

12/11/17

Mr. Mitch Little
Hellman & Associates
11913 W Interstate 70 Frontage Rd N
Wheat Ridge, CO 80033

H2S Analysis by GC-FPD

Dear Mr. Little,

APT Laboratory Services was delivered six gas phase samples in foil lined Tedlar bags on December 6, 2017. An H2S analysis was performed by APT on December 7, 2017, utilizing a modified ASTM Method D5504. A three-point calibration was performed on a HP 5890 gas chromatograph equipped with a flame photometric detector. Samples were analyzed in triplicate for hydrogen sulfide and a post calibration check was performed to show the stability of the instrument. All calibrations and sample results are enclosed. A summary of the results is shown below.

Hellman & Associates – H2S by GC-FPD, December 7, 2017	
Sample	H2S Conc. (ppm)
Razor 25B Test Separator 171205	36.3
Horsetail 08C WH1738 171205	23.5
Razor 25 M,N Test Separator 171205	15.4
Razor 25M WH2401 171205	52.0
Horsetail 08D WH1734 171205	29.4
Horsetail 08D WH1735 171205	30.2
Razor 25B WH2449 171205	31.2
Horsetail 08D WH1704 171205	178.3
Horsetail 08 B,C Production Separator 171205	44.2
Horsetail 08D WH1703 171205	95.9
Horsetail 08D Production Separator 171205	53.0
Razor 25B WH2551 171205	27.8
Razor 25B Production Separator 171205	59.5
Razor 25B WH2549 171205	26.3
Razor 25 M,N Production Separator 171205	33.7
Razor 25 O,P Production Separator 171205	22.6

Modified ASTM D5504 Results

DENVER OFFICE
5530 Marshall Street
Arvada, CO 80002
(303) 420-5949
FAX (303) 420-5920
(800) 268-6213

We look forward to being of service to Hellman & Associates in the future. Please call me with any questions or comments at (303) 420-5949 or (800) 268-6213.

Regards,



Daniel Williams
Asst Director of Laboratory Services

APT Project: LWTO7153

Hellman & Associates

Wheat Ridge, CO

12/7/2017

Modified ASTM D5504: Determination of Gaseous Reduced Sulfur Compounds using Gas Chromatography

Initial Three-Point Calibration									
Low Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1		Inj. 2		Inj. 3		Average	
		RT	AC	RT	AC	RT	AC	RT	AC
Hydrogen Sulfide	10.13	1.987	43140.2	1.989	42152.1	1.988	42717.4	1.988	42670
Low-Mid Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1		Inj. 2		Inj. 3		Average	
		RT	AC	RT	AC	RT	AC	RT	AC
Hydrogen Sulfide	40.50	1.989	346644.0	1.989	373033.1	1.989	366323.3	1.989	362000
High-Mid Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1		Inj. 2		Inj. 3		Average	
		RT	AC	RT	AC	RT	AC	RT	AC
Hydrogen Sulfide	81.00	1.989	1303835.7	1.989	1324632	1.989	1305918.4	1.989	1311462
High Level Calibration Standard									
Cpd ID	Conc. (ppm)	Inj. 1		Inj. 2		Inj. 3		Average	
		RT	AC	RT	AC	RT	AC	RT	AC
Hydrogen Sulfide	162.00	1.989	5032009.0	1.989	4953181	1.989	5200956.5	1.989	5062049

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Wheat Ridge, CO
12/7/2017

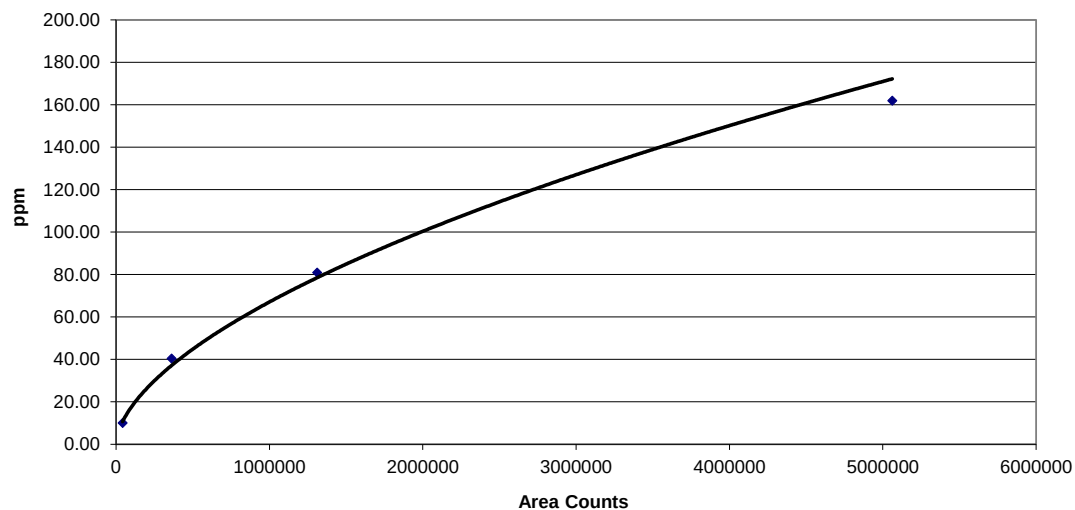
Modified ASTM D5504: Determination of Gaseous Reduced Sulfur Compounds using Gas Chromatography

Power Regression Calculations

$$\text{conc} = A \cdot \text{area}^B$$

Hydrogen Sulfide					
Certified ppm	Average AC	Power Regression Statistics			ppm from curve
		R ²	A	B	
10.13	42670	0.9970	0.021764	0.581459	10.71
40.50	362000				37.14
81.00	1311462				78.52
162.00	5062049				172.20

Hydrogen Sulfide



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Wheat Ridge, CO

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Modified ASTM D5504: Determination of Gaseous Reduced Sulfur Compounds using Gas Chromatography

Sample Analysis									
Razor 25B Test Separator 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.988	357459.6	1.989	343115	1.989	341507.6	1.989	347361	Y 36.26
Horsetail 08C WH1738 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.989	166625.7	1.989	164805.3	1.988	164254.1	1.989	165228	Y 23.54
Razor 25 M,N Test Separator 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.990	78338.9	1.989	82038.8	1.988	79620.6	1.989	79999	Y 15.44
Razor 25M WH2401 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.988	637346.1	1.988	641178.5	1.989	659391.8	1.988	645972	Y 52.02
Horsetail 08D WH1734 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.989	243976.1	1.988	251667.4	1.989	232311.6	1.989	242652	Y 29.44
Horsetail 08D WH1735 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.988	260798.2	1.988	253654.4	1.988	247009.3	1.988	253821	Y 30.22
Razor 25B WH2449 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.989	265513.4	1.989	265256.2	1.989	271476.6	1.989	267415	Y 31.15
Horsetail 08D WH1704 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.989	5233426.5	1.988	5415804	1.989	5466369	1.989	5371866	Y 178.25

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12/7/2017

Modified ASTM D5504: Determination of Gaseous Reduced Sulfur Compounds using Gas Chromatography

Sample Analysis									
Horsetail 08 B,C Production Separator 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.989	475572.7	1.988	502245.4	1.988	485215.2	1.988	487678	Y 44.17
Horsetail 08D 1703 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.989	1821597.4	1.988	1854245	1.989	1877019	1.989	1850954	Y 95.93
Horsetail 08D Production Separator 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.988	677180.4	1.988	658735.4	1.988	665681.7	1.988	667199	Y 53.00
Razor 25B WH2551 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.988	219267.8	1.989	230100	1.988	209645	1.988	219671	Y 27.78
Razor 25B Production Separator 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.988	829453.1	1.988	802754.6	1.989	811282.6	1.988	814497	Y 59.52
Razor 25B WH2549 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.989	206766.1	1.989	196491	1.989	196758.2	1.989	200005	Y 26.31
Razor 25 M,N Production Separator 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.988	308818	1.989	298278.2	1.988	309419.8	1.988	305505	Y 33.66
Razor 25 O,P Production Separator 171205									
Cpd ID	Inj. 1		Inj. 2		Inj. 3		Average		
	RT	AC	RT	AC	RT	AC	RT	AC	OK? ppm
Hydrogen Sulfide	1.988	153247.2	1.988	154336.7	1.989	153762.8	1.988	153782	Y 22.58



Hellman & Associates

Wheat Ridge, CO

12/7/2017

Modified ASTM D5504: Determination of Gaseous Reduced Sulfur Compounds using Gas Chromatography

Quality Assurance													
Recovery / Spike (mid-level calibration gas to the sample probe)													
Cpd ID	Conc. (ppm)	Inj. 1		Inj. 2		Inj. 3		Average			Triplicate OK?	Recovery OK?	Audit OK?
		RT	AC	RT	AC	RT	AC	RT	AC	ppm			
Hydrogen Sulfide	40.50	1.989	388800.6	1.99	396820.2	1.99	402438.9	1.990	396020	39.14	Y	Y	Y

CHAIN OF CUSTODY - Shipping Receipt

Temperature on Receipt _____

AIR POLLUTION TESTING
5530 MARSHALL ST.
ARVADA, CO 80002
T. 303.420.5949
F. 303.420.5948

Record all of the unit temperatures, unit pressures, collection dates and ambient conditions.

Project Manager

CHAIN OF CUSTODY #

Page _____ of _____

PROJECT CODE

66707153

TELEPHONE # / FAX #

1-800-444-4444

CLIENT NAME

Helen & Associates, Inc.

DATE

12/05/17

CONTRACT/PURCHASE/QUOTE #

11913101-70 Forage (24N)

CITY

Wheat Ridge

STATE

CO

ZIP CODE

80033

SITE CONTACT

LAB CONTACT

LAB NUMBER

303-420-5949 x 22

CARRIER / WAREHOUSE

LAB CONTACT

LAB NUMBER

303-420-5949 x 22

SITE NAME

WELL ID & SAMPLE

Cylinder #

Time of Last Cycle

Sample Port Surface Temp (°F) (prepost)

Probe Pressure (psi) (prepost)

Sample Cylinder Surf. Temp. (°F)

Separator Gauge Pressure (psi)

Separator Gauge Temperature (°F)

Ambient T (°F)

Ambient P (psi)

Start/Stop Time

Date Collected

Sampler's Initials

Analysis Method

ASTM D5504

171205

Horizontal 08C WH1738

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1735

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1704

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1734

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1734

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1734

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1734

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1734

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1734

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Horizontal 08D WH1734

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

171205

Notes:

For WH's put designation before WH # (WH)

1. Relinquished By

12/06/17

Date

11:30

Time

1. Received By

12-6-17

Date

11:30

Time

2. Relinquished By

12-6-17

Date

11:30

Time

2. Received By

12-6-17

Date

11:30

Time

2. Relinquished By

12-6-17

Date

11:30

Time

2. Received By

12-6-17

Date

11:30

Time

2. Relinquished By

12-6-17

Date

11:30

Time

2. Received By

12-6-17

Date

Time

3. Relinquished By

12-6-17

Date

11:30

Time

3. Received By

12-6-17

Date

11:30

Time

3. Relinquished By

12-6-17

Date

11:30

Time

3. Received By

12-6-17

Date

Time

Comments:

CHAIN OF CUSTODY RECORD - Shipping Receipt

Temperature on Receipt _____

AIR POLLUTION TESTING
5530 MARSHALL ST.
ARVADA, CO 80002
T (303) 426-0400
F (303) 426-0400

Record all of the unit temperatures, unit pressures, collection dates and ambient conditions.

PROJECT CODE

LW70 715 3

Project Manager

MTH LTH

CLIENT NAME

Heliman and Assoc.

TELEPHONE # / FAX #

Page _____ of _____

ADDRESS

11913 W. 170 Frontage Rd. W.

DATE 12/05/17

CONTRACT/INVOICE/QUOTE #

CITY

Westcliffe

STATE

CO

ZIP CODE

80033

SITE CONTACT

LAB CONTACT

Mike Pearson

LAB NUMBER

303-420-5949 X 22

CARRIER /WAYBILL #

SITE NAME

WELL ID & SAMPLE

Cylinder #

Time of Last Cycle

Sample Port Surface Temp (°F) (pre/post)

Probe Pressure (psi) (pre/post)

Sample Cylinder Surf. Temp. (°F)

Separator Gauge Pressure (psi)

Separator Gauge Temperature (°F)

Ambient T (°F)

Ambient P (psi)

Start/Stop Time

Date Collected

Sampler's Initials

Analysis Method

ASTM D5504

Razor 25B

2549 WH 171205

Razor 25B

Production Sep 171205

Hosetai 108D

1703 WH 171205

Hosetai 108D

Production Sep 171205

Razor 25 WH

0.8 Production Sep 171205

Razor 25B

2551 WH 171205

Razor 25

MIN Production 171205 Separator

Notes:

For WHs put designation before WH # (WH#)

1. Relinquished By

Date

Time

2. Received By

Date

Time

2. Relinquished By

Date

Time

3. Received By

Date

Time

3. Relinquished By

Date

Time

4. Received By

Date

Time

Comments:

LTH F1 LTH

Landon Bunkert