZ	14808-60-7	0.025 mg/m3		

OSHA

Components	CAS #	TWA	STEL	Ceiling
CALCIUM CARBONATE	1317-65-3	15 mg/m3		

Engineering controls	Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Personal protective equipment

Eye protection	Wear safety glasses with side shields (or goggles) and a face shield.
Hand protection	Protective gloves.
Skin and body protection	Use of impervious boots is recommended. Use of protective coveralls and long sleeves is recommended.
Respiratory protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
General hygeine considerations	When using do not smoke. Keep away from food and drink. Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Appearance / Color / Form	Powder. Dark grey. Solid.
Odor	Slight.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	Not available
Melting point	176 °F (80 °C) estimated
Freezing point	Not available
Boiling point	> 1200 °F (> 648.9 °C)
Flash point	> 505 °F (> 262.8 °C)

Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	1.15 - 1.25
Relative density	Not available
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	905 °F (485 °C) estimated
Decomposition temperature	Not available

10. Chemical Stability & Reactivity Information

Chemical stability	Risk of ignition. Stable at normal conditions.
Conditions to avoid	Heat, flames and sparks.
Incompatible materials	Acids. Fluorine. Strong oxidizing agents.
Hazardous decomposition products	May include oxides of oxides of carbon. May include oxides of phosphorus.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Acute effects

Acute LD50: 5824.59 mg/kg estimated, Rat, Oral
Acute LD50: 2801.12 mg/kg estimated, Rat, Dermal

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

ASPHALT	8052-42-4	Oral LD50 Rat: >5000 mg/kg; Dermal LD50 Rabbit: >2000 mg/kg
CRYSTALLINE SILICA, QUARTZ	14808-60-7	Oral LD50 Rat: 500 mg/kg

Local effects

May cause skin irritation and/or dermatitis.

Chronic effects

Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material.

Carcinogenicity

Contains material which may cause cancer.

ACGIH - Threshold Limits Values - Carcinogens

ASPHALT	8052-42-4	A4 - Not Classifiable as a Human Carcinogen (as benzene soluble aerosol)
CRYSTALLINE SILICA, QUARTZ	14808-60-7	A2 - Suspected Human Carcinogen

NTP (National Toxicology Program) - Report on Carcinogens - Known Carcinogens

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Known Carcinogen

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life.
Environmental effects	An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. Disposal Considerations

Disposal instructions	Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations

This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

NTP (National Toxicology Program) - Report on Carcinogens - Known Carcinogens

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Known Carcinogen

U.S. - FDA - Food Additives Generally Recognized as Safe (GRAS)

CALCIUM CARBONATE	1317-65-3	21 CFR 184.1409

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

Regulations

The product is classified and labelled in accordance with EC directives or respective national laws. This safety datasheet complies with the requirements of Directive 2001/58/EC.

IARC - Group 1 (Carcinogenic to Humans)

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Monograph 68 [1997] (listed under Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources)

State regulations

WARNING: This product contains a chemical known to the State of California to cause cancer.

U.S. - California - Proposition 65 - Carcinogens List

CRYSTALLINE SILICA, QUARTZ	14808-60-7	carcinogen, initial date 10/1/88 (airborne particles of respirable size)

U.S. - Massachusetts - Right To Know List

ASPHALT	8052-42-4	Present
CALCIUM CARBONATE	1317-65-3	Present
CRYSTALLINE SILICA, QUARTZ	14808-60-7	Carcinogen; Extraordinarily hazardous

U.S. - New Jersey - Right to Know Hazardous Substance List

ASPHALT	8052-42-4	sn 0170
CRYSTALLINE SILICA, QUARTZ	14808-60-7	sn 1660

U.S. - Pennsylvania - RTK (Right to Know) List

ASPHALT	8052-42-4	Present
CALCIUM CARBONATE	1317-65-3	Present
CRYSTALLINE SILICA, QUARTZ	14808-60-7	Present

16. Other Information

HMIS® ratings

Health: 1*
Flammability:0
Physical hazard: 0
Personal protection: B

NFPA ratings

Health: 0
Flammability: 0
Instability: 0

Disclaimer

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US preparer

Cheryl Hood - (713)625-4888

Issue date

16-Nov-2007

Supercedes date

11-16-2007

MATERIAL SAFETY DATA SHEET

05/24/2019

CHEK-LOSS® PLUS

Drilling Fluids

1. Product and Company Identification

Material name	**CHEK-LOSS® PLUS**
Chemical name	Lignin/Cellulose Powder
Applications	Seepage Loss Control & Differential Sticking Preventative
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
CELLULOSE	9004-34-6	100

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

3. Hazards Identification

Emergency overview Exposure to powder or dusts may be irritating to eyes, nose and throat.

Potential health effects

Eyes Dust or powder may irritate eye tissue.

Skin Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis (rash).

Inhalation Inhalation of dusts may cause respiratory irritation.

Ingestion Health injuries are not known or expected under normal use.

4. First Aid Measures

First aid procedures

Eye contact Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Wash off skin with soap and water. Get medical attention if irritation develops or persists.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.

Ingestion Have victim rinse mouth thoroughly with water. If ingestion of a large amount does occur, seek medical attention.

General advice If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties High concentration of airborne dust may form explosive mixture with air. Will burn if involved in a fire.

Hazardous combustion products None known.

Extinguishing media

Suitable extinguishing media Dry chemical, CO2, or water spray.

Protection of firefighters

Protective equipment for firefighters Firefighters should wear full protective clothing including self contained breathing apparatus.

6. Accidental Release Measures

Personal precautions Do not touch or walk through spilled material. Avoid inhalation of dust from the spilled material.

Evacuation procedures Keep unnecessary personnel away. Avoid inhalation of dust from the spilled material.

Environmental precautions Prevent further leakage or spillage if safe to do so. Do not contaminate surface water.

Methods for containment Eliminate all sources of ignition or flammables that may come into contact with a spill of this material. Prevent entry into waterways, sewers, basements or confined areas.

Methods for cleaning up Vacuum or sweep up material and place in a disposal container. Avoid dust formation.

7. Handling and Storage

05/24/2019

Handling Do not get this material in your eyes, on your skin, or on your clothing. Avoid dust formation. Wash hands after handling and before eating.

Storage Keep tightly closed in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away from heat, sparks, and flame.

8. Exposure Controls / Personal Protection

Exposure limits

ACGIH

Components	CAS #	TWA	STEL	Ceiling
CELLULOSE	9004-34-6	10 mg/m3		

OSHA

Components	CAS #	TWA	STEL	Ceiling
CELLULOSE	9004-34-6	15 mg/m3		

Engineering controls Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Personal protective equipment

Eye / face protection Wear safety glasses with side shields.

Hand protection Protective gloves.

Skin protection Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.

Respiratory protection Use a particulate filter respirator for particulate concentrations exceeding the Occupational Exposure Limit.

General hygeine considerations Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Powder. Brown. Solid.
Odor	Woody.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	Not available
Melting point	Not available
Freezing point	Not available
Boiling point	Not available
Flash point	Not available
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	0.8 - 1
Relative density	Not available
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available

10. Chemical Stability and Reativity Information

Conditions to avoid Heat, flames and sparks. Dust may form explosive mixture in air.

Incompatible materials Strong oxidizing agents.

Hazardous decomposition products None known.

Possibility of hazardous reactions Will not occur.

11. Toxicological Information

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

CELLULOSE	9004-34-6	Inhalation LC50 Rat: >5800 mg/m3/4H; Oral LD50 Rat: >5 g/kg; Dermal LD50 Rabbit: >2 g/kg

12. Ecological Information

Ecotoxicity This material is not expected to be harmful to aquatic life.

13. Disposal Considerations

Disposal instructions Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations The product does not need to be labelled in accordance with EC directives or respective national laws.

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

05/24/2019

Massachusetts - Right To Know List

CELLULOSE	9004-34-6	Present

Pennsylvania - RTK (Right to Know) List

CELLULOSE	9004-34-6	Present

16. Other Information

HMIS® ratings
Health: 0
Flammability:1
Physical hazard: 0

NFPA ratings
Health: 0
Flammability: 1
Instability: 0

Disclaimer
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US preparer Cheryl Hood - (713)625-4888

Issue date 15-Sep-2006

MATERIAL SAFETY DATA SHEET

05/24/2019

DFE-459

Drilling Fluids

1. Product and Company Identification

Material name DFE-459

Product use Emulsifier / Wetting Agent

Revision date 05-12-2009

Supplier Baker Hughes Drilling Fluids
2001 Rankin Rd.
Houston, TX 77073

Emergency CHEMTREC 800-424-9300

2. Hazards Identification

Emergency overview Harmful: may cause lung damage if swallowed. Contact with eyes may cause irritation.

Potential health effects

Eyes Contact can cause moderate to severe irritation and possible injury to the eyes.

Skin Brief contact may cause slight irritation with itching and local redness. Prolonged or repeated skin contact may result in redness, burning sensation or dermatitis.

Inhalation Inhalation of vapors or mists of the product may be irritating to the respiratory system.

Ingestion Moderately toxic. Harmful: may cause lung damage if swallowed. Small amounts of this product, if aspirated into the lungs, may cause mild to severe pulmonary injury.

3. Composition / Information on Ingredients

Components	CAS #	Percent
2-Butoxyethanol	111-76-2	3
Non-hazardous and other components below reportable levels		> 90

4. First Aid Measures

First aid procedures

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Remove contaminated clothing. Wash off skin with soap and water. Get medical attention if irritation develops or persists. Wash clothing separately before reuse.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion Have victim rinse mouth thoroughly with water. Do not induce vomiting without medical advice. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Get medical attention immediately.

General advice Keep victim under observation. If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Flammable properties Burning may produce thick, irritating smoke.

Hazardous combustion products Combustion products include fumes, smoke, carbon monoxide, carbon dioxide and sulfur dioxide.

Extinguishing media

Suitable extinguishing media Water Fog. Dry chemical. Carbon dioxide (CO_2). alcohol-resistant foam

Protection of firefighters

Protective equipment and precautions for firefighters Move containers from fire area if you can do it without risk. Withdraw immediately in case of rising sound from venting safety devices or any discoloration of tanks due to fire. Do not scatter spilled material with high pressure water streams. Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

6. Accidental Release Measures

Personal precautions Keep people away from and upwind of spill/leak. Do not touch or walk through spilled material. Ventilate closed spaces before entering. Use personal protective equipment.

Environmental precautions Do not flush into surface water or sanitary sewer system.

Methods for containment Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Prevent entry into waterways, sewers, basements or confined areas. Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.

Methods for cleaning up Large Spills: Dike far ahead of liquid spill for later disposal. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly. After removal flush contaminated area thoroughly with water.

7. Handling and Storage

Handling Do not breathe gas/fumes/vapor/spray. Do not use in areas without adequate ventilation. Do not get this material in your eyes, on your skin, or on your clothing. Do not handle or store near an open flame, heat or other sources of ignition.

Storage Keep away from heat and flame. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure Controls / Personal Protection

Occupational exposure limits

ACGIH

Components	Type	Value
2-Butoxyethanol (111-76-2)	TWA	20 ppm

U.S. - OSHA

Components	Type	Value
2-Butoxyethanol (111-76-2)	PEL	240 mg/m3 50 ppm
	TWA	120 mg/m3 25 ppm

Engineering controls Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Personal protective equipment

Eye / face protection Wear chemical goggles.

Hand protection Impervious butyl rubber gloves.

Skin protection Use of impervious boots is recommended. Use of protective coveralls and long sleeves is recommended.

Respiratory protection In case of insufficient ventilation wear suitable respiratory equipment.

General hygeine considerations When using do not smoke. Keep away from food and drink. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical & Chemical Properties

Appearance / Color / Form Brown. Liquid.

Odor Ether-like.

Form Liquid.

pH Not available.

Melting point Not available.

Freezing point Not available.

Boiling point Not available.

Flash point 181.4 °F (83 °C) Tag Closed Cup

Evaporation rate Not available.

Flammability limits in air, upper, % by volume Not available.

Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Specific gravity	Not available.
Relative density	0.925 g/cm3
Solubility	Insoluble in water.
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
VOC	3 % estimated
Percent volatile	3 % estimated

10. Chemical Stability & Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Heat, flames and sparks.
Incompatible materials	This product may react with strong acids. Strong oxidizing agents.
Hazardous decomposition products	Upon decomposition, this product may yield gaseous nitrogen oxides, carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons. Aldehydes, ketones,or organic acids.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Toxicological data

Product	**Test Results**
DFE-459 (Mixture)	Acute Dermal LD50 Rabbit: 13333 mg/kg estimated
	Acute Oral LD50 Guinea pig: 40000 mg/kg estimated
	Acute Oral LD50 Mouse: 40000 mg/kg estimated
	Acute Oral LD50 Rabbit: 10667 mg/kg estimated
Components	**Test Results**
2-Butoxyethanol (111-76-2)	Acute Dermal LD50 Rabbit: 400 mg/kg
	Acute Oral LD50 Guinea pig: 1200 mg/kg
	Acute Oral LD50 Mouse: 1200 mg/kg
	Acute Oral LD50 Rabbit: 320 mg/kg
	Acute Oral LD50 Rat: 1480 mg/kg

* Estimates for product may be based on additional component data not shown.

Acute effects	Acute LD50: 13333 mg/kg, Rabbit, Dermal, estimated Acute LD50: 40000 mg/kg, Guinea pig, Oral, estimated Acute LD50: 40000 mg/kg, Mouse, Oral, estimated
Local effects	Harmful by inhalation.

Carcinogenicity

IARC Monographs on Occupational Exposures to Chemical Agents: Overall evaluation

2-Butoxyethanol (111-76-2)	3 Classification not possible from current data.

US ACGIH Threshold Limit Values: A3 carcinogen

2-Butoxyethanol (111-76-2)	Group A3 Confirmed animal carcinogen with unknown relevance to humans.

12. Ecological Information

Ecotoxicological data

Product	**Test Results**
DFE-459 (Mixture)	LC50 Fish: 45667 mg/l 96.00 Hours estimated
Components	**Test Results**
2-Butoxyethanol (111-76-2)	LC50 Inland silverside (Menidia beryllina): 1250 mg/l 96.00 Hours

* Estimates for product may be based on additional component data not shown.

Ecotoxicity	Components of this product have been identified as having potential environmental concerns.
Environmental effects	An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Persistence and degradability	Not available.

13. Disposal Considerations

Disposal instructions	Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

BULK SHIPMENTS (>119 gallons)

Basic shipping requirements:

Proper shipping name	Combustible liquid, n.o.s. (2-Butoxyethanol)
Hazard class	Comb liq
Subsidiary hazard class	None
UN number	NA1993
Packing group	III

Additional information:

Special provisions	IB3, T1, T4, TP1
Packaging exceptions	150
Packaging non bulk	203
Packaging bulk	241

Department of Transportation (DOT) Requirements

NON-BULK SHIPMENTS (<119 gallons)

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations

All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration

2-Butoxyethanol (111-76-2)	1.0 % N230

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

2-Butoxyethanol (111-76-2)	N230 Listed.

CERCLA (Superfund) reportable quantity

2-Butoxyethanol: 1.0000

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes

Country(s) or region	Inventory name	On inventory (yes/no)*
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

US - New Jersey Community RTK (EHS Survey): Reportable threshold

2-Butoxyethanol (111-76-2) 500 LBS

US - Pennsylvania RTK - Hazardous Substances: Listed substance

2-Butoxyethanol (111-76-2) Listed.

16. Other Information

HMIS® ratings
Health: 1*
Flammability: 0
Physical hazard: 0
Personal protection: D

NFPA ratings
Health: 1
Flammability: 0
Instability: 0

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US preparer Cheryl Hood - Tel +1 713-625-4888

Issue date 05-12-2009

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : ECCO-BLOK™

Supplier : Baker Hughes Drilling Fluids
A Baker Hughes Company
2001 Rankin Road
Houston, TX 77073

Material Uses : Special: Filtration Control Agent

Code : 5015DF

Validation date : 3/28/2012.

Print date : 3/28/2012.

Version : 1.01

In case of emergency : For Chemical Emergency:
713-439-8900
1-800-424-9300

2 . Hazards identification

Physical state : Solid. [Powder.]

Color : Black.

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : WARNING!

CAUSES RESPIRATORY TRACT IRRITATION. MAY CAUSE ALLERGIC SKIN REACTION. MAY CAUSE EYE AND SKIN IRRITATION.

Fine dust clouds may form explosive mixtures with air. Handling and/or processing of this material may generate a dust which can cause mechanical irritation of the eyes, skin, nose and throat. Keep away from heat, sparks and flame. Prevent dust accumulation. Do not breathe dust. Do not get on skin or clothing. Avoid contact with eyes. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Potential acute health effects

Inhalation : Irritating to respiratory system.

Ingestion : No known significant effects or critical hazards.

Skin : Moderately irritating to the skin. May cause sensitization by skin contact.

Eyes : Moderately irritating to eyes. No significant irritation expected other than possible mechanical irritation.

Potential chronic health effects

Chronic effects : Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Over-exposure signs/symptoms

Inhalation : respiratory tract irritation, coughing

Ingestion : None known.

Skin : irritation, redness

Eyes : irritation, watering, redness

Medical conditions aggravated by over-exposure : Pre-existing skin disorders may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Asphaltite	12002-43-6	60 - 100

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wear suitable protective clothing and gloves. Remove contaminated clothing and shoes.

5 . Fire-fighting measures

Flammability of the product : Fine dust clouds may form explosive mixtures with air.

Extinguishing media

Suitable : In case of fire, use water spray (fog), foam, dry chemical or CO_2.

Not suitable : Do not use water jet.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Hazardous thermal decomposition products : No specific data.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labeled waste container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

6 . Accidental release measures

Large spill : Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Vacuum or sweep up material and place in a designated, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing dust. Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation. Use only with adequate ventilation. Electrical equipment and lighting should be protected to appropriate standards to prevent dust coming into contact with hot surfaces, sparks or other ignition sources. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
No exposure limit value known.											

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. Use explosion-proof ventilation equipment.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : Approved/certified disposable particulate dust mask. Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Recommended: Wear a respirator conforming to EN140 with Type A/P2 filter or better.

Hands : Chemical-resistant gloves: Rubber gloves.

8 . Exposure controls/personal protection

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state : Solid. [Powder.]

Flash point : Closed cup: >150°C (>302°F)

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Color : Black.

Odor : Not available.

pH : Not available.

Boiling/condensation point : Not available.

Initial Boiling Point : Not available.

Melting/freezing point : 140 to 205°C (284 to 401°F)

Relative density : 1.05 (20°C)

Density : Not available.

Vapor density : Not available.

Odor threshold : Not available.

Evaporation rate : Not available.

VOC : Not available.

Viscosity : Not available.

Solubility (Water) : Not available.

Vapor pressure : Not available.

Pour Point : Not available.

Partition coefficient (LogKow) : Not available.

10 . Stability and Reactivity

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Prevent dust accumulation.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11 . Toxicological information

No additional information.

Chronic toxicity Remarks

1) Asphaltite

Not available.

12 . Ecological information

Aquatic ecotoxicity

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	Not regulated.	Not available.	-	-		-
TDG Classification	Not regulated.	Not available.	-	-		-
IMDG Class	Not regulated.	Not available.	-	-		-
IATA-DGR Class	Not regulated.	Not available.	-	-		-

PG* : Packing group

DOT Reportable Quantity Not applicable.

Marine pollutant Not applicable.

North-America NAERG : Not available.

15 . Regulatory information

HCS Classification : Irritating material
Sensitizing material

U.S. Federal regulations : **United States inventory (TSCA 8b)**: Not determined.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products were found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products were found.

CERCLA: Hazardous substances.: No products were found.

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

15 . Regulatory information

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :

Not listed

United States inventory (TSCA 8b) : Not determined.

Canada

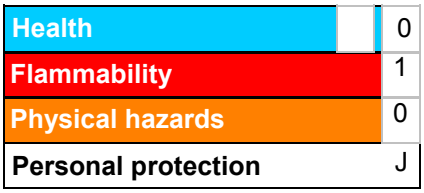
WHMIS (Canada) : Not controlled under WHMIS (Canada).

Canada (CEPA DSL): : All components are listed or exempted.

16 . Other information

Label requirements : CAUSES RESPIRATORY TRACT IRRITATION. MAY CAUSE ALLERGIC SKIN REACTION. MAY CAUSE EYE AND SKIN IRRITATION.

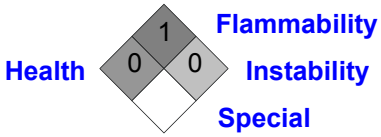
Hazardous Material Information System (U.S.A.) :



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :



Date of printing : **3/28/2012.**

Indicates information that has changed from previously issued version.

Notice to reader

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes Drilling Fluids, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

MATERIAL SAFETY DATA SHEET

05/24/2019

MIL-BAR® 410

Drilling Fluids

1. Product and Company Identification

Material name **MIL-BAR® 410**

Version # 01

Revision date 10-03-2008

Chemical name Barite

Product use Weighting Agent

Supplier Baker Hughes Drilling Fluids
2001 Rankin Rd.
Houston, TX 77073
For Emergencies, call CHEMTREC 800-424-9300

2. Hazards Identification

Emergency overview Contact with this material can cause irritation to the skin, eyes and mucous membranes. Prolonged exposure may cause chronic effects.

Potential health effects

Eyes Dust or powder may irritate eye tissue. Eye contact may result in corneal injury.

Skin Health injuries are not known or expected under normal use. Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis (rash).

Inhalation Inhalation of dusts may cause respiratory irritation.

Ingestion Health injuries are not known or expected under normal use. Ingestion of large amounts may produce gastrointestinal disturbances including irritation, nausea, and diarrhea.

Target organs Eyes. Lungs. Respiratory system.

Chronic effects Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material. Shortness of breath. May cause delayed lung damage.

Signs and symptoms Cough. Discomfort in the chest. Shortness of breath. Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material. Conjunctivitis. Corneal damage.

Potential environmental effects This material is not expected to be harmful to aquatic life.

3. Composition / Information on Ingredients

Components	CAS #	Percent
CRYSTALLINE SILICA, QUARTZ	14808-60-7	4 - 6
MICA	12001-26-2	1 - 5
Non-hazardous and other components below reportable levels		80 - 90

4. First Aid Measures

First aid procedures

Eye contact Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact Wash off with soap and water. Get medical attention if irritation develops or persists.

Inhalation Remove to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.

Ingestion If swallowed, rinse mouth with water (only if the person is conscious). If ingestion of a large amount does occur, seek medical attention.

General advice Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Call a physician if symptoms develop or persist.

5. Fire Fighting Measures

Flammable properties Not a fire hazard.

Hazardous combustion products Combustion products include fumes, smoke, carbon monoxide, carbon dioxide and sulfur dioxide.

Extinguishing media

Suitable extinguishing media

Use any media suitable for the surrounding fires.

Large Fires: Water spray, fog or regular foam.

Small Fires: Dry chemical, CO2, water spray or regular foam.

Protection of firefighters

Protective equipment and precautions for firefighters

Move containers from fire area if you can do it without risk. Use water spray to cool unopened containers. Firefighters should wear full protective clothing including self contained breathing apparatus.

6. Accidental Release Measures

Personal precautions

Keep unnecessary personnel away. Surfaces may become slippery after spillage. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

Environmental precautions

Do not flush into surface water or sanitary sewer system.

Methods for containment

Stop the flow of material, if this is without risk. Contain the discharged material.

Methods for cleaning up

Vacuum or sweep up material and place in a disposal container. Avoid the generation of dusts during clean-up. Do not flush with water. Forms smooth, slippery surfaces on floors, posing an accident risk.

7. Handling and Storage

Handling

Wear personal protective equipment. Minimize dust generation and accumulation. Do not breathe dust from this material. In case of insufficient ventilation, wear suitable respiratory equipment.

Storage

Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away from aluminum.

8. Exposure Controls / Personal Protection

Occupational exposure limits

ACGIH

Components	Type	Value	Form
CRYSTALLINE SILICA, QUARTZ (14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.

U.S. - OSHA

Components	Type	Value	Form
CRYSTALLINE SILICA, QUARTZ (14808-60-7)	TWA	0.1 mg/m3	Respirable.
		2.4 mppcf	Respirable.
		0.3 mg/m3	Total dust.
		0.1 mg/m3	Respirable dust.

Engineering controls

Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Personal protective equipment

Eye / face protection

Wear dust goggles.

Hand protection

Rubber or plastic gloves.

Skin protection

Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.

Respiratory protection

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Suitable mask with particle filter P3 (European Norm 143)

General hygeine considerations

Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practice. Do not breathe dust.

9. Physical & Chemical Properties

Appearance / Color / Form

Powder. Tan. Solid.

Odor

None.

Form

Solid.

pH

7 (2% aq. solution)

Melting point

Not available.

Freezing point

2876 °F (1580 °C)

Boiling point

Not available.

Flash point	Non-flammable
Evaporation rate	Not available.
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Specific gravity	4.1 g/ml @ 20 deg C
Relative density	4100 kg/m3
Solubility	Insoluble in water.
Solubility (water)	2.2 mg/L
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
VOC	0 % estimated
Bulk density	1714 - 2163 kg/m3 @ 20 deg C
Percent volatile	0 % estimated

10. Chemical Stability & Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Exposure to water vapor.
Incompatible materials	Fluoride. Powerful oxidizers.
Hazardous decomposition products	May include oxides of nitrogen. May include oxides of phosphorus.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Chronic effects Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material.

Carcinogenicity

IARC Monographs on Occupational Exposures to Chemical Agents: Overall evaluation

CRYSTALLINE SILICA, QUARTZ (14808-60-7) 1 Human carcinogen.

US ACGIH Threshold Limit Values: A2 carcinogen

CRYSTALLINE SILICA, QUARTZ (14808-60-7) Group A2 Suspected human carcinogen.

US NTP Report on Carcinogens: Known carcinogen

CRYSTALLINE SILICA, QUARTZ (14808-60-7) Known carcinogen.

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life.
Persistence and degradability	The methods for determining the biological degradability are not applicable to inorganic substances.
Bioaccumulation / Accumulation	Not expected to bioaccumulate.
Mobility in environmental media	This material is insoluble in water and will sink in the marine environment.

13. Disposal Considerations

Disposal instructions Can be landfilled, when in compliance with local regulations. Dispose in accordance with all applicable regulations. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations

All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance

No

Section 311 hazardous chemical

Yes

Food and Drug Administration (FDA)

Indirect food additive

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations

WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

CRYSTALLINE SILICA, QUARTZ (14808-60-7) Listed.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

CRYSTALLINE SILICA, QUARTZ (14808-60-7) Listed: October 1, 1988 Carcinogenic.

US - Pennsylvania RTK - Hazardous Substances: Listed substance

CRYSTALLINE SILICA, QUARTZ (14808-60-7) Listed.
MICA (12001-26-2) Listed.

16. Other Information

HMIS® ratings

Health: 1*
Flammability: 0
Physical hazard: 0
Personal protection: E

NFPA ratings

Health: 1
Flammability: 0
Instability: 0

Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
US preparer	Cheryl Hood - Tel +1 713-625-4888
Issue date	10-03-2008
Supercedes date	05-11-2007
This data sheet contains changes from the previous version in section(s):	Physical & Chemical Properties: Solubility

MATERIAL SAFETY DATA SHEET

05/24/2019

MIL-LIME™

Drilling Fluids

1. Product and Company Identification

Material name	**MIL-LIME™**
Chemical name	Calcium hydroxide
Chemical description	Lime
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
CALCIUM HYDROXIDE	1305-62-0	100

Composition comments This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

3. Hazards Identification

Emergency overview Harmful in contact with eyes. Risk of serious damage to eyes. Irritating to skin. Prolonged exposure may cause chronic effects.

Potential health effects

Routes of exposure	Skin contact. Inhalation. Eye contact.
Eyes	Contact may irritate or burn eyes. Eye contact may result in corneal injury. Corrosive to the eyes and may cause severe damage including blindness.
Skin	Contact may irritate or burn skin. Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis (rash).
Inhalation	Dusts of this product may cause irritation of the nose, throat, and respiratory tract.
Ingestion	Ingestion may produce burns to the lips, oral cavity, upper airway, esophagus and possibly the digestive tract.

Target organs Eyes. Respiratory system. Skin.

Chronic effects Shortness of breath. May cause delayed lung damage. Prolonged skin contact may defat the skin and produce dermatitis. Conjunctiva.

Signs and symptoms Cough. Discomfort in the chest. Shortness of breath. Defatting of the skin. Rash. Irritation. Conjunctivitis. Corneal damage.

4. First Aid Measures

First aid procedures

Eye contact	Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately.
Skin contact	Remove and isolate contaminated clothing and shoes. Wash off with warm water and soap. Launder contaminated clothing before reuse. Get medical attention immediately.
Inhalation	Remove to fresh air. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion	Do not induce vomiting. If conscious, drink plenty of water. Do not induce vomiting without medical advice. Get medical attention immediately.

Notes to physician Symptoms may be delayed.

General advice Keep victim warm. Keep victim under observation. In case of shortness of breath, give oxygen. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire Fighting Measures

Hazardous combustion products Carbon monoxide, carbon dioxide, various hydrocarbon fragments as well as thick smoke.

Extinguishing media

Suitable extinguishing media Use extinguishing agent suitable for type of surrounding fire.

Protection of firefighters

Protective equipment for firefighters	Firefighters should wear full protective clothing including self contained breathing apparatus.

6. Accidental Release Measures

Personal precautions	Surfaces may become slippery after spillage. Do not touch or walk through spilled material. Wear appropriate protective equipment and clothing during clean-up. For recommended protective clothing and equipment, see section 8 "Exposure Controls and Personal Protection".
Evacuation procedures	Keep unnecessary personnel away.
Environmental precautions	Do not contaminate surface water. Avoid subsoil penetration.
Methods for containment	Stop the flow of material, if this is without risk. Prevent entry into waterways, sewers, basements or confined areas.
Methods for cleaning up	Sweep up or gather material and place in appropriate container for disposal. Avoid the generation of dusts during clean-up.

7. Handling and Storage

Handling	Avoid contact with skin and eyes. Do not use in areas without adequate ventilation.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Keep this material away from food, drink and animal feed.

8. Exposure Controls / Personal Protection

Exposure guidelines

ACGIH - Threshold Limits Values - Time Weighted Averages (TLV-TWA)

CALCIUM HYDROXIDE	1305-62-0	5 Mg/m3 TWA

ACGIH - Threshold Limits Values - TLV Basis - Critical Effects

CALCIUM HYDROXIDE	1305-62-0	irritation

OSHA - Final PELs - Time Weighted Averages (TWAs)

CALCIUM HYDROXIDE	1305-62-0	15 Mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)

Engineering controls	Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

Eye / face protection	Wear dust goggles. Face-shield.
Skin protection	Use of protective coveralls and long sleeves is recommended. Rubber or plastic boots.
Hand protection	Chemical resistant gloves made of butyl rubber or nitrile rubber category III according to EN 374.
Respiratory protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
General hygeine considerations	Wash hands before breaks and immediately after handling the product. Avoid contact with the skin and the eyes. Keep away from food and drink. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Appearance / Color / Form	Crystalline. White. Solid.
Odor	Odourless.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	12.4 At 25 C (saturated solution)
Melting point	1076 °F (580 °C)
Freezing point	Not available
Boiling point	Not available
Flash point	Not applicable
Evaporation rate	1
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	0 HPa at 20 °C
Vapor density	Not available
Specific gravity	2.24

Relative density	Not available
Solubility	Soluble in water.
Octanol/H2O coeff	1.7
Auto-ignition temperature	Not available
Decomposition temperature	Not available
Percent volatile	5 % in water
Molecular weight	74.10 g/mol
Molecular formula	Ca(OH)2

10. Chemical Stability and Reativity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Exposure to moisture.
Incompatible materials	This product reacts with acids. Nitroethane. Nitropropane. Nitromethane. Nitroparaffins. Maleic anhydride.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

CALCIUM HYDROXIDE	1305-62-0	Oral LD50 Rat: 7340 mg/kg

Further information Causes severe irritation of eyes, skin and mucous membranes.

12. Ecological Information

Persistence / degradability	Expected to be slow, but will ultimately degrade in the aquatic environment.
Bioaccumulation / accumulation	Not expected to bioaccumulate.
Partition coefficient	1.7
Mobility in environmental media	This product will disperse readily in bodies of water or in wet soil.

13. Disposal Considerations

Disposal instructions Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

FDA - Food Additives Generally Recognized as Safe (GRAS)

CALCIUM HYDROXIDE	1305-62-0	21 CFR 184.1205

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical	Yes

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance	No
Section 311 hazardous chemical	Yes
Food and Drug Administration (FDA)	Total food additive GRAS food additive

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations	The product is classified and labelled in accordance with EC directives or respective national laws.
State regulations	This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

Massachusetts - Right To Know List

CALCIUM HYDROXIDE	1305-62-0	Present

New Jersey - Right to Know Hazardous Substance List

CALCIUM HYDROXIDE	1305-62-0	sn 0322

Pennsylvania - RTK (Right to Know) List

CALCIUM HYDROXIDE	1305-62-0	Present

16. Other Information

HMIS ratings	Health: 3 Flammability: 0 Physical hazard: 0 Personal protection: J
NFPA ratings	Health: 3 Flammability: 0 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
EU preparer	Melanie Thatcher - Tel +44 (0)1224 721597
US preparer	Cheryl Hood - (713)625-4888
Issue date	04-21-2006

MATERIAL SAFETY DATA SHEET

WALNUT SHELLS

Drilling Fluids

1. Product and Company Identification

Material name	**WALNUT SHELLS**
Chemical name	Ground Cellulosic Material
Chemical description	Ground Walnut Shells
Applications	Lost Circulation Material
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200.

3. Hazards Identification

Emergency overview	Exposure to powder or dusts may be irritating to eyes, nose and throat.
Potential health effects	
Eyes	Dust or powder may irritate eye tissue.
Skin	Dust or powder may irritate the skin.
Inhalation	Inhalation of dusts may cause respiratory irritation.
Ingestion	Health injuries are not known or expected under normal use.

4. First Aid Measures

First aid procedures	
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.
Skin contact	Wash off skin with soap and water. Get medical attention if irritation develops or persists.
Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Ingestion	Have victim rinse mouth thoroughly with water. If ingestion of a large amount does occur, seek medical attention.
General advice	Call a physician if symptoms develop or persist.

5. Fire Fighting Measures

Flammable properties	High concentration of airborne dust may form explosive mixture with air. Will burn if involved in a fire.
Hazardous combustion products	None known.
Extinguishing media	
Suitable extinguishing media	Dry chemical, CO2, or water spray.
Protection of firefighters	
Protective equipment for firefighters	Firefighters should wear full protective clothing including self contained breathing apparatus.

6. Accidental Release Measures

Personal precautions	Do not touch or walk through spilled material. Avoid inhalation of dust from the spilled material.
Evacuation procedures	Keep unnecessary personnel away. Avoid inhalation of dust from the spilled material.
Environmental precautions	Prevent further leakage or spillage if safe to do so. Do not contaminate surface water.
Methods for containment	Eliminate all sources of ignition or flammables that may come into contact with a spill of this material. Prevent entry into waterways, sewers, basements or confined areas.
Methods for cleaning up	Vacuum or sweep up material and place in a disposal container. Avoid dust formation.

7. Handling and Storage

05/24/2019

Handling	Do not get this material in your eyes, on your skin, or on your clothing. Avoid dust formation. Wash hands after handling and before eating.
Storage	Keep tightly closed in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away from heat, sparks, and flame.

8. Exposure Controls / Personal Protection

Exposure guidelines	Nuisance Particulates: OSHA PEL 15 mg/m3 (total dust) - 8-hr. TWA 5 mg/m3 (respirable dust) - 8-hr. TWA ACGIH TLV 10 mg/m3 (inhalable) 8-hr TWA 3 mg/m3 (respirable) 8-hr TWA
Engineering controls	Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.
Personal protective equipment	
Eye / face protection	Wear dust goggles.
Hand protection	Protective gloves.
Skin protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Respiratory protection	Use a particulate filter respirator for particulate concentrations exceeding the Occupational Exposure Limit.
General hygeine considerations	Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Powder. Tan. Solid.
Odor	Odourless.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	Not available
Melting point	Not available
Freezing point	Not available
Boiling point	Not available
Flash point	380 °F (193.3 °C)
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available
Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	Not available
Relative density	1.5 g/cc
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available

10. Chemical Stability and Reativity Information

Conditions to avoid	Heat, flames and sparks. Dust may form explosive mixture in air.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	None known.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

05/24/2019

Not available

12. Ecological Information

Not available

13. Disposal Considerations

Disposal instructions Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical No

CERCLA (Superfund) reportable quantity None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Korean Inventory of Chemicals (KICS)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other Information

HMIS® ratings Health: 1
Flammability:0
Physical hazard: 0
Personal protection: C

NFPA ratings Health: 1
Flammability: 0
Instability: 0

Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
US preparer	Cheryl Hood - (713)625-4888
Issue date	15-Sep-2006

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : HCl 15%

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Acid

Code : 398004

Validation date : 3/19/2012.

Print date : 3/19/2012.

Version : 1

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Liquid.

Odor : Pungent. Acid.

Color : Light yellow

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : DANGER!

CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. HARMFUL IF INHALED. MAY BE HARMFUL IF SWALLOWED. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

Do not breathe vapor or mist. Do not ingest. Do not get in eyes or on skin or clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Inhalation.

Potential acute health effects

Inhalation : Toxic by inhalation. Corrosive to the respiratory system.

Ingestion : Harmful if swallowed. May cause burns to mouth, throat and stomach.

Skin : Corrosive to the skin. Causes burns.

Eyes : Corrosive to eyes. Causes burns.

Potential chronic health effects

Chronic effects : Contains material that may cause target organ damage, based on animal data.

Target organs : Contains material which may cause damage to the following organs: lungs, upper respiratory tract, skin, eyes.

Over-exposure signs/symptoms

Inhalation : respiratory tract irritation, coughing

Ingestion : stomach pains

Skin : pain or irritation, redness, blistering may occur

Eyes : pain, watering, redness

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Hydrochloric acid	7647-01-0	10 - 30

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush the eye(s) continuously with lukewarm, gently flowing water for at least 20-60 minutes while holding the eyelid(s) open.

Skin contact : Wash affected area with soap and mild detergent for at least 20 - 60 minutes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wear suitable protective clothing and gloves. Remove contaminated clothing and shoes.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Hazardous thermal decomposition products : halogenated compounds

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Do not breathe vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose

6 . Accidental release measures

the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

If RQ (Reportable Quantity) is exceeded, report to National Spill Response Office at 1-800-424-8802.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Keep away from alkalis. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Separate from alkalis. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
Hydrochloric acid	US ACGIH OSHA PEL OSHA PEL 1989	- - -	- - -	- - -	- - -	- - -	- - -	2 5 5	- 7 7	- - -	

Consult local authorities for acceptable exposure limits.

Only components of this product with established exposure limits appear in the box above.

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted, air purifying or supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant gloves: Plastic. or Rubber gloves.

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and chemical resistant apron to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state	:	Liquid.
Flash point	:	Not available.
Auto-ignition temperature	:	Not available.
Flammable limits	:	Not available.
Color	:	Light yellow
Odor	:	Pungent. Acid.
pH	:	<1
Boiling/condensation point	:	82.778°C (181°F)
Initial Boiling Point	:	Not available.
Melting/freezing point	:	-46.111°C (-51°F)
Relative density	:	1.14 to 1.16
Density	:	9.49 to 9.66 (lbs/gal)
Vapor density	:	>1.27 [Air = 1]
Volatility	:	100% (v/v)
Odor threshold	:	Not available.
Evaporation rate	:	>1 (butyl acetate = 1)
VOC	:	Not available.
Viscosity	:	Not available.
Solubility (Water)	:	Complete.
Vapor pressure	:	4.7 kPa (35 mm Hg)
Pour Point	:	Not available.
Partition coefficient (LogKow)	:	Not available.

10 . Stability and Reactivity

Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Hazardous polymerization	:	Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	:	No specific data.
Materials to avoid	:	Reactive or incompatible with the following materials: oxidizing materials. Strong oxidizers such as liquid chlorine, sodium or calcium hypochlorite and pure oxygen.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Conditions of reactivity	:	Non-flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.

11 . Toxicological information

Carcinogenicity

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Hydrochloric acid	A4	3	-	-	-	-

Chronic toxicity Remarks

1) Hydrochloric acid

Not available.

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Hydrochloric acid	Acute LC50 240000 ug/L Marine water	Crustaceans - Green or Europeon shore crab - Carcinus maenas - Adult	48 hours
	Acute LC50 282000 ug/L Fresh water	Fish - Western mosquitofish - Gambusia affinis - Adult	96 hours

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN1789	HYDROCHLORIC ACID	8	II		**Reportable quantity** 5000 lbs. (2270 kg)
TDG Classification	UN1789	HYDROCHLORIC ACID	8	II		-
IMDG Class	UN1789	HYDROCHLORIC ACID	8	II		-
IATA-DGR Class	UN1789	HYDROCHLORIC ACID	8	II		-

PG* : Packing group

DOT Reportable Quantity Hydrochloric acid, 3481 gal of this product.

Marine pollutant Not applicable.

North-America NAERG : 157

15 . Regulatory information

HCS Classification : Toxic material
Corrosive material
Target organ effects

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: HCl 15%
SARA 302/304/311/312 hazardous chemicals: Hydrogen chloride
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: HCl 15%: Immediate (acute) health hazard, Delayed (chronic) health hazard

CERCLA: Hazardous substances.: HCl 15%: 5000 lbs. (2270 kg)

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: Hydrogen chloride

Clean Air Act (CAA) 112 regulated flammable substances: Hydrogen chloride

Clean Air Act (CAA) 112 regulated toxic substances: Hydrogen chloride

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :
Listed

SARA 313

	Product name	CAS number	Concentration
Supplier notification :	Hydrochloric acid	7647-01-0	10 - 30

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

WHMIS (Canada) : Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class E: Corrosive material

Canada (CEPA DSL): : All components are listed or exempted.

16 . Other information

Label requirements : CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. HARMFUL IF INHALED. MAY BE HARMFUL IF SWALLOWED. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

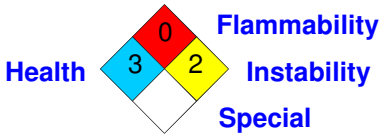
Hazardous Material Information System (U.S.A.) :

Health	3
Flammability	0
Physical hazards	2
Personal protection	j

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :



Date of printing : **3/19/2012.**

Indicates information that has changed from previously issued version.

16 . Other information

Notice to reader

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : ALPHA 1427

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Biocide.

Code : 411402

Validation date : 12/27/2011.

Print date : 12/27/2011.

Version : 1

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Liquid.

Odor : Fruity.

Color : Colorless to light yellow.

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : DANGER!

CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. HARMFUL IF SWALLOWED. MAY CAUSE ALLERGIC SKIN REACTION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

Do not breathe vapor or mist. Do not ingest. Do not get in eyes or on skin or clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Inhalation.

Potential acute health effects

Inhalation : Corrosive to the respiratory system.

Ingestion : Toxic if swallowed. May cause burns to mouth, throat and stomach.

Skin : Corrosive to the skin. Causes burns. May cause sensitization by skin contact.

Eyes : Corrosive to eyes. Causes burns.

Potential chronic health effects

Chronic effects : Contains material that may cause target organ damage, based on animal data. Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels.

Target organs : Contains material which may cause damage to the following organs: blood, the nervous system, the reproductive system, liver, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.

Over-exposure signs/symptoms

Inhalation : respiratory tract irritation, coughing

Ingestion : stomach pains

Skin : pain or irritation, redness, blistering may occur

Eyes : pain, watering, redness

2 . Hazards identification

Medical conditions aggravated by over-exposure : Pre-existing skin disorders and disorders involving any other target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Glutaraldehyde	111-30-8	10 - 30
Didecyl dimethyl ammonium chloride	7173-51-5	5 - 10
Quaternary ammonium compound	68424-85-1	1 - 5
Ethanol	64-17-5	1 - 5

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush the eye(s) continuously with lukewarm, gently flowing water for at least 20-60 minutes while holding the eyelid(s) open.

Skin contact : Wash affected area with soap and mild detergent for at least 20 - 60 minutes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wear suitable protective clothing and gloves. Remove contaminated clothing and shoes.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides,halogenated compounds

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Do not breathe vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

6 . Accidental release measures

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
Glutaraldehyde	US ACGIH	-	-	-	-	-	-	0.05	-	-	[3]
	OSHA PEL 1989	-	-	-	-	-	-	0.2	0.8	-	
Ethanol	US ACGIH	-	-	-	1000	-	-	-	-	-	
	OSHA PEL	1000	1900	-	-	-	-	-	-	-	
	OSHA PEL 1989	1000	1900	-	-	-	-	-	-	-	

[3]Skin sensitization

Consult local authorities for acceptable exposure limits.

Only components of this product with established exposure limits appear in the box above.

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted, air purifying or supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

8 . Exposure controls/personal protection

Hands	:	Chemical-resistant gloves.
Eyes	:	Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.
Skin	:	Wear long sleeves and chemical resistant apron to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state	:	Liquid.
Flash point	:	Closed cup: >99.3°C (>210.7°F) [Tagliabue.]
Auto-ignition temperature	:	Not available.
Flammable limits	:	Not available.
Color	:	Colorless to light yellow.
Odor	:	Fruity.
pH	:	4.5
Boiling/condensation point	:	99.3°C (210.7°F)
Initial Boiling Point	:	Not available.
Melting/freezing point	:	-9.4444°C (15°F)
Relative density	:	1.05 (23°C)
Density	:	8.75 (lbs/gal)
Vapor density	:	Not available.
Odor threshold	:	Not available.
Evaporation rate	:	Not available.
VOC	:	Not available.
Viscosity	:	Kinematic (21°C): 9.233 cSt
Solubility (Water)	:	Soluble
Vapor pressure	:	Not available.
Pour Point	:	-9°C (15.8°F)
Partition coefficient (LogKow)	:	Not available.

10 . Stability and Reactivity

Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Hazardous polymerization	:	Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	:	No specific data.
Materials to avoid	:	Reactive or incompatible with the following materials: oxidizing materials, reducing materials, metals, acids and alkalis. amines Ammonia.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Conditions of reactivity	:	Flammable in the presence of the following materials or conditions: heat. Slightly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Glutaraldehyde	LD50 Dermal	Rat	>2500 mg/kg	-
	LD50 Dermal	Rabbit	560 uL/kg	-
	LD50 Oral	Rat	140 mg/kg	-
	LD50 Oral	Rat	134 mg/kg	-
	LC50 Inhalation Vapor	Rat	480 mg/m3	4 hours
Didecyl dimethyl ammonium chloride	LD50 Dermal	Rabbit	4177 mg/kg	-
	LD50 Oral	Rat	560 mg/kg	-
	LD50 Oral	Rat	84 mg/kg	-
Quaternary ammonium compound	LD50 Oral	Rat	426 mg/kg	-
Ethanol	LD50 Oral	Rat	7 g/kg	-
	LD50 Oral	Rat	15010 mg/kg	-
	LD50 Oral	Rat	7060 mg/kg	-
	LD50 Oral	Rabbit	6300 mg/kg	-
	LC50 Inhalation Vapor	Rat	124700 mg/m3	4 hours
	LC50 Inhalation Vapor	Rat	5900 mg/m3	6 hours
	LC50 Inhalation Vapor	Rat	20000 ppm	10 hours
	LC50 Inhalation Gas.	Rat	20000 ppm	10 hours

Carcinogenicity

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Glutaraldehyde	A4	-	-	-	-	-
Ethanol	A3	-	-	-	-	-

Chronic toxicity Remarks

1) Glutaraldehyde

Glutaraldehyde is a component of this product. In long-term experimental animal studies, glutaraldehyde caused liver damage in mice (ACGIH, 1992), but it was not neurotoxic in rats (Spencer et al, 1978).

Female rats had increased large granular lymphocytic leukemias after receiving glutaraldehyde in the drinking water at levels up to 1,000 ppm for 2 years (Andersen, 1996).

The results of genetic studies have been mixed with no conclusive evidence of positive effects.

In 2-year inhalation studies, there was no evidence of carcinogenic activity in male or female rats exposed to 250, 500 or 750 ppb, or in male or female mice exposed to 62.5, 125, or 250 ppb glutaraldehyde. Incidences of nasal and respiratory lesions were increased in both male/female rats and mice. Reduction in body weight, as compared to the controls was also noted.

2) Didecyl dimethyl ammonium chloride

Not available.

3) Quaternary ammonium compound

Not available.

4) Ethanol

Ethanol is a component of this product. Inhalation exposure to an airborne concentration of 14 to 28 mg/L over a 10 day period was sufficient to produce chemical dependence in rats (Ferko & Bobyock, 1977); 1.4 mg/L for 1 to 2 weeks produced dependency in rats, although blood alcohol levels could not be detected (French & Morris, 1972). Chronic exposures are well known to produce ethanol tolerance in mice (Grieve & Littleton, 1978) and humans. Tolerance may follow a "wave-like" pattern with time in attempts to correlate blood alcohol levels with performance or behavioral effects

11 . Toxicological information

(Pavienko & Guseva, 1973). Ethanol is mainly metabolized in the liver, which is also one of the primary target organs. While ethanol is well known to cause cirrhosis of the liver in alcoholics, liver cirrhosis has also been produced in rabbits exposed by inhalation (Clayton & Clayton, 1994). Other effects of chronic exposures involve the heart, with progressive dysfunction, congestive cardiomyopathy (disease of the muscular tissues of the heart) , and arrhythmias (irregular heart beat) (HSDB). Occupational exposure to ethanol has been linked with an increased risk for ischemic heart disease (reduced blood flow to the heart usually due to a blockage in the arteries) in rubber workers who were also exposed to other chemicals (Wilcosky & Tyroler, 1983).

Ethanol should be regarded as a possible human co-carcinogen. Ethanol was not carcinogenic when applied to the skin of mice, but did increase the activity of other known carcinogens (Stenback, 1969; Barauskaite, 1983; Hills & Venable, 1982; Radike et al, 1977). Ethanol has been called an equivocal tumorigenic agent when given orally (or rectally) to mice (HSDB). NTP is conducting a two year study at this time, but results were not available for review (LOLI).

Ethanol has also been widely studied for genetic effects in many species. The genetic effects of ethanol have been reviewed (Obe & Ristow, 1979). Increased single-strand DNA breaks were seen in rat brain cells 4 hours after a single oral exposure to 4 g/kg ethanol (Singh et al, 1995). Ethanol itself is not mutagenic in the Ames test, but its metabolite, acetaldehyde, is mutagenic (Obe, 1981). Ethanol did not increase the mutagenicity of diesel exhaust when used as a fuel extender (Clark et al, 1984). Ethanol has been reported to damage the chromosomes in mammalian cells and to induce a variety of genetic effects in micro-organisms (RTECS, 1996). These effects may have been due to the metabolite, acetaldehyde.

The effects of ethanol on the fetus have been reviewed (Brien & Smith, 1991). Ethanol can affect male fertility and produce reduced birth weight in newborns through paternal exposure, but is not known to be teratogenic through the father (Pearn, 1983). Ethanol inhibited the production of testosterone when given to male rats at 1,000 ppm (the TLV) (Cameron et al, 1985), and this effect may be due to its metabolite, acetaldehyde (Santucci et al, 1983; Cicero & Bell, 1980). Ethanol does not seem to affect fertility in female rats (Berliner, 1977); however, there is not sufficient evidence in women to allow a definite conclusion about ethanol and female fertility. Ethanol ingestion by pregnant women is well known to be causative for Fetal Alcohol Syndrome (FAS) (Ashley; 1981, Sokol, 1981; Wright & Toplis, 1986). Fetal alcohol syndrome is characterized by low birth weight, low IQ, slow growth, certain facial abnormalities, CNS defects, and other major or minor structural malformations (Rosett et al, 1983).

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Glutaraldehyde	Acute EC50 0.75 to 1 ppm Fresh water	Daphnia - Water flea - Daphnia magna - <20 hours	48 hours
	Acute LC50 3.5 to 4.8 ppm Fresh water	Fish - Rainbow trout,donaldson trout - Oncorhynchus mykiss	96 hours
Didecyl dimethyl ammonium chloride	Acute EC50 18 to 22 ppb Fresh water	Daphnia - Water flea - Daphnia magna - <20 hours	48 hours
	Acute EC50 240 ug/L Fresh water	Fish - Guppy - Poecilia reticulata - 21 to 28 days	96 hours
	Acute LC50 39 ug/L Marine water	Crustaceans - Opossum shrimp - Americamysis bahia - Juvenile (Fledgling, Hatchling, Weanling)	48 hours
	Chronic NOEC 0.2 mg/L Fresh water	Fish - Coho salmon,silver salmon - Oncorhynchus kisutch - 10.97 cm	96 hours
Quaternary ammonium compound	Acute EC50 5.9 to 7.5 ppb Fresh water	Daphnia - Water flea - Daphnia magna - <24 hours	48 hours
	Acute LC50 0.28 to 0.34 ppm Fresh water	Fish - Fathead minnow - Pimephales promelas	96 hours
Ethanol	Acute EC50 2000 ug/L Fresh water	Daphnia - Water flea - Daphnia magna	48 hours
	Acute LC50 25500 ug/L Marine water	Crustaceans - Brine shrimp - Artemia franchiscana - LARVAE	48 hours
	Acute LC50 42000 ug/L Fresh water	Fish - Rainbow trout,donaldson trout - Oncorhynchus mykiss	4 days
	Chronic NOEC <6.3 g/L Fresh water	Daphnia - Water flea - Daphnia magna	48 hours

12 . Ecological information

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN1903	Disinfectant, liquid, corrosive, n. o. s. (Contains: Quaternary ammonium compound)	8	III		-
TDG Classification	UN1903	Disinfectant, liquid, corrosive, n. o. s. (Contains: Quaternary ammonium compound)	8	III		-
IMDG Class	UN1903	Disinfectant, liquid, corrosive, n. o. s. (Contains: Quaternary ammonium compound)	8	III	 	-
IATA-DGR Class	UN1903	Disinfectant, liquid, corrosive, n. o. s. (Contains: Quaternary ammonium compound)	8	III	 	-

PG* : Packing group

DOT Reportable Quantity Not applicable.

Marine pollutant Not applicable.

North-America NAERG : 154

15 . Regulatory information

HCS Classification : Toxic material
Corrosive material
Sensitizing material
Target organ effects

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: ALPHA 1427
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: ALPHA 1427: Immediate (acute) health hazard, Delayed (chronic) health hazard

CERCLA: Hazardous substances.: No products were found.

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :
Not listed

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

WHMIS (Canada) : Class D-1B: Material causing immediate and serious toxic effects (Toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class E: Corrosive material

Canada (CEPA DSL): : All components are listed or exempted.

16 . Other information

Label requirements : CAUSES RESPIRATORY TRACT, EYE AND SKIN BURNS. HARMFUL IF SWALLOWED. MAY CAUSE ALLERGIC SKIN REACTION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

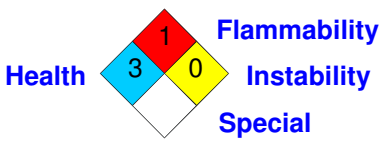
Hazardous Material Information System (U.S.A.) :

Health	3
Flammability	1
Physical hazards	0
Personal protection	I

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :



Date of printing : **12/27/2011.**

Indicates information that has changed from previously issued version.

Notice to reader

16 . Other information

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : CI-14

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Corrosion Inhibitor

Code : 499779

Validation date : 3/13/2012.

Print date : 3/13/2012.

Version : 2.01

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Liquid. [Clear.]

Odor : Sweet.

Color : Amber. [Dark]

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : WARNING!

FLAMMABLE LIQUID AND VAPOR. HARMFUL IF ABSORBED THROUGH SKIN OR IF SWALLOWED. INHALATION CAUSES HEADACHES, DIZZINESS, DROWSINESS AND NAUSEA AND MAY LEAD TO UNCONSCIOUSNESS. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. MAY CAUSE BLINDNESS IF SWALLOWED. PROLONGED OR REPEATED CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

Keep away from heat, sparks and flame. Do not breathe vapor or mist. Do not ingest. Do not get in eyes or on skin or clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flashback. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material.

Routes of entry : Dermal contact. Eye contact. Inhalation.

Potential acute health effects

Inhalation : Can cause central nervous system (CNS) depression. Irritating to respiratory system.

Ingestion : Toxic if swallowed. Can cause central nervous system (CNS) depression. May cause blindness if swallowed.

Skin : Toxic in contact with skin. Severely irritating to the skin.

Eyes : Severely irritating to eyes. Risk of serious damage to eyes.

Potential chronic health effects

Chronic effects : Contains material that may cause target organ damage, based on animal data. Prolonged or repeated contact can defat the skin and lead to irritation, cracking and/or dermatitis.

Target organs : Contains material which may cause damage to the following organs: kidneys, the nervous system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.

Over-exposure signs/symptoms

05/24/2019

2 . Hazards identification

Inhalation : respiratory tract irritation, nausea or vomiting, coughing, headache, drowsiness/fatigue, dizziness/vertigo, unconsciousness

Ingestion : None known.

Skin : irritation, redness, dryness, cracking

Eyes : pain or irritation, watering, redness

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Methanol	67-56-1	60 - 100
Polyoxyalkylenes	Trade secret.	10 - 30
Fatty acids	Trade secret.	5 - 10
Propargyl alcohol	107-19-7	1 - 5
Olefin	Trade secret.	1 - 5

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wear suitable protective clothing and gloves. Remove contaminated clothing and shoes.

Additional information

If product is ingested and vomiting occurs naturally, have person lean forward to reduce the risk of aspiration into the lungs.

5 . Fire-fighting measures

Flammability of the product : Flammable liquid. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Extinguishing media

Suitable : Use dry chemical, CO_2, water spray (fog) or foam.

Not suitable : Do not use water jet.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides,sulfur oxides

5 . Fire-fighting measures

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Special remarks on fire hazards : HAZARDOUS DECOMPOSITION PRODUCTS: carbon monoxide, carbon dioxide. FLAMMABLE. Vapors may form explosive mixture with air. Explosive mixtures may form at temperatures at or above the flash point. Vapors can travel to source of ignition and flash back. Never use welding or cutting torch on or near drums, even when empty. Explosion may result. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Do not breathe vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

If RQ (Reportable Quantity) is exceeded, report to National Spill Response Office at 1-800-424-8802.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
Methanol	US ACGIH	200	262	-	250	328	-	-	-	-	[1]
	OSHA PEL	200	260	-	-	-	-	-	-	-	
	OSHA PEL 1989	200	260	-	250	325	-	-	-	-	[1]
Propargyl alcohol	US ACGIH	1	2.3	-	-	-	-	-	-	-	[1]
	OSHA PEL 1989	1	2	-	-	-	-	-	-	-	[1]

[1]Absorbed through skin.

Consult local authorities for acceptable exposure limits.

Only components of this product with established exposure limits appear in the box above.

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. Use explosion-proof ventilation equipment.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant gloves: neoprene Viton gloves.

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state : Liquid. [Clear.]

Flash point : Closed cup: 10 to 15.6°C (50 to 60.1°F) [TCC]

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Color : Amber. [Dark]

Odor : Sweet.

pH : 3.2 to 3.4 [Conc. (% w/w): 5%]

: 5% of product in 75% water/25% IPA

Boiling/condensation point : Not available.

Initial Boiling Point : Not available.

Melting/freezing point : Not available.

Relative density : 0.87 (15.6°C)

Density : 7.25 (lbs/gal)

Vapor density : >1 [Air = 1]

Odor threshold : Not available.

Evaporation rate : Not available.

VOC : Not available.

9 . Physical and chemical properties

Viscosity : Not available.

Solubility (Water) : Dispersible

Vapor pressure : 12.5 kPa (94 mm Hg) at 21.1°C (Calculated Value for all Components.)

Pour Point : -23.3°C (-9.9°F)

Partition coefficient (LogKow) : Not available.

10 . Stability and Reactivity

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Materials to avoid : Reactive or incompatible with the following materials: oxidizing materials and reducing materials.
Methanol is incompatible and may react with acetyl bromide, alkyl aluminum solutions, beryllium hydride, boron trichloride, nitric acid, cyanuric chloride, dichloromethane, diethylzinc, metals (granulated forms of aluminum and magnesium – including aluminum and zinc salts), phosphorus III oxide, and potassium tert-butoxide.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Conditions of reactivity : Highly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.
HAZARDOUS DECOMPOSITION PRODUCTS: carbon monoxide, carbon dioxide.
FLAMMABLE. Vapors may form explosive mixture with air. Explosive mixtures may form at temperatures at or above the flash point. Vapors can travel to source of ignition and flash back. Never use welding or cutting torch on or near drums, even when empty. Explosion may result. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Fatty acids	LD50 Oral	Rat	>10000 mg/kg	-
Methanol	LD50 Dermal	Rabbit	15800 mg/kg	-
	LD50 Oral	Rabbit	14200 mg/kg	-
	LD50 Oral	Rat	5600 mg/kg	-
	LC50 Inhalation Gas.	Rat	145000 ppm	1 hours
	LC50 Inhalation Gas.	Rat	64000 ppm	8 hours
	LC50 Inhalation Gas.	Rat	64000 ppm	4 hours
	LC50 Inhalation Vapor	Mouse	50000 ppm	4 hours
Propargyl alcohol	LD50 Dermal	Rabbit	88 mg/kg	-
	LD50 Dermal	Rabbit	16 mg/kg	-
	LD50 Oral	Rat	55 mg/kg	-
	LD50 Oral	Rat	20 mg/kg	-
	LC50 Inhalation Vapor	Rat	1.8 g/m3	2 hours
	LC50 Inhalation Gas.	Rat	1040 ppm	1 hours
	LC50 Inhalation Gas.	Rat	873 ppm	2 hours

11 . Toxicological information

	LC50 Inhalation Vapor	Rat	520 ppm	4 hours
Polyoxyalkylenes	LD50 Dermal	Rabbit	5000 mg/kg	-
	LD50 Oral	Rat	1000 mg/kg	-
CI-14	LD50 Dermal	Rabbit	<1000 mg/kg	-

Chronic toxicity Remarks

1) Methanol

Methanol is a component of this product. Because methanol is eliminated from the body more slowly than ethanol, it can have cumulative toxicity with repeated exposures (ACGIH, 1992).

Acute dermal, oral, and inhalation exposure to methanol can cause Central Nervous System effects, optic nerve effects, diminished vision, and brain effects (necrosis and hemorrhaging). (Bennett, I.L. et al, 1953)

Ingestion of methanol can cause Central Nervous System depression, metabolic acidosis, blurred vision and blindness, gastrointestinal effects, and coma and death. (Clayton, G.D. and Clayton, F.E., 1982, Patty's Industrial Hygiene and Toxicology, Vol2C) Dermal exposure to methanol can cause Central Nervous System depression, blurred vision, and gastrointestinal effects. (Downie, A et al, 1992, Occupational Medicine, 42, pp 47-9) Chronic inhalation of methanol can cause Central Nervous System depression, blurred vision, and gastrointestinal effects. (Frederick, L.J. et al, 1984, AIHA Journal, 45, pp 51-5) Chronic inhalation of methanol has caused liver effects in laboratory animals. (Poon, R et al, 1994, Toxocology and Industrial Health 10: 231-245) Chronic oral exposure has caused Central Nervous System effects and eye effects in laboratory animals. [Youssef, A. F. et al (1993) Neurotoxicology and Teratology 15: 223-227; Baumbach, G.L. et al (1977) Archives of Ophthalmology 95: 1859-1865; Hayreh, M.S. et al (1977) Archives of Ophthalmology 95: 1851-1858; Hayreh, M.S. et al (1980) Ocular toxicity of methanol: An experimental study – Raven Press, New York, pages 35-53; and Martin-Amat, G. et al (1977) Archives of Ophthalmology 95: 1847-1850]

Methanol has produced in vivo mutagenicity in animal studies. (Pereira, M.A. et al, 1982) and (Ward, J. B. et al, 1983)

Methanol was mutagenic in yeast (RTECS). Methanol has caused chromosome aberrations in yeast (RTECS) and grasshoppers (Saha & Khudabaksh, 1974).

Methanol has caused birth defects in rats exposed by the oral (Infurna et al, 1981) and inhalation (Nelson et al, 1984; Nelson et al, 1985) routes. Exencephaly (a defect in the skull bone structure that leaves the brain exposed) and cleft palate (a fissure or unformed bone structure in the roof of the mouth (palate), lip, or facial area, occurring during the embryonic stage of development) were increased in fetal mice exposed to methanol at an airborne concentration of 5,000 ppm or higher for 7 hours/day on days 6 to 15 of gestation.

Embryotoxicity and fetotoxicity were seen with maternal exposure to airborne concentrations of 7,500 ppm and above, and reduced fetal weights with concentrations of 10,000 ppm or greater. The NOAEL was 1,000 ppm. Effects similar to those seen in the 10,000 ppm dosage group were also seen in offspring of mice given a dose of 4 g/kg orally (Rogers et al, 1993).

2) Polyoxyalkylenes

Not available.

3) Fatty acids

Fatty acids are a component of this product. Eye contact may produce some irritation. Repeated or prolonged skin contact may cause irritation. Inhalation of vapors or mists may cause dizziness, nausea, or respiratory tract irritation. Aspiration into the lungs during ingestion or vomiting of swallowed material may produce chemical pneumonitis, pulmonary edema, and hemorrhaging. Repeated exposures to Fatty acids via the oral route did not produce any signs of toxicity up to 2,500 mg/kg-bw/day and slight decreases in food consumption at higher doses. Histopathological evaluation of all tissues and organs including reproductive organs was unremarkable. No reproductive or developmental toxicity was observed in rats exposed to fatty acids in the diet for two-generations. The Fatty acids did not show mutagenic potential in in vitro tests. The Fatty acid was clastogenic only at cytotoxic levels leading to the conclusion that this chemical was not clastogenic (EPA, 2007).

4) Propargyl alcohol

Propargyl alcohol is a component of this product. Exposure may damage the liver and kidneys. This component has been shown to cause internal bleeding from acute oral and dermal exposure to animals.

11 . Toxicological information

It has produced in vitro mutagenicity in animal studies. (Blakey, D.H. et al, 1994) and (Basu, A.K. and L.J. Marnett, 1984) Chronic inhalation of propargyl alcohol has caused nasal tumors and mononuclear cell leukemia in laboratory animals. National Toxicology Program Technical Report (2008).

5) Olefin

Not available.

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Methanol	Acute LC50 2500000 ug/L Marine water	Crustaceans - Common shrimp, sand shrimp - Crangon crangon - Adult	48 hours
	Acute LC50 3289 to 4395 mg/L Fresh water	Daphnia - Water flea - Daphnia magna - Neonate - <24 hours	48 hours
	Acute LC50 >100000 ug/L Fresh water	Fish - Fathead minnow - Pimephales promelas - Juvenile (Fledgling, Hatchling, Weanling) - 0.2 to 0.5 g	96 hours
Propargyl alcohol	Acute LC50 1530 to 1560 ug/L Fresh water	Fish - Fathead minnow - Pimephales promelas - Juvenile (Fledgling, Hatchling, Weanling) - 29 to 33 days - 19.7 mm - 119 mg	96 hours
Polyoxyalkylenes	Acute EC50 0.22 mg/L Fresh water	Daphnia - Water flea - Daphnia magna - <24 hours	48 hours
	Acute LC50 1400 to 1700 ug/L Fresh water	Crustaceans - Scud, Amphipod - Gammarus sp. - 4.3 mm	48 hours
	Acute LC50 650 to 680 ug/L Fresh water	Fish - Bluegill - Lepomis macrochirus - Juvenile (Fledgling, Hatchling, Weanling) - 1.19 g	4 days

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN1992	FLAMMABLE LIQUID, TOXIC, N.O.S. (Contains: Methanol, Propargyl alcohol)	3 (6.1)	II		-
TDG Classification	UN1992	FLAMMABLE LIQUID, TOXIC, N.O.S. (Contains: Methanol, Propargyl alcohol)	3 (6.1)	II		-
IMDG Class	UN1992	FLAMMABLE LIQUID, TOXIC, N.O.S. (Contains: Methanol, Propargyl alcohol)	3 (6.1)	II		**Emergency schedules (EmS)** F-E S-E
IATA-DGR Class	UN1992	FLAMMABLE LIQUID, TOXIC, N.O.S. (Contains: Methanol, Propargyl alcohol)	3 (6.1)	II		-

PG* : Packing group

DOT Reportable Quantity Methanol, 1048 gal of this product.
Propargyl alcohol, 4140 gal of this product.

Marine pollutant Not applicable.

North-America NAERG : 131

15 . Regulatory information

HCS Classification : Flammable liquid
Toxic material
Irritating material
Target organ effects

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Propargyl alcohol; Methanol
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: CI-14: Fire hazard, Immediate (acute) health hazard, Delayed (chronic) health hazard

CERCLA: Hazardous substances.: Propargyl alcohol: 1000 lbs. (454 kg); Formaldehyde: 100 lbs. (45.4 kg); Methanol: 5000 lbs. (2270 kg); Hydrogen chloride: 5000 lbs. (2270 kg);

Clean Water Act (CWA) 307: No products were found.

15 . Regulatory information

Clean Water Act (CWA) 311: Hydrogen chloride; Formaldehyde

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :

Listed

SARA 313

	Product name	CAS number	Concentration
Supplier notification :	Methanol	67-56-1	60 - 100
	Propargyl alcohol	107-19-7	1 - 5

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

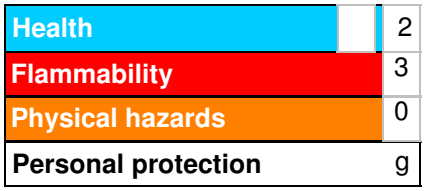
WHMIS (Canada) : Class B-2: Flammable liquid
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Canada (CEPA DSL): : All components are listed or exempted.

16 . Other information

Label requirements : FLAMMABLE LIQUID AND VAPOR. HARMFUL IF ABSORBED THROUGH SKIN OR IF SWALLOWED. INHALATION CAUSES HEADACHES, DIZZINESS, DROWSINESS AND NAUSEA AND MAY LEAD TO UNCONSCIOUSNESS. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. MAY CAUSE BLINDNESS IF SWALLOWED. PROLONGED OR REPEATED CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

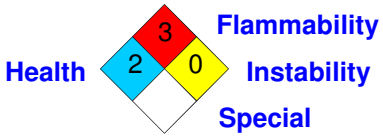
Hazardous Material Information System (U.S.A.) :



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :



Date of printing : **3/13/2012.**

Indicates information that has changed from previously issued version.

Notice to reader

16 . Other information

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : Enzyme G-NE

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Breaker

Code : 398381

Validation date : 9/22/2011.

Print date : 9/22/2011.

Version : 1.01

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Liquid.

Odor : Fermentation.

Color : Clear. to Dark- brown

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Emergency overview : Within the present knowledge of the supplier, this product does not contain any hazardous ingredients in quantities requiring reporting, in accordance with local regulations.

Avoid prolonged contact with eyes, skin and clothing.

Potential acute health effects

Inhalation : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Potential chronic health effects

Over-exposure signs/symptoms

Inhalation : None known.

Ingestion : None known.

Skin : None known.

Eyes : None known.

See toxicological information (section 11)

3 . Composition/information on ingredients

Name	CAS number	%
No hazardous ingredient		

4 . First aid measures

Eye contact : Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention if symptoms occur.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if symptoms occur.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Hazardous thermal decomposition products : No specific data.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking.

7 . Handling and storage

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
No exposure limit value known.											

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants. If this product contains ingredients with exposure limits, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted, air purifying or supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant gloves.

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state : Liquid.

Flash point : Not available.

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Color : Clear. to Dark- brown

Odor : Fermentation.

pH : 3.8 to 9

Boiling/condensation point : Not available.

Initial Boiling Point : Not available.

Melting/freezing point : Not available.

Relative density : 1

Density : 8.34 (lbs/gal)

Vapor density : Not available.

Odor threshold : Not available.

9 . Physical and chemical properties

Evaporation rate : Not available.

VOC : Not available.

Viscosity : Not available.

Solubility (Water) : Readily Soluble

Vapor pressure : Not available.

Pour Point : Not available.

Partition coefficient (LogKow) : Not available.

10 . Stability and Reactivity

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11 . Toxicological information

No additional information.

12 . Ecological information

Aquatic ecotoxicity

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	Not regulated.	-	-	-		-
TDG Classification	Not regulated.	-	-	-		-
IMDG Class	Not regulated.	-	-	-		-

14 . Transport information

IATA-DGR Class	Not regulated.	-	-	-		-

PG* : Packing group

DOT Reportable Quantity Not applicable.

Marine pollutant Not applicable.

North-America NAERG : Not available.

15 . Regulatory information

HCS Classification : Not regulated.

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products were found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products were found.

CERCLA: Hazardous substances.: No products were found.

Clean Air Act (CAA) 112 accidental release prevention: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :

Not listed

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

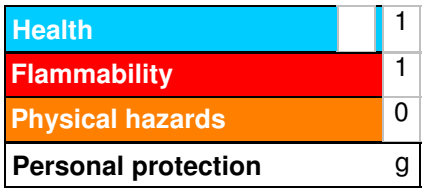
WHMIS (Canada) : Not controlled under WHMIS (Canada).

Canada (CEPA DSL): : Not determined.

16 . Other information

Label requirements : Within the present knowledge of the supplier, this product does not contain any hazardous ingredients in quantities requiring reporting, in accordance with local regulations.

Hazardous Material Information System (U.S.A.) :

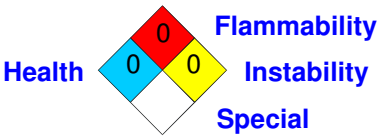


Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :

16 . Other information



Date of printing : **9/22/2011.**

Indicates information that has changed from previously issued version.

Notice to reader

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : Ferrotrol 300L

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Iron control

Code : 100091

Validation date : 1/15/2013.

Print date : 1/15/2013.

Version : 1.05

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Liquid.

Odor : Odorless.

Color : Clear. Light Yellow. to Brown.

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : WARNING!

CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION.

Do not get in eyes. Avoid breathing vapor or mist. Avoid contact with skin and clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Inhalation.

Potential acute health effects

Inhalation : Irritating to respiratory system.

Ingestion : Ingestion may cause gastrointestinal irritation and diarrhea.

Skin : Irritating to skin.

Eyes : Severely irritating to eyes. Risk of serious damage to eyes.

Potential chronic health effects

Over-exposure signs/symptoms

Inhalation : respiratory tract irritation, coughing

Ingestion : None known.

Skin : irritation, redness

Eyes : pain or irritation, watering, redness

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Citric acid	77-92-9	30 - 60

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Keep away from alkalis. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Separate from alkalis. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
No exposure limit value known.											

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted, air purifying or supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Recommended: particulate filter

Hands : Chemical-resistant gloves: butyl rubber

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state : Liquid.

Flash point : Not available.

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Color : Clear. Light Yellow. to Brown.

Odor : Odorless.

pH : <2

Boiling/condensation point : 105°C (221°F)

9 . Physical and chemical properties

Initial Boiling Point	:	Not available.
Melting/freezing point	:	-15 to -10°C (5 to 14°F)
Relative density	:	1.24 to 1.26
Density	:	10.32 to 10.49 (lbs/gal)
Vapor density	:	Not available.
Odor threshold	:	Not available.
Evaporation rate	:	Not available.
VOC	:	Not available.
Viscosity	:	Dynamic: 10 to 12 cP
Solubility (Water)	:	Completely Miscible
Vapor pressure	:	Not available.
Pour Point	:	Not available.
Partition coefficient (LogKow)	:	Not available.

10 . Stability and Reactivity

Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Hazardous polymerization	:	Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	:	No specific data.
Materials to avoid	:	Reactive or incompatible with the following materials: oxidizing materials, metals, acids and alkalis. Prolonged contact with incompatible metals may generate explosive hydrogen gas.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Conditions of reactivity	:	Non-flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Citric acid	LD50 Oral	Rat	3 g/kg	-
	LD50 Oral	Rat	11700 mg/kg	-

Chronic toxicity Remarks

1) Citric acid

Not available.

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Citric acid	Acute LC50 160000 ug/L Marine water	Crustaceans - Green or Europeon shore crab - Carcinus maenas - Adult	48 hours

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN3265	Corrosive liquid, acidic, organic, n.o.s. (Contains: Citric acid)	8	III		-
TDG Classification	UN3265	Corrosive liquid, acidic, organic, n.o.s. (Contains: Citric acid)	8	III		-
IMDG Class	UN3265	Corrosive liquid, acidic, organic, n.o.s. (Contains: Citric acid)	8	III		**Emergency schedules (EmS)** F-A, S-B
IATA-DGR Class	UN3265	Corrosive liquid, acidic, organic, n.o.s. (Contains: Citric acid)	8	III		-

PG* : Packing group

DOT Reportable Quantity Not applicable.

Marine pollutant Not applicable.

North-America NAERG : 153

15 . Regulatory information

HCS Classification : Irritating material

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: CITRIC ACID
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Ferrotrol 300L: Immediate (acute) health hazard

CERCLA: Hazardous substances.: No products were found.

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :

15 . Regulatory information

Not listed

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

WHMIS (Canada) : Class E: Corrosive material

Canada (CEPA DSL): : All components are listed or exempted.

16 . Other information

Label requirements : CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION.

Hazardous Material Information System (U.S.A.) :

Health	2
Flammability	1
Physical hazards	0
Personal protection	g

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :

Date of printing : **1/15/2013.**

Indicates information that has changed from previously issued version.

Notice to reader

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : FRW-18

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Friction Reducer.

Code : 488420

Validation date : 12/5/2012.

Print date : 12/5/2012.

Version : 2.02

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Liquid.

Odor : oil [Slight]

Color : Milky-white.opaque

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Emergency overview : MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION. HARMFUL OR FATAL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. ASPIRATION HAZARD.

Do not ingest. Avoid breathing vapor or mist. Avoid contact with eyes. Avoid prolonged or repeated contact with skin. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Inhalation : Slightly irritating to the respiratory system.

Ingestion : Aspiration hazard if swallowed. Can enter lungs and cause damage. Ingestion may cause gastrointestinal irritation and diarrhea.

Skin : Slightly irritating to the skin.

Eyes : Slightly irritating to the eyes.

Potential chronic health effects

Over-exposure signs/symptoms

Inhalation : respiratory tract irritation, coughing

Ingestion : nausea or vomiting

Skin : irritation, redness

Eyes : irritation, watering, redness

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Petroleum distillates	64742-47-8	10 - 30

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Special remarks on explosion hazards : Spills produce extremely slippery surfaces.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8). Surfaces subject to spills may become slippery.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact

6 . Accidental release measures

information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
Petroleum distillates	US ACGIH	-	200	-	-	-	-	-	-	-	[1]

[1]Absorbed through skin.

Consult local authorities for acceptable exposure limits.

Only components of this product with established exposure limits appear in the box above.

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted, air purifying or supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant gloves.

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state	:	Liquid.
Flash point	:	Closed cup: >93.33°C (>200°F)
Auto-ignition temperature	:	>215°C (>419°F)
Flammable limits	:	Not available.
Color	:	Milky-white.opaque
Odor	:	oil [Slight]
pH	:	Not available.
Boiling/condensation point	:	>100°C (>212°F)
Initial Boiling Point	:	Not available.
Melting/freezing point	:	<-20°C (<-4°F)
Relative density	:	1.06
Density	:	8.84 (lbs/gal)
Vapor density	:	Not available.
Volatility	:	50% (w/w)
Odor threshold	:	Not available.
Evaporation rate	:	Not available.
VOC	:	Not available.
Viscosity	:	Not available.
Solubility (Water)	:	Soluble as inverted emulsion
Vapor pressure	:	Not available.
Pour Point	:	Not available.
Partition coefficient (LogKow)	:	Not available.

10 . Stability and Reactivity

Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Hazardous polymerization	:	Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	:	No specific data.
Materials to avoid	:	Reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Conditions of reactivity	:	Slightly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat. Spills produce extremely slippery surfaces.

11 . Toxicological information

Carcinogenicity

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Petroleum distillates	A3	-	-	-	-	-

Chronic toxicity Remarks

1) Petroleum distillates

Not available.

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Petroleum distillates	Acute LC50 2200 ug/L Fresh water	Fish - Bluegill - Lepomis macrochirus - 35 to 75 mm	4 days

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	Not regulated.	-	-	-		-
TDG Classification	Not regulated.	-	-	-		-
IMDG Class	Not regulated.	-	-	-		-
IATA-DGR Class	Not regulated.	-	-	-		-

PG* : Packing group

DOT Reportable Quantity Not applicable.

Marine pollutant Not applicable.

North-America NAERG : Not available.

15 . Regulatory information

HCS Classification : Not regulated.

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products were found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: FRW-18: Immediate (acute) health hazard

CERCLA: Hazardous substances.: No products were found.

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

15 . Regulatory information

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :
Not listed

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

WHMIS (Canada) : Not controlled under WHMIS (Canada).

Canada (CEPA DSL): : All components are listed or exempted.

16 . Other information

Label requirements : MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION. HARMFUL OR FATAL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. ASPIRATION HAZARD.

Hazardous Material Information System (U.S.A.) :

Health	1
Flammability	0
Physical hazards	0
Personal protection	a

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :

Date of printing : **12/5/2012.**

Indicates information that has changed from previously issued version.

Notice to reader

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : FRW-26D

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Friction Reducer.

Code : 488633

Validation date : 8/29/2012.

Print date : 8/29/2012.

Version : 1

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Solid. [Granular.]

Odor : None.

Color : White.

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this MSDS contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.

Emergency overview : Within the present knowledge of the supplier, this product does not contain any hazardous ingredients in quantities requiring reporting, in accordance with local regulations.

Avoid prolonged contact with eyes, skin and clothing.

Potential acute health effects

Inhalation : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Skin : No known significant effects or critical hazards.

Eyes : No known significant effects or critical hazards.

Potential chronic health effects

Over-exposure signs/symptoms

Inhalation : None known.

Ingestion : None known.

Skin : None known.

Eyes : None known.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
No hazardous ingredient		

4 . First aid measures

Eye contact : Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention if symptoms occur.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if symptoms occur.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms occur.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention if symptoms occur.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training.

5 . Fire-fighting measures

Flammability of the product : No specific fire or explosion hazard.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Surfaces subject to spills may become slippery.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,nitrogen oxides

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Put on appropriate personal protective equipment (see Section 8). Surfaces subject to spills may become slippery.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Move containers from spill area. Vacuum or sweep up material and place in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor.

Large spill : Move containers from spill area. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Vacuum or sweep up material and place in a designated, labeled waste container. Dispose of via a licensed waste disposal contractor. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking.

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
No exposure limit value known.											

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : No special ventilation requirements. Good general ventilation should be sufficient to control worker exposure to airborne contaminants. If this product contains ingredients with exposure limits, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant gloves.

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state : Solid. [Granular.]

Flash point : Not available.

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Color : White.

Odor : None.

pH : 4 to 9 [Conc. (% w/w): 0.5%]

Boiling/condensation point : Not available.

Initial Boiling Point : Not available.

Melting/freezing point : Not available.

Relative density : Not available.

Density : Not available.

Vapor density : Not available.

Odor threshold : Not available.

Evaporation rate : Not available.

VOC : Not available.

Viscosity : Not available.

Solubility (Water) : Not available.

Vapor pressure : Not available.

Pour Point : Not available.

9 . Physical and chemical properties

Partition coefficient (LogKow) : Not available.

10 . Stability and Reactivity

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Conditions of reactivity : Slightly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
FRW-26D	LD50 Oral	Rat	>5000 mg/kg	-

Irritation/Corrosion

Conclusion/Summary

Skin : Rabbit Non-irritant to skin.

Eyes : Non-irritating to the eyes.

Sensitizer

Conclusion/Summary

Skin : Not sensitizing

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
FRW-26D	IC50 >100 mg/l	Algae	72 hours
	LC50 >100 mg/l	Daphnia	48 hours
	LC50 >100 mg/l	Fish	96 hours

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not readily biodegradable.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	Not regulated.	-	-	-		-
TDG Classification	Not regulated.	-	-	-		-
IMDG Class	Not regulated.	-	-	-		-
IATA-DGR Class	Not regulated.	-	-	-		-

PG* : Packing group

DOT Reportable Quantity Not applicable.

Marine pollutant Not applicable.

North-America NAERG : Not available.

15 . Regulatory information

HCS Classification : Not regulated.

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products were found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products were found.

CERCLA: Hazardous substances.: No products were found.

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :
Not listed

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

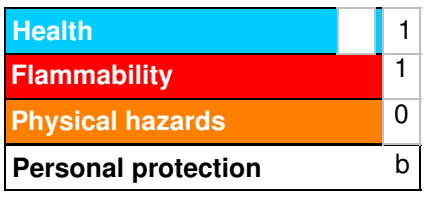
WHMIS (Canada) : Not controlled under WHMIS (Canada).

Canada (CEPA DSL): : All components are listed or exempted.

16 . Other information

Label requirements : Within the present knowledge of the supplier, this product does not contain any hazardous ingredients in quantities requiring reporting, in accordance with local regulations.

Hazardous Material Information System (U.S.A.) :



16 . Other information

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :

Date of printing : **8/29/2012.**

Indicates information that has changed from previously issued version.

Notice to reader

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : GW-3LDF

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Water gellant

Code : 411323

Validation date : 7/5/2012.

Print date : 7/5/2012.

Version : 2.04

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Liquid.

Odor : Hydrocarbon. [Slight]

Color : Opaque. [Light]

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : WARNING!

CAUSES EYE IRRITATION. MAY CAUSE RESPIRATORY TRACT AND SKIN IRRITATION. HARMFUL OR FATAL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER. ASPIRATION HAZARD.

Do not breathe vapor or mist. Do not ingest. Do not get in eyes. Avoid contact with skin and clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation.

Potential acute health effects

Inhalation : Slightly irritating to the respiratory system.

Ingestion : Harmful if swallowed. Aspiration hazard if swallowed. Can enter lungs and cause damage.

Skin : Moderately irritating to the skin.

Eyes : Severely irritating to eyes. Risk of serious damage to eyes.

Potential chronic health effects

Chronic effects : Contains material that may cause target organ damage, based on animal data.

Carcinogenicity : Contains material which can cause cancer. Risk of cancer depends on duration and level of exposure.The cancer risk associated with this product applies to the dry material. Inhalation exposure to respirable crystalline silica is expected to be zero (extremely low and within acceptable limits) when this product is in liquid form. See Chronic Toxicity Remarks in Section 11 of this MSDS.

Target organs : Contains material which may cause damage to the following organs: lungs, upper respiratory tract, eye, lens or cornea.

Over-exposure signs/symptoms

Inhalation : respiratory tract irritation, coughing

Ingestion : nausea or vomiting

2 . Hazards identification

Skin : irritation, redness

Eyes : pain or irritation, watering, redness

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Guar gum	9000-30-0	30 - 60
Petroleum distillates	64742-47-8	10 - 30
Paraffinic petroleum distillate	64742-55-8	10 - 30
Crystalline silica: Quartz (SiO2)	14808-60-7	1 - 5
Isotridecanol, ethoxylated	9043-30-5	1 - 5
1-Butoxy-2-propanol	5131-66-8	1 - 5

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wear suitable protective clothing and gloves. Remove contaminated clothing and shoes.

Additional information

If vomiting occurs, the head should be kept low so that vomit does not enter the lungs.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,metal oxide/oxides

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Use only with adequate ventilation. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
Guar gum, Inhalable fraction.	US ACGIH	-	10	-	-	-	-	-	-	-	
Guar gum, Total dust	OSHA PEL	-	15	-	-	-	-	-	-	-	
Petroleum distillates	US ACGIH	-	200	-	-	-	-	-	-	-	[1]
Paraffinic petroleum distillate	US ACGIH	-	5	-	-	-	-	-	-	-	[a]
	OSHA PEL	-	5	-	-	-	-	-	-	-	
Crystalline silica: Quartz (SiO2)	US ACGIH	-	0.025	-	-	-	-	-	-	-	[b]
Crystalline silica: Quartz (SiO2), as quartz	OSHA PEL 1989	-	0.1	-	-	-	-	-	-	-	[c][A]

[1]Absorbed through skin.
Form: [a]Inhalable fraction. See Appendix C, paragraph A. Inhalable Particulate Mass TLVs (IPM–TLVs) for those materials that are hazardous when deposited anywhere in the respiratory tract. [b]Respirable fraction; see Appendix C [c]Respirable dust
Notes: [A]as quartz

Consult local authorities for acceptable exposure limits.

Only components of this product with established exposure limits appear in the box above.

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

8 . Exposure controls/personal protection

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted, air purifying or supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant gloves: Neoprene gloves. , Nitrile gloves.

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state : Liquid.

Flash point : Closed cup: >93.333°C (>200°F)

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Color : Opaque. [Light]

Odor : Hydrocarbon. [Slight]

pH : Not available.

Boiling/condensation point : Not available.

Initial Boiling Point : Not available.

Melting/freezing point : Not available.

Relative density : Not available.

Density : 8.74 to 9.57 (lbs/gal)

Vapor density : Not available.

Odor threshold : Not available.

Evaporation rate : Not available.

VOC : Not available.

Viscosity : Not available.

Solubility (Water) : Not available.

Vapor pressure : Not available.

Pour Point : Not available.

Partition coefficient (LogKow) : Not available.

10 . Stability and Reactivity

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid : No specific data.

Materials to avoid : Reactive or incompatible with the following materials: oxidizing materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Conditions of reactivity : Slightly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Guar gum	LD50 Oral	Rabbit	7 g/kg	-
	LD50 Oral	Rat	6770 mg/kg	-
Paraffinic petroleum distillate	LC50 Inhalation Vapor	Rat	3900 mg/m3	4 hours
1-Butoxy-2-propanol	LD50 Dermal	Rabbit	3100 mg/kg	-
	LD50 Oral	Rat	5660 uL/kg	-

Carcinogenicity

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Petroleum distillates	A3	-	-	-	-	-
Paraffinic petroleum distillate	A4	-	-	-	-	-
Crystalline silica: Quartz (SiO2)	A2	1	-	+	Proven.	+

Chronic toxicity Remarks

1) Guar gum

Not available.

2) Petroleum distillates

Not available.

3) Paraffinic petroleum distillate

Not available.

4) Crystalline silica: Quartz (SiO2)

Chronic inhalation of respirable crystalline silica may result in shortness of breath, dyspnea (difficult breathing) and dry cough. These symptoms are generally a first sign of a pulmonary disease called Silicosis. The development of Silicosis generally occurs over many years of exposure. The occurrence of Silicosis is most common in persons who have received prolonged and repeated exposure to the silica dust (e.g. sandblasting and quartz mining operations). In mild cases of Silicosis there is little or no signs of disease; however, the disease may progress after exposure has stopped.

Free crystalline silica is listed as a Group 1 carcinogen (carcinogenic to humans) by IARC. This classification applies to the inhalation of respirable crystalline silica. (IARC - International Agency for Research on Cancer)

5) Isotridecanol, ethoxylated

Not available.

6) 1-Butoxy-2-propanol

Not available.

11 . Toxicological information

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Guar gum	Acute LC50 42000 ug/L Fresh water	Daphnia - Water flea - Daphnia magna - Neonate	48 hours
	Acute LC50 218000 ug/L Fresh water	Fish - Rainbow trout,donaldson trout - Oncorhynchus mykiss	96 hours
Petroleum distillates	Acute LC50 2200 ug/L Fresh water	Fish - Bluegill - Lepomis macrochirus - 35 to 75 mm	4 days
Isotridecanol, ethoxylated	EC50 17 mg/l	Algae - Desmodesmus subspicatus	72 hours
	EC50 8.2 mg/l	Algae - Desmodesmus subspicatus (green algae)	72 hours
	EC50 2.5 mg/l	Daphnia	48 hours
	EC50 4.7 mg/l	Daphnia	48 hours
	LC50 5.8 mg/l	Fish - Danio rerio (zebra fish)	96 hours
	LC50 12 mg/l	Fish - Danio rerio (zebra fish)	96 hours

Conclusion/Summary : Based on IMDG, following their criteria for ecotoxicity and biodegradability, the isotridecanol, ethoxylated is not a Marine Pollutant.

Biodegradability

Product/ingredient name	Test	Result	Dose	Inoculum
Isotridecanol, ethoxylated	OECD 301A	>70 % - Readily - 28 days	-	-
	OECD 301B	>60 % - Readily - 28 days	-	-

Conclusion/Summary : Based on IMDG, following their criteria for ecotoxicity and biodegradability, the isotridecanol, ethoxylated is not a Marine Pollutant.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	Not regulated.	-	-	-		-
TDG Classification	Not regulated.	-	-	-		-
IMDG Class	Not regulated.	-	-	-		-
IATA-DGR Class	Not regulated.	-	-	-		-

14 . Transport information

PG* : Packing group

DOT Reportable Quantity Not applicable.

Marine pollutant Not applicable.

North-America NAERG : Not available.

15 . Regulatory information

HCS Classification : Irritating material
Carcinogen
Target organ effects

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Quartz (SiO2)
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: GW-3LDF: Immediate (acute) health hazard

CERCLA: Hazardous substances.: No products were found.

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :
Not listed

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

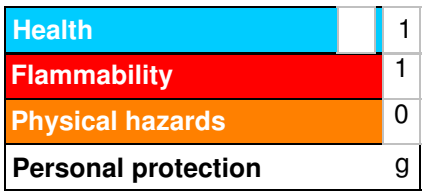
WHMIS (Canada) : Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Canada (CEPA DSL): : All components are listed or exempted.

16 . Other information

Label requirements : CAUSES EYE IRRITATION. MAY CAUSE RESPIRATORY TRACT AND SKIN IRRITATION. HARMFUL OR FATAL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER. ASPIRATION HAZARD.

Hazardous Material Information System (U.S.A.) :



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :

16 . Other information

Date of printing : **7/5/2012.**

Indicates information that has changed from previously issued version.

Notice to reader

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The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet 05/24/2019

1 . Product and company identification

Product name : SCALETROL 720

Supplier : Baker Hughes, Inc.
12645 W. Airport Blvd.
Sugar Land, TX 77478
For Product Information/MSDSs Call: 281-351-8131

Material Uses : Special: Scale Inhibitor

Code : 488265

Validation date : 12/28/2011.

Print date : 12/28/2011.

Version : 2

Responsible name : Global Regulatory Affairs - Telephone 281-276-5400 or 800-231-3606

In case of emergency : CHEMTREC 800-424-9300 (U.S. 24 hour)
(001)281-276-5400
CANUTEC 613-996-6666 (Canada 24 hours)CHEMTREC Int'l 01-703-527-3887 (International 24 hour)

2 . Hazards identification

Physical state : Liquid. [Clear.]

Odor : Mild.

Color : Colorless to light yellow.

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : CAUTION!

MAY BE HARMFUL IF SWALLOWED. MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

Do not ingest. Avoid breathing vapor or mist. Avoid contact with eyes, skin and clothing. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Inhalation.

Potential acute health effects

Inhalation : Slightly irritating to the respiratory system.

Ingestion : Harmful if swallowed.

Skin : Moderately irritating to the skin.

Eyes : Moderately irritating to eyes.

Potential chronic health effects

Chronic effects : Contains material that may cause target organ damage, based on animal data.

Target organs : Contains material which may cause damage to the following organs: kidneys, the nervous system, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.

Over-exposure signs/symptoms

Inhalation : respiratory tract irritation, coughing

Ingestion : None known.

Skin : irritation, redness

Eyes : irritation, watering, redness

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Ethylene glycol	107-21-1	10 - 30
Calcium chloride (CaCl2)	10043-52-4	1 - 5

4 . First aid measures

Eye contact : Get medical attention immediately. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

5 . Fire-fighting measures

Flammability of the product : In a fire or if heated, a pressure increase will occur and the container may burst.

Extinguishing media

Suitable : Use an extinguishing agent suitable for the surrounding fire.

Not suitable : None known.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Hazardous thermal decomposition products : carbon dioxide,carbon monoxide,halogenated compounds,metal oxide/oxides

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Absorb with an inert material. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Dike spill area and do not allow product to reach sewage system or surface or ground water. Notify any reportable spill to authorities. (See section 12 for environmental risks and 13 for disposal information.) Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

If RQ (Reportable Quantity) is exceeded, report to National Spill Response Office at 1-800-424-8802.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8 . Exposure controls/personal protection

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			
Ingredients:	List name	ppm	mg/m³	Other	ppm	mg/m³	Other	ppm	mg/m³	Other	Notations
Ethylene glycol	US ACGIH OSHA PEL 1989	- -	- -	- -	- -	- -	- -	- 50	100 125	- -	[a]

Form: [a]Aerosol

Consult local authorities for acceptable exposure limits.

Only components of this product with established exposure limits appear in the box above.

If OSHA permissible exposure levels are shown above they are the OSHA 1989 levels or are from subsequent OSHA regulatory actions. Although the 1989 levels have been vacated the 11th Circuit Court of Appeals, Baker Hughes recommends that these lower exposure levels be observed as reasonable worker protection.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Take off contaminated clothing and wash before reuse.

Personal protection

Respiratory : If a risk assessment indicates it is necessary, use a properly fitted, air purifying or supplied air respirator complying with an approved standard. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant gloves.

Eyes : Wear chemical safety goggles. When transferring material wear face-shield in addition to chemical safety goggles.

Skin : Wear long sleeves and other protective clothing to prevent repeated or prolonged skin contact.

9 . Physical and chemical properties

Physical state : Liquid. [Clear.]

Flash point : Closed cup: >93.4°C (>200.1°F) [TCC]

Auto-ignition temperature : Not available.

Flammable limits : Not available.

Color : Colorless to light yellow.

Odor : Mild.

9 . Physical and chemical properties

pH	:	6 to 8
Boiling/condensation point	:	Not available.
Initial Boiling Point	:	Not available.
Melting/freezing point	:	Not available.
Relative density	:	1.19
Density	:	9.91 (lbs/gal)
Vapor density	:	Not available.
Odor threshold	:	Not available.
Evaporation rate	:	Not available.
VOC	:	Not available.
Viscosity	:	Not available.
Solubility (Water)	:	Complete.
Vapor pressure	:	Not available.
Pour Point	:	Not available.
Partition coefficient (LogKow)	:	Not available.

10 . Stability and Reactivity

Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Hazardous polymerization	:	Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	:	No specific data.
Materials to avoid	:	Reactive or incompatible with the following materials: oxidizing materials and alkalis. Slightly reactive or incompatible with the following materials: acids.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Conditions of reactivity	:	Slightly flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Ethylene glycol	LD50 Dermal	Rabbit	9530 uL/kg	-
	LD50 Oral	Rat	4700 mg/kg	-
	LD50 Oral	Female rat	4000 mg/kg	-
Calcium chloride (CaCl2)	LD50 Oral	Rat	1 g/kg	-
	LD50 Oral	Rabbit	1384 mg/kg	-

Carcinogenicity Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Ethylene glycol	A4	-	-	-	-	-

Chronic toxicity Remarks

1) Ethylene glycol

Ethylene glycol (EG) is a component of this product. Chronic ingestion has shown to cause adverse kidney, liver, bladder, and blood effects in laboratory animals (NTP Technical Report, 1993; Fund. Appl. Toxicol. 7:547-65; FD Cosmet Toxicol. Vol. 3:229-34; Drug and Chem Toxicol 13(1):43-70). Also, chronic ingestion has caused adverse effect on the sperm (decreased motility and increased percentage of abnormal sperm) in laboratory animals. [Morrissey, R.E. et al, 1988, Fund Appl Toxicol, 11(2), pp 359-71]

Ingestion of ethylene glycol has produced Central Nervous System depression, effects on the cardiopulmonary system, and neurological impairment. [Gosselin, R.E., Smith, R.P., and Hodge, H.C., 1984, Clinical Toxicology of Commercial Products;

11 . Toxicological information

NTP Techical Report 413, 1993; CCOHS CHEMINFO, 2003, Record No. 41 for ethylene glycol; Mallya, K.B. et al, 1986, J Neurol Sce, 13(4) pp 340-41; Anderson, B. , 1990, Am J. Med, 88, pp 87-88]

EG is an animal teratogen at doses which produced mild toxicity to the mother. EG given at doses up to 5,000 mg/kg/day to pregnant rats or up to 3,000 mg/kg/day to mice induced a wide variety of fetal malformations, including those of the musculoskeletal, bone marrow, and spleen (RTECS, 1996). It was also a teratogen and an embryotoxin at doses producing no toxicity to the mother in laboratory animals. (Lamb, J.C. et al, 1985, Toxicol Appl Pharmacol, 81, p 100 and Price, C.J. et al, 1985, Appl Pharmacol, 81, pp113-27)

Ethylene glycol is used to cryopreserve embryos of many mammalian species, including pigs, goats, cows and horses (Otoi et al, 1995; Fieni et al, 1995; Hochi et al, 1994). This makes it unlikely that ethylene glycol itself is the active teratogen in whole animal studies. The EG metabolite, glycolic acid, was active in contrast to EG itself for inducing developmental defects in whole rat embryos in culture (Carney et al, 1996). EG inhibited metabolic cooperation of Chinese hamster cells in vitro, a finding which may have implications for its mechanism of teratogenicity (Loch-Caruso et al, 1984).

2) Calcium chloride (CaCl2)

Calcium chloride is a component of this product. Calcium chloride has been found to cause mutagenic effects, and tumors in tests on laboratory animals (Vendor MSDS). Prolonged inhalation has resulted in perforation of the nasal septum (HSDB, 1998). Prolonged inhalation has resulted in perforation of the nasal septum (HSD, 1998).

12 . Ecological information

Aquatic ecotoxicity

Product/ingredient name	Result	Species	Exposure
Ethylene glycol	Acute LC50 >100000 ug/L Marine water	Crustaceans - Common shrimp, sand shrimp - Crangon crangon - Adult	48 hours
	Acute LC50 6900000 to 8800000 ug/L Fresh water	Daphnia - Water flea - Ceriodaphnia dubia - Neonate	48 hours
	Acute LC50 8050000 ug/L Fresh water	Fish - Fathead minnow - Pimephales promelas - <=7 days	96 hours
	Chronic NOEC 11610000 ug/L Fresh water	Daphnia - Water flea - Ceriodaphnia dubia - <=24 hours	48 hours
	Chronic NOEC 6090000 ug/L Fresh water	Fish - Fathead minnow - Pimephales promelas - <=7 days	96 hours
Calcium chloride (CaCl2)	Acute EC50 52000 ug/L Fresh water	Daphnia - Water flea - Daphnia magna - 12 hours	48 hours
	Acute LC50 270 mg/L Marine water	Crustaceans - Opossum shrimp - Americamysis bahia - 4 to 5 days	48 hours
	Acute LC50 2110 mg/L Fresh water	Fish - Fathead minnow - Pimephales promelas	96 hours
	Chronic NOEC 260.12 mg/L Marine water	Crustaceans - Opossum shrimp - Americamysis bahia - 4 to 5 days	48 hours
	Chronic NOEC 0.75 g/L Fresh water	Daphnia - Water flea - Daphnia magna - 5 days	48 hours

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13. Disposal considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

13. Disposal considerations

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
DOT Classification	UN3082	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Contains: Ethylene glycol)	9	III		**Remarks** This material is Not Regulated if transported in a package that does not meet or exceed the Reportable Quantity (RQ).
TDG Classification	Not regulated.	-	-	-		-
IMDG Class	Not regulated.	-	-	-		-
IATA-DGR Class	Not regulated.	-	-	-		-

PG* : Packing group

DOT Reportable Quantity Ethylene glycol, 1682 gal of this product.

Marine pollutant Not applicable.

North-America NAERG : 171

15 . Regulatory information

HCS Classification : Irritating material
Target organ effects

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Ethylene glycol; CALCIUM CHLORIDE
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: SCALETROL 720: Immediate (acute) health hazard, Delayed (chronic) health hazard

CERCLA: Hazardous substances.: Ethylene glycol: 5000 lbs. (2270 kg);

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

Clean Air Act Section 112(b) Hazardous Air Pollutants (HAPs) :
Listed

SARA 313

	Product name	CAS number	Concentration
Supplier notification :	Ethylene glycol	107-21-1	10 - 30

United States inventory (TSCA 8b) : All components are listed or exempted.

Canada

15 . Regulatory information

WHMIS (Canada) : Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Canada (CEPA DSL): : At least one component is not listed.

16 . Other information

Label requirements : MAY BE HARMFUL IF SWALLOWED. MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION. CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

Hazardous Material Information System (U.S.A.) :

Health	1
Flammability	1
Physical hazards	0
Personal protection	b

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.) :

Date of printing : **12/28/2011.**

Indicates information that has changed from previously issued version.

Notice to reader

NOTE: The information on this MSDS is based on data which is considered to be accurate. Baker Hughes, however, makes no guarantees or warranty, either expressed or implied of the accuracy or completeness of this information.

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.

This MSDS was prepared and is to be used for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

	BJ SERVICES COMPANY MATERIAL SAFETY DATA SHEET	Region USA

SECTION I - GENERAL INFORMATION

PRODUCT NAME:	**Frac Sand (All Meshes)**
ITEM NUMBER:	See specific Sand for item number.
CHEMICAL DESCRIPTION:	Silica Sand (various mesh sizes)
PRODUCT USE:	Proppant
SUPPLIER:	BJ Services Company
ADDRESS:	11211 FM 2920 Tomball, TX 77375
EMERGENCY TELEPHONE NUMBER	(800)424-9300 for CHEMTREC (202)483-7616 Alaska and International
PREPARED BY:	BJ Services Environmental Group (281)351-8131
DATE PREPARED:	August 31, 2000 Supersedes: January 26, 2000

HMIS HAZARD INDEX

HEALTH:	2
FLAMMABILITY:	0
REACTIVITY:	0
PERSONAL PROTECTION:	e

SECTION II - HAZARDOUS COMPONENTS

HAZARDOUS COMPONENTS	CAS #	PERCENT	HAZARD
Crystalline silica (quartz)	14808-60-7	89.0 – 99.9	Respiratory irritant

SECTION III - FIRE AND EXPLOSION HAZARD DATA

FLASHPOINT (METHOD):	N.A.
UPPER EXPLOSION LIMIT(% BY VOL):	N.A.
LOWER EXPLOSION LIMIT(% BY VOL):	N.A
AUTO-IGNITION TEMPERATURE:	N.A.
EXTINGUISHING MEDIA:	N.A. Material does not burn
SPECIAL FIRE FIGHTING PROCEDURES:	None
EXPLOSION DATA:	N.A.
HAZARDOUS COMBUSTION PRODUCTS:	Silica will dissolve in hydrofluoric acid and produce a corrosive gas, silicon tetrachloride.

SECTION IV - HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY: Inhalation

ACUTE OVEREXPOSURE EFFECTS:

SKIN CONTACT:	No effects
SKIN ABSORPTION:	Not absorbed by skin.
EYE CONTACT:	Crystalline silica (quartz) may cause abrasion of the cornea.
INHALATION:	Respirable crystalline silica (quartz) can cause silicosis, a fibrosis (scarring) of the lungs. Silicosis may be progressive; it may lead to disability and death. Silicosis is associated with the increased incidence of scleroderma and increases the risk of tuberculosis and incidence of kidney disorders. There are generally no signs or symptoms of exposure to crystalline silica (quartz). Often, chronic silicosis has no symptoms. The symptoms of chronic silicosis, if present, are shortness of breath, wheezing, cough and sputum production. The condition of individuals with lung disease (e.g., bronchitis, emphysema, chronic obstructive pulmonary disease) can be aggravated by exposure.
INGESTION:	None

CHRONIC OVEREXPOSURE EFFECTS: Excessive inhalation of dust may result in silicosis, cancer, scleroderma, tuberculosis, and nephrotoxicity.

EXPOSURE LIMITS:

HAZARDOUS COMPONENT	ACGIH TLV	OSHA PEL
Crystalline silica (quartz)	0.1 mg/m3 (respirable dust)	10 mg/m3

CARCINOGENICITY, REPRODUCTIVE EFFECTS:
IARC: Crystalline silica (quartz) is classified in IARC Group 1.
NTP: Respirable crystalline silica (quartz) is reasonably anticipated to be a carcinogen.
OSHA: Does not regulate crystalline silica (quartz) as a carcinogen.

TERATOGENICITY, MUTAGENICITY:
No effects listed.

TOXICITY STUDIES:
LD(50) N.E.
LC(50) N.E.

SECTION V - FIRST AID PROCEDURES

FOR EYES:	Wash immediately with water. If irritation persists, seek medical attention.
FOR SKIN:	N.A.
FOR INHALATION:	No specific first-aid is necessary since the adverse health effects associated with exposure to crystalline silica (quartz) result from chronic exposures. If there is a gross inhalation of crystalline silica (quartz), remove the person immediately to fresh air, give artificial respiration as needed, seek medical attention as needed.
FOR INGESTION:	N.A.

SECTION VI - PHYSICAL DATA

APPEARANCE AND ODOR:	White or tan [redacted]; granular with no odor
SPECIFIC GRAVITY:	2.65
VAPOR PRESSURE:	N.A.
VAPOR DENSITY (air=1):	N.A
EVAPORATION RATE:	N.A.
BOILING POINT:	4046°F
FREEZING POINT:	N.A.
SOLUBILITY IN H20:	Insoluble
pH:	N.A.

SECTION VII - REACTIVITY DATA

CHEMICAL STABILITY:	Stable
INCOMPATIBLE MATERIALS:	Contact with powerful oxidizing agents such as fluorine, chlorine trifluoride, and oxygen difluoride may cause fires.
HAZARDOUS POLYMERIZATION:	Does not polymerize
HAZARDOUS DECOMPOSITION PRODUCTS:	Silica will dissolve in hydrofluoric acid and produce a corrosive gas, silicon tetrafluoride.

SECTION VIII - SPECIAL/PERSONAL PROTECTION

VENTILATION:	The use of mechanical ventilation is recommended whenever this product is used in a confined space. Where engineering controls are not feasible, assure use is in an area where there is natural air movement.
RESPIRATORY PROTECTION:	Dust mask under normal conditions. Dust respirator if high concentrations exist.
PROTECTIVE GLOVES:	Rubber
EYE PROTECTION:	Goggles
OTHER PROTECTIVE EQUIPMENT:	Eyewash bottles or other rinsing equipment should be easily accessible.

SECTION IX - HANDLING PRECAUTIONS

LEAK AND SPILL PROCEDURES:	Collect using a dustless method (vacuum) and place into closable container for disposal. Do not dry sweep. Wear protective equipment.
WASTE DISPOSAL:	If this product becomes a waste it does not meet the requirements of a RCRA hazardous waste. Always dispose of according to all local/state/and federal regulations.
HANDLING & SPECIAL EQUIPMENT:	Do not breathe dust. Use with adequate ventilation and dust collection. Keep airborne dust concentrations below PEL. Practice good housekeeping. Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Wash clothing which has become dusty.
STORAGE REQUIREMENTS:	Store in a cool, dry, well ventilated area. Do not permit accumulation of dusts. Avoid breakage of bagged material or spills of bulk material.

SECTION X - REGULATORY INFORMATION

SHIPPING INFORMATION

PROPER SHIPPING NAME:	Not DOT Regulated
HAZARD CLASS:	N.A.
UN/NA NUMBER:	N.A.
PACKING GROUP W/ "PG":	N.A.
SUBSIDIARY RISK:	N.A.
REPORTABLE QUANTITY (RQ):	N.A.
EMERGENCY RESPONSE GUIDE #:	N.A.

ENVIRONMENTAL INFORMATION

SARA TITLE III

SECTION 302/304	This product does not contain ingredients listed as an Extremely Hazardous Substance.
SECTION 311/312	Delayed
SECTION 313	This product does not contain ingredients (at a level of 1% or greater) on the List of Toxic Chemicals.

OTHER REGULATORY INFORMATION

TSCA INVENTORY:	All of the components in this appear on the TSCA inventory.
CALIFORNIA PROP 65:	This product contains crystalline silica, known to the State of California to cause cancer.

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.