

HILCORP ENERGY COMPANY
KODY CHRISTIANSEN
MOFFAT COHIAWATHA B-2
WELLHEAD

UIC Facility 15907

Report Date: 04-14-2021
Sample #: 5332Sampled: 04-12-2021 at 0000
Sample ID: 274419**CATIONS**

Calcium (as Ca)	14.36
Magnesium (as Mg)	3.49
Barium (as Ba)	1.20
Strontium (as Sr)	0.894
Sodium (as Na)	251.53
Potassium (as K)	2.06
Lithium (as Li)	0.00
Ammonia (as NH ₃)	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	115.40
Manganese (as Mn)	1.24
Zinc (as Zn)	0.303
Lead (as Pb)	0.00

ANIONS

Chloride (as Cl)	500.00
Sulfate (as SO ₄)	25.00
Bromine (as Br)	0.00
Dissolved CO ₂ (as CO ₂)	210.00
Bicarbonate (as HCO ₃)	97.60
Carbonate (as CO ₃)	0.00
Oxalic acid (as C ₂ O ₄)	0.00
Silica (as SiO ₂)	0.00
Phosphate(as PO ₄)	0.00
H ₂ S (as H ₂ S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO ₃)	0.00
Boron (as B)	0.794

PARAMETERS

Calculated T.D.S.	1091
Molar Conductivity	1605
Resistivity	622.93
Sp.Gr.(g/mL)	1.00
Pressure(atm)	1.00
pCO ₂ (atm)	0.0304
pH ₂ S(atm)	0.00
Temperature (°F)	70.00
pH	6.05

CORROSION RATE PREDICTION

CO ₂ - H ₂ S Rate(mpy)	0.109
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COMMENTS

MOFFAT CO

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

HILCORP ENERGY COMPANY
KODY CHRISTIANSEN
MOFFAT COHIAWATHA B-2
WELLHEADReport Date: 04-14-2021
Sample #: 5332Sampled: 04-12-2021 at 0000
Sample ID: 274419**SATURATION RATIO as IAP/Ksp**

Calcite (CaCO ₃)	0.00
Aragonite (CaCO ₃)	0.00
Witherite (BaCO ₃)	0.00
Strontianite (SrCO ₃)	0.00
Calcium oxalate (CaC ₂ O ₄)	0.00
Magnesite (MgCO ₃)	0.00
Anhydrite (CaSO ₄)	0.00
Gypsum (CaSO ₄ *2H ₂ O)	0.00
Barite (BaSO ₄)	7.46
Celestite (SrSO ₄)	0.00
Fluorite (CaF ₂)	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO ₂)	0.00
Brucite (Mg(OH) ₂)	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) ₃)	58.85
Strengite (FePO ₄ *2H ₂ O)	0.00
Siderite (FeCO ₃)	40.68
Halite (NaCl)	0.00
Thenardite (Na ₂ SO ₄)	0.00
Iron sulfide (FeS)	0.00

MOMENTARY EXCESS (Lbs/1000 Barrels)

Calcite (CaCO ₃)	-1.17
Aragonite (CaCO ₃)	-1.24
Witherite (BaCO ₃)	-5.70
Strontianite (SrCO ₃)	-1.76
Calcium oxalate (CaC ₂ O ₄)	-0.589
Magnesite (MgCO ₃)	-3.41
Anhydrite (CaSO ₄)	-522.26
Gypsum (CaSO ₄ *2H ₂ O)	-448.40
Barite (BaSO ₄)	0.614
Celestite (SrSO ₄)	-45.56
Fluorite (CaF ₂)	-18.50
Calcium phosphate	>-0.001
Hydroxyapatite	-153.93
Silica (SiO ₂)	-37.97
Brucite (Mg(OH) ₂)	< 0.001
Magnesium silicate	-69.41
Iron hydroxide (Fe(OH) ₃)	< 0.001
Strengite (FePO ₄ *2H ₂ O)	>-0.001
Siderite (FeCO ₃)	0.00447
Halite (NaCl)	-141945
Thenardite (Na ₂ SO ₄)	-35609
Iron sulfide (FeS)	-0.00520

SIMPLE INDICES

Langelier	-2.52
Ryznar	11.09
Puckorius	9.82
Larson-Skold Index	9.17
Stiff Davis Index	-2.74
Oddo-Tomson	-2.56

BOUND IONS

Calcium	14.36	13.98
Barium	1.20	1.20
Carbonate	0.00913	0.00681
Phosphate	0.00	0.00
Sulfate	25.00	21.62

TOTAL**FREE****OPERATING CONDITIONS**

Temperature (°F)	70.00
Time(secs)	0.00

DownHole SAT™ Water Analysis Report

SYSTEM IDENTIFICATION

HILCORP ENERGY COMPANY
HIAWATHA B-2
KODY CHRISTIANSEN
WELLHEAD
MOFFAT CO

Sample ID#: 5332
Sample ID: 274419
Sample Date: 04-12-2021 at 0000
Report Date: 04-14-2021

WATER CHEMISTRY

CATIONS

Calcium(as Ca)	14.36
Magnesium(as Mg)	3.49
Barium(as Ba)	1.20
Strontium(as Sr)	0.894
Sodium(as Na)	251.53
Potassium(as K)	2.06
Lithium(as Li)	0.00
Iron(as Fe)	115.40
Field Iron(as Fe)	0.00
Ammonia(as NH ₃)	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	1.24
Zinc(as Zn)	0.303
Lead(as Pb)	0.00

ANIONS

Chloride(as Cl)	500.00
Sulfate(as SO ₄)	25.00
Bromine(as Br)	0.00
Dissolved CO ₂ (as CO ₂)	210.00
Bicarbonate(as HCO ₃)	97.60
Carbonate(as CO ₃)	0.00
Silica(as SiO ₂)	0.00
Phosphate(as PO ₄)	0.00
H ₂ S (as H ₂ S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO ₃)	0.00
Boron(as B)	0.794

PARAMETERS

Temperature(°F)	70.00	Sample pH	6.05
Conductivity	1605	Sp.Gr.(g/mL)	1.00
Resistivity	622.93	T.D.S.	1091

SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO ₃		Anhydrite CaSO ₄		Gypsum CaSO ₄ *2H ₂ O		Barite BaSO ₄		Celestite SrSO ₄		Siderite FeCO ₃		Mackawenite FeS		CO ₂ (mpy)	pCO ₂ (atm)
50.00	0.00	0.00239	-1.40	< 0.001	-524.61	0.00111	-438.83	12.45	0.654	0.00354	-44.64	27.23	0.00416	0.00	-0.00410	0.0704	0.0304
65.45	0.00	0.00302	-1.22	< 0.001	-525.12	0.00106	-446.96	8.31	0.624	0.00339	-45.61	38.67	0.00458	0.00	-0.00477	0.203	0.0304
80.91	0.00	0.00377	-1.07	< 0.001	-510.46	0.00104	-450.25	5.90	0.588	0.00346	-45.00	53.75	0.00500	0.00	-0.00539	0.142	0.0304
96.36	0.00	0.00464	-0.944	< 0.001	-483.47	0.00104	-449.15	4.43	0.547	0.00365	-43.55	73.24	0.00542	0.00	-0.00591	0.193	0.0304
111.82	0.00	0.00564	-0.840	< 0.001	-447.41	0.00113	-427.93	3.47	0.502	0.00390	-41.79	97.97	0.00584	0.00	-0.00635	0.212	0.0304
127.27	0.00	0.00678	-0.754	< 0.001	-405.50	0.00131	-395.97	2.76	0.448	0.00416	-40.19	128.86	0.00628	0.00	-0.00679	0.191	0.0304
142.73	0.00	0.00805	-0.680	0.00122	-360.78	0.00149	-368.24	2.22	0.384	0.00441	-38.77	166.65	0.00671	0.00	-0.00726	0.167	0.0304
158.18	0.00	0.00945	-0.618	0.00157	-315.60	0.00169	-343.97	1.80	0.309	0.00465	-37.50	212.13	0.00715	0.00	-0.00777	0.159	0.0304
173.64	0.00	0.0110	-0.565	0.00208	-271.87	0.00190	-322.67	1.47	0.221	0.00488	-36.38	266.06	0.00759	0.00	-0.00832	0.149	0.0304
189.09	0.00	0.0127	-0.520	0.00281	-230.91	0.00212	-303.91	1.21	0.118	0.00510	-35.39	328.80	0.00804	0.00	-0.00893	0.0645	0.0304
204.55	0.00	0.0145	-0.481	0.00390	-193.56	0.00234	-287.34	1.000	>-0.001	0.00531	-34.51	400.45	0.00848	0.00	-0.00959	0.0474	0.0304
220.00	0.171	0.0163	-0.452	0.00547	-161.18	0.00255	-274.24	0.826	-0.144	0.00545	-33.94	478.02	0.00895	0.00	-0.0105	0.0638	0.0356
		Lbs per xSAT 1000 Barrels		Lbs per xSAT 1000 Barrels		Lbs per xSAT 1000 Barrels		Lbs per xSAT 1000 Barrels		Lbs per xSAT 1000 Barrels		Lbs per xSAT 1000 Barrels		Lbs per xSAT 1000 Barrels			

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO₃}/K_{sp}. pCO₂ (atm) is the partial pressure of CO₂ in the gas phase.

Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.

