

### CORROSION BACTERIA EVALUTATION

PROJECT NO. : 201505098  
COMPANY NAME : PIONEER NATURAL RESOURCES

ANALYSIS NO. : 01  
ANALYSIS DATE: MAY 25, 2015  
SAMPLE DATE : MAY 20, 2015 07:00  
CYLINDER NO. : 1 QT JAR

ACCOUNT NO. :  
NAME/DESCRIP : BILL HEIMER 31-33-1652H  
FRAC TANK WATER 07:00

\*\*\*FIELD DATA\*\*\*

SAMPLED BY : PIONEER CREW MEMBER  
SAMPLE PRES. :  
COMMENTS : SPOT

SAMPLE TEMP. :  
AMBIENT TEMP.:

<u>TEST PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>REPORTED RESULTS</u>	<u>UNITS</u>
APB	API RP38		Strong	colonies
SRB	API RP38	10 <sup>3</sup>	10 <sup>4</sup>	colonies
PH	SM 4500-H B		7	units
IRON	SM 3120 B		NA	mg/L
CHLORIDE	SM 4500-Cl B		NA	mg/L
SULFIDE	SM 4500-S <sup>2-</sup> F	1	1.8	mg/L
APPEARANCE	VISUAL	<u>GREENISH W/BLACK PRECIPITATION</u>		
OIL/WATER RATIO	% OIL	0.1	% WATER	99.9

**BDL** - *B*elow *D*etection *L*imit

**ND** - *N*ot *D*etected

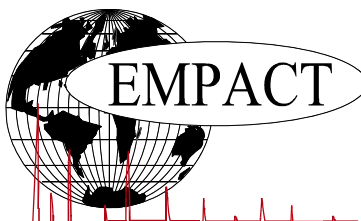
**NA** - *N*ot *A*nalyzed

**APB** - Acid production is based upon growth of *A*cid *P*roducing *B*acteria

Bacteria appearance after 1-2 days is strong; after 3-4 days is medium; after 5 weak

**SRB** - *S*ulfur *R*educing *B*acteria

*The data presented herein has been acquired by means of current analytical techniques and represents the judicious conclusion EMPACT Analytical Systems, Inc. Results of the analysis can be affected by the sampling conditions, therefore, are only warranted through proper lab protocol. EMPACT assumes no responsibility for interpretation or any consequences from application of the reported information and is the sole liability of the user. The reproduction in any media of this reported information may not be made, in portion or as a whole, without the written permission of EMPACT Analytical Systems, Inc.*



### CORROSION BACTERIA EVALUTATION

PROJECT NO. : 201505098  
COMPANY NAME : PIONEER NATURAL RESOURCES

ANALYSIS NO. : 02  
ANALYSIS DATE: MAY 25, 2015  
SAMPLE DATE : MAY 20, 2015 07:30  
CYLINDER NO. : 1 QT JAR

ACCOUNT NO. :  
NAME/DESCRIP : BILL HEIMER 31-33-1652H  
WELL HEAD WATER 07:30

\*\*\*FIELD DATA\*\*\*

SAMPLED BY : PIONEER CREW MEMBER  
SAMPLE PRES. :  
COMMENTS : SPOT

SAMPLE TEMP. :  
AMBIENT TEMP.:

<u>TEST PARAMETER</u>	<u>METHOD</u>	<u>DETECTION LIMIT</u>	<u>REPORTED RESULTS</u>	<u>UNITS</u>
APB	API RP38		Strong	colonies
SRB	API RP38	10 <sup>3</sup>	BDL	colonies
PH	SM 4500-H B		7	units
IRON	SM 3120 B		NA	mg/L
CHLORIDE	SM 4500-Cl B		NA	mg/L
SULFIDE	SM 4500-S <sup>2-</sup> F	1	3.4	mg/L
APPEARANCE	VISUAL	<u>BLACK W/BLACK PRECIPITATION</u>		
OIL/WATER RATIO	% OIL	0.1	% WATER	99.9

**BDL** - *B*elow *D*etection *L*imit

**ND** - *N*ot *D*etected

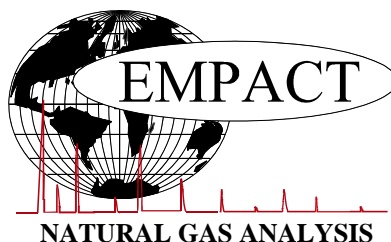
**NA** - *N*ot *A*nalyzed

**APB** - Acid production is based upon growth of *A*cid *P*roducing *B*acteria

Bacteria appearance after 1-2 days is strong; after 3-4 days is medium; after 5 weak

**SRB** - *S*ulfur *R*educing *B*acteria

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PROJECT NO. : 201505098 ANALYSIS NO. : 03  
COMPANY NAME : PIONEER ANALYSIS DATE: MAY 21, 2015  
ACCOUNT NO. : SAMPLE DATE : MAY 20, 2015  
PRODUCER : TO:  
LEASE NO. : CYLINDER NO. : 1L TEDLAR BAG  
NAME/DESCRIP : WELL HEAD GAS 07:30  
BILL HEIMER 31-33-1652H

\*\*\*FIELD DATA\*\*\*

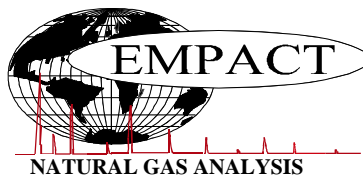
SAMPLED BY : PIONEER CREW MEMBER SAMPLE TEMP. :  
SAMPLE PRES. : AMBIENT TEMP.:  
COMMENTS : SPOT; SAMPLE # 1 OF 3

COMPONENTS	NORM. MOLE%	GPM @ 14.65	GPM @ 14.73
HELIUM	0.01	-	-
HYDROGEN	0.00	-	-
OXYGEN/ARGON	19.60	-	-
NITROGEN	77.58	-	-
CO2	0.35	-	-
METHANE	1.95	-	-
ETHANE	0.24	0.064	0.064
PROPANE	0.11	0.030	0.030
ISOBUTANE	0.01	0.003	0.003
N-BUTANE	0.03	0.009	0.009
ISOPENTANE	0.01	0.004	0.004
N-PENTANE	0.01	0.004	0.004
HEXANES+	0.10	0.043	0.043
TOTAL	100.00	0.157	0.157

BTU @ 60 DEG F	14.65	14.73
GROSS DRY REAL =	33.9	34.0
GROSS SATURATED REAL =	33.3	33.4

RELATIVE DENSITY ( AIR=1 @14.696 PSIA 60F) : 0.9916  
COMPRESSIBILITY FACTOR : 0.99958

NOTE: REFERENCE GPA 2261(ASTM D1945 & ASME-PTC), 2145, & 2172 CURRENT PUBLICATIONS



PROJECT NO: 201505098      SAMPLE NO: 03  
 COMPANY NAME: PIONEER      ANALYSIS DATE: MAY 21, 2015  
 NAME/DESCRIP: WELL HEAD GAS 07:30      SAMPLE DATE: MAY 20, 2015  
                          BILL HEIMER 31-33-1652H      SAMPLED BY: PIONEER CREW MEMBER  
 COMMENTS: SPOT; SAMPLE # 1 OF 3

**TEST PROCEDURE / METHOD:** SULFUR BY GAS CHROMATOGRAPH SCD350 \*

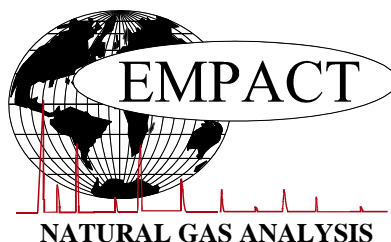
COMPONENT	SULFUR	
	ppm mole (ul/L)	ppm wt (ug/g)
Hydrogen Sulfide (H2S)	0.2	0.5
Carbonyl Sulfide (COS)/ Sulfur Dioxide (SO2)	BDL	
Methanethiol (MeSH)	6.8	16.7
Ethanethiol (EtSH)	0.2	0.5
Dimethylsulfide (DMS)	0.2	0.5
Carbon Disulfide (CS2)	0.6	2.5
i-Propanethiol (i-PrSH)	0.1	0.5
t-Butanethiol (t-BuSH)	BDL	
n-Propanethiol (n-PrSH)	BDL	
Methylethylsulfide (MES)	BDL	
s-Butanethiol (s-BuSH)	BDL	
i-Butanethiol (i-BuSH)	BDL	
Thiophene (TP)	BDL	
Diethylsulfide (DES)	BDL	
n-Butanethiol (n-BuSH)	BDL	
Dimethyldisulfide (DMDS)	0.6	3.0
Unidentified Sulfurs - Light Ends	BDL	
Methylthiophenes (MTP)	BDL	
2-Ethylthiophene (2-ETP)	BDL	
Methylethylsulfide (MEDS)	BDL	
Dimethylthiophenes (DMTP)	0.1	0.5
Diethyldisulfide (DEDS)	BDL	
Benzothiophene (BzTP)	BDL	
Unidentified Sulfurs - Mid Range	BDL	
Methylbenzothiophenes (MBzTP)	BDL	
Dimethylbenzothiophenes (DMBzTP)	BDL	
Trimethylbenzothiophenes (TMBzTP)	0.3	2.5
Dibenzothiophenes (DBzTP)	BDL	
Methyldibenzothiophenes (MDBzTP)	BDL	
Unidentified Sulfurs - Heavy Ends	0.1	1.0
<b>TOTAL SULFUR</b>	<b>9.3</b>	<b>28.2</b>

**TOTAL GRAINS OF SULFUR      1.0316 / 100 scf**  
**GRAINS OF H2S      0.0146 / 100 scf**  
**TOTAL POUNDS OF SULFUR      0.0015 / 1000 scf**  
**POUNDS OF H2S      0.0000 / 1000 scf**

\* ASTM D5504

\*\* DETECTION LIMIT DETERMINED TO BE 0.1 ppm (ul/L) Sulfur - BDL (BELOW DETECTION LIMIT)

THE DATA PRESENTED HEREIN HAS BEEN ACQUIRED THROUGH JUDICIOUS APPLICATION OF CURRENT STATE-OF-THE ART ANALYTICAL TECHNIQUES. THE APPLICATIONS OF THIS INFORMATION IS THE RESPONSIBILITY OF THE USER. EMPACT ANALYTICAL SYSTEMS, INC. ASSUMES NO RESPONSIBILITY FOR ACCURACY OF THE REPORTED INFORMATION NOR ANY CONSEQUENCES OF IT'S APPLICATION.



PROJECT NO. :	<b>201505098</b>	ANALYSIS NO. :	<b>04</b>
COMPANY NAME :	<b>PIONEER</b>	ANALYSIS DATE:	MAY 21, 2015
ACCOUNT NO. :		SAMPLE DATE :	MAY 20, 2015
PRODUCER :		TO:	
LEASE NO. :		CYLINDER NO. :	1L TEDLAR BAG
NAME/DESCRIP :	WELL HEAD GAS 08:00 BILL HEIMER 31-33-1652H		

\*\*\*FIELD DATA\*\*\*

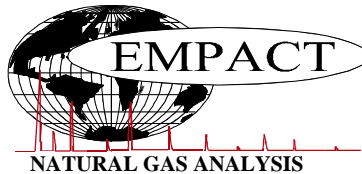
SAMPLED BY :	PIONEER CREW MEMBER	SAMPLE TEMP. :	
SAMPLE PRES. :		AMBIENT TEMP.:	
COMMENTS :	SPOT; SAMPLE # 2 OF 3		

COMPONENTS	NORM. MOLE%	GPM @ 14.65	GPM @ 14.73
HELIUM	0.25	-	-
HYDROGEN	0.06	-	-
OXYGEN/ARGON	1.52	-	-
NITROGEN	48.03	-	-
CO2	2.40	-	-
METHANE	39.36	-	-
ETHANE	4.61	1.226	1.233
PROPANE	1.85	0.507	0.510
ISOBUTANE	0.15	0.049	0.049
N-BUTANE	0.51	0.160	0.161
ISOPENTANE	0.14	0.051	0.051
N-PENTANE	0.18	0.065	0.065
HEXANES+	0.94	0.406	0.408
TOTAL	100.00	2.464	2.477

BTU @ 60 DEG F	<b>14.65</b>	<b>14.73</b>
GROSS DRY REAL =	607.5	610.8
GROSS SATURATED REAL =	596.9	600.2

RELATIVE DENSITY ( AIR=1 @14.696 PSIA 60F) :	0.8646
COMPRESSIBILITY FACTOR :	0.99844

NOTE: REFERENCE GPA 2261(ASTM D1945 & ASME-PTC), 2145, & 2172 CURRENT PUBLICATIONS



PROJECT NO: 201505098      SAMPLE NO: 04  
 COMPANY NAME: PIONEER      ANALYSIS DATE: MAY 21, 2015  
 NAME/DESCRIP: WELL HEAD GAS 08:00      SAMPLE DATE: MAY 20, 2015  
                          BILL HEIMER 31-33-1652H      SAMPLED BY: PIONEER CREW MEMBER  
 COMMENTS: SPOT; SAMPLE # 2 OF 3

**TEST PROCEDURE / METHOD:** SULFUR BY GAS CHROMATOGRAPH SCD350 \*

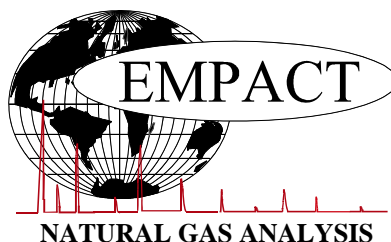
COMPONENT	SULFUR	
	ppm mole (ul/L)	ppm wt (ug/g)
Hydrogen Sulfide (H2S)	BDL	
Carbonyl Sulfide (COS)/ Sulfur Dioxide (SO2)	BDL	
Methanethiol (MeSH)	51.1	124.2
Ethanethiol (EtSH)	1.9	6.1
Dimethylsulfide (DMS)	1.5	4.5
Carbon Disulfide (CS2)	0.9	3.5
i-Propanethiol (i-PrSH)	1.7	6.6
t-Butanethiol (t-BuSH)	0.3	1.5
n-Propanethiol (n-PrSH)	0.3	1.0
Methylethylsulfide (MES)	0.2	1.0
s-Butanethiol (s-BuSH)	BDL	
i-Butanethiol (i-BuSH)	BDL	
Thiophene (TP)	0.2	1.0
Diethylsulfide (DES)	BDL	
n-Butanethiol (n-BuSH)	BDL	
Dimethyldisulfide (DMDS)	10.5	50.0
Unidentified Sulfurs - Light Ends	BDL	
Methylthiophenes (MTP)	BDL	
2-Ethylthiophene (2-ETP)	BDL	
Methylethylidysulfide (MEDS)	BDL	
Dimethylthiophenes (DMTP)	9.2	52.0
Diethyldisulfide (DEDS)	BDL	
Benzothiophene (BzTP)	BDL	
Unidentified Sulfurs - Mid Range	0.1	0.5
Methylbenzothiophenes (MBzTP)	BDL	
Dimethylbenzothiophenes (DMBzTP)	BDL	
Trimethylbenzothiophenes (TMBzTP)	5.3	46.9
Dibenzothiophenes (DBzTP)	BDL	
Methyldibenzothiophenes (MDBzTP)	BDL	
Unidentified Sulfurs - Heavy Ends	0.1	1.0
<b>TOTAL SULFUR</b>	<b>83.3</b>	<b>299.8</b>

**TOTAL GRAINS OF SULFUR**      **10.9668 / 100 scf**  
**GRAINS OF H2S**      **0.0000 / 100 scf**  
**TOTAL POUNDS OF SULFUR**      **0.0157 / 1000 scf**  
**POUNDS OF H2S**      **0.0000 / 1000 scf**

\* ASTM D5504

\*\* DETECTION LIMIT DETERMINED TO BE 0.1 ppm (ul/L) Sulfur - BDL (BELOW DETECTION LIMIT)

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PROJECT NO. : 201505098 ANALYSIS NO. : 05  
COMPANY NAME : PIONEER ANALYSIS DATE: MAY 21, 2015  
ACCOUNT NO. : SAMPLE DATE : MAY 20, 2015  
PRODUCER : TO:  
LEASE NO. : CYLINDER NO. : 1L TEDLAR BAG  
NAME/DESCRIP : WELL HEAD GAS 08:30  
BILL HEIMER 31-33-1652H

\*\*\*FIELD DATA\*\*\*

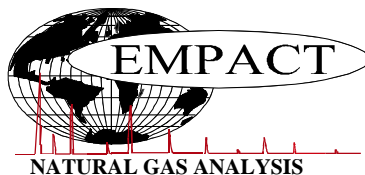
SAMPLED BY : PIONEER CREW MEMBER SAMPLE TEMP. :  
SAMPLE PRES. : AMBIENT TEMP.:  
COMMENTS : SPOT; SAMPLE # 3 OF 3

COMPONENTS	NORM. MOLE%	GPM @ 14.65	GPM @ 14.73
HELIUM	0.25	-	-
HYDROGEN	0.19	-	-
OXYGEN/ARGON	2.35	-	-
NITROGEN	47.93	-	-
CO2	1.41	-	-
METHANE	38.96	-	-
ETHANE	4.73	1.258	1.265
PROPANE	1.99	0.545	0.548
ISOBUTANE	0.18	0.059	0.059
N-BUTANE	0.61	0.191	0.192
ISOPENTANE	0.17	0.062	0.062
N-PENTANE	0.23	0.083	0.083
HEXANES+	1.00	0.431	0.434
TOTAL	100.00	2.629	2.643

BTU @ 60 DEG F	14.65	14.73
GROSS DRY REAL =	620.0	623.4
GROSS SATURATED REAL =	609.1	612.6

RELATIVE DENSITY ( AIR=1 @14.696 PSIA 60F) : 0.8655  
COMPRESSIBILITY FACTOR : 0.99842

NOTE: REFERENCE GPA 2261(ASTM D1945 & ASME-PTC), 2145, & 2172 CURRENT PUBLICATIONS



PROJECT NO: 201011066	SAMPLE NO: 05
COMPANY NAME: PIONEER	ANALYSIS DATE: MAY 21, 2015
NAME/DESCRIP: WELL HEAD GAS 08:30	SAMPLE DATE: MAY 20, 2015
BILL HEIMER 31-33-1652H	SAMPLED BY: PIONEER CREW MEMBER
COMMENTS: SPOT; SAMPLE # 3 OF 3	

**TEST PROCEDURE / METHOD:** SULFUR BY GAS CHROMATOGRAPH SCD350 \*

COMPONENT	SULFUR	
	ppm mole (ul/L)	ppm wt (ug/g)
Hydrogen Sulfide (H <sub>2</sub> S)	BDL	
Carbonyl Sulfide (COS)/ Sulfur Dioxide (SO <sub>2</sub> )	BDL	
Methanethiol (MeSH)	7.9	19.2
Ethanethiol (EtSH)	0.6	2.0
Dimethylsulfide (DMS)	0.8	2.5
Carbon Disulfide (CS <sub>2</sub> )	0.8	3.0
i-Propanethiol (i-PrSH)	0.8	3.0
t-Butanethiol (t-BuSH)	0.1	0.5
n-Propanethiol (n-PrSH)	0.1	0.5
Methylethylsulfide (MES)	0.1	0.5
s-Butanethiol (s-BuSH)	BDL	
i-Butanethiol (i-BuSH)	BDL	
Thiophene (TP)	0.1	0.5
Diethylsulfide (DES)	BDL	
n-Butanethiol (n-BuSH)	BDL	
Dimethyldisulfide (DMDS)	7.8	36.8
Unidentified Sulfurs - Light Ends	BDL	
Methylthiophenes (MTP)	0.3	1.5
2-Ethylthiophene (2-ETP)	BDL	
Methylethyldisulfide (MEDS)	BDL	
Dimethylthiophenes (DMTP)	18.6	105.5
Diethyldisulfide (DEDS)	BDL	
Benzothiophene (BzTP)	BDL	
Unidentified Sulfurs - Mid Range	1.1	7.6
Methylbenzothiophenes (MBzTP)	BDL	
Dimethylbenzothiophenes (DMBzTP)	BDL	
Trimethylbenzothiophenes (TMBzTP)	11.9	106.0
Dibenzothiophenes (DBzTP)	BDL	
Methyldibenzothiophenes (MDBzTP)	0.1	1.0
Unidentified Sulfurs - Heavy Ends	0.7	7.1
<b>TOTAL SULFUR</b>	<b>51.9</b>	<b>297.2</b>

<b>TOTAL GRAINS OF SULFUR</b>	<b>10.8717 / 100 scf</b>
<b>GRAINS OF H<sub>2</sub>S</b>	<b>0.0000 / 100 scf</b>
<b>TOTAL POUNDS OF SULFUR</b>	<b>0.0155 / 1000 scf</b>
<b>POUNDS OF H<sub>2</sub>S</b>	<b>0.0000 / 1000 scf</b>

\* ASTM D5504

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