Doc # 2619249

Navajo Water Analysis
API: 103-09144

Rocky Mountain Area Laboratory
350 Cole Creek Road,
Evansville, WY 82636

Upstream Chemicals

REPORT DATE: 9/13/2018

COMPLETE WATER ANALYSIS REPORT SSP v.2010

CUSTOMER:	CHEVRON	**ACCOUNT REP:**	PRESTON M. STEWART
DISTRICT:	WESTERN DIVIDE	**SAMPLE ID:**	201812017155
AREA/LEASE:	RANGELY	**SAMPLE DATE:**	9/4/2018
SAMPLE POINT NAME	COLLECTION STATION 5 LACY S.B. 11Y	**ANALYSIS DATE:**	9/13/2018
SITE TYPE:		**ANALYST:**	KS
SAMPLE POINT DESCRIPTION:			

CHEVRON, RANGELY, COLLECTION STATION 5 LACY S.B. 11Y

FIELD DATA

Initial Temperature (°F):	250
Final Temperature (°F):	116
Initial Pressure (psi):	100
Final Pressure (psi):	15
pH:	
pH at time of sampling:	7.4

ALKALINITY BY TITRATION:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	937.0	15.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	ND
aqueous H_2S (ppm):	3.5
aqueous O2 (ppb):	ND
Calculated TDS (mg/L):	10247
Density/Specific Gravity (g/cm^3):	1.0044
Measured Specific Gravity	ND
Conductivity (mmhos):	ND
Resistivity:	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

ANALYSIS OF SAMPLE

ANIONS:	**mg/L**	**meq/L**
Chloride (Cl^-):	5064.4	142.9
Sulfate (SO_4^{2-}):	375.3	7.8
Borate (H_3BO_3):	69.3	1.1
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	0.0	0.0
Silica (SiO_2):	29.7	

ORGANIC ACIDS:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.01

CATIONS:	**mg/L**	**meq/L**
Sodium (Na^+):	3682.7	160.3
Potassium (K^+):	69.5	1.8
Magnesium (Mg^{2+}):	8.4	0.7
Calcium (Ca^{2+}):	62.3	3.1
Strontium (Sr^{2+}):	15.9	0.4
Barium (Ba^{2+}):	0.0	0.0
Iron (Fe^{2+}):	1.5	0.1
Manganese (Mn^{2+}):	0.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.1	0.0
Aluminum (Al^{3+}):	ND	
Chromium (Cr^{3+}):	ND	
Cobalt (Co^{2+}):	ND	
Copper (Cu^{2+}):	ND	
Molybdenum (Mo^{2+}):	ND	
Nickel (Ni^{2+}):	ND	
Tin (Sn^{2+}):	ND	
Titanium (Ti^{2+}):	ND	
Vanadium (V^{2+}):	ND	
Zirconium (Zr^{2+}):	ND	
Lithium (Li):	ND	
Total Hardness:	209	N/A

ND = Not Determined

SCALE PREDICTIONS BASED ON FIELD PROVIDED DATA; FUTHER MODELING MAY BE REQUIRED FOR VALIDATION OF SCALE PREDICTION RESULTS.

Conditions		**Barite ($BaSO_4$)**		**Calcite ($CaCO_3$)**		**Gypsum ($CaSO_4 \cdot 2H_2O$)**		**Anhydrite ($CaSO_4$)**	
Temp	**Press.**	**Index**	**Amt (ptb)**	**Index**	**Amt (ptb)**	**Index**	**Amt (ptb)**	**Index**	**Amt (ptb)**
116°F	15 psi		0.000	0.63	33.493	-1.70	0.000	-1.79	0.000
131°F	24 psi		0.000	0.65	34.344	-1.68	0.000	-1.70	0.000
146°F	34 psi		0.000	0.72	36.567	-1.67	0.000	-1.62	0.000
161°F	43 psi		0.000	0.80	39.119	-1.65	0.000	-1.52	0.000
176°F	53 psi		0.000	0.89	41.618	-1.62	0.000	-1.42	0.000
190°F	62 psi		0.000	0.99	43.903	-1.60	0.000	-1.31	0.000
205°F	72 psi		0.000	1.09	45.911	-1.57	0.000	-1.20	0.000
220°F	81 psi		0.000	1.21	47.741	-1.53	0.000	-1.09	0.000
235°F	91 psi		0.000	1.33	49.280	-1.50	0.000	-0.98	0.000
250°F	100 psi		0.000	1.45	50.504	-1.47	0.000	-0.86	0.000

Conditions		**Celestite ($SrSO_4$)**		**Halite (NaCl)**		**Iron Sulfide (FeS)**		**Iron Carbonate ($FeCO_3$)**	
Temp	**Press.**	**Index**	**Amt (ptb)**	**Index**	**Amt (ptb)**	**Index**	**Amt (ptb)**	**Index**	**Amt (ptb)**
116°F	15 psi	-0.61	0.000	-3.52	0.000	1.84	0.808	0.93	0.956
131°F	24 psi	-0.59	0.000	-3.53	0.000	1.77	0.805	0.99	0.973
146°F	34 psi	-0.57	0.000	-3.53	0.000	1.75	0.805	1.09	0.994
161°F	43 psi	-0.53	0.000	-3.53	0.000	1.77	0.805	1.19	1.013
176°F	53 psi	-0.49	0.000	-3.53	0.000	1.80	0.806	1.30	1.029
190°F	62 psi	-0.44	0.000	-3.52	0.000	1.85	0.808	1.40	1.040
205°F	72 psi	-0.39	0.000	-3.52	0.000	1.90	0.810	1.50	1.050
220°F	81 psi	-0.33	0.000	-3.51	0.000	1.98	0.812	1.61	1.057
235°F	91 psi	-0.26	0.000	-3.50	0.000	2.06	0.814	1.72	1.063
250°F	100 psi	-0.19	0.000	-3.48	0.000	2.15	0.815	1.82	1.068

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the eight (8) scales.

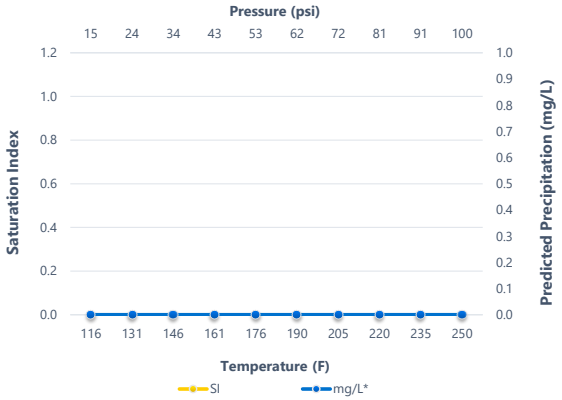
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; %CO_2 is not included in the calculations.

ScaleSoftPitzer™ SSP2010

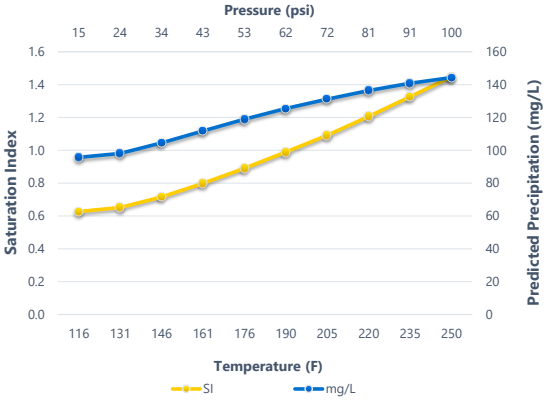
Comments: API # 0510309144-00; Navajo Formation; Perforated Interval 4515' to 5053'; Barrels flowed back 660; Sample Time 1:15am: Ba<0.3125 P<0.125 ppm

SAMPLE ID: 201812017155 CHEVRON, RANGELY, COLLECTION STATION 5 LACY S.B. 11Y

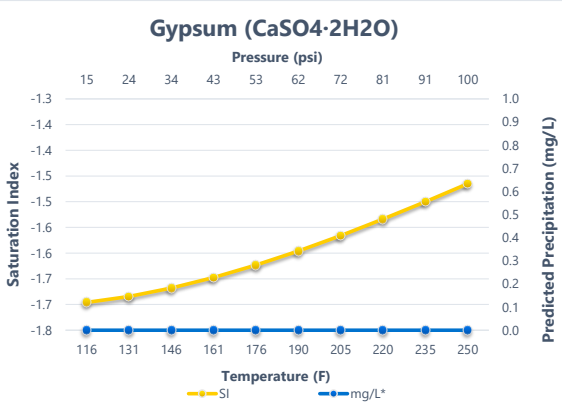
Barite (BaSO4)



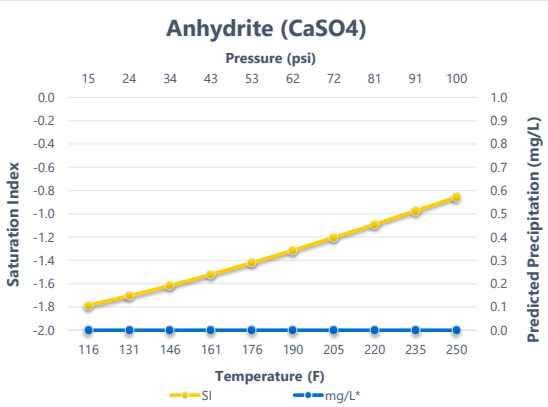
Calcite (CaCO3)



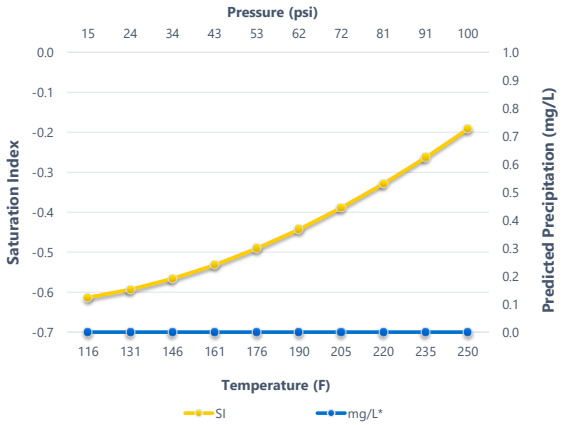
Gypsum (CaSO4·2H2O)



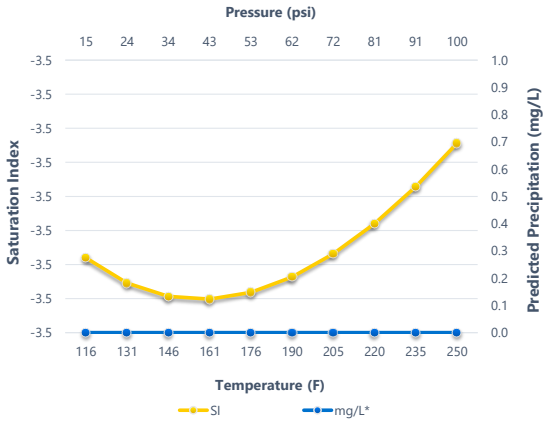
Anhydrite (CaSO4)



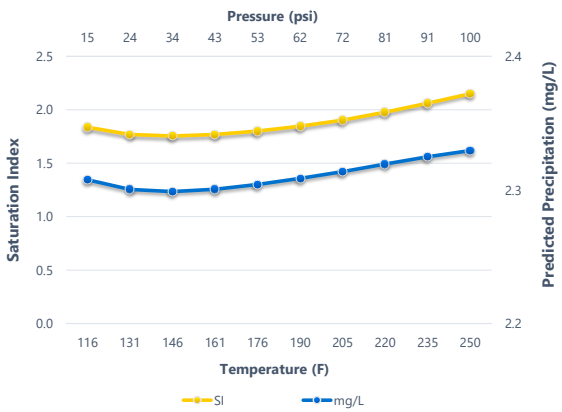
Celestite (SrSO4)



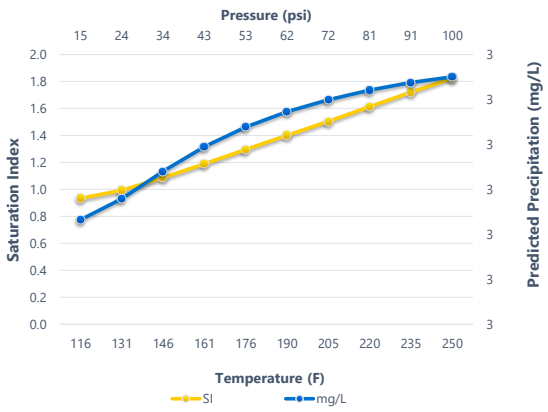
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



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