02618321

Progressive Consulting, Inc.
600 17th Street Suite 2800 South
Denver CO 80202
303-456-9038

RECEIVED
JAN 28 2015
COGCC

January 23, 2015

Colorado Oil and Gas Conservation Commission
Robert P. Koehler, PhD
Department of Natural Resources
1120 Lincoln Street Suite 801
Denver, CO 80203

RE: Caerus Piceance LLC - Nolte 1-14 SWD (API: 04-045-22315) Form 26

Dear Bob Koehler:

On behalf of Caerus Piceance LLC, please find enclosed a hard copy and electronic copy of the Form 26 spreadsheet that lists all the sources of water to be added to the Nolte 1-14 SWD (API: 04-045-22315). An electronic copy of the spreadhseet was sent to you via email today.

Per our discussion for the wells that we do not have water analyses for, the TDS column has been left blank. We have enclosed a majority of the water analyses for the list of wells for your reference both electronically and a hard copy as well. Please note that we are still waiting on approval for the Form 31 and Form 33 for the Nolte 1-14 SWD.

Please contact me by phone at (720) 299-4495 or by e-mail at sdemattee@progressivepcs.net with any questions.

Sincerely,

Shauna DeMattee
Regulatory Analyst
Progressive Consulting, Inc.

Enclosures:
Nolte 1-14 SWD (API: 04-045-22315) Form 26 Spreadsheet
Water Analyses

Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11D-24 Separator
District:	Four Corners	**Sample ID:**	201506001244
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 11D-24 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1220.0	20.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22522
Density/Specific Gravity (g/cm^3):	1.0130
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	31.1
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12382.7	349.3
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.9	0.1
Silica (SiO_2):	48.1	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.96	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8345.9	363.2
Potassium (K^+):	53.8	1.4
Magnesium (Mg^{2+}):	42.4	3.5
Calcium (Ca^{2+}):	251.8	12.6
Strontium (Sr^{2+}):	38.9	0.9
Barium (Ba^{2+}):	135.1	2.0
Iron (Fe^{2+}):	43.9	1.6
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	2.7	0.1
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	
Total Hardness:	947	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.45	74.017		0.000		0.000
99°F	24 psi		0.000	0.51	82.825		0.000		0.000
118°F	34 psi		0.000	0.61	95.934		0.000		0.000
137°F	43 psi		0.000	0.72	110.001		0.000		0.000
156°F	53 psi		0.000	0.85	123.896		0.000		0.000
174°F	62 psi		0.000	0.97	137.139		0.000		0.000
193°F	72 psi		0.000	1.10	149.498		0.000		0.000
212°F	81 psi		0.000	1.25	161.721		0.000		0.000
231°F	91 psi		0.000	1.40	172.642		0.000		0.000
250°F	100 psi		0.000	1.55	182.234		0.000		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)**
80°F	15 psi		0.000	-2.79	0.000	1.95	1.593	1.49	30.590
99°F	24 psi		0.000	-2.81	0.000	1.89	1.590	1.61	30.912
118°F	34 psi		0.000	-2.83	0.000	1.90	1.590	1.76	31.192
137°F	43 psi		0.000	-2.84	0.000	1.93	1.591	1.91	31.393
156°F	53 psi		0.000	-2.84	0.000	1.98	1.594	2.06	31.533
174°F	62 psi		0.000	-2.84	0.000	2.04	1.596	2.20	31.628
193°F	72 psi		0.000	-2.84	0.000	2.12	1.599	2.34	31.695
212°F	81 psi		0.000	-2.83	0.000	2.22	1.601	2.48	31.745
231°F	91 psi		0.000	-2.82	0.000	2.32	1.604	2.61	31.779
250°F	100 psi		0.000	-2.81	0.000	2.43	1.606	2.73	31.803

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.

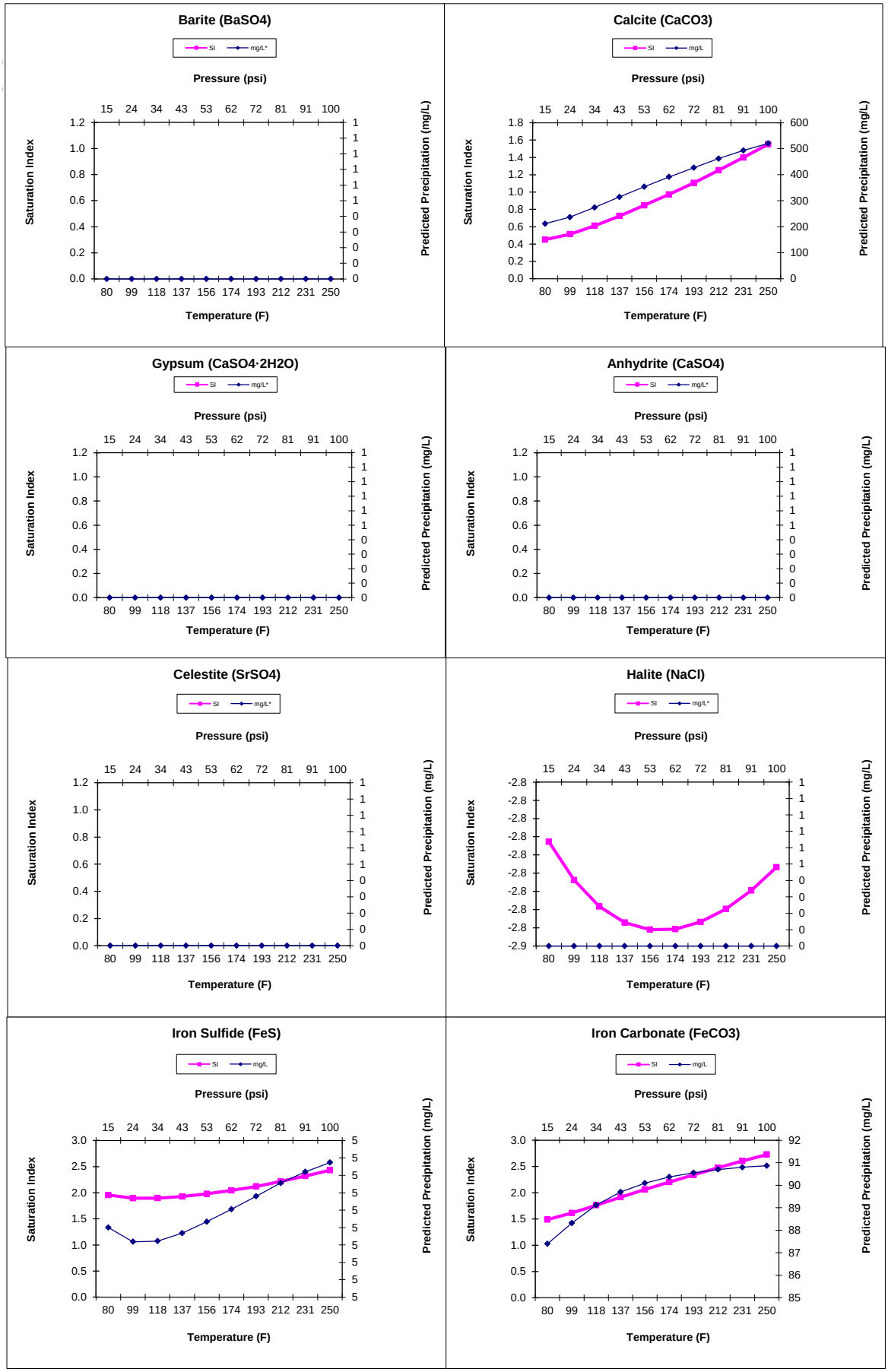
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 11D-24 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23A-13 Separator
District:	Four Corners	**Sample ID:**	201506001245
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 23A-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	1159.0	19.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	370.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20810
Density/Specific Gravity (g/cm^3):	1.0118
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	28.9
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	11739.4	331.2
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.2	0.1
Silica (SiO_2):	49.2	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Cations:	mg/L	meq/L
Sodium (Na^+):	7334.1	319.2
Potassium (K^+):	65.0	1.7
Magnesium (Mg^{2+}):	43.1	3.5
Calcium (Ca^{2+}):	254.7	12.7
Strontium (Sr^{2+}):	35.0	0.8
Barium (Ba^{2+}):	90.3	1.3
Iron (Fe^{2+}):	84.3	3.0
Manganese (Mn^{2+}):	0.9	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.2	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	
Total Hardness:	920	N/A

Anion/Cation Ratio:	1.02

ND = Not Determined

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)
80°F	15 psi		0.000	0.11	21.526		0.000		0.000
99°F	24 psi		0.000	0.17	32.423		0.000		0.000
118°F	34 psi		0.000	0.27	49.285		0.000		0.000
137°F	43 psi		0.000	0.38	67.490		0.000		0.000
156°F	53 psi		0.000	0.50	85.517		0.000		0.000
174°F	62 psi		0.000	0.63	102.753		0.000		0.000
193°F	72 psi		0.000	0.77	119.658		0.000		0.000
212°F	81 psi		0.000	0.92	135.728		0.000		0.000
231°F	91 psi		0.000	1.07	150.238		0.000		0.000
250°F	100 psi		0.000	1.23	163.227		0.000		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)
80°F	15 psi		0.000	-2.87	0.000	1.90	2.869	1.43	57.870
99°F	24 psi		0.000	-2.89	0.000	1.85	2.864	1.55	58.673
118°F	34 psi		0.000	-2.90	0.000	1.87	2.866	1.70	59.395
137°F	43 psi		0.000	-2.91	0.000	1.92	2.871	1.85	59.923
156°F	53 psi		0.000	-2.92	0.000	1.99	2.876	2.00	60.290
174°F	62 psi		0.000	-2.91	0.000	2.07	2.882	2.14	60.543
193°F	72 psi		0.000	-2.91	0.000	2.17	2.888	2.29	60.726
212°F	81 psi		0.000	-2.90	0.000	2.28	2.893	2.43	60.855
231°F	91 psi		0.000	-2.89	0.000	2.40	2.897	2.56	60.944
250°F	100 psi		0.000	-2.88	0.000	2.52	2.900	2.69	61.007

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.

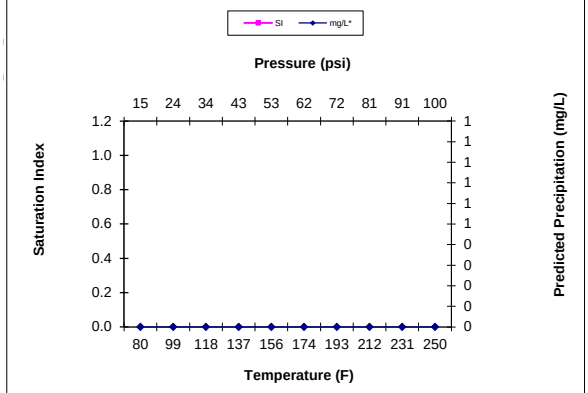
Calculate

ScaleSoftPitzer™ SSP2010

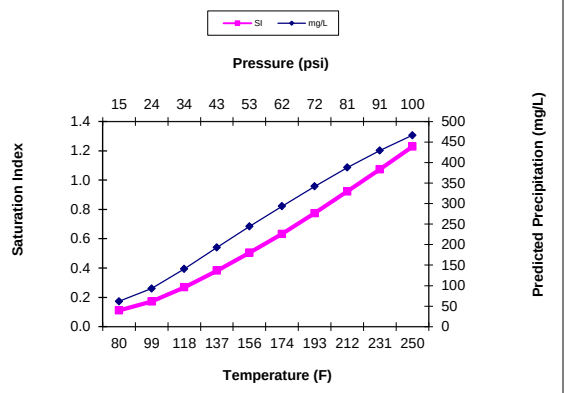
Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 23A-13 Separator

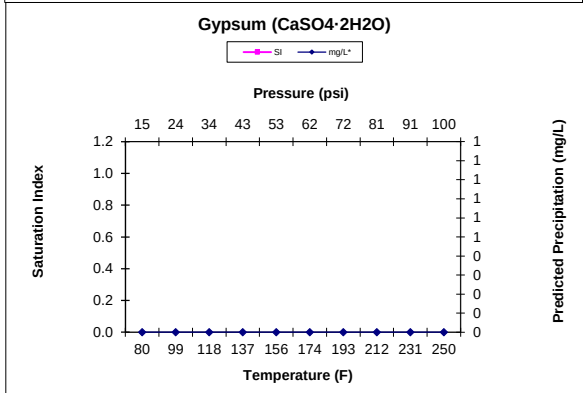
Barite (BaSO4)



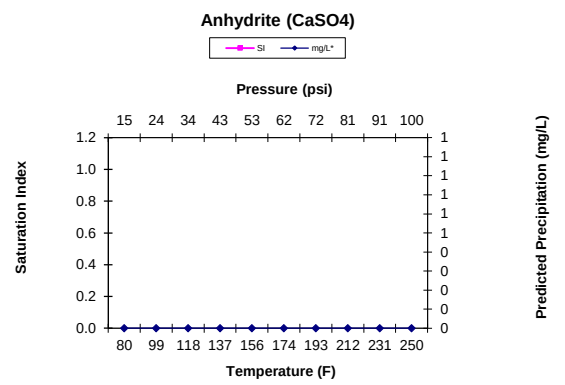
Calcite (CaCO3)



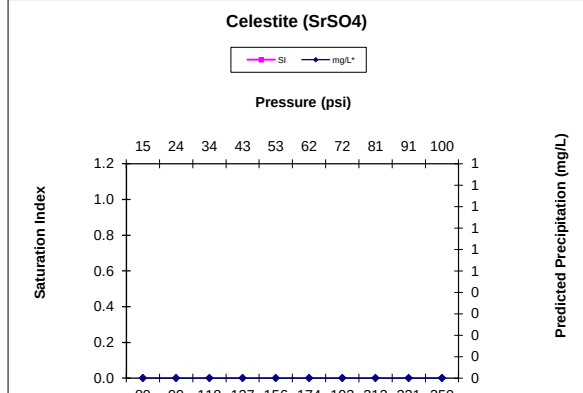
Gypsum (CaSO4·2H2O)



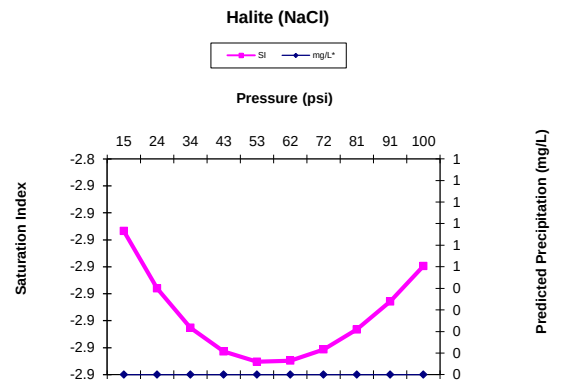
Anhydrite (CaSO4)



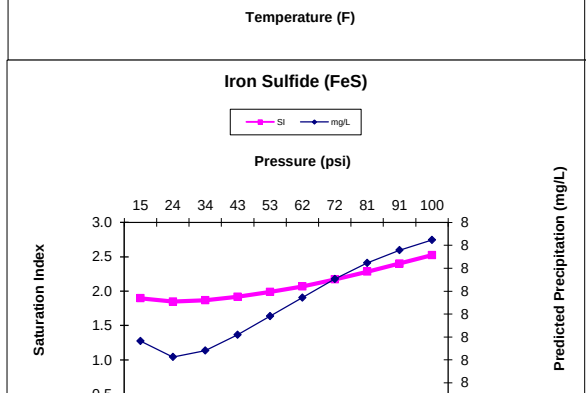
Celestite (SrSO4)



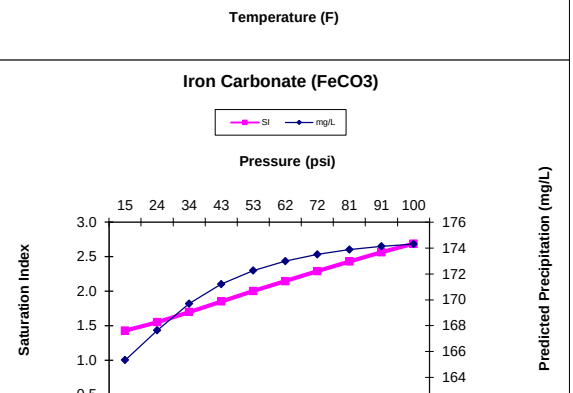
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23B-13 Separator
District:	Four Corners	**Sample ID:**	201506001246
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 23B-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.8

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	1159.0	19.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	190.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23609
Density/Specific Gravity (g/cm^3):	1.0139
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	30.6
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	13059.2	368.4
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	10.1	0.3
Silica (SiO_2):	50.6	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.96

Cations:	mg/L	meq/L
Sodium (Na^+):	8641.5	376.0
Potassium (K^+):	62.3	1.6
Magnesium (Mg^{2+}):	50.7	4.2
Calcium (Ca^{2+}):	310.7	15.5
Strontium (Sr^{2+}):	42.7	1.0
Barium (Ba^{2+}):	120.4	1.8
Iron (Fe^{2+}):	149.0	5.3
Manganese (Mn^{2+}):	2.0	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.8	0.1
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	
Total Hardness:	1122	N/A

ND = Not Determined

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)
80°F	15 psi		0.000	0.39	71.295		0.000		0.000
99°F	24 psi		0.000	0.45	81.061		0.000		0.000
118°F	34 psi		0.000	0.55	95.824		0.000		0.000
137°F	43 psi		0.000	0.66	111.786		0.000		0.000
156°F	53 psi		0.000	0.78	127.695		0.000		0.000
174°F	62 psi		0.000	0.91	143.042		0.000		0.000
193°F	72 psi		0.000	1.04	157.697		0.000		0.000
212°F	81 psi		0.000	1.19	172.455		0.000		0.000
231°F	91 psi		0.000	1.34	186.021		0.000		0.000
250°F	100 psi		0.000	1.49	198.439		0.000		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)
80°F	15 psi		0.000	-2.76	0.000	2.68	4.320	1.86	104.972
99°F	24 psi		0.000	-2.78	0.000	2.62	4.318	1.98	105.763
118°F	34 psi		0.000	-2.79	0.000	2.63	4.319	2.13	106.465
137°F	43 psi		0.000	-2.80	0.000	2.67	4.320	2.28	106.977
156°F	53 psi		0.000	-2.81	0.000	2.73	4.321	2.43	107.333
174°F	62 psi		0.000	-2.81	0.000	2.79	4.322	2.57	107.580
193°F	72 psi		0.000	-2.80	0.000	2.88	4.323	2.71	107.753
212°F	81 psi		0.000	-2.80	0.000	2.98	4.325	2.84	107.881
231°F	91 psi		0.000	-2.79	0.000	3.09	4.326	2.97	107.970
250°F	100 psi		0.000	-2.77	0.000	3.20	4.327	3.09	108.033

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.

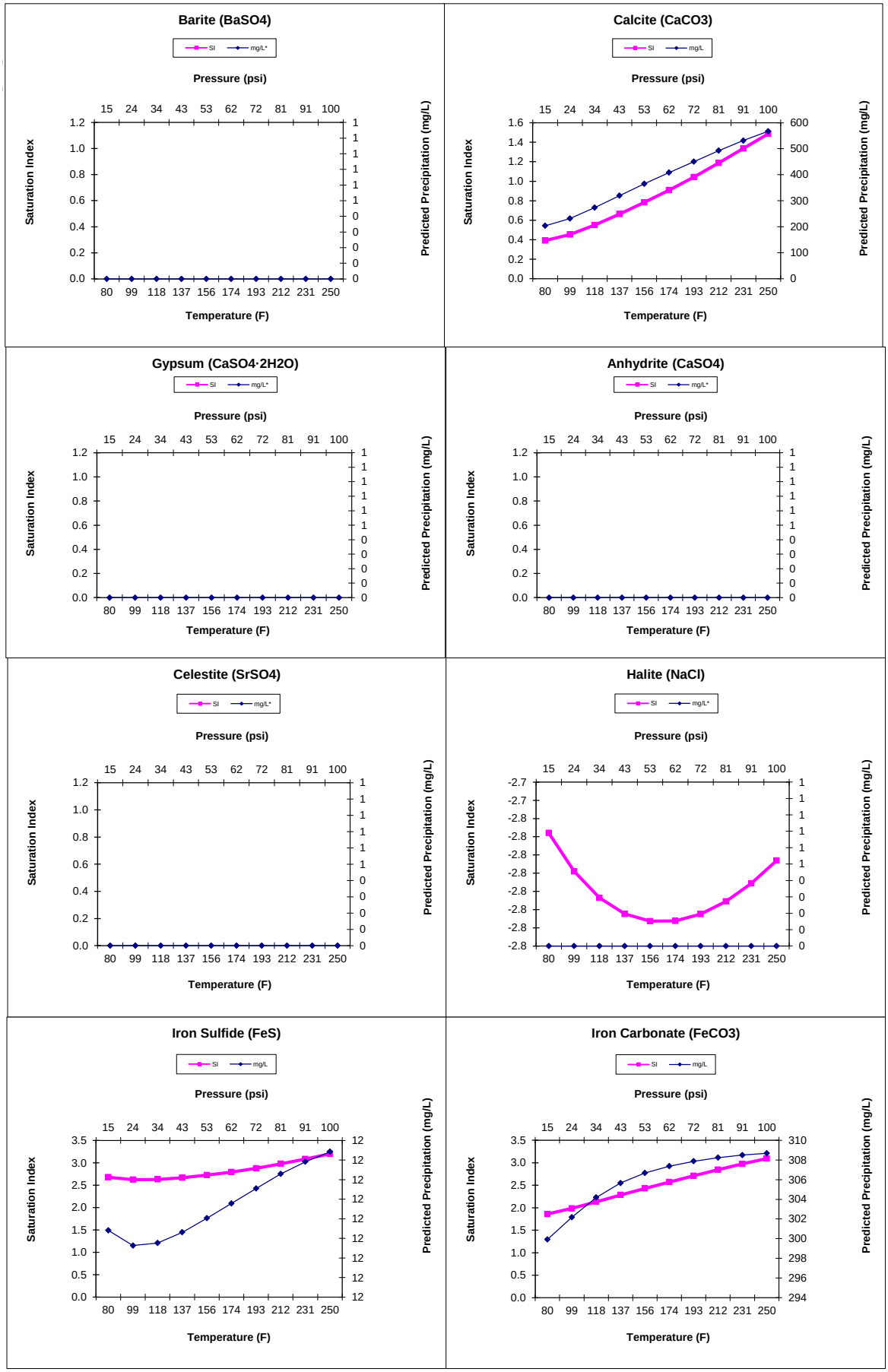
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 23B-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23C-13 Separator
District:	Four Corners	**Sample ID:**	201506001247
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 23C-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
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^-):	1195.6	19.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22712
Density/Specific Gravity (g/cm^3):	1.0130
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	20.7
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	12768.5	360.2
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.8	0.1
Silica (SiO_2):	43.9	

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^+):	8181.1	356.0
Potassium (K^+):	66.5	1.7
Magnesium (Mg^{2+}):	41.1	3.4
Calcium (Ca^{2+}):	257.1	12.8
Strontium (Sr^{2+}):	39.8	0.9
Barium (Ba^{2+}):	127.1	1.9
Iron (Fe^{2+}):	29.7	1.1
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.6	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	
Total Hardness:	950	N/A

ND = Not Determined

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)
80°F	15 psi		0.000	0.95	117.645		0.000		0.000
99°F	24 psi		0.000	1.02	124.147		0.000		0.000
118°F	34 psi		0.000	1.11	133.732		0.000		0.000
137°F	43 psi		0.000	1.22	144.078		0.000		0.000
156°F	53 psi		0.000	1.34	154.367		0.000		0.000
174°F	62 psi		0.000	1.46	164.226		0.000		0.000
193°F	72 psi		0.000	1.59	173.458		0.000		0.000
212°F	81 psi		0.000	1.73	182.383		0.000		0.000
231°F	91 psi		0.000	1.87	190.556		0.000		0.000
250°F	100 psi		0.000	2.01	197.697		0.000		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)
80°F	15 psi		0.000	-2.79	0.000	2.61	1.822	1.81	21.143
99°F	24 psi		0.000	-2.81	0.000	2.52	1.821	1.93	21.250
118°F	34 psi		0.000	-2.82	0.000	2.49	1.820	2.08	21.341
137°F	43 psi		0.000	-2.83	0.000	2.50	1.820	2.23	21.406
156°F	53 psi		0.000	-2.84	0.000	2.52	1.821	2.37	21.452
174°F	62 psi		0.000	-2.84	0.000	2.56	1.821	2.51	21.483
193°F	72 psi		0.000	-2.83	0.000	2.62	1.822	2.64	21.504
212°F	81 psi		0.000	-2.83	0.000	2.69	1.823	2.77	21.521
231°F	91 psi		0.000	-2.82	0.000	2.78	1.823	2.89	21.532
250°F	100 psi		0.000	-2.80	0.000	2.87	1.824	3.01	21.540

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.

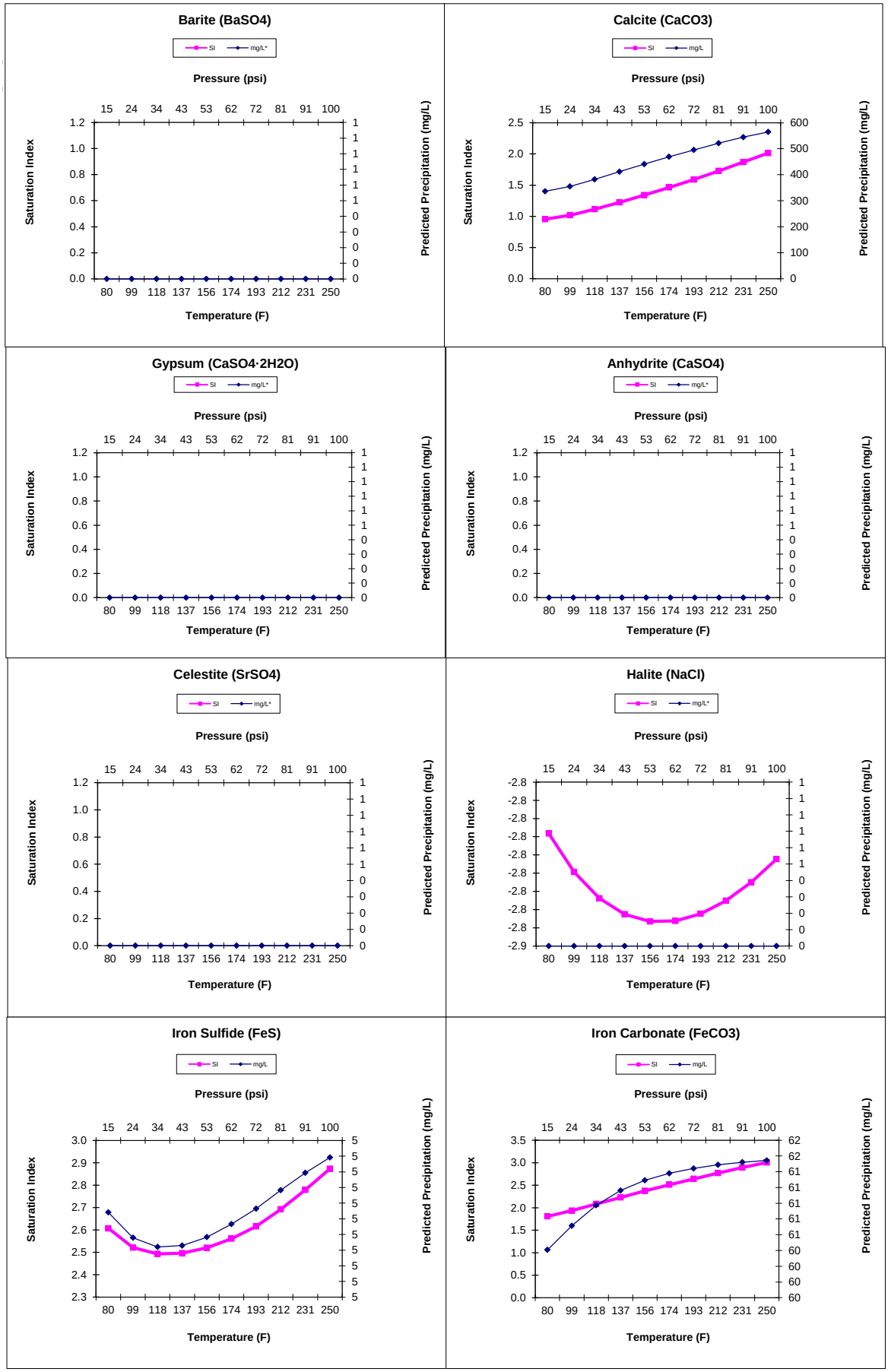
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 23C-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23D-13 Separator
District:	Four Corners	**Sample ID:**	201506001248
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 23D-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.1

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	976.0	16.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22951
Density/Specific Gravity (g/cm^3):	1.0134
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	28.6
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	12779.1	360.5
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	2.9	0.1
Silica (SiO_2):	46.7	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Cations:	mg/L	meq/L
Sodium (Na^+):	8599.8	374.2
Potassium (K^+):	61.1	1.6
Magnesium (Mg^{2+}):	49.1	4.0
Calcium (Ca^{2+}):	305.4	15.2
Strontium (Sr^{2+}):	40.9	0.9
Barium (Ba^{2+}):	117.2	1.7
Iron (Fe^{2+}):	13.9	0.5
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	5.7	0.2
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	
Total Hardness:	1098	N/A

Anion/Cation Ratio:	0.95

ND = Not Determined

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)
80°F	15 psi		0.000	0.64	87.057		0.000		0.000
99°F	24 psi		0.000	0.71	94.535		0.000		0.000
118°F	34 psi		0.000	0.81	105.634		0.000		0.000
137°F	43 psi		0.000	0.92	117.728		0.000		0.000
156°F	53 psi		0.000	1.04	129.923		0.000		0.000
174°F	62 psi		0.000	1.16	141.834		0.000		0.000
193°F	72 psi		0.000	1.29	153.273		0.000		0.000
212°F	81 psi		0.000	1.43	164.804		0.000		0.000
231°F	91 psi		0.000	1.58	175.782		0.000		0.000
250°F	100 psi		0.000	1.73	185.980		0.000		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)
80°F	15 psi		0.000	-2.77	0.000	1.90	2.088	1.08	9.167
99°F	24 psi		0.000	-2.79	0.000	1.83	2.081	1.21	9.401
118°F	34 psi		0.000	-2.80	0.000	1.82	2.080	1.35	9.600
137°F	43 psi		0.000	-2.81	0.000	1.84	2.082	1.50	9.744
156°F	53 psi		0.000	-2.82	0.000	1.88	2.086	1.65	9.844
174°F	62 psi		0.000	-2.82	0.000	1.93	2.091	1.79	9.912
193°F	72 psi		0.000	-2.81	0.000	1.99	2.096	1.92	9.959
212°F	81 psi		0.000	-2.80	0.000	2.08	2.101	2.06	9.995
231°F	91 psi		0.000	-2.79	0.000	2.18	2.106	2.18	10.020
250°F	100 psi		0.000	-2.78	0.000	2.28	2.110	2.30	10.037

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.

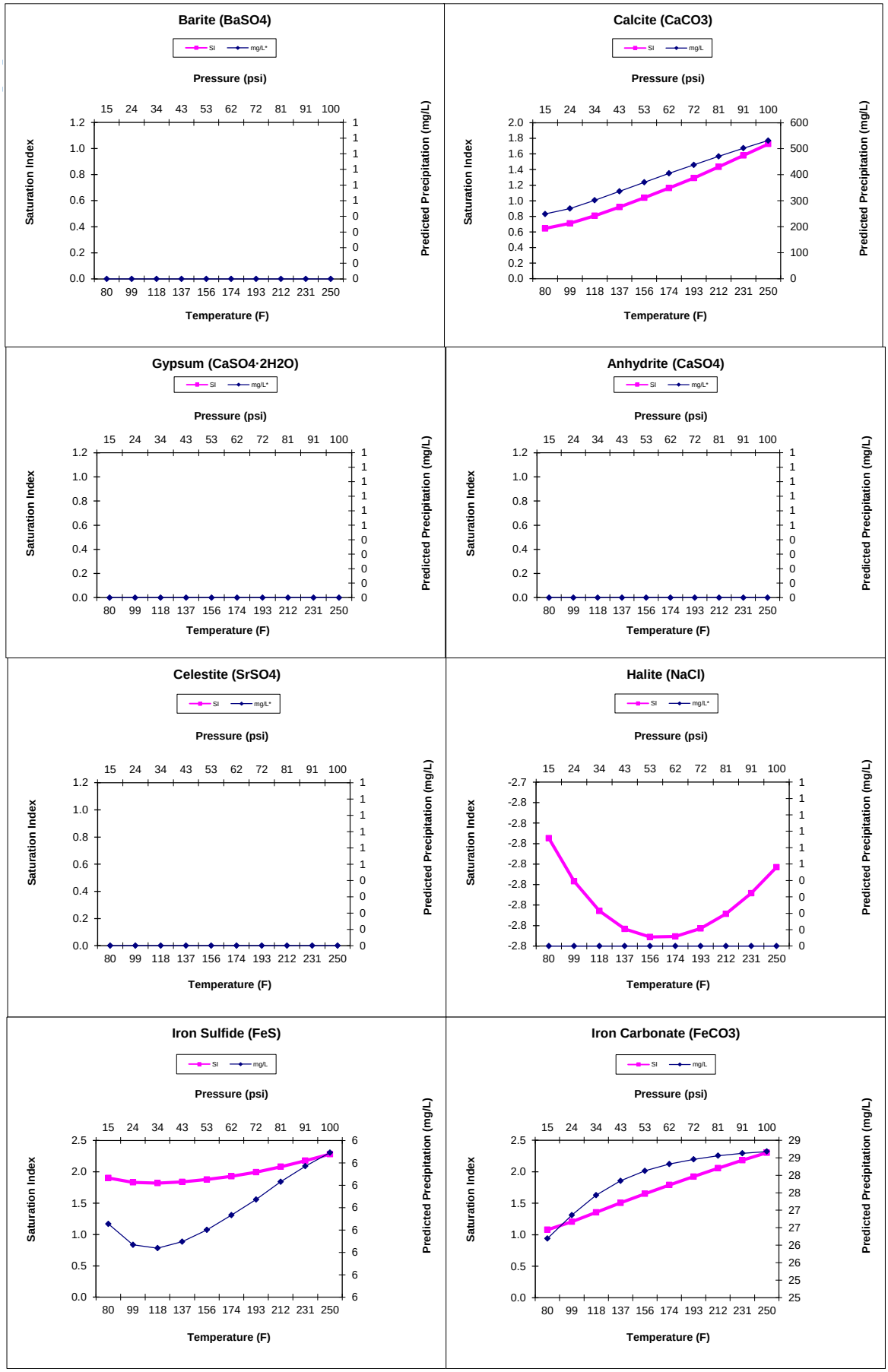
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 23D-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24A-13 Separator
District:	Four Corners	**Sample ID:**	201506001249
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 24A-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.8

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1098.0	18.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	300.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24478
Density/Specific Gravity (g/cm³):	1.0143
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	30.5
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13849.9	390.7
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	4.0	0.1
Silica (SiO_2):	49.4	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8865.9	385.8
Potassium (K^+):	61.8	1.6
Magnesium (Mg^{2+}):	52.2	4.3
Calcium (Ca^{2+}):	328.0	16.4
Strontium (Sr^{2+}):	45.9	1.0
Barium (Ba^{2+}):	136.1	2.0
Iron (Fe^{2+}):	33.7	1.2
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.9	0.1
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	
Total Hardness:	1187	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.42	74.232		0.000		0.000
99°F	24 psi		0.000	0.49	83.713		0.000		0.000
118°F	34 psi		0.000	0.59	97.950		0.000		0.000
137°F	43 psi		0.000	0.70	113.364		0.000		0.000
156°F	53 psi		0.000	0.82	128.773		0.000		0.000
174°F	62 psi		0.000	0.94	143.691		0.000		0.000
193°F	72 psi		0.000	1.08	157.900		0.000		0.000
212°F	81 psi		0.000	1.22	172.376		0.000		0.000
231°F	91 psi		0.000	1.37	185.783		0.000		0.000
250°F	100 psi		0.000	1.52	198.149		0.000		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)**
80°F	15 psi		0.000	-2.72	0.000	1.87	2.497	1.22	22.703
99°F	24 psi		0.000	-2.74	0.000	1.81	2.491	1.34	23.139
118°F	34 psi		0.000	-2.76	0.000	1.82	2.492	1.49	23.518
137°F	43 psi		0.000	-2.77	0.000	1.86	2.496	1.64	23.793
156°F	53 psi		0.000	-2.77	0.000	1.91	2.501	1.79	23.983
174°F	62 psi		0.000	-2.77	0.000	1.97	2.506	1.93	24.114
193°F	72 psi		0.000	-2.77	0.000	2.05	2.511	2.06	24.206
212°F	81 psi		0.000	-2.76	0.000	2.15	2.517	2.20	24.274
231°F	91 psi		0.000	-2.75	0.000	2.26	2.521	2.33	24.321
250°F	100 psi		0.000	-2.74	0.000	2.37	2.525	2.45	24.355

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.

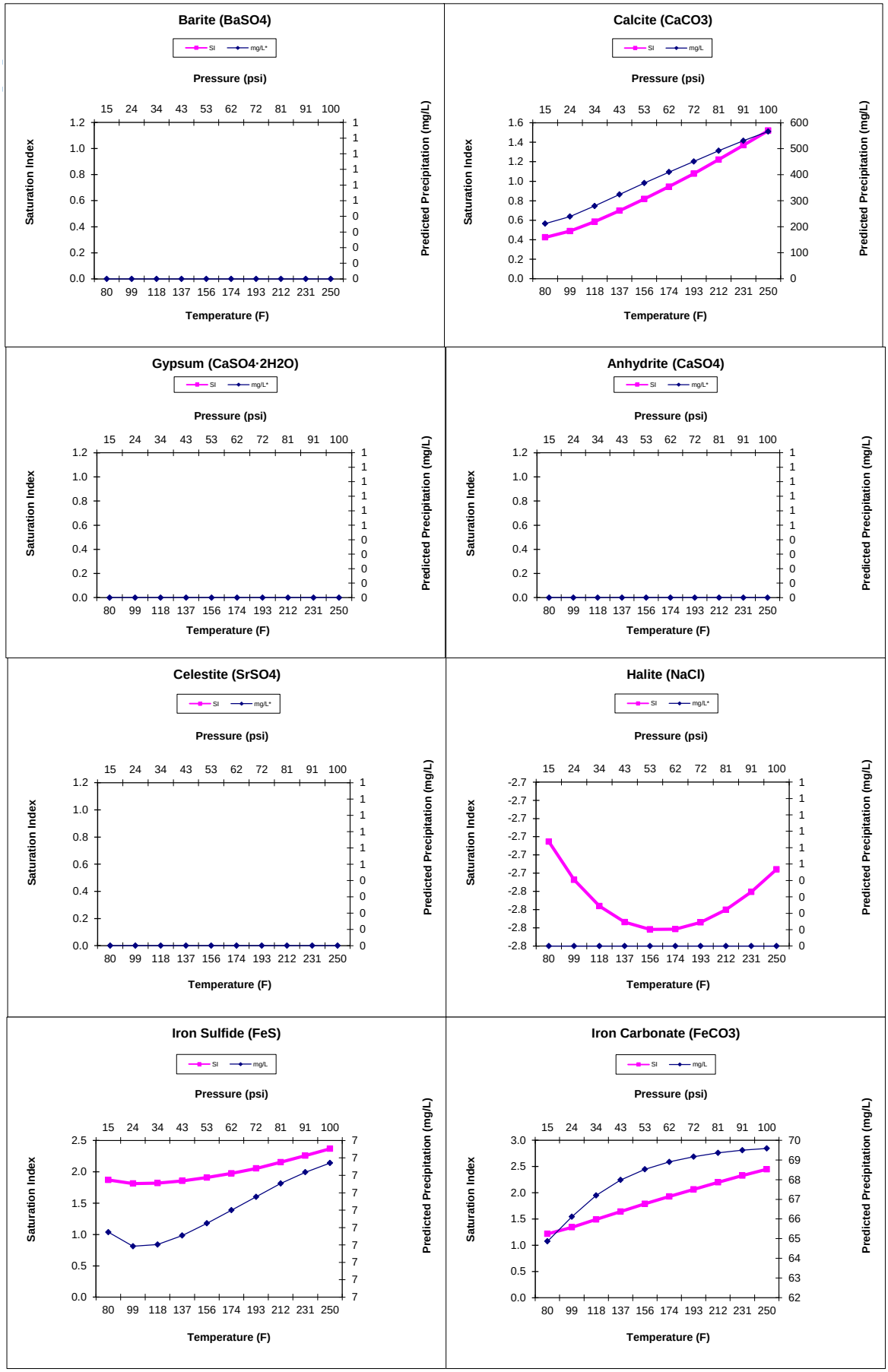
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 24A-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24B-13 Separator
District:	Four Corners	**Sample ID:**	201506001250
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 24B-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	1207.8	19.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24054
Density/Specific Gravity (g/cm^3):	1.0140
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	31.0
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	13395.2	377.9
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	2.9	0.1
Silica (SiO_2):	43.7	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Cations:	mg/L	meq/L
Sodium (Na^+):	8841.1	384.7
Potassium (K^+):	61.5	1.6
Magnesium (Mg^{2+}):	46.2	3.8
Calcium (Ca^{2+}):	286.3	14.3
Strontium (Sr^{2+}):	45.4	1.0
Barium (Ba^{2+}):	146.4	2.1
Iron (Fe^{2+}):	18.7	0.7
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.8	0.1
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	
Total Hardness:	1065	N/A

Anion/Cation Ratio:	0.97

ND = Not Determined

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)
80°F	15 psi		0.000	0.64	100.528		0.000		0.000
99°F	24 psi		0.000	0.71	108.750		0.000		0.000
118°F	34 psi		0.000	0.81	120.967		0.000		0.000
137°F	43 psi		0.000	0.92	134.160		0.000		0.000
156°F	53 psi		0.000	1.04	147.305		0.000		0.000
174°F	62 psi		0.000	1.16	159.966		0.000		0.000
193°F	72 psi		0.000	1.29	171.929		0.000		0.000
212°F	81 psi		0.000	1.44	183.801		0.000		0.000
231°F	91 psi		0.000	1.58	194.773		0.000		0.000
250°F	100 psi		0.000	1.73	204.645		0.000		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)
80°F	15 psi		0.000	-2.74	0.000	1.96	2.177	1.25	12.716
99°F	24 psi		0.000	-2.76	0.000	1.89	2.172	1.37	12.929
118°F	34 psi		0.000	-2.77	0.000	1.88	2.171	1.52	13.112
137°F	43 psi		0.000	-2.78	0.000	1.90	2.173	1.67	13.244
156°F	53 psi		0.000	-2.79	0.000	1.95	2.177	1.82	13.335
174°F	62 psi		0.000	-2.79	0.000	2.00	2.180	1.96	13.398
193°F	72 psi		0.000	-2.78	0.000	2.07	2.185	2.09	13.441
212°F	81 psi		0.000	-2.77	0.000	2.16	2.189	2.23	13.474
231°F	91 psi		0.000	-2.76	0.000	2.26	2.193	2.35	13.497
250°F	100 psi		0.000	-2.75	0.000	2.36	2.197	2.47	13.513

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.

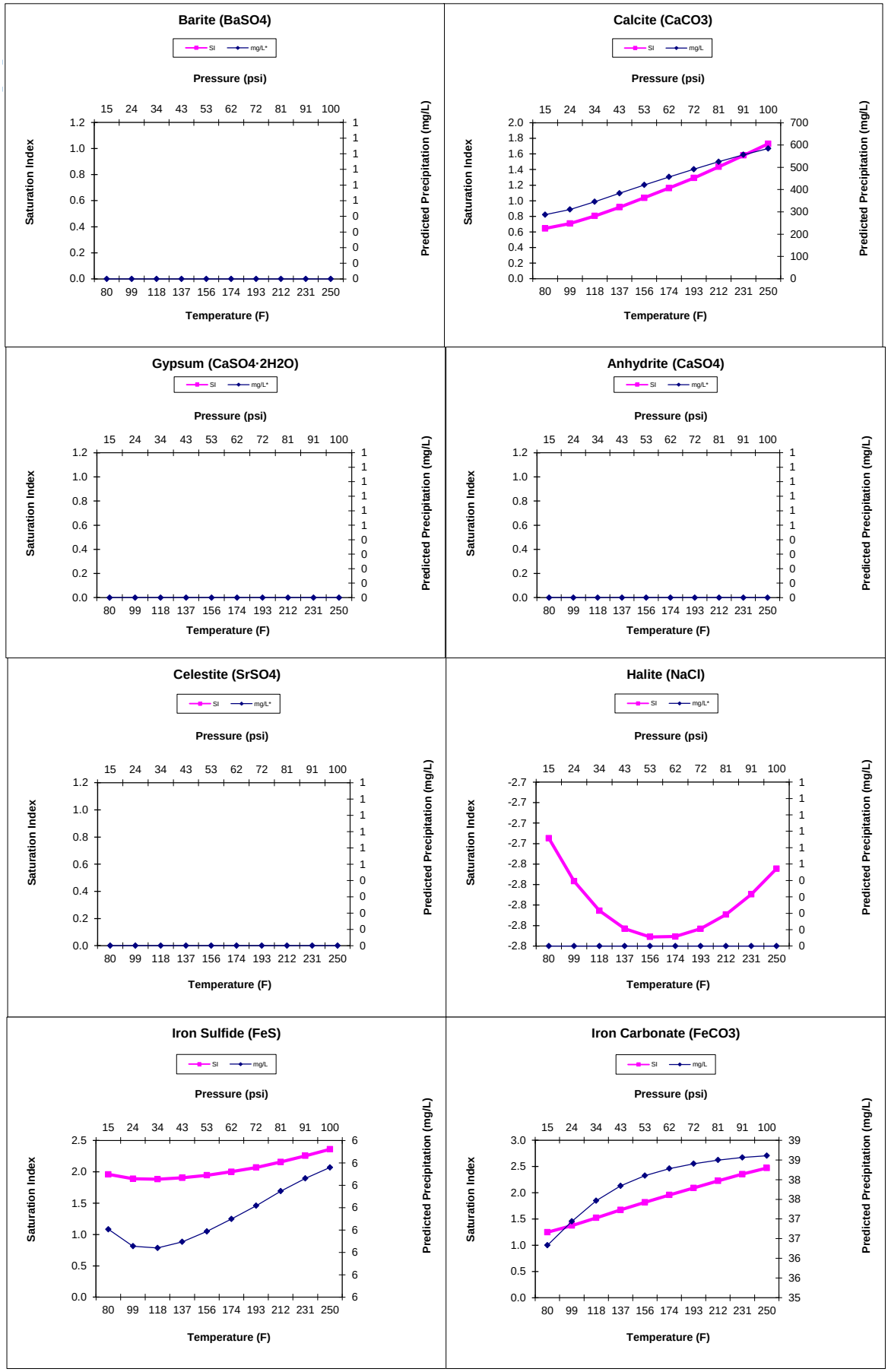
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 24B-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24C-13 Separator
District:	Four Corners	**Sample ID:**	201506001251
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 24C-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.8

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1439.6	23.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	280.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	25021
Density/Specific Gravity (g/cm³):	1.0146
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	31.3
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14036.4	395.9
Sulfate (SO_4^{2-}):	1.5	0.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	2.9	0.1
Silica (SiO_2):	45.0	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.02	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8894.4	387.0
Potassium (K^+):	67.0	1.7
Magnesium (Mg^{2+}):	46.2	3.8
Calcium (Ca^{2+}):	289.0	14.4
Strontium (Sr^{2+}):	47.8	1.1
Barium (Ba^{2+}):	157.0	2.3
Iron (Fe^{2+}):	37.3	1.3
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.8	0.1
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	
Total Hardness:	1082	N/A

ND = Not Determined

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)**
80°F	15 psi	0.65	1.015	0.51	97.187	-3.74	0.000	-3.98	0.000
99°F	24 psi	0.50	0.889	0.57	106.882	-3.75	0.000	-3.91	0.000
118°F	34 psi	0.37	0.744	0.67	121.518	-3.74	0.000	-3.82	0.000
137°F	43 psi	0.26	0.590	0.78	137.174	-3.73	0.000	-3.72	0.000
156°F	53 psi	0.18	0.435	0.90	152.542	-3.71	0.000	-3.60	0.000
174°F	62 psi	0.11	0.290	1.02	167.078	-3.69	0.000	-3.48	0.000
193°F	72 psi	0.06	0.162	1.16	180.610	-3.66	0.000	-3.36	0.000
212°F	81 psi	0.02	0.058	1.30	193.802	-3.63	0.000	-3.23	0.000
231°F	91 psi	-0.01	0.000	1.45	205.408	-3.60	0.000	-3.09	0.000
250°F	100 psi	-0.02	0.000	1.60	215.455	-3.57	0.000	-2.95	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)**
80°F	15 psi	-2.86	0.000	-2.72	0.000	1.79	1.649	1.42	25.920
99°F	24 psi	-2.86	0.000	-2.74	0.000	1.73	1.645	1.54	26.216
118°F	34 psi	-2.85	0.000	-2.75	0.000	1.73	1.645	1.69	26.474
137°F	43 psi	-2.83	0.000	-2.76	0.000	1.77	1.648	1.84	26.661
156°F	53 psi	-2.81	0.000	-2.76	0.000	1.82	1.652	1.99	26.790
174°F	62 psi	-2.77	0.000	-2.76	0.000	1.88	1.656	2.13	26.879
193°F	72 psi	-2.72	0.000	-2.76	0.000	1.97	1.660	2.27	26.942
212°F	81 psi	-2.67	0.000	-2.75	0.000	2.06	1.664	2.40	26.988
231°F	91 psi	-2.60	0.000	-2.74	0.000	2.17	1.667	2.53	27.020
250°F	100 psi	-2.53	0.000	-2.73	0.000	2.28	1.670	2.65	27.042

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.

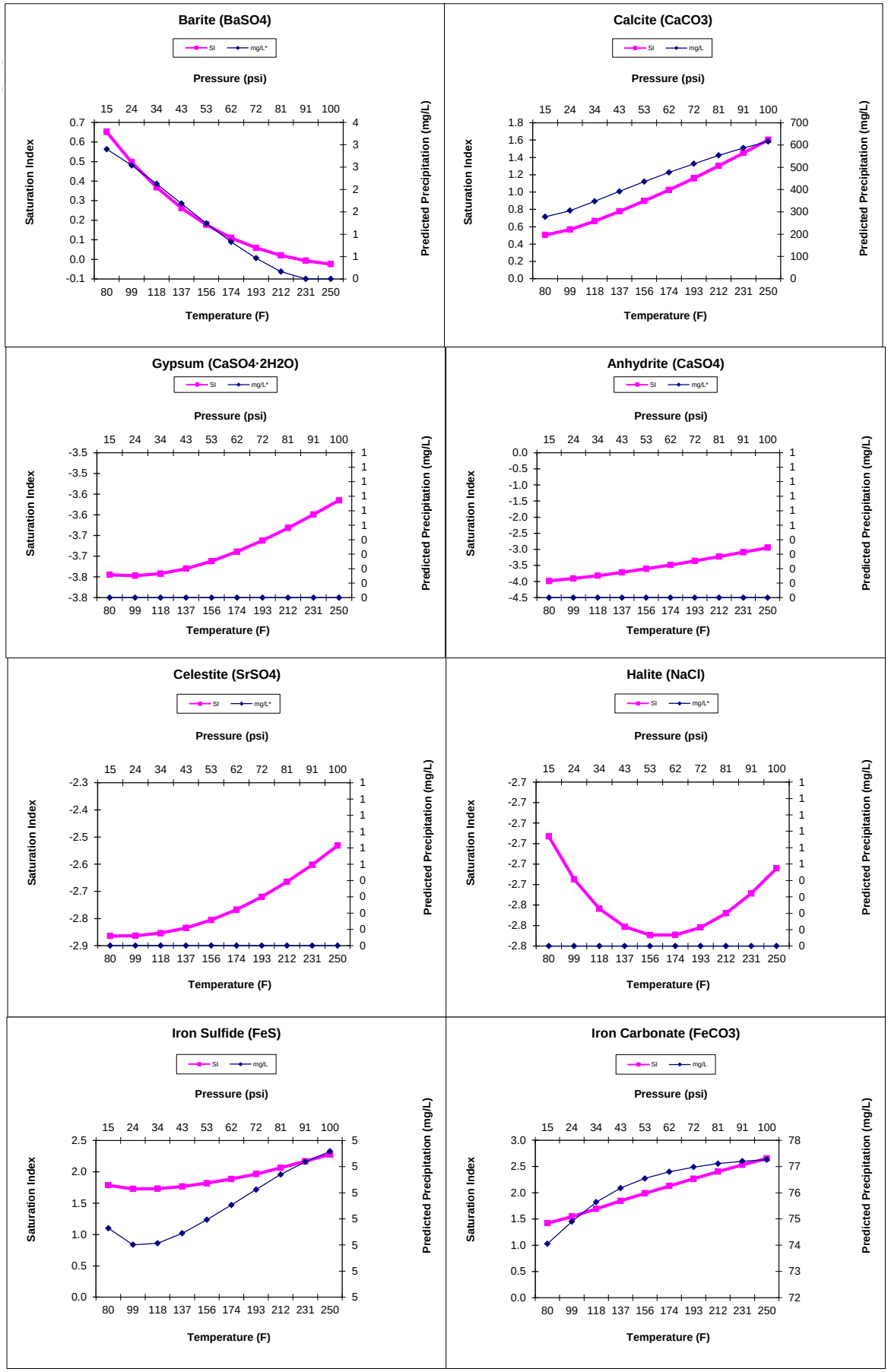
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 24C-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24D-13 Separator
District:	Four Corners	**Sample ID:**	201506001252
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	ISLAND RANCH	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, ISLAND RANCH, 24D-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
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^-):	1403.0	23.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	160.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22196
Density/Specific Gravity (g/cm^3):	1.0127
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	29.2
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	12202.0	344.2
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	2.6	0.1
Silica (SiO_2):	43.7	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Cations:	mg/L	meq/L
Sodium (Na^+):	8076.5	351.5
Potassium (K^+):	55.5	1.4
Magnesium (Mg^{2+}):	38.5	3.2
Calcium (Ca^{2+}):	236.5	11.8
Strontium (Sr^{2+}):	41.2	0.9
Barium (Ba^{2+}):	122.5	1.8
Iron (Fe^{2+}):	15.3	0.5
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	2.7	0.1
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	
Total Hardness:	886	N/A

Anion/Cation Ratio:	0.99

ND = Not Determined

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)
80°F	15 psi		0.000	1.00	127.007		0.000		0.000
99°F	24 psi		0.000	1.06	133.117		0.000		0.000
118°F	34 psi		0.000	1.16	141.989		0.000		0.000
137°F	43 psi		0.000	1.27	151.324		0.000		0.000
156°F	53 psi		0.000	1.39	160.306		0.000		0.000
174°F	62 psi		0.000	1.51	168.573		0.000		0.000
193°F	72 psi		0.000	1.63	175.950		0.000		0.000
212°F	81 psi		0.000	1.77	182.687		0.000		0.000
231°F	91 psi		0.000	1.92	188.437		0.000		0.000
250°F	100 psi		0.000	2.06	193.085		0.000		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)
80°F	15 psi		0.000	-2.81	0.000	2.35	1.810	1.62	10.822
99°F	24 psi		0.000	-2.83	0.000	2.26	1.808	1.74	10.898
118°F	34 psi		0.000	-2.85	0.000	2.24	1.807	1.89	10.962
137°F	43 psi		0.000	-2.86	0.000	2.24	1.807	2.04	11.008
156°F	53 psi		0.000	-2.86	0.000	2.26	1.808	2.18	11.040
174°F	62 psi		0.000	-2.86	0.000	2.31	1.809	2.32	11.062
193°F	72 psi		0.000	-2.86	0.000	2.36	1.810	2.45	11.077
212°F	81 psi		0.000	-2.85	0.000	2.44	1.812	2.58	11.088
231°F	91 psi		0.000	-2.84	0.000	2.52	1.814	2.71	11.096
250°F	100 psi		0.000	-2.83	0.000	2.62	1.815	2.82	11.102

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.

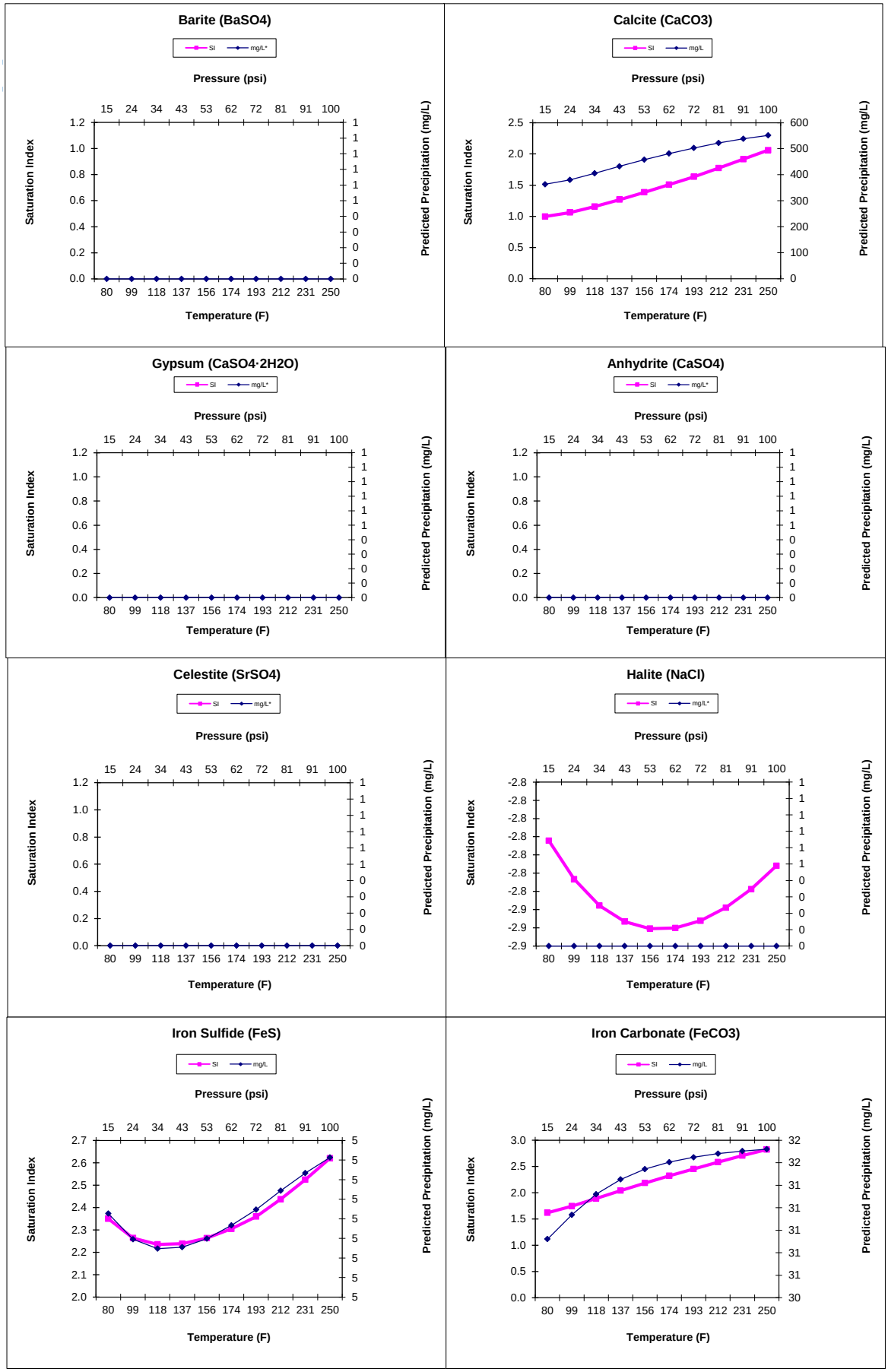
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, ISLAND RANCH, 24D-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11A-24 Separator
District:	Four Corners	**Sample ID:**	201506001253
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 11A-24 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1037.0	17.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22981
Density/Specific Gravity (g/cm³):	1.0133
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	29.7
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12849.8	362.5
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	2.4	0.1
Silica (SiO_2):	47.2	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.97

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8572.7	373.1
Potassium (K^+):	53.5	1.4
Magnesium (Mg^{2+}):	39.4	3.2
Calcium (Ca^{2+}):	243.2	12.1
Strontium (Sr^{2+}):	41.4	0.9
Barium (Ba^{2+}):	133.3	1.9
Iron (Fe^{2+}):	6.8	0.2
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.8	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	
Total Hardness:	915	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.73	87.669		0.000		0.000
99°F	24 psi		0.000	0.79	94.381		0.000		0.000
118°F	34 psi		0.000	0.89	104.287		0.000		0.000
137°F	43 psi		0.000	1.00	115.047		0.000		0.000
156°F	53 psi		0.000	1.12	125.849		0.000		0.000
174°F	62 psi		0.000	1.24	136.328		0.000		0.000
193°F	72 psi		0.000	1.37	146.294		0.000		0.000
212°F	81 psi		0.000	1.51	156.172		0.000		0.000
231°F	91 psi		0.000	1.65	165.415		0.000		0.000
250°F	100 psi		0.000	1.80	173.766		0.000		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)**
80°F	15 psi		0.000	-2.77	0.000	1.61	1.253	0.95	4.337
99°F	24 psi		0.000	-2.79	0.000	1.53	1.244	1.08	4.484
118°F	34 psi		0.000	-2.80	0.000	1.51	1.241	1.23	4.608
137°F	43 psi		0.000	-2.81	0.000	1.52	1.243	1.37	4.698
156°F	53 psi		0.000	-2.81	0.000	1.55	1.247	1.52	4.760
174°F	62 psi		0.000	-2.81	0.000	1.60	1.252	1.66	4.803
193°F	72 psi		0.000	-2.81	0.000	1.66	1.259	1.79	4.832
212°F	81 psi		0.000	-2.80	0.000	1.74	1.266	1.92	4.854
231°F	91 psi		0.000	-2.79	0.000	1.83	1.273	2.05	4.870
250°F	100 psi		0.000	-2.78	0.000	1.93	1.279	2.16	4.881

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.

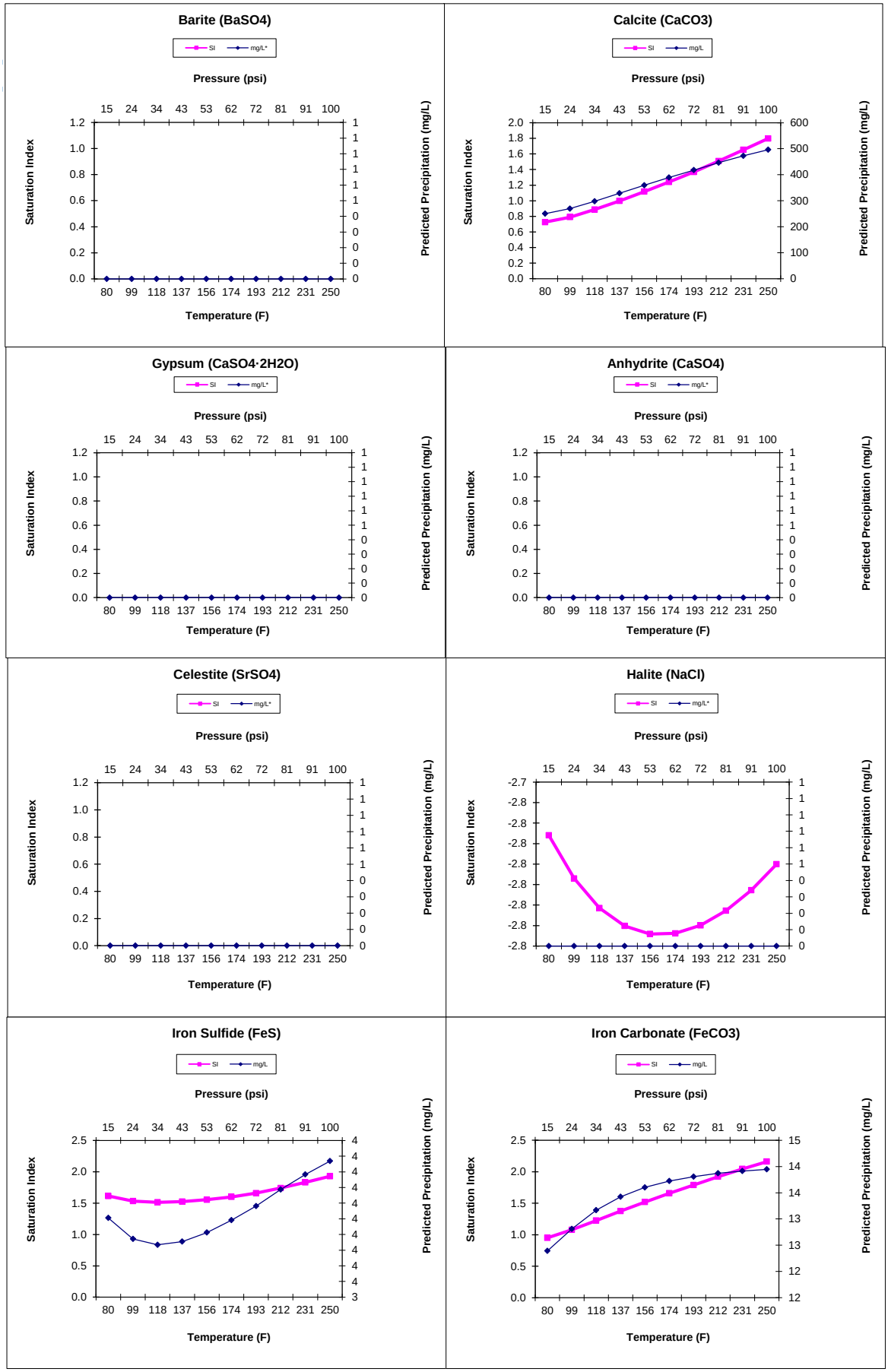
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 11A-24 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11B-24 Separator
District:	Four Corners	**Sample ID:**	201506001254
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 11B-24 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.1

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1037.0	17.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	140.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23415
Density/Specific Gravity (g/cm³):	1.0136
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	30.7
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13185.4	371.9
Sulfate (SO_4^{2-}):	4.6	0.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.8	0.1
Silica (SiO_2):	48.6	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.98	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8604.1	374.4
Potassium (K^+):	62.2	1.6
Magnesium (Mg^{2+}):	43.6	3.6
Calcium (Ca^{2+}):	273.5	13.6
Strontium (Sr^{2+}):	42.8	1.0
Barium (Ba^{2+}):	139.5	2.0
Iron (Fe^{2+}):	16.1	0.6
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.9	0.1
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	
Total Hardness:	1014	N/A

ND = Not Determined

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)**
80°F	15 psi	1.10	3.578	0.63	85.782	-3.28	0.000	-3.52	0.000
99°F	24 psi	0.95	3.440	0.69	93.292	-3.28	0.000	-3.44	0.000
118°F	34 psi	0.82	3.283	0.79	104.415	-3.28	0.000	-3.35	0.000
137°F	43 psi	0.71	3.115	0.90	116.501	-3.26	0.000	-3.25	0.000
156°F	53 psi	0.63	2.948	1.02	128.644	-3.25	0.000	-3.14	0.000
174°F	62 psi	0.56	2.792	1.15	140.453	-3.22	0.000	-3.02	0.000
193°F	72 psi	0.51	2.655	1.28	151.734	-3.20	0.000	-2.89	0.000
212°F	81 psi	0.47	2.544	1.42	163.040	-3.16	0.000	-2.76	0.000
231°F	91 psi	0.45	2.461	1.57	173.696	-3.13	0.000	-2.62	0.000
250°F	100 psi	0.43	2.407	1.72	183.482	-3.10	0.000	-2.48	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)**
80°F	15 psi	-2.42	0.000	-2.75	0.000	1.80	1.388	1.18	10.863
99°F	24 psi	-2.41	0.000	-2.78	0.000	1.73	1.383	1.31	11.080
118°F	34 psi	-2.40	0.000	-2.79	0.000	1.72	1.382	1.46	11.266
137°F	43 psi	-2.38	0.000	-2.80	0.000	1.74	1.383	1.61	11.400
156°F	53 psi	-2.35	0.000	-2.80	0.000	1.78	1.386	1.75	11.493
174°F	62 psi	-2.32	0.000	-2.80	0.000	1.83	1.389	1.89	11.556
193°F	72 psi	-2.27	0.000	-2.80	0.000	1.89	1.393	2.02	11.600
212°F	81 psi	-2.21	0.000	-2.79	0.000	1.98	1.397	2.16	11.633
231°F	91 psi	-2.15	0.000	-2.78	0.000	2.07	1.400	2.28	11.657
250°F	100 psi	-2.08	0.000	-2.77	0.000	2.18	1.403	2.40	11.673

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.

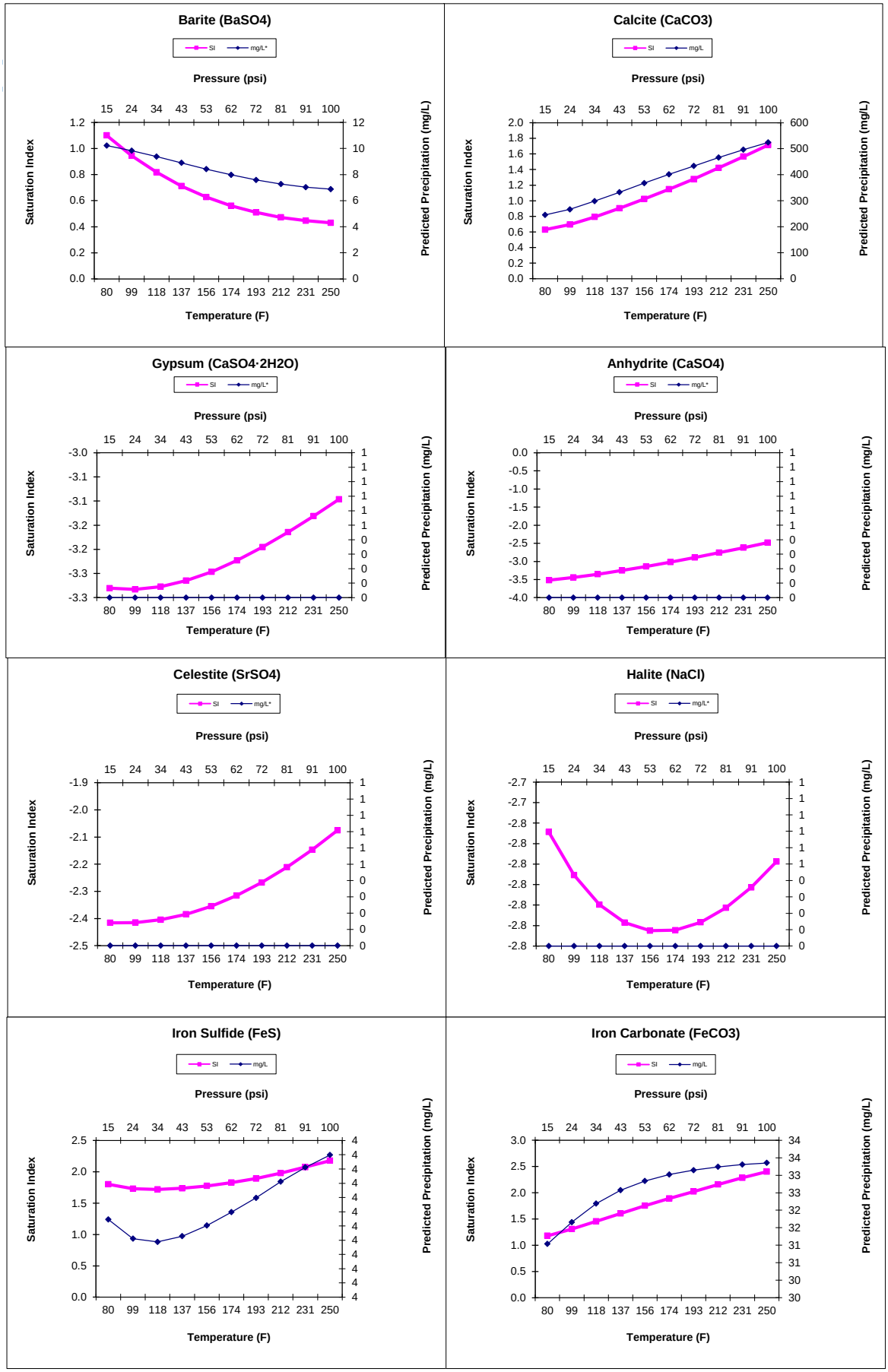
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 11B-24 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13A-13 Separator
District:	Four Corners	**Sample ID:**	201506001255
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 13A-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1073.6	17.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	260.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21353
Density/Specific Gravity (g/cm³):	1.0122
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	25.2
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11878.6	335.1
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	4.4	0.1
Silica (SiO_2):	50.8	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.97	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7882.6	343.0
Potassium (K^+):	58.7	1.5
Magnesium (Mg^{2+}):	40.9	3.4
Calcium (Ca^{2+}):	247.5	12.3
Strontium (Sr^{2+}):	37.6	0.9
Barium (Ba^{2+}):	118.3	1.7
Iron (Fe^{2+}):	9.7	0.3
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.9	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	
Total Hardness:	916	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.41	62.496		0.000		0.000
99°F	24 psi		0.000	0.48	70.913		0.000		0.000
118°F	34 psi		0.000	0.57	83.425		0.000		0.000
137°F	43 psi		0.000	0.69	96.937		0.000		0.000
156°F	53 psi		0.000	0.81	110.401		0.000		0.000
174°F	62 psi		0.000	0.93	123.369		0.000		0.000
193°F	72 psi		0.000	1.07	135.623		0.000		0.000
212°F	81 psi		0.000	1.21	147.893		0.000		0.000
231°F	91 psi		0.000	1.36	159.116		0.000		0.000
250°F	100 psi		0.000	1.51	169.224		0.000		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)**
80°F	15 psi		0.000	-2.83	0.000	1.63	3.012	0.79	5.875
99°F	24 psi		0.000	-2.85	0.000	1.57	2.988	0.92	6.175
118°F	34 psi		0.000	-2.87	0.000	1.57	2.989	1.07	6.433
137°F	43 psi		0.000	-2.88	0.000	1.60	3.003	1.22	6.619
156°F	53 psi		0.000	-2.88	0.000	1.65	3.022	1.37	6.748
174°F	62 psi		0.000	-2.88	0.000	1.71	3.044	1.51	6.837
193°F	72 psi		0.000	-2.88	0.000	1.79	3.067	1.65	6.898
212°F	81 psi		0.000	-2.87	0.000	1.89	3.091	1.79	6.944
231°F	91 psi		0.000	-2.86	0.000	1.99	3.112	1.92	6.975
250°F	100 psi		0.000	-2.85	0.000	2.10	3.130	2.04	6.998

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.

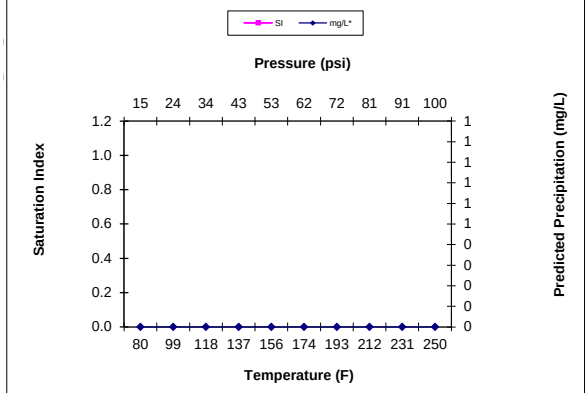
Calculate

ScaleSoftPitzer™ SSP2010

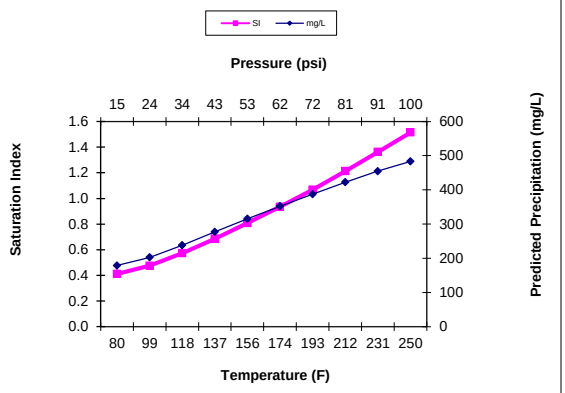
Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 13A-13 Separator

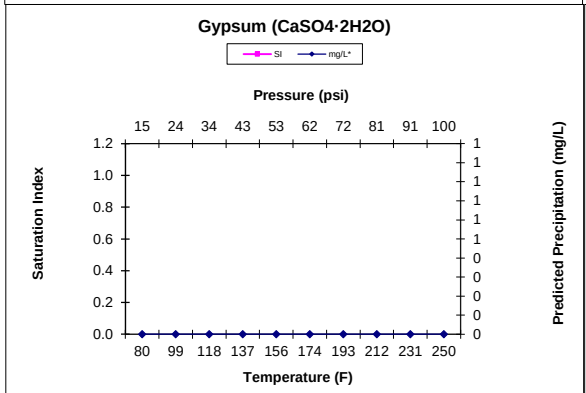
Barite (BaSO4)



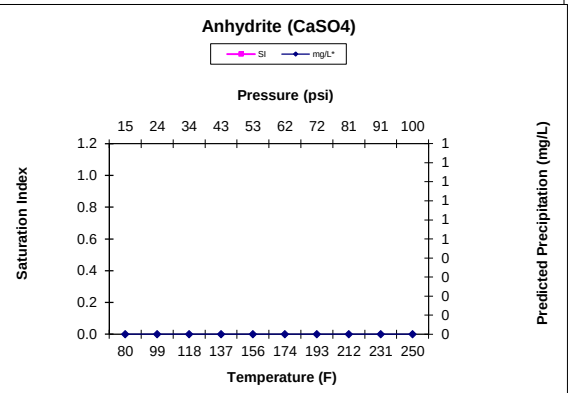
Calcite (CaCO3)



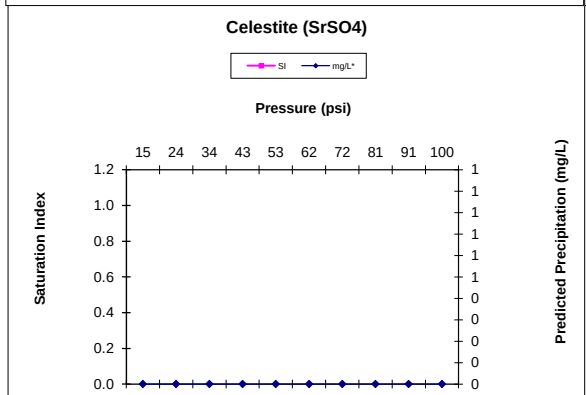
Gypsum (CaSO4·2H2O)



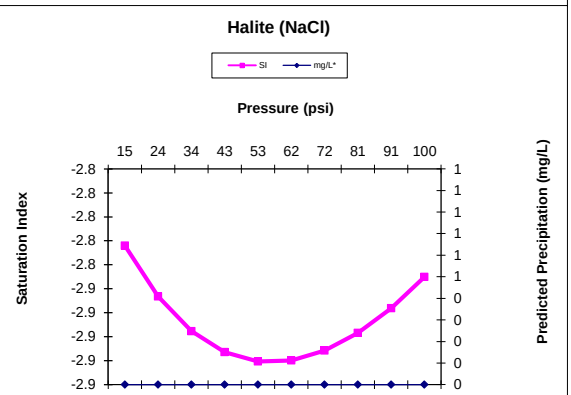
Anhydrite (CaSO4)



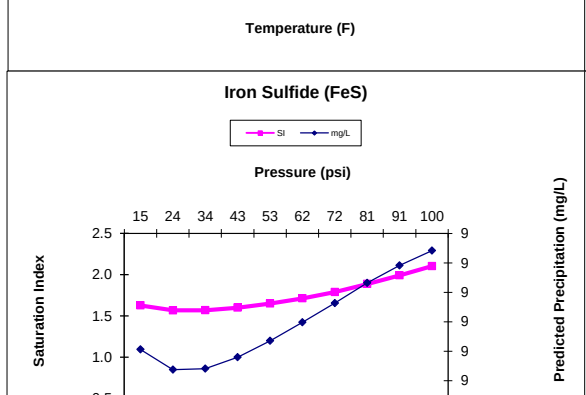
Celestite (SrSO4)



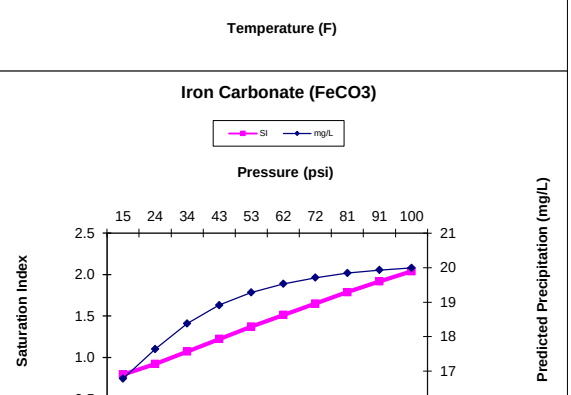
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13B-13 Separator
District:	Four Corners	**Sample ID:**	201506001256
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 13B-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1037.0	17.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21763
Density/Specific Gravity (g/cm³):	1.0124
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	28.8
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12220.2	344.7
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	4.5	0.1
Silica (SiO_2):	51.3	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7989.6	347.7
Potassium (K^+):	59.3	1.5
Magnesium (Mg^{2+}):	43.4	3.6
Calcium (Ca^{2+}):	251.9	12.6
Strontium (Sr^{2+}):	36.3	0.8
Barium (Ba^{2+}):	109.7	1.6
Iron (Fe^{2+}):	9.6	0.3
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.4	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	
Total Hardness:	930	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.38	58.146		0.000		0.000
99°F	24 psi		0.000	0.45	66.639		0.000		0.000
118°F	34 psi		0.000	0.55	79.263		0.000		0.000
137°F	43 psi		0.000	0.66	92.914		0.000		0.000
156°F	53 psi		0.000	0.78	106.543		0.000		0.000
174°F	62 psi		0.000	0.91	119.704		0.000		0.000
193°F	72 psi		0.000	1.04	132.185		0.000		0.000
212°F	81 psi		0.000	1.19	144.749		0.000		0.000
231°F	91 psi		0.000	1.34	156.308		0.000		0.000
250°F	100 psi		0.000	1.49	166.808		0.000		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)**
80°F	15 psi		0.000	-2.81	0.000	1.46	2.270	0.75	5.685
99°F	24 psi		0.000	-2.84	0.000	1.41	2.249	0.88	6.012
118°F	34 psi		0.000	-2.85	0.000	1.41	2.251	1.03	6.294
137°F	43 psi		0.000	-2.86	0.000	1.44	2.262	1.18	6.498
156°F	53 psi		0.000	-2.86	0.000	1.49	2.279	1.33	6.639
174°F	62 psi		0.000	-2.86	0.000	1.56	2.298	1.47	6.736
193°F	72 psi		0.000	-2.86	0.000	1.63	2.317	1.60	6.803
212°F	81 psi		0.000	-2.85	0.000	1.73	2.337	1.74	6.853
231°F	91 psi		0.000	-2.84	0.000	1.84	2.355	1.87	6.888
250°F	100 psi		0.000	-2.83	0.000	1.95	2.369	1.99	6.912

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.

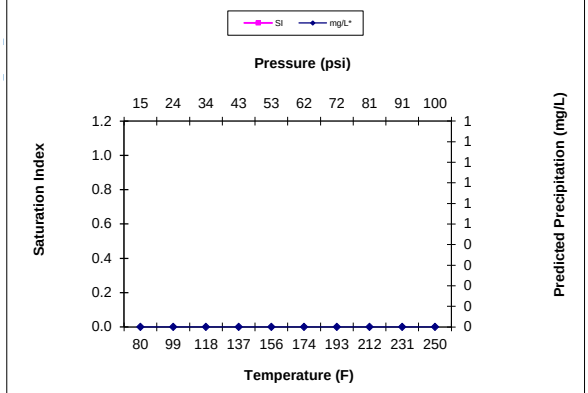
Calculate

ScaleSoftPitzer™ SSP2010

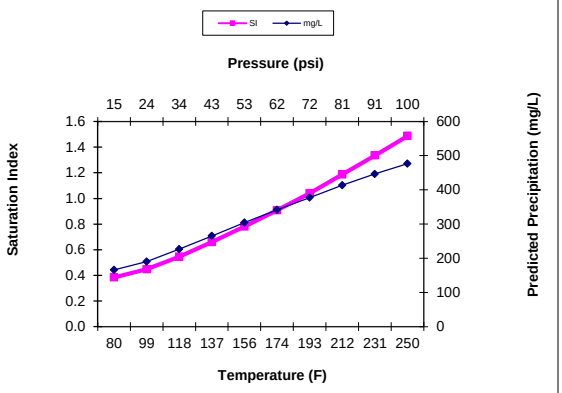
Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 13B-13 Separator

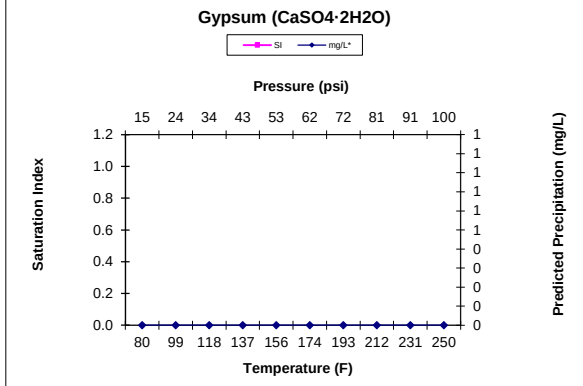
Barite (BaSO4)



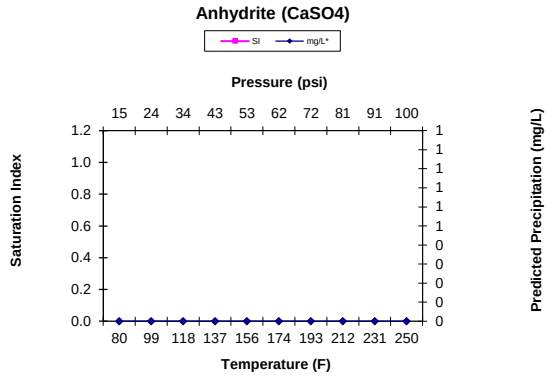
Calcite (CaCO3)



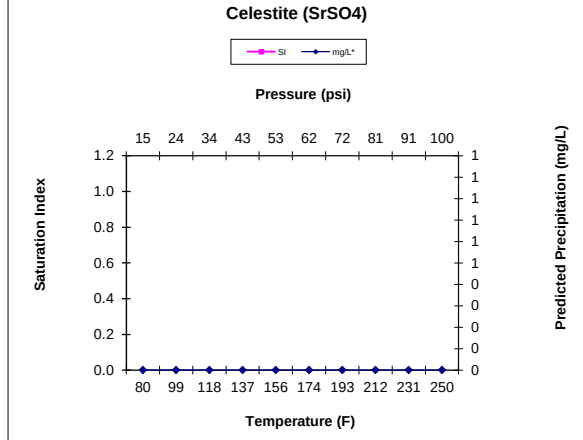
Gypsum (CaSO4·2H2O)



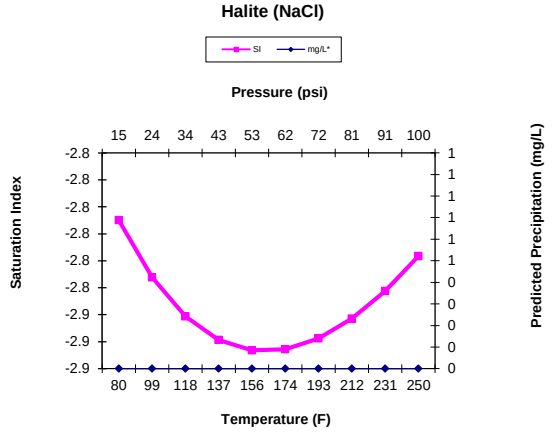
Anhydrite (CaSO4)



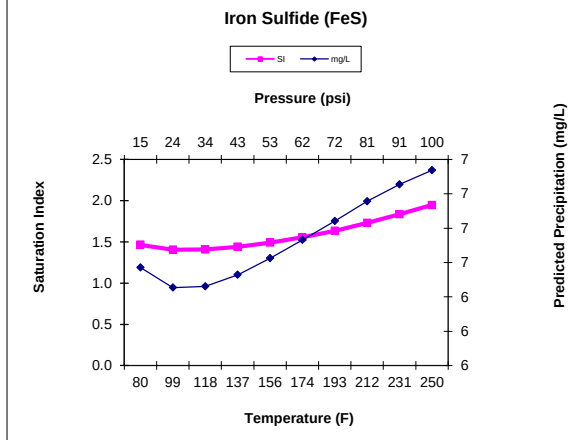
Celestite (SrSO4)



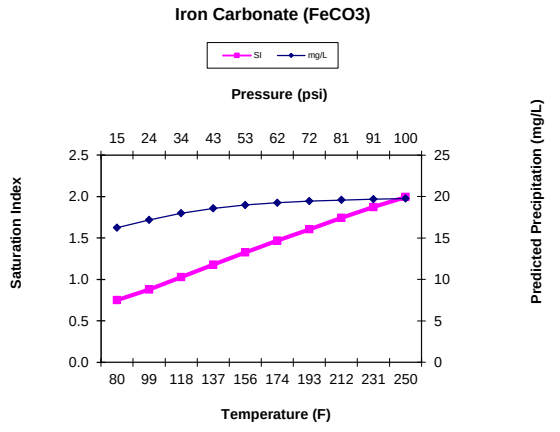
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13C-13 Separator
District:	Four Corners	**Sample ID:**	201506001257
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 13C-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1195.6	19.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22263
Density/Specific Gravity (g/cm³):	1.0127
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	29.3
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12493.1	352.4
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.4	0.1
Silica (SiO_2):	52.9	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8066.4	351.0
Potassium (K^+):	58.3	1.5
Magnesium (Mg^{2+}):	38.3	3.2
Calcium (Ca^{2+}):	240.1	12.0
Strontium (Sr^{2+}):	37.7	0.9
Barium (Ba^{2+}):	115.8	1.7
Iron (Fe^{2+}):	13.5	0.5
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.7	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	
Total Hardness:	885	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.48	74.466		0.000		0.000
99°F	24 psi		0.000	0.54	82.811		0.000		0.000
118°F	34 psi		0.000	0.64	95.184		0.000		0.000
137°F	43 psi		0.000	0.75	108.456		0.000		0.000
156°F	53 psi		0.000	0.87	121.561		0.000		0.000
174°F	62 psi		0.000	1.00	134.037		0.000		0.000
193°F	72 psi		0.000	1.13	145.656		0.000		0.000
212°F	81 psi		0.000	1.28	157.065		0.000		0.000
231°F	91 psi		0.000	1.43	167.248		0.000		0.000
250°F	100 psi		0.000	1.58	176.132		0.000		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)**
80°F	15 psi		0.000	-2.80	0.000	1.70	2.277	1.02	8.785
99°F	24 psi		0.000	-2.82	0.000	1.63	2.266	1.15	9.035
118°F	34 psi		0.000	-2.84	0.000	1.63	2.266	1.30	9.250
137°F	43 psi		0.000	-2.85	0.000	1.66	2.272	1.45	9.405
156°F	53 psi		0.000	-2.85	0.000	1.71	2.279	1.60	9.512
174°F	62 psi		0.000	-2.85	0.000	1.77	2.288	1.74	9.586
193°F	72 psi		0.000	-2.85	0.000	1.85	2.298	1.87	9.637
212°F	81 psi		0.000	-2.84	0.000	1.94	2.307	2.01	9.675
231°F	91 psi		0.000	-2.83	0.000	2.04	2.316	2.14	9.702
250°F	100 psi		0.000	-2.82	0.000	2.15	2.323	2.26	9.720

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.

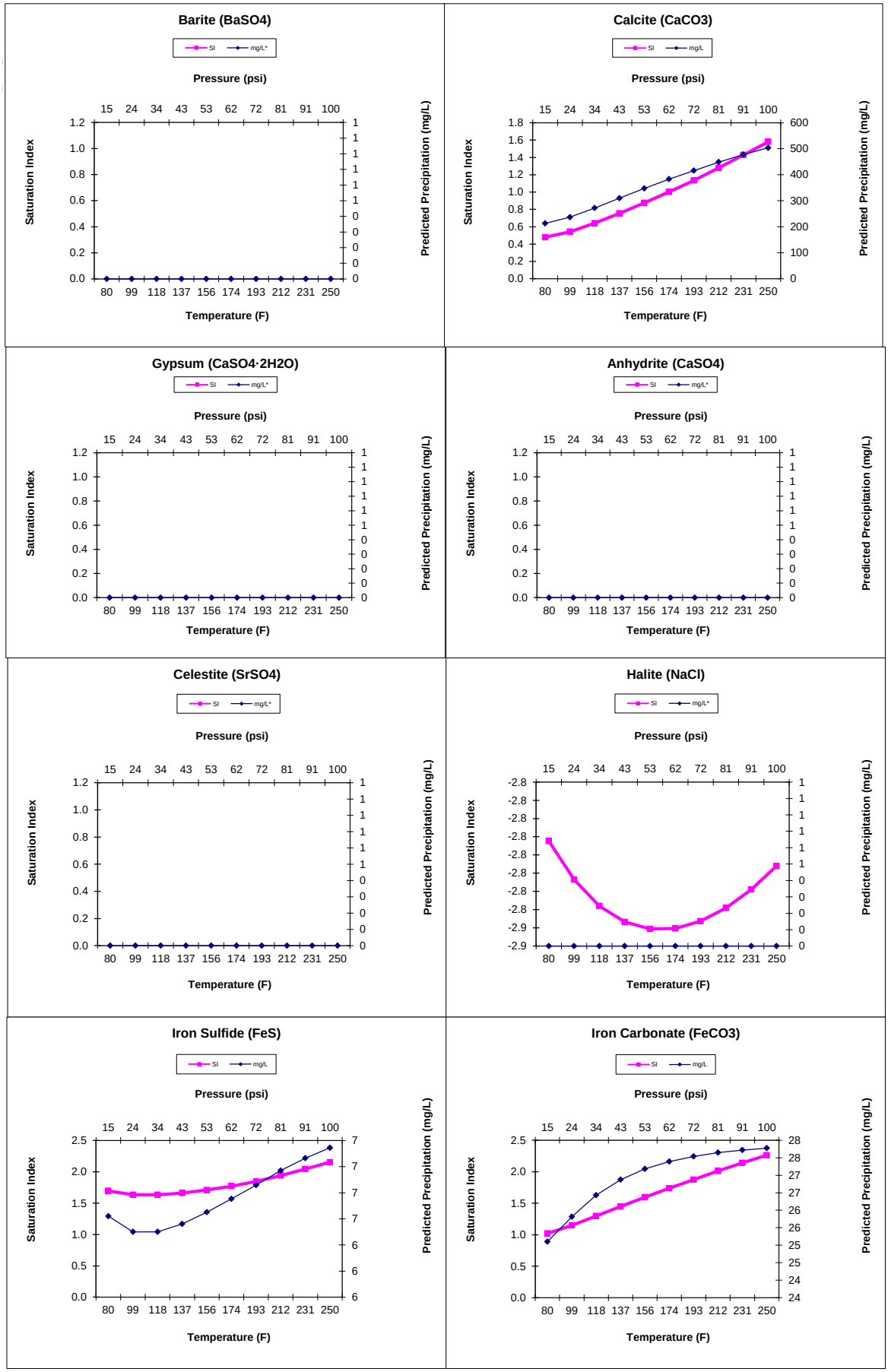
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 13C-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13D-13 Separator
District:	Four Corners	**Sample ID:**	201506001258
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 13D-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1098.0	18.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	170.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16479
Density/Specific Gravity (g/cm^3):	1.0087
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	20.3
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9005.0	254.0
Sulfate (SO_4^{2-}):	115.5	2.4
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.0	0.1
Silica (SiO_2):	39.0	

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^+):	5980.2	260.2
Potassium (K^+):	49.9	1.3
Magnesium (Mg^{2+}):	29.8	2.5
Calcium (Ca^{2+}):	158.7	7.9
Strontium (Sr^{2+}):	20.6	0.5
Barium (Ba^{2+}):	3.6	0.1
Iron (Fe^{2+}):	13.7	0.5
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.5	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	
Total Hardness:	546	N/A

ND = Not Determined

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)**
80°F	15 psi	1.07	1.959	0.41	49.499	-1.98	0.000	-2.22	0.000
99°F	24 psi	0.91	1.878	0.47	56.207	-1.98	0.000	-2.14	0.000
118°F	34 psi	0.78	1.786	0.57	65.954	-1.97	0.000	-2.05	0.000
137°F	43 psi	0.68	1.690	0.69	76.246	-1.96	0.000	-1.95	0.000
156°F	53 psi	0.60	1.595	0.81	86.197	-1.94	0.000	-1.83	0.000
174°F	62 psi	0.53	1.508	0.94	95.411	-1.91	0.000	-1.71	0.000
193°F	72 psi	0.49	1.435	1.08	103.688	-1.88	0.000	-1.58	0.000
212°F	81 psi	0.45	1.378	1.22	111.426	-1.84	0.000	-1.44	0.000
231°F	91 psi	0.43	1.340	1.38	117.939	-1.81	0.000	-1.30	0.000
250°F	100 psi	0.42	1.320	1.53	123.243	-1.77	0.000	-1.16	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)**
80°F	15 psi	-1.20	0.000	-3.06	0.000	1.88	2.179	1.15	9.157
99°F	24 psi	-1.20	0.000	-3.08	0.000	1.82	2.172	1.28	9.353
118°F	34 psi	-1.18	0.000	-3.09	0.000	1.82	2.172	1.43	9.520
137°F	43 psi	-1.16	0.000	-3.10	0.000	1.84	2.175	1.58	9.640
156°F	53 psi	-1.13	0.000	-3.10	0.000	1.89	2.180	1.74	9.723
174°F	62 psi	-1.08	0.000	-3.10	0.000	1.95	2.186	1.88	9.779
193°F	72 psi	-1.03	0.000	-3.10	0.000	2.03	2.191	2.02	9.818
212°F	81 psi	-0.96	0.000	-3.09	0.000	2.13	2.197	2.16	9.847
231°F	91 psi	-0.89	0.000	-3.08	0.000	2.23	2.202	2.30	9.867
250°F	100 psi	-0.81	0.000	-3.06	0.000	2.35	2.207	2.43	9.881

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.

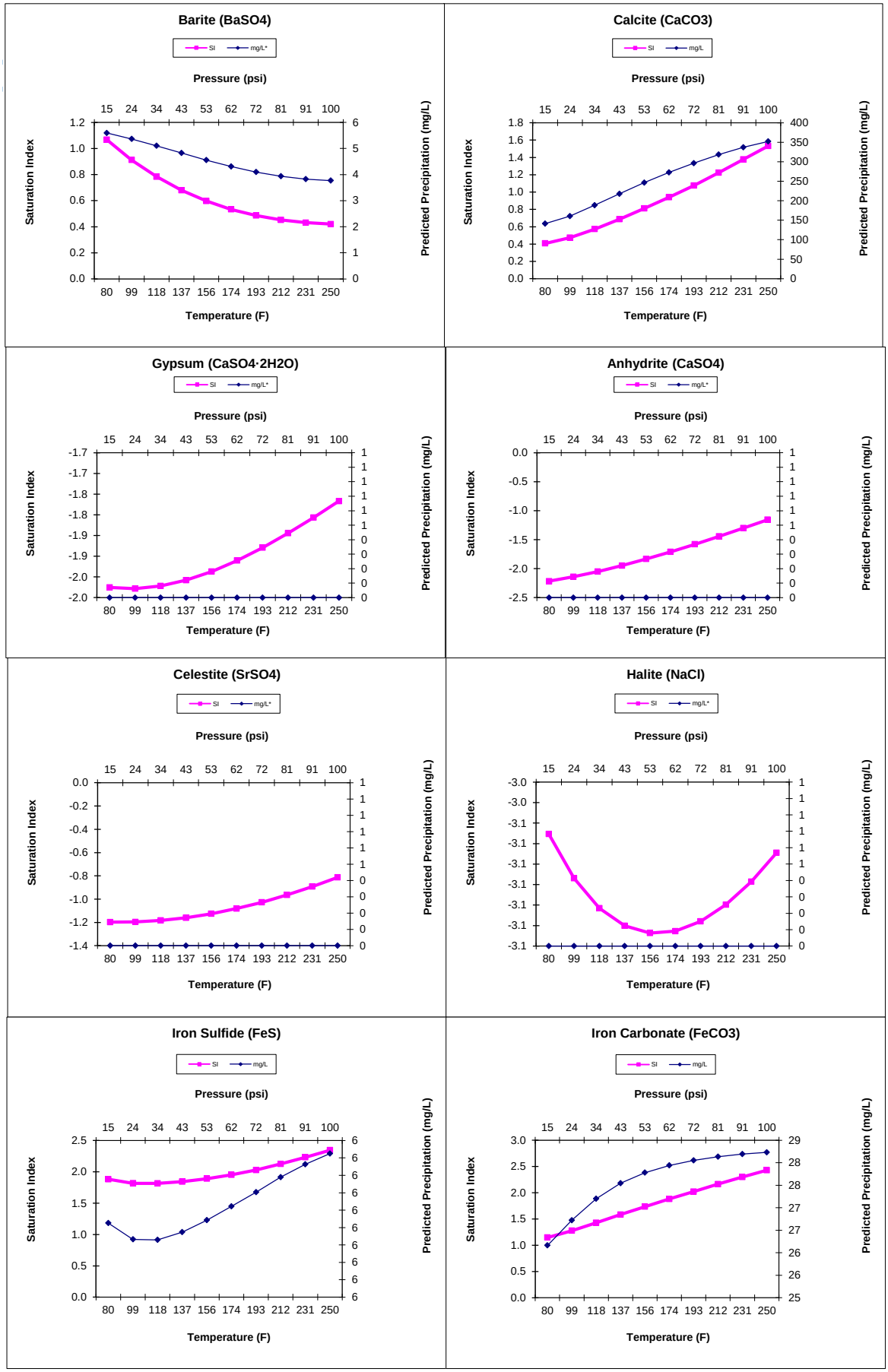
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 13D-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14A-13 Separator
District:	Four Corners	**Sample ID:**	201506001259
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 14A-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.1

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1085.8	17.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	170.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21877
Density/Specific Gravity (g/cm^3):	1.0125
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	25.9
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12264.0	346.0
Sulfate (SO_4^{2-}):	7.3	0.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.5	0.1
Silica (SiO_2):	50.0	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8020.1	349.0
Potassium (K^+):	63.7	1.6
Magnesium (Mg^{2+}):	36.8	3.0
Calcium (Ca^{2+}):	225.7	11.3
Strontium (Sr^{2+}):	37.1	0.8
Barium (Ba^{2+}):	118.8	1.7
Iron (Fe^{2+}):	13.3	0.5
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.1	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	
Total Hardness:	845	N/A

ND = Not Determined

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)**
80°F	15 psi	1.26	5.800	0.53	71.698	-3.13	0.000	-3.37	0.000
99°F	24 psi	1.11	5.643	0.59	79.165	-3.14	0.000	-3.30	0.000
118°F	34 psi	0.98	5.465	0.69	90.178	-3.13	0.000	-3.21	0.000
137°F	43 psi	0.87	5.275	0.80	102.045	-3.12	0.000	-3.11	0.000
156°F	53 psi	0.79	5.088	0.92	113.834	-3.10	0.000	-2.99	0.000
174°F	62 psi	0.72	4.913	1.05	125.134	-3.08	0.000	-2.87	0.000
193°F	72 psi	0.67	4.762	1.18	135.736	-3.05	0.000	-2.75	0.000
212°F	81 psi	0.64	4.640	1.32	146.161	-3.02	0.000	-2.61	0.000
231°F	91 psi	0.61	4.551	1.47	155.628	-2.98	0.000	-2.47	0.000
250°F	100 psi	0.60	4.495	1.62	163.977	-2.95	0.000	-2.33	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)**
80°F	15 psi	-2.25	0.000	-2.81	0.000	1.84	2.144	1.08	8.798
99°F	24 psi	-2.25	0.000	-2.83	0.000	1.78	2.136	1.21	9.016
118°F	34 psi	-2.24	0.000	-2.85	0.000	1.77	2.135	1.36	9.202
137°F	43 psi	-2.22	0.000	-2.86	0.000	1.79	2.138	1.51	9.336
156°F	53 psi	-2.19	0.000	-2.86	0.000	1.83	2.143	1.66	9.429
174°F	62 psi	-2.15	0.000	-2.86	0.000	1.89	2.148	1.80	9.493
193°F	72 psi	-2.10	0.000	-2.86	0.000	1.96	2.154	1.93	9.537
212°F	81 psi	-2.04	0.000	-2.85	0.000	2.05	2.161	2.07	9.570
231°F	91 psi	-1.97	0.000	-2.84	0.000	2.15	2.167	2.20	9.593
250°F	100 psi	-1.90	0.000	-2.83	0.000	2.25	2.172	2.32	9.609

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.

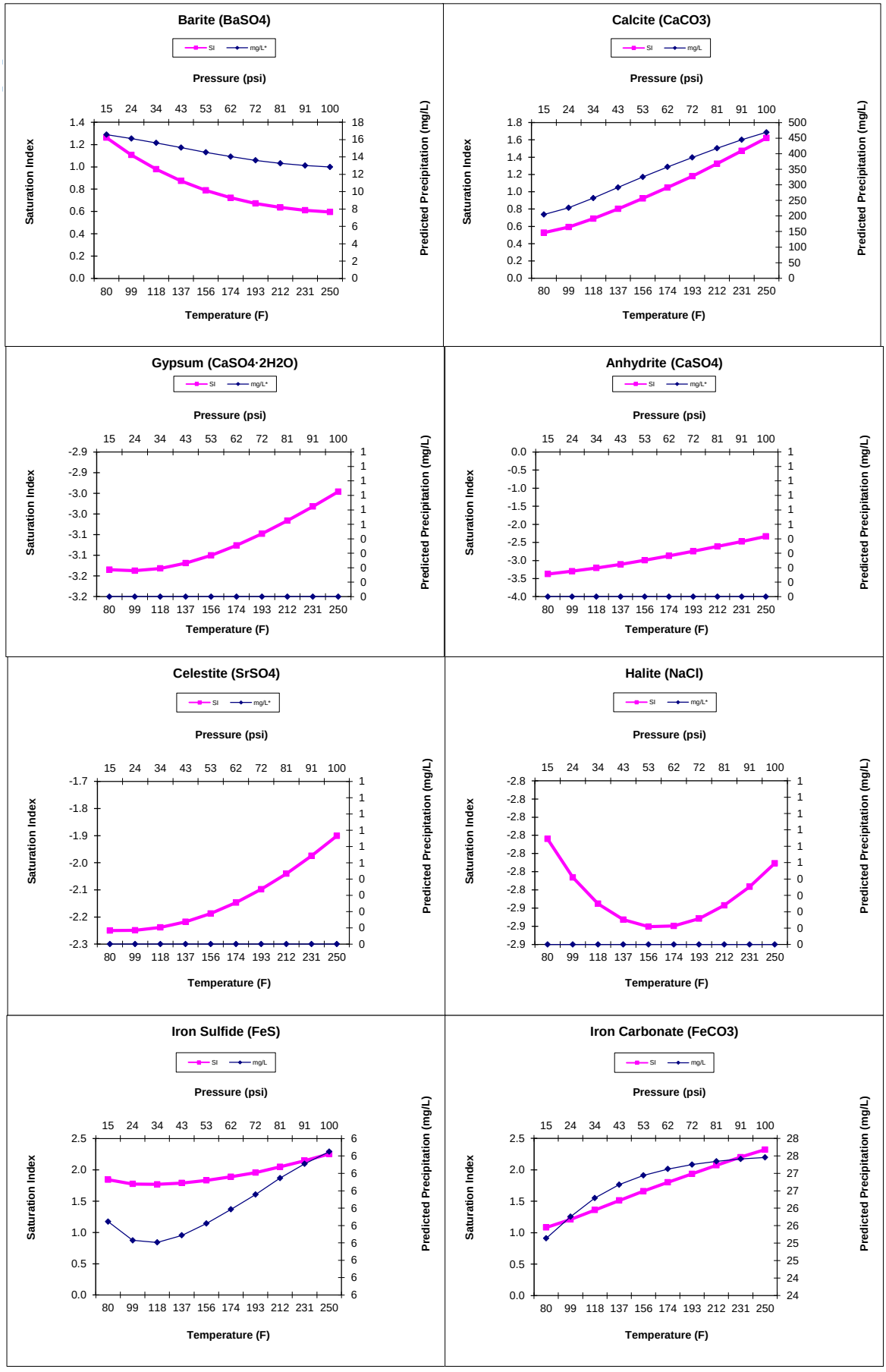
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 14A-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14B-13 Separator
District:	Four Corners	**Sample ID:**	201506001260
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 14B-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1354.2	22.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	200.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22616
Density/Specific Gravity (g/cm³):	1.0130
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	29.7
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12414.6	350.2
Sulfate (SO_4^{2-}):	6.4	0.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	5.4	0.2
Silica (SiO_2):	63.1	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.98	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8323.3	362.2
Potassium (K^+):	65.4	1.7
Magnesium (Mg^{2+}):	35.9	3.0
Calcium (Ca^{2+}):	228.9	11.4
Strontium (Sr^{2+}):	37.7	0.9
Barium (Ba^{2+}):	124.4	1.8
Iron (Fe^{2+}):	15.8	0.6
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	3.4	0.1
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	
Total Hardness:	854	N/A

ND = Not Determined

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)**
80°F	15 psi	1.21	5.077	0.80	109.166	-3.19	0.000	-3.43	0.000
99°F	24 psi	1.06	4.924	0.87	115.877	-3.20	0.000	-3.36	0.000
118°F	34 psi	0.93	4.749	0.97	125.661	-3.19	0.000	-3.27	0.000
137°F	43 psi	0.82	4.564	1.08	135.994	-3.18	0.000	-3.16	0.000
156°F	53 psi	0.74	4.379	1.20	145.992	-3.16	0.000	-3.05	0.000
174°F	62 psi	0.67	4.207	1.32	155.262	-3.14	0.000	-2.93	0.000
193°F	72 psi	0.62	4.057	1.45	163.612	-3.11	0.000	-2.80	0.000
212°F	81 psi	0.58	3.935	1.59	171.366	-3.08	0.000	-2.67	0.000
231°F	91 psi	0.56	3.846	1.74	178.030	-3.04	0.000	-2.53	0.000
250°F	100 psi	0.54	3.788	1.88	183.494	-3.01	0.000	-2.39	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)**
80°F	15 psi	-2.31	0.000	-2.79	0.000	2.16	1.958	1.45	11.007
99°F	24 psi	-2.31	0.000	-2.81	0.000	2.08	1.954	1.57	11.120
118°F	34 psi	-2.30	0.000	-2.83	0.000	2.07	1.953	1.72	11.217
137°F	43 psi	-2.28	0.000	-2.84	0.000	2.08	1.954	1.87	11.287
156°F	53 psi	-2.25	0.000	-2.84	0.000	2.11	1.955	2.02	11.335
174°F	62 psi	-2.21	0.000	-2.84	0.000	2.16	1.958	2.16	11.368
193°F	72 psi	-2.16	0.000	-2.84	0.000	2.22	1.960	2.29	11.391
212°F	81 psi	-2.11	0.000	-2.83	0.000	2.30	1.963	2.42	11.408
231°F	91 psi	-2.04	0.000	-2.82	0.000	2.39	1.965	2.55	11.420
250°F	100 psi	-1.97	0.000	-2.81	0.000	2.49	1.967	2.67	11.429

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.

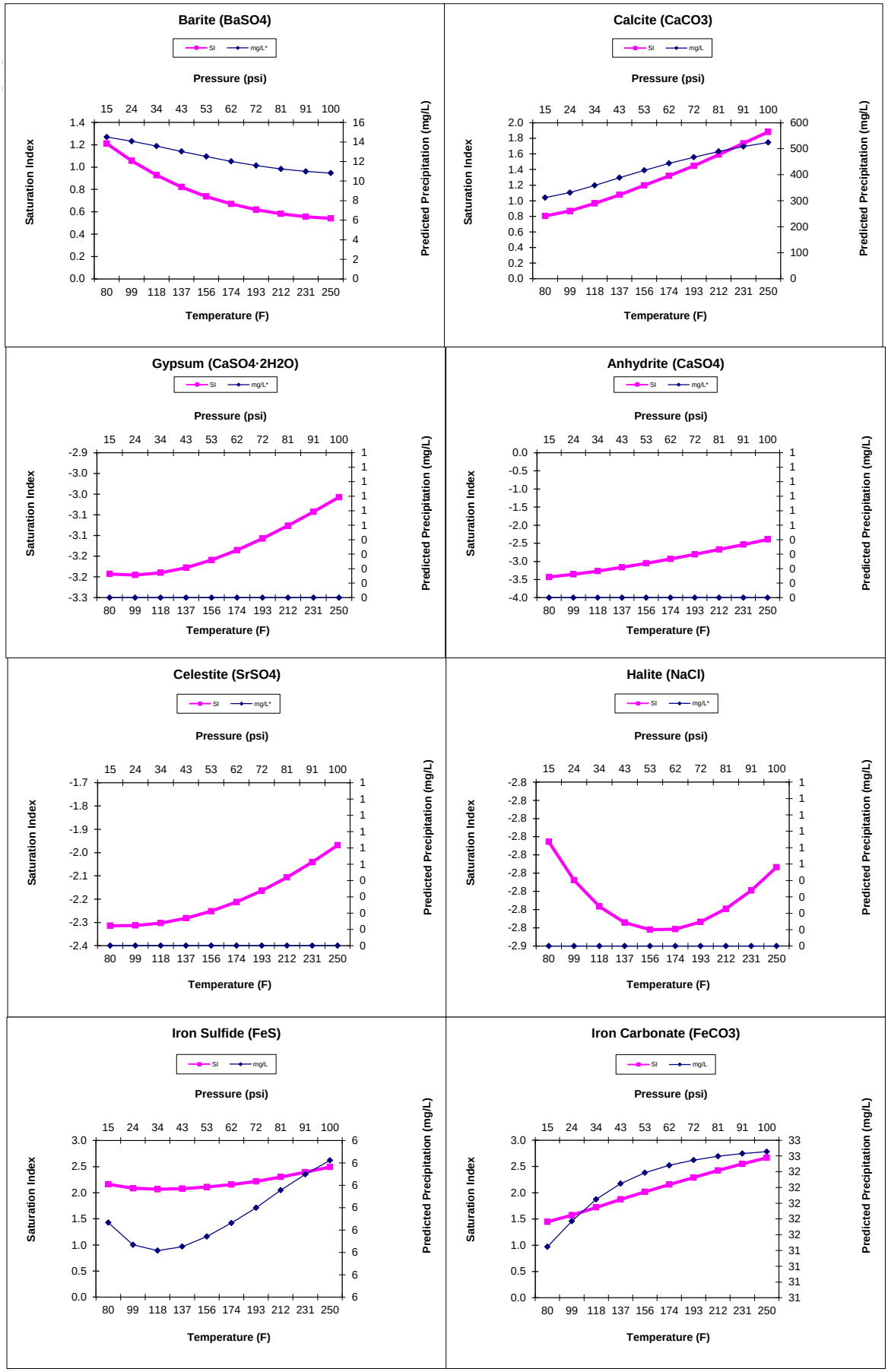
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 14B-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14C-13 Separator
District:	Four Corners	**Sample ID:**	201506001261
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 14C-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1500.6	24.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23252
Density/Specific Gravity (g/cm³):	1.0135
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	28.7
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12689.2	357.9
Sulfate (SO_4^{2-}):	1.1	0.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.8	0.1
Silica (SiO_2):	58.4	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8552.9	372.2
Potassium (K^+):	64.9	1.7
Magnesium (Mg^{2+}):	32.5	2.7
Calcium (Ca^{2+}):	211.7	10.6
Strontium (Sr^{2+}):	39.4	0.9
Barium (Ba^{2+}):	141.9	2.1
Iron (Fe^{2+}):	12.7	0.5
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.2	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	
Total Hardness:	811	N/A

ND = Not Determined

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)**
80°F	15 psi	0.51	0.667	0.79	108.879	-3.98	0.000	-4.22	0.000
99°F	24 psi	0.35	0.537	0.86	115.263	-3.98	0.000	-4.14	0.000
118°F	34 psi	0.22	0.389	0.96	124.454	-3.98	0.000	-4.05	0.000
137°F	43 psi	0.12	0.231	1.07	133.966	-3.97	0.000	-3.95	0.000
156°F	53 psi	0.03	0.074	1.19	142.941	-3.95	0.000	-3.84	0.000
174°F	62 psi	-0.03	0.000	1.31	151.022	-3.93	0.000	-3.72	0.000
193°F	72 psi	-0.08	0.000	1.44	158.065	-3.90	0.000	-3.59	0.000
212°F	81 psi	-0.12	0.000	1.58	164.388	-3.87	0.000	-3.46	0.000
231°F	91 psi	-0.15	0.000	1.73	169.591	-3.83	0.000	-3.32	0.000
250°F	100 psi	-0.16	0.000	1.87	173.691	-3.80	0.000	-3.18	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)**
80°F	15 psi	-3.05	0.000	-2.77	0.000	1.88	1.308	1.39	8.847
99°F	24 psi	-3.05	0.000	-2.79	0.000	1.80	1.304	1.51	8.950
118°F	34 psi	-3.04	0.000	-2.81	0.000	1.78	1.303	1.66	9.037
137°F	43 psi	-3.02	0.000	-2.82	0.000	1.80	1.304	1.81	9.101
156°F	53 psi	-2.99	0.000	-2.82	0.000	1.83	1.306	1.96	9.144
174°F	62 psi	-2.95	0.000	-2.82	0.000	1.88	1.308	2.10	9.174
193°F	72 psi	-2.90	0.000	-2.82	0.000	1.94	1.311	2.23	9.195
212°F	81 psi	-2.85	0.000	-2.81	0.000	2.02	1.315	2.36	9.210
231°F	91 psi	-2.78	0.000	-2.80	0.000	2.11	1.318	2.49	9.221
250°F	100 psi	-2.71	0.000	-2.79	0.000	2.22	1.320	2.61	9.229

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.

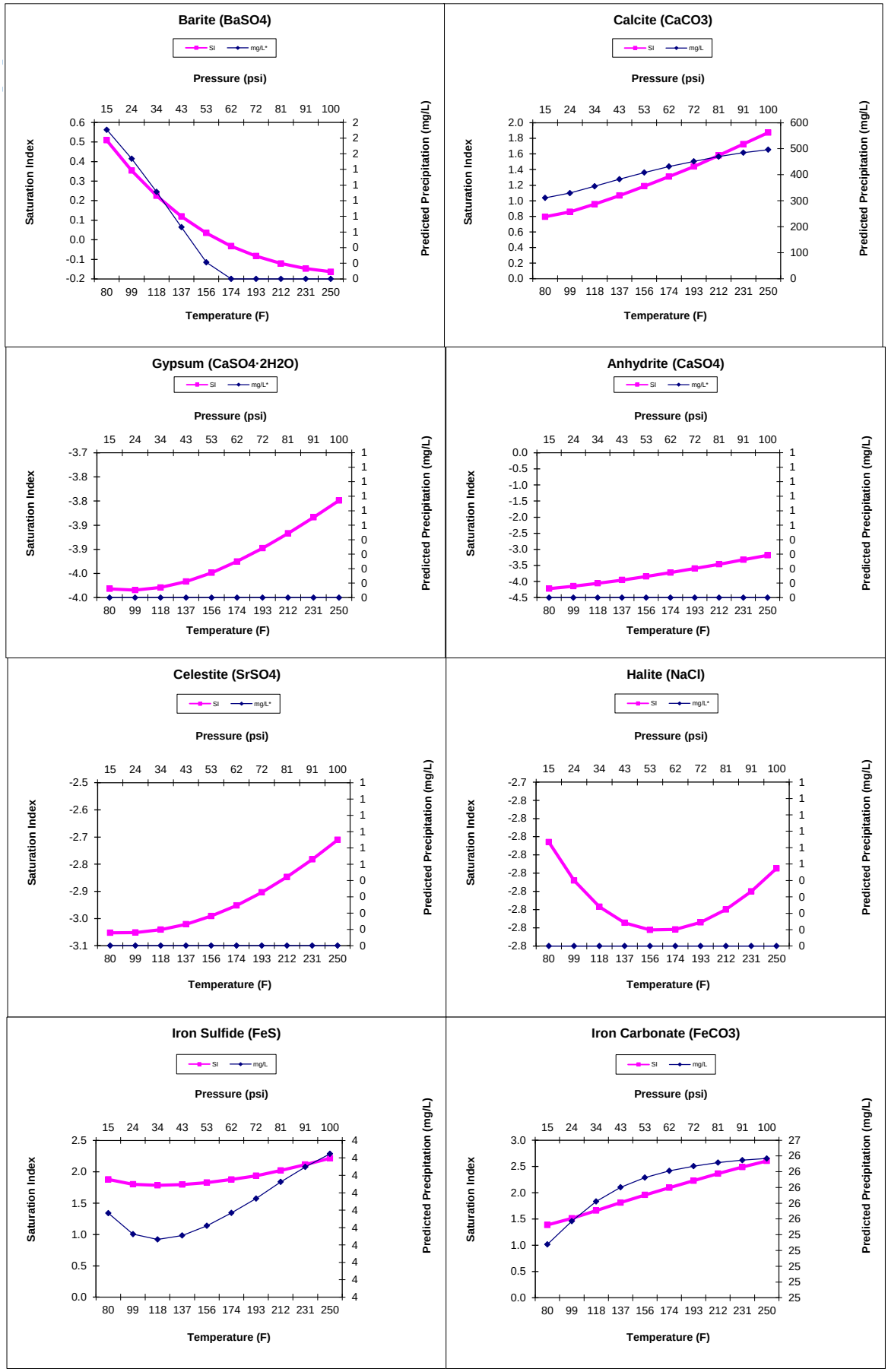
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 14C-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14D-13 Separator
District:	Four Corners	**Sample ID:**	201506001262
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 14D-13 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1232.2	20.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	140.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22628
Density/Specific Gravity (g/cm³):	1.0130
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	30.2
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12538.8	353.7
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.3	0.1
Silica (SiO_2):	53.6	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8352.7	363.5
Potassium (K^+):	62.1	1.6
Magnesium (Mg^{2+}):	37.1	3.1
Calcium (Ca^{2+}):	232.8	11.6
Strontium (Sr^{2+}):	39.2	0.9
Barium (Ba^{2+}):	116.4	1.7
Iron (Fe^{2+}):	12.0	0.4
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.8	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	
Total Hardness:	864	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.85	106.430		0.000		0.000
99°F	24 psi		0.000	0.91	112.930		0.000		0.000
118°F	34 psi		0.000	1.01	122.451		0.000		0.000
137°F	43 psi		0.000	1.12	132.632		0.000		0.000
156°F	53 psi		0.000	1.24	142.639		0.000		0.000
174°F	62 psi		0.000	1.36	152.094		0.000		0.000
193°F	72 psi		0.000	1.49	160.796		0.000		0.000
212°F	81 psi		0.000	1.63	169.060		0.000		0.000
231°F	91 psi		0.000	1.77	176.404		0.000		0.000
250°F	100 psi		0.000	1.92	182.624		0.000		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)**
80°F	15 psi		0.000	-2.79	0.000	2.13	1.873	1.35	8.264
99°F	24 psi		0.000	-2.81	0.000	2.05	1.869	1.48	8.370
118°F	34 psi		0.000	-2.82	0.000	2.02	1.868	1.63	8.460
137°F	43 psi		0.000	-2.83	0.000	2.03	1.868	1.78	8.525
156°F	53 psi		0.000	-2.84	0.000	2.06	1.870	1.92	8.569
174°F	62 psi		0.000	-2.83	0.000	2.10	1.872	2.06	8.600
193°F	72 psi		0.000	-2.83	0.000	2.16	1.875	2.19	8.621
212°F	81 psi		0.000	-2.82	0.000	2.24	1.878	2.32	8.637
231°F	91 psi		0.000	-2.81	0.000	2.33	1.881	2.45	8.649
250°F	100 psi		0.000	-2.80	0.000	2.43	1.884	2.56	8.657

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.

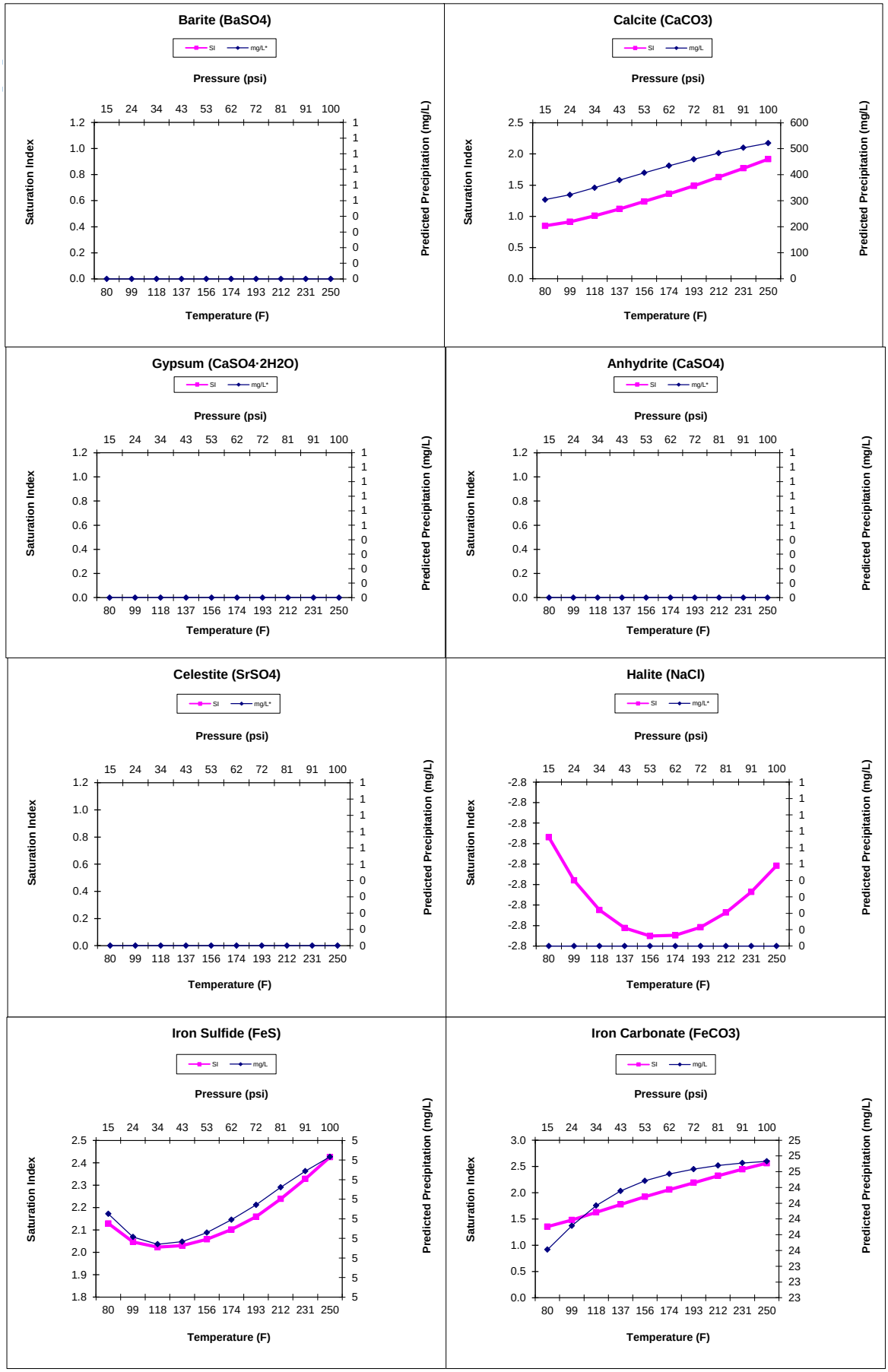
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 14D-13 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	43A-14 Separator
District:	Four Corners	**Sample ID:**	201506001263
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 43A-14 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1061.4	17.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	200.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19220
Density/Specific Gravity (g/cm³):	1.0106
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	23.7
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10680.1	301.3
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	4.5	0.1
Silica (SiO_2):	45.6	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7065.6	307.5
Potassium (K^+):	57.9	1.5
Magnesium (Mg^{2+}):	32.6	2.7
Calcium (Ca^{2+}):	191.6	9.6
Strontium (Sr^{2+}):	28.9	0.7
Barium (Ba^{2+}):	84.1	1.2
Iron (Fe^{2+}):	12.5	0.4
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.5	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	
Total Hardness:	707	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.45	58.053		0.000		0.000
99°F	24 psi		0.000	0.52	65.184		0.000		0.000
118°F	34 psi		0.000	0.62	75.654		0.000		0.000
137°F	43 psi		0.000	0.73	86.872		0.000		0.000
156°F	53 psi		0.000	0.85	97.929		0.000		0.000
174°F	62 psi		0.000	0.98	108.416		0.000		0.000
193°F	72 psi		0.000	1.11	118.121		0.000		0.000
212°F	81 psi		0.000	1.26	127.512		0.000		0.000
231°F	91 psi		0.000	1.41	135.811		0.000		0.000
250°F	100 psi		0.000	1.56	142.919		0.000		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)**
80°F	15 psi		0.000	-2.92	0.000	1.82	2.161	1.06	8.195
99°F	24 psi		0.000	-2.94	0.000	1.75	2.153	1.19	8.411
118°F	34 psi		0.000	-2.95	0.000	1.75	2.153	1.34	8.596
137°F	43 psi		0.000	-2.96	0.000	1.77	2.156	1.49	8.730
156°F	53 psi		0.000	-2.97	0.000	1.82	2.162	1.64	8.822
174°F	62 psi		0.000	-2.97	0.000	1.88	2.168	1.78	8.885
193°F	72 psi		0.000	-2.96	0.000	1.95	2.175	1.92	8.928
212°F	81 psi		0.000	-2.95	0.000	2.04	2.182	2.06	8.961
231°F	91 psi		0.000	-2.94	0.000	2.14	2.188	2.19	8.983
250°F	100 psi		0.000	-2.93	0.000	2.25	2.194	2.31	8.999

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.

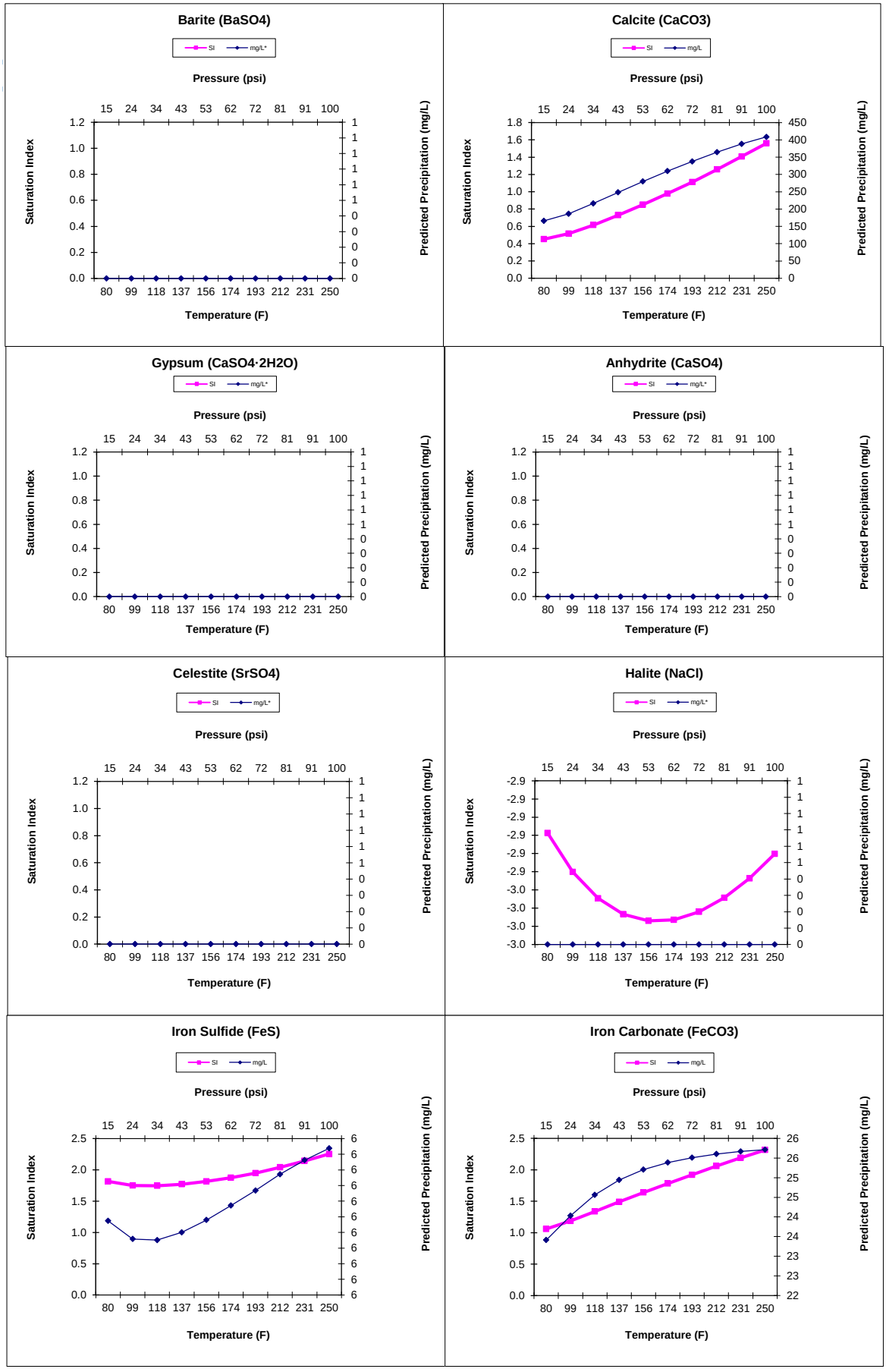
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 43A-14 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	43B-14 Separator
District:	Four Corners	**Sample ID:**	201506001264
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 43B-14 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.1

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1061.4	17.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19098
Density/Specific Gravity (g/cm³):	1.0106
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	23.3
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10513.0	296.6
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.5	0.1
Silica (SiO_2):	42.7	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.96	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7151.5	311.2
Potassium (K^+):	57.3	1.5
Magnesium (Mg^{2+}):	30.9	2.5
Calcium (Ca^{2+}):	173.0	8.6
Strontium (Sr^{2+}):	25.4	0.6
Barium (Ba^{2+}):	73.7	1.1
Iron (Fe^{2+}):	7.6	0.3
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.3	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	
Total Hardness:	642	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.44	53.665		0.000		0.000
99°F	24 psi		0.000	0.51	60.392		0.000		0.000
118°F	34 psi		0.000	0.61	70.215		0.000		0.000
137°F	43 psi		0.000	0.72	80.690		0.000		0.000
156°F	53 psi		0.000	0.84	90.952		0.000		0.000
174°F	62 psi		0.000	0.97	100.607		0.000		0.000
193°F	72 psi		0.000	1.10	109.451		0.000		0.000
212°F	81 psi		0.000	1.25	117.890		0.000		0.000
231°F	91 psi		0.000	1.40	125.230		0.000		0.000
250°F	100 psi		0.000	1.55	131.392		0.000		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)**
80°F	15 psi		0.000	-2.92	0.000	1.65	2.064	0.88	4.740
99°F	24 psi		0.000	-2.94	0.000	1.58	2.049	1.01	4.934
118°F	34 psi		0.000	-2.96	0.000	1.58	2.047	1.16	5.099
137°F	43 psi		0.000	-2.96	0.000	1.60	2.053	1.31	5.218
156°F	53 psi		0.000	-2.97	0.000	1.64	2.063	1.46	5.300
174°F	62 psi		0.000	-2.97	0.000	1.70	2.075	1.60	5.357
193°F	72 psi		0.000	-2.96	0.000	1.77	2.088	1.74	5.395
212°F	81 psi		0.000	-2.96	0.000	1.86	2.102	1.88	5.424
231°F	91 psi		0.000	-2.94	0.000	1.96	2.115	2.01	5.444
250°F	100 psi		0.000	-2.93	0.000	2.07	2.125	2.13	5.458

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.

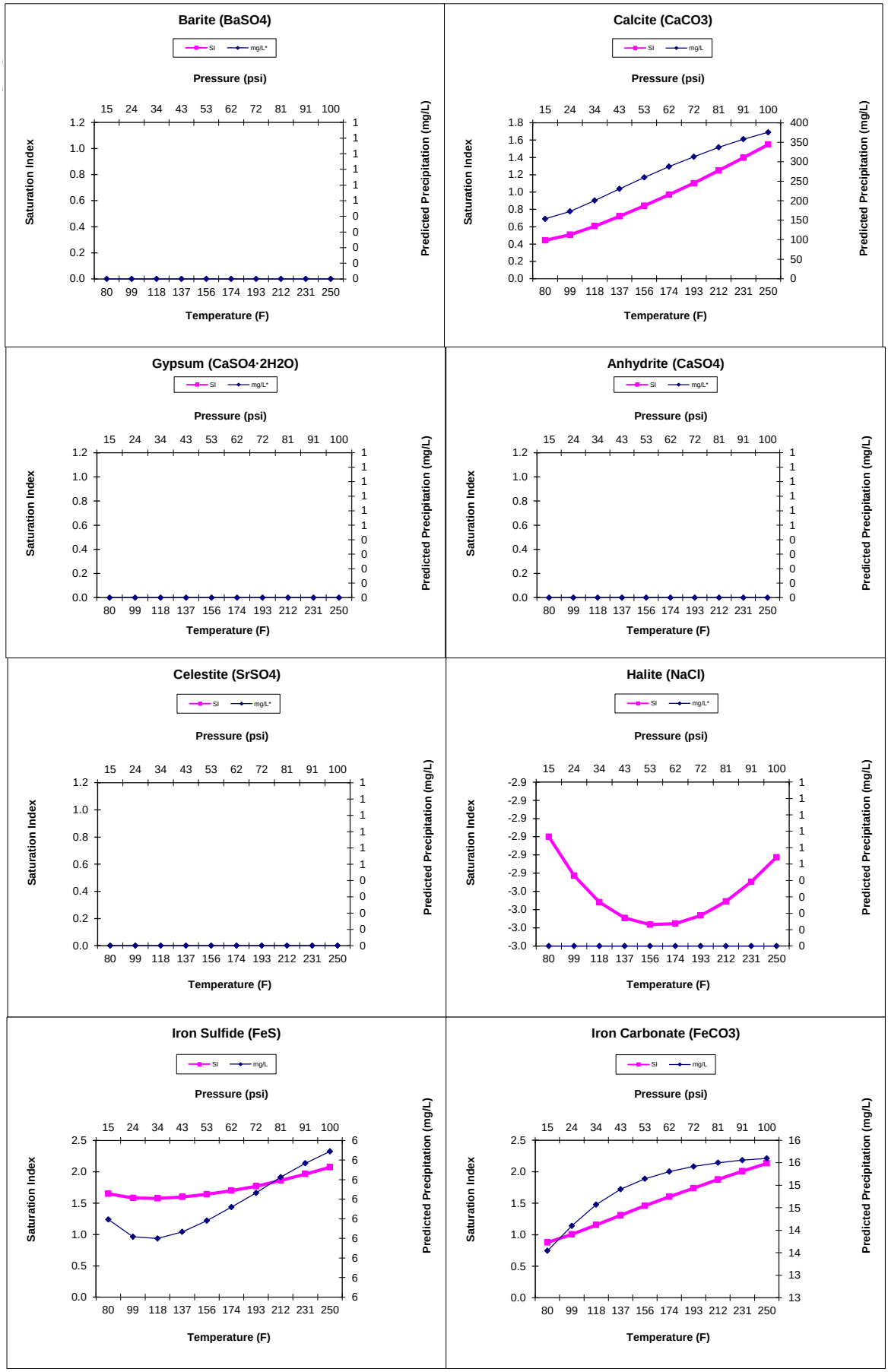
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 43B-14 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	43C-14 Separator
District:	Four Corners	**Sample ID:**	201506001265
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 43C-14 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1183.4	19.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	18665
Density/Specific Gravity (g/cm^3):	1.0104
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	22.8
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10051.0	283.5
Sulfate (SO_4^{2-}):	1.0	0.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	5.3	0.2
Silica (SiO_2):	55.7	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.94	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7018.0	305.4
Potassium (K^+):	56.7	1.4
Magnesium (Mg^{2+}):	33.7	2.8
Calcium (Ca^{2+}):	198.4	9.9
Strontium (Sr^{2+}):	25.7	0.6
Barium (Ba^{2+}):	60.0	0.9
Iron (Fe^{2+}):	29.2	1.0
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	2.4	0.1
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	
Total Hardness:	708	N/A

ND = Not Determined

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)**
80°F	15 psi	0.18	0.283	0.41	59.759	-3.99	0.000	-4.23	0.000
99°F	24 psi	0.02	0.038	0.48	67.597	-3.99	0.000	-4.15	0.000
118°F	34 psi	-0.11	0.000	0.58	79.143	-3.98	0.000	-4.06	0.000
137°F	43 psi	-0.21	0.000	0.69	91.424	-3.97	0.000	-3.96	0.000
156°F	53 psi	-0.30	0.000	0.81	103.411	-3.95	0.000	-3.85	0.000
174°F	62 psi	-0.36	0.000	0.94	114.654	-3.92	0.000	-3.72	0.000
193°F	72 psi	-0.41	0.000	1.07	124.924	-3.90	0.000	-3.59	0.000
212°F	81 psi	-0.45	0.000	1.22	134.780	-3.86	0.000	-3.46	0.000
231°F	91 psi	-0.47	0.000	1.37	143.270	-3.83	0.000	-3.32	0.000
250°F	100 psi	-0.48	0.000	1.53	150.397	-3.79	0.000	-3.18	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)**
80°F	15 psi	-3.21	0.000	-2.95	0.000	2.18	3.107	1.38	20.169
99°F	24 psi	-3.21	0.000	-2.97	0.000	2.12	3.103	1.51	20.426
118°F	34 psi	-3.20	0.000	-2.98	0.000	2.12	3.103	1.66	20.647
137°F	43 psi	-3.17	0.000	-2.99	0.000	2.15	3.105	1.82	20.806
156°F	53 psi	-3.14	0.000	-2.99	0.000	2.20	3.108	1.97	20.915
174°F	62 psi	-3.10	0.000	-2.99	0.000	2.27	3.112	2.11	20.991
193°F	72 psi	-3.05	0.000	-2.99	0.000	2.35	3.115	2.25	21.043
212°F	81 psi	-2.99	0.000	-2.98	0.000	2.45	3.119	2.39	21.081
231°F	91 psi	-2.92	0.000	-2.97	0.000	2.55	3.122	2.52	21.108
250°F	100 psi	-2.84	0.000	-2.96	0.000	2.67	3.125	2.65	21.127

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.

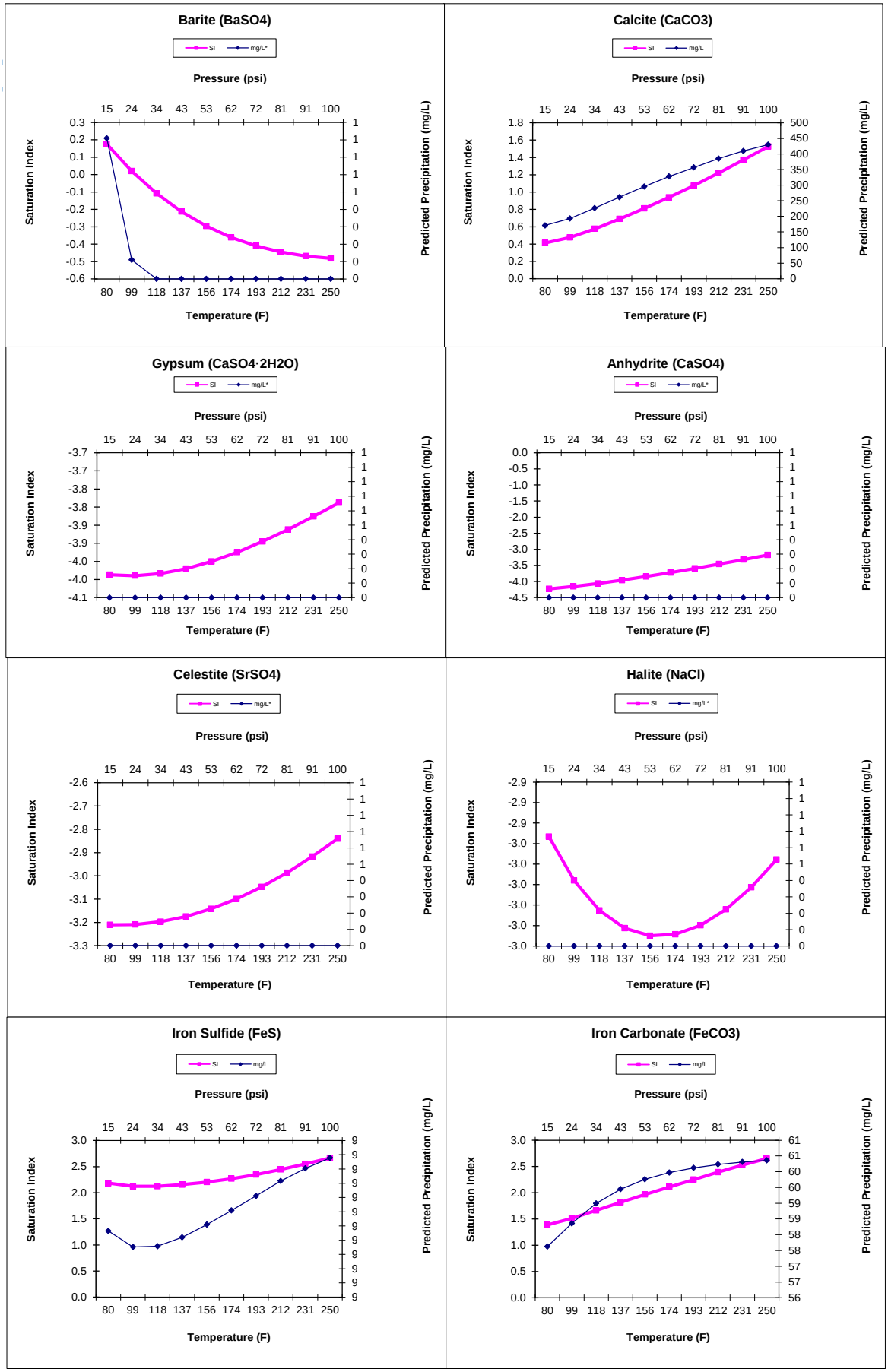
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 43C-14 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44A-14 Separator
District:	Four Corners	**Sample ID:**	201506001266
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 44A-14 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1012.6	16.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21337
Density/Specific Gravity (g/cm³):	1.0122
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	25.1
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11787.0	332.5
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	4.0	0.1
Silica (SiO_2):	44.6	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.95

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8045.9	350.1
Potassium (K^+):	55.8	1.4
Magnesium (Mg^{2+}):	38.0	3.1
Calcium (Ca^{2+}):	229.8	11.5
Strontium (Sr^{2+}):	34.8	0.8
Barium (Ba^{2+}):	100.1	1.5
Iron (Fe^{2+}):	28.5	1.0
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	0.4	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	
Total Hardness:	844	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.39	54.951		0.000		0.000
99°F	24 psi		0.000	0.45	62.935		0.000		0.000
118°F	34 psi		0.000	0.55	74.749		0.000		0.000
137°F	43 psi		0.000	0.66	87.515		0.000		0.000
156°F	53 psi		0.000	0.79	100.253		0.000		0.000
174°F	62 psi		0.000	0.91	112.539		0.000		0.000
193°F	72 psi		0.000	1.04	124.165		0.000		0.000
212°F	81 psi		0.000	1.19	135.795		0.000		0.000
231°F	91 psi		0.000	1.34	146.468		0.000		0.000
250°F	100 psi		0.000	1.49	156.087		0.000		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)**
80°F	15 psi		0.000	-2.83	0.000	2.01	2.312	1.27	19.370
99°F	24 psi		0.000	-2.85	0.000	1.95	2.308	1.39	19.704
118°F	34 psi		0.000	-2.86	0.000	1.95	2.308	1.54	19.992
137°F	43 psi		0.000	-2.87	0.000	1.98	2.311	1.69	20.200
156°F	53 psi		0.000	-2.87	0.000	2.03	2.314	1.84	20.344
174°F	62 psi		0.000	-2.87	0.000	2.09	2.317	1.98	20.443
193°F	72 psi		0.000	-2.87	0.000	2.17	2.321	2.12	20.511
212°F	81 psi		0.000	-2.86	0.000	2.26	2.325	2.26	20.562
231°F	91 psi		0.000	-2.85	0.000	2.36	2.328	2.39	20.598
250°F	100 psi		0.000	-2.84	0.000	2.47	2.331	2.51	20.623

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.

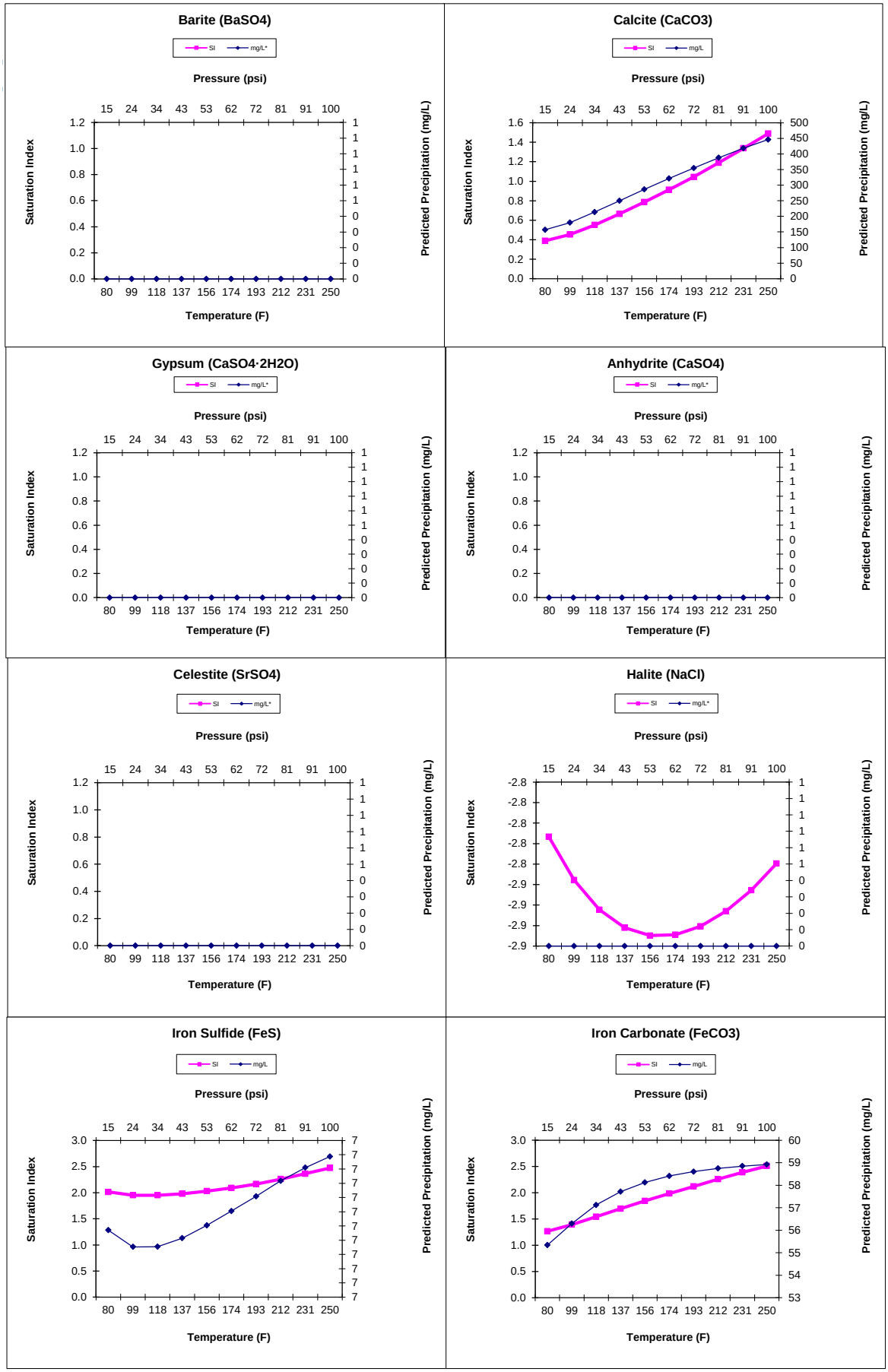
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 44A-14 Separator



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44B-14 Separator
District:	Four Corners	**Sample ID:**	201506001267
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 44B-14 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1159.0	19.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	200.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20151
Density/Specific Gravity (g/cm³):	1.0114
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	24.6
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11043.6	311.5
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	4.4	0.1
Silica (SiO_2):	46.4	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.96

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7525.8	327.5
Potassium (K^+):	49.6	1.3
Magnesium (Mg^{2+}):	30.1	2.5
Calcium (Ca^{2+}):	187.7	9.4
Strontium (Sr^{2+}):	32.2	0.7
Barium (Ba^{2+}):	99.3	1.4
Iron (Fe^{2+}):	17.7	0.6
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.3	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	
Total Hardness:	702	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.33	47.876		0.000		0.000
99°F	24 psi		0.000	0.40	55.869		0.000		0.000
118°F	34 psi		0.000	0.50	67.627		0.000		0.000
137°F	43 psi		0.000	0.61	80.129		0.000		0.000
156°F	53 psi		0.000	0.73	92.331		0.000		0.000
174°F	62 psi		0.000	0.86	103.779		0.000		0.000
193°F	72 psi		0.000	0.99	114.244		0.000		0.000
212°F	81 psi		0.000	1.14	124.327		0.000		0.000
231°F	91 psi		0.000	1.29	133.000		0.000		0.000
250°F	100 psi		0.000	1.44	140.294		0.000		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)**
80°F	15 psi		0.000	-2.88	0.000	1.78	2.344	1.10	11.756
99°F	24 psi		0.000	-2.90	0.000	1.72	2.336	1.23	12.034
118°F	34 psi		0.000	-2.92	0.000	1.72	2.337	1.38	12.273
137°F	43 psi		0.000	-2.92	0.000	1.75	2.341	1.54	12.446
156°F	53 psi		0.000	-2.93	0.000	1.80	2.348	1.68	12.565
174°F	62 psi		0.000	-2.93	0.000	1.87	2.355	1.83	12.647
193°F	72 psi		0.000	-2.92	0.000	1.95	2.362	1.97	12.704
212°F	81 psi		0.000	-2.92	0.000	2.05	2.369	2.11	12.746
231°F	91 psi		0.000	-2.91	0.000	2.15	2.376	2.24	12.775
250°F	100 psi		0.000	-2.89	0.000	2.26	2.381	2.36	12.795

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.

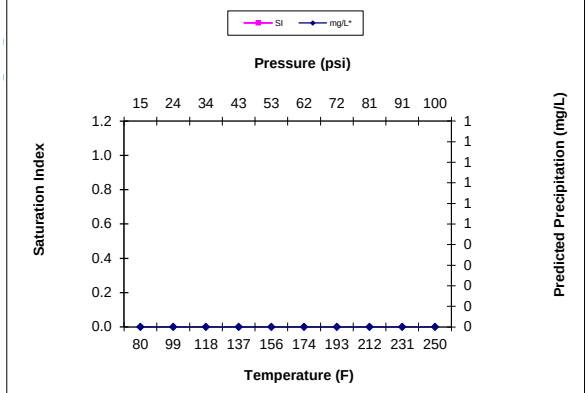
Calculate

ScaleSoftPitzer™ SSP2010

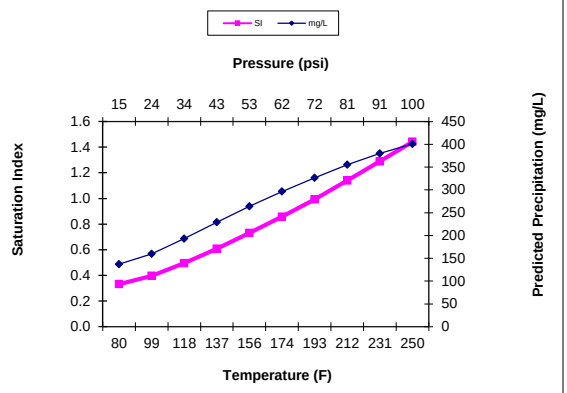
Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 44B-14 Separator

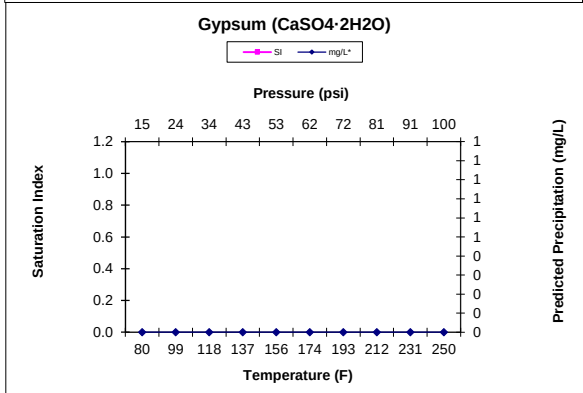
Barite (BaSO4)



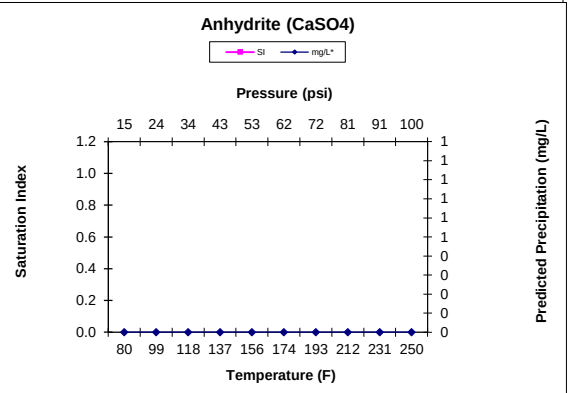
Calcite (CaCO3)



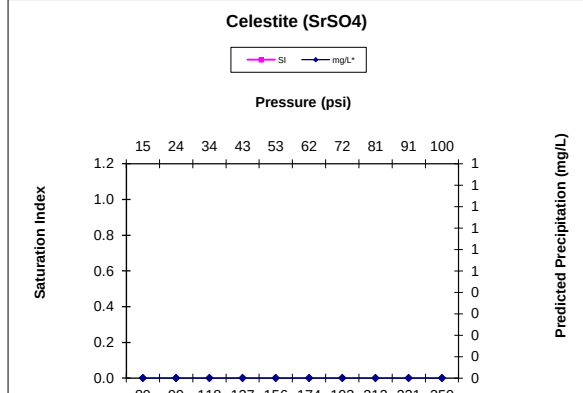
Gypsum (CaSO4·2H2O)



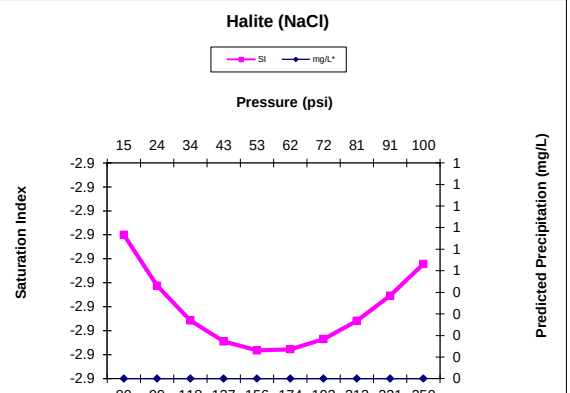
Anhydrite (CaSO4)



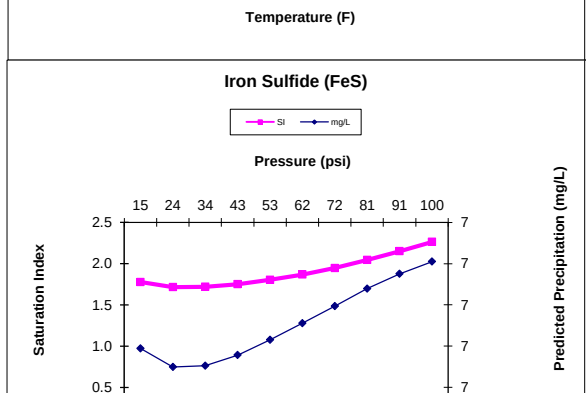
Celestite (SrSO4)



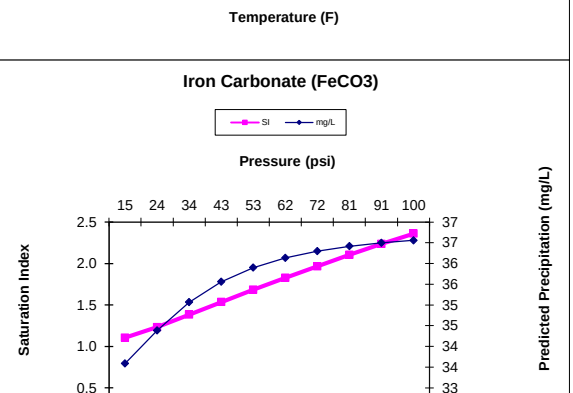
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Pacific Coast Area Laboratory
3901 Fanucchi Way
Shafter, CA. 93263

Report Date: 1/16/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44C-14 Separator
District:	Four Corners	**Sample ID:**	201506001268
Sales Rep:	Sean Higgins	**Sample Date:**	1/13/2015
Lease:	Nolte	**Log Out Date:**	1/16/2015
Site Type:		**Analyst:**	SR/IL
Sample Point Description:			

CAERUS OIL & GAS, Nolte, 44C-14 Separator

Field Data

Initial Temperature (°F):	250
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1159.0	19.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21680
Density/Specific Gravity (g/cm³):	1.0123
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	28.7
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12217.8	344.6
Sulfate (SO_4^{2-}):	ND	
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	3.6	0.1
Silica (SiO_2):	42.8	

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^+):	7817.7	340.2
Potassium (K^+):	53.5	1.4
Magnesium (Mg^{2+}):	39.3	3.2
Calcium (Ca^{2+}):	238.2	11.9
Strontium (Sr^{2+}):	35.1	0.8
Barium (Ba^{2+}):	100.9	1.5
Iron (Fe^{2+}):	13.0	0.5
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	1.5	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	
Total Hardness:	871	N/A

ND = Not Determined

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)**
80°F	15 psi		0.000	0.58	82.644		0.000		0.000
99°F	24 psi		0.000	0.64	90.312		0.000		0.000
118°F	34 psi		0.000	0.74	101.650		0.000		0.000
137°F	43 psi		0.000	0.85	113.842		0.000		0.000
156°F	53 psi		0.000	0.97	125.915		0.000		0.000
174°F	62 psi		0.000	1.10	137.444		0.000		0.000
193°F	72 psi		0.000	1.23	148.209		0.000		0.000
212°F	81 psi		0.000	1.37	158.736		0.000		0.000
231°F	91 psi		0.000	1.52	168.226		0.000		0.000
250°F	100 psi		0.000	1.67	176.524		0.000		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)**
80°F	15 psi		0.000	-2.82	0.000	1.95	2.879	1.10	8.621
99°F	24 psi		0.000	-2.85	0.000	1.89	2.870	1.23	8.822
118°F	34 psi		0.000	-2.86	0.000	1.88	2.869	1.38	8.994
137°F	43 psi		0.000	-2.87	0.000	1.90	2.873	1.53	9.118
156°F	53 psi		0.000	-2.87	0.000	1.95	2.879	1.68	9.204
174°F	62 psi		0.000	-2.87	0.000	2.00	2.886	1.82	9.263
193°F	72 psi		0.000	-2.87	0.000	2.07	2.893	1.96	9.303
212°F	81 psi		0.000	-2.86	0.000	2.16	2.901	2.09	9.334
231°F	91 psi		0.000	-2.85	0.000	2.26	2.908	2.22	9.355
250°F	100 psi		0.000	-2.84	0.000	2.37	2.914	2.34	9.370

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.

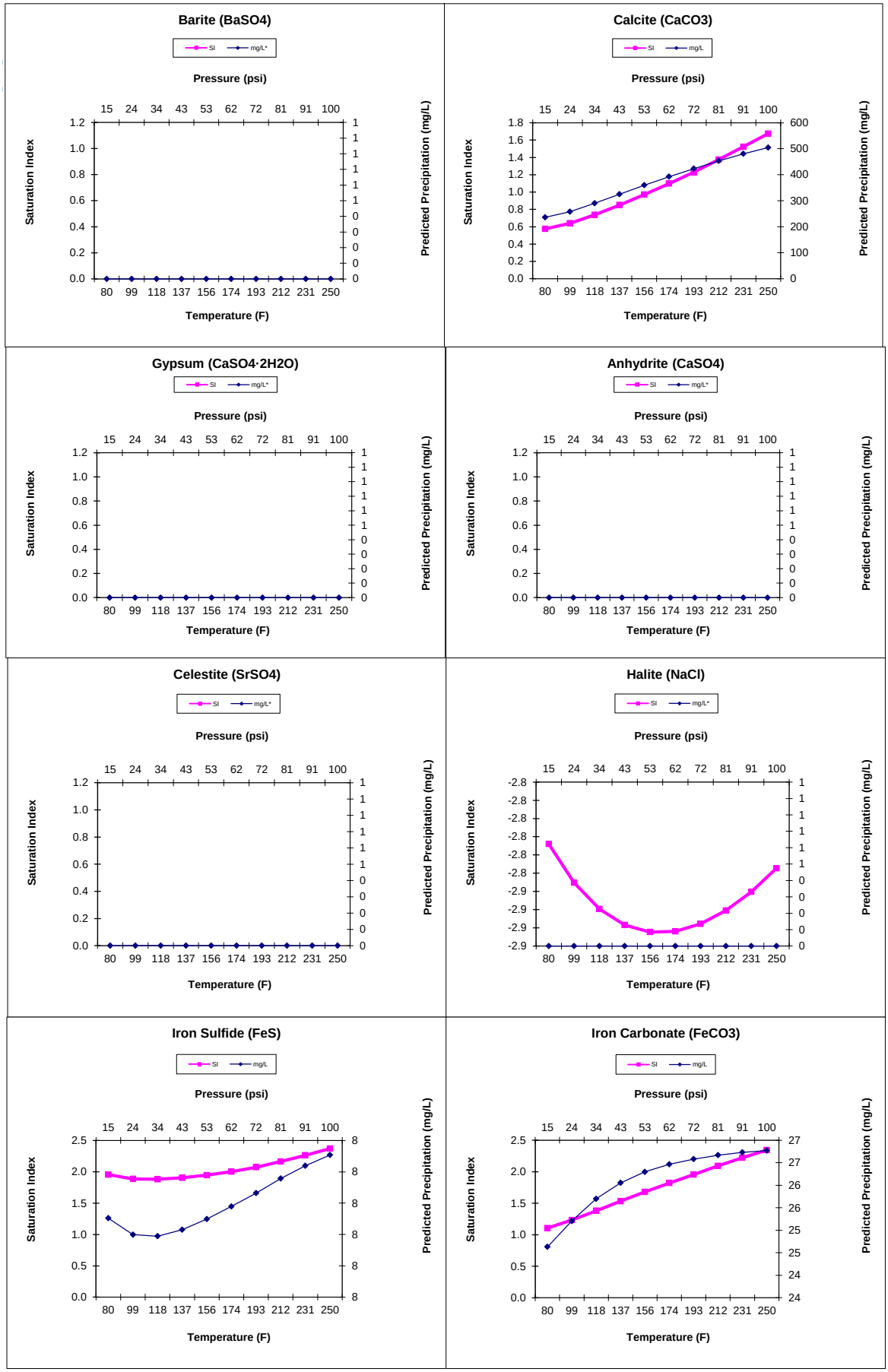
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 42017 CAERUS OIL & GAS, Nolte, 44C-14 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11D-7D Separator
District:	Four Corners	**Sample ID:**	201201035699
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 11D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	5014
Density/Specific Gravity (g/cm^3):	1.0007
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	2780.0	78.4
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.04

Cations:	mg/L	meq/L
Sodium (Na^+):	1801.0	78.4
Potassium (K^+):	9.0	0.2
Magnesium (Mg^{2+}):	2.0	0.2
Calcium (Ca^{2+}):	26.0	1.3
Strontium (Sr^{2+}):	2.0	0.0
Barium (Ba^{2+}):	5.0	0.1
Iron (Fe^{2+}):	34.0	1.2
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	79	N/A

ND = Not Determined

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)
80°F	15 psi	1.30	2.816	-1.79	0.000	-2.72	0.000	-2.97	0.000
96°F	24 psi	1.17	2.761	-1.76	0.000	-2.72	0.000	-2.91	0.000
111°F	34 psi	1.06	2.700	-1.68	0.000	-2.72	0.000	-2.83	0.000
127°F	43 psi	0.97	2.638	-1.59	0.000	-2.70	0.000	-2.75	0.000
142°F	53 psi	0.90	2.576	-1.48	0.000	-2.68	0.000	-2.65	0.000
158°F	62 psi	0.84	2.520	-1.37	0.000	-2.66	0.000	-2.55	0.000
173°F	72 psi	0.80	2.471	-1.24	0.000	-2.63	0.000	-2.44	0.000
189°F	81 psi	0.77	2.433	-1.11	0.000	-2.60	0.000	-2.32	0.000
204°F	91 psi	0.74	2.406	-0.98	0.000	-2.56	0.000	-2.20	0.000
220°F	100 psi	0.73	2.390	-0.85	0.000	-2.52	0.000	-2.08	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)
80°F	15 psi	-2.15	0.000	-4.00	0.000	0.46	1.405	0.10	3.439
96°F	24 psi	-2.15	0.000	-4.02	0.000	0.41	1.299	0.19	6.348
111°F	34 psi	-2.14	0.000	-4.03	0.000	0.43	1.342	0.31	9.817
127°F	43 psi	-2.11	0.000	-4.04	0.000	0.49	1.448	0.45	12.955
142°F	53 psi	-2.08	0.000	-4.05	0.000	0.56	1.575	0.58	15.566
158°F	62 psi	-2.04	0.000	-4.05	0.000	0.66	1.710	0.72	17.711
173°F	72 psi	-1.99	0.000	-4.04	0.000	0.77	1.842	0.87	19.461
189°F	81 psi	-1.94	0.000	-4.04	0.000	0.90	1.948	1.01	20.769
204°F	91 psi	-1.87	0.000	-4.03	0.000	1.02	2.032	1.14	21.742
220°F	100 psi	-1.80	0.000	-4.02	0.000	1.15	2.097	1.27	22.465

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.

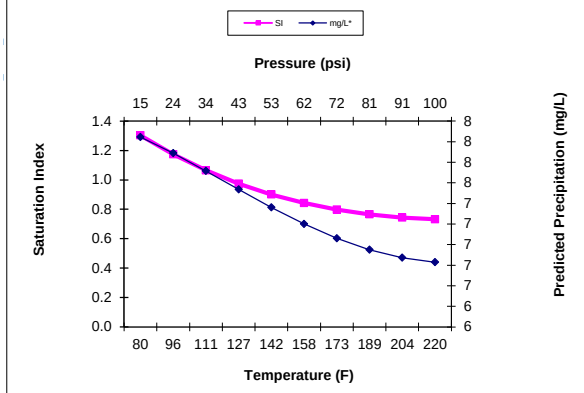
Calculate

ScaleSoftPitzer™ SSP2010

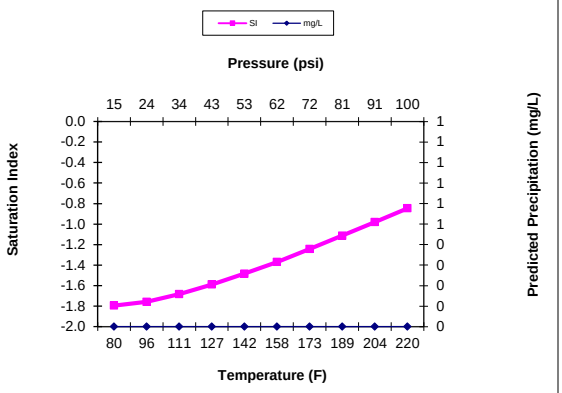
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 11D-7D Separator

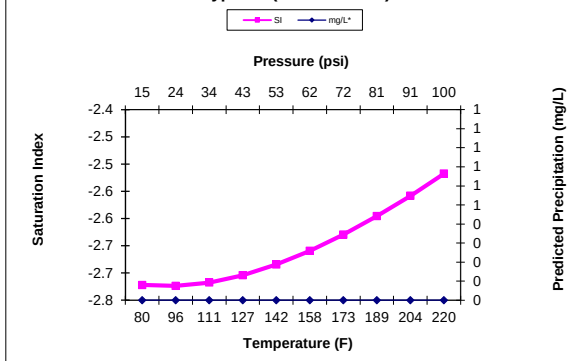
Barite (BaSO4)



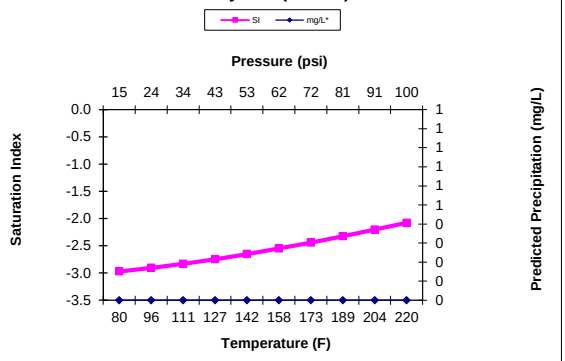
Calcite (CaCO3)



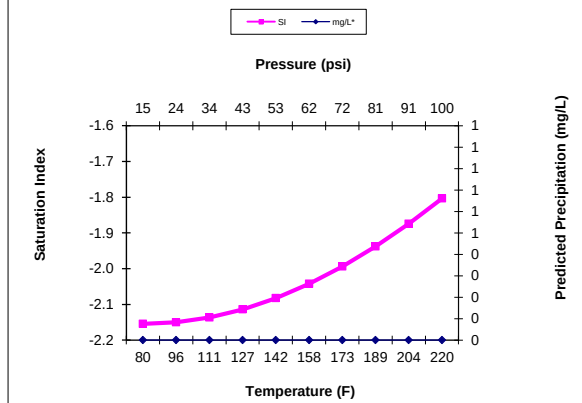
Gypsum (CaSO4·2H2O)



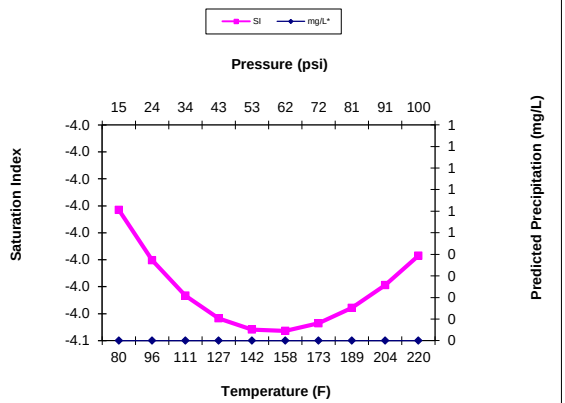
Anhydrite (CaSO4)



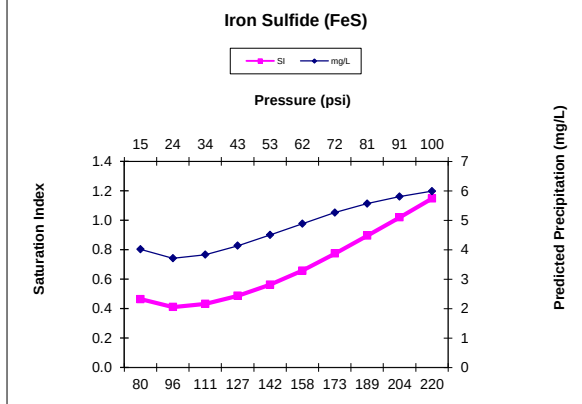
Celestite (SrSO4)



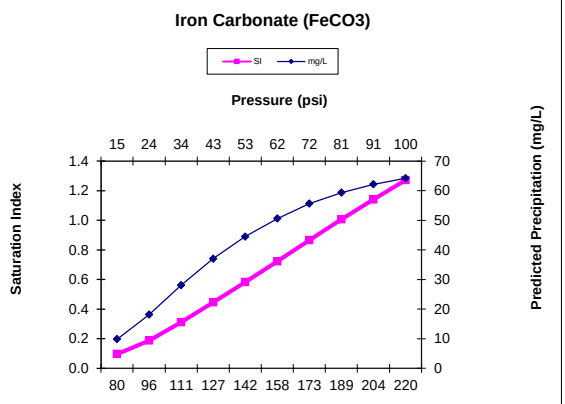
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12-17D Separator
District:	Four Corners	**Sample ID:**	201201035665
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 12-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	390.0	6.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	65.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	10814
Density/Specific Gravity (g/cm^3):	1.0046
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	6200.0	174.9
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	4018.0	174.8
Potassium (K^+):	31.0	0.8
Magnesium (Mg^{2+}):	3.0	0.2
Calcium (Ca^{2+}):	30.0	1.5
Strontium (Sr^{2+}):	30.0	0.7
Barium (Ba^{2+}):	5.0	0.1
Iron (Fe^{2+}):	7.0	0.3
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	125	N/A

ND = Not Determined

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)**
80°F	15 psi	1.33	2.829	-0.75	0.000	-2.61	0.000	-2.86	0.000
96°F	24 psi	1.20	2.779	-0.71	0.000	-2.62	0.000	-2.80	0.000
111°F	34 psi	1.09	2.722	-0.64	0.000	-2.61	0.000	-2.72	0.000
127°F	43 psi	0.99	2.662	-0.55	0.000	-2.60	0.000	-2.64	0.000
142°F	53 psi	0.92	2.602	-0.45	0.000	-2.59	0.000	-2.55	0.000
158°F	62 psi	0.85	2.545	-0.34	0.000	-2.57	0.000	-2.45	0.000
173°F	72 psi	0.80	2.493	-0.23	0.000	-2.54	0.000	-2.35	0.000
189°F	81 psi	0.77	2.450	-0.11	0.000	-2.51	0.000	-2.24	0.000
204°F	91 psi	0.74	2.416	0.02	0.603	-2.48	0.000	-2.12	0.000
220°F	100 psi	0.72	2.392	0.14	4.866	-2.45	0.000	-2.00	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)**
80°F	15 psi	-0.93	0.000	-3.36	0.000	1.65	2.787	0.38	2.802
96°F	24 psi	-0.93	0.000	-3.38	0.000	1.58	2.752	0.47	3.228
111°F	34 psi	-0.92	0.000	-3.39	0.000	1.57	2.748	0.59	3.667
127°F	43 psi	-0.90	0.000	-3.40	0.000	1.59	2.759	0.72	4.022
142°F	53 psi	-0.88	0.000	-3.41	0.000	1.63	2.779	0.85	4.291
158°F	62 psi	-0.84	0.000	-3.41	0.000	1.67	2.804	0.98	4.490
173°F	72 psi	-0.80	0.000	-3.41	0.000	1.74	2.834	1.11	4.640
189°F	81 psi	-0.75	0.000	-3.40	0.000	1.82	2.866	1.24	4.754
204°F	91 psi	-0.70	0.000	-3.39	0.000	1.90	2.896	1.36	4.836
220°F	100 psi	-0.64	0.000	-3.39	0.000	1.99	2.924	1.48	4.895

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.

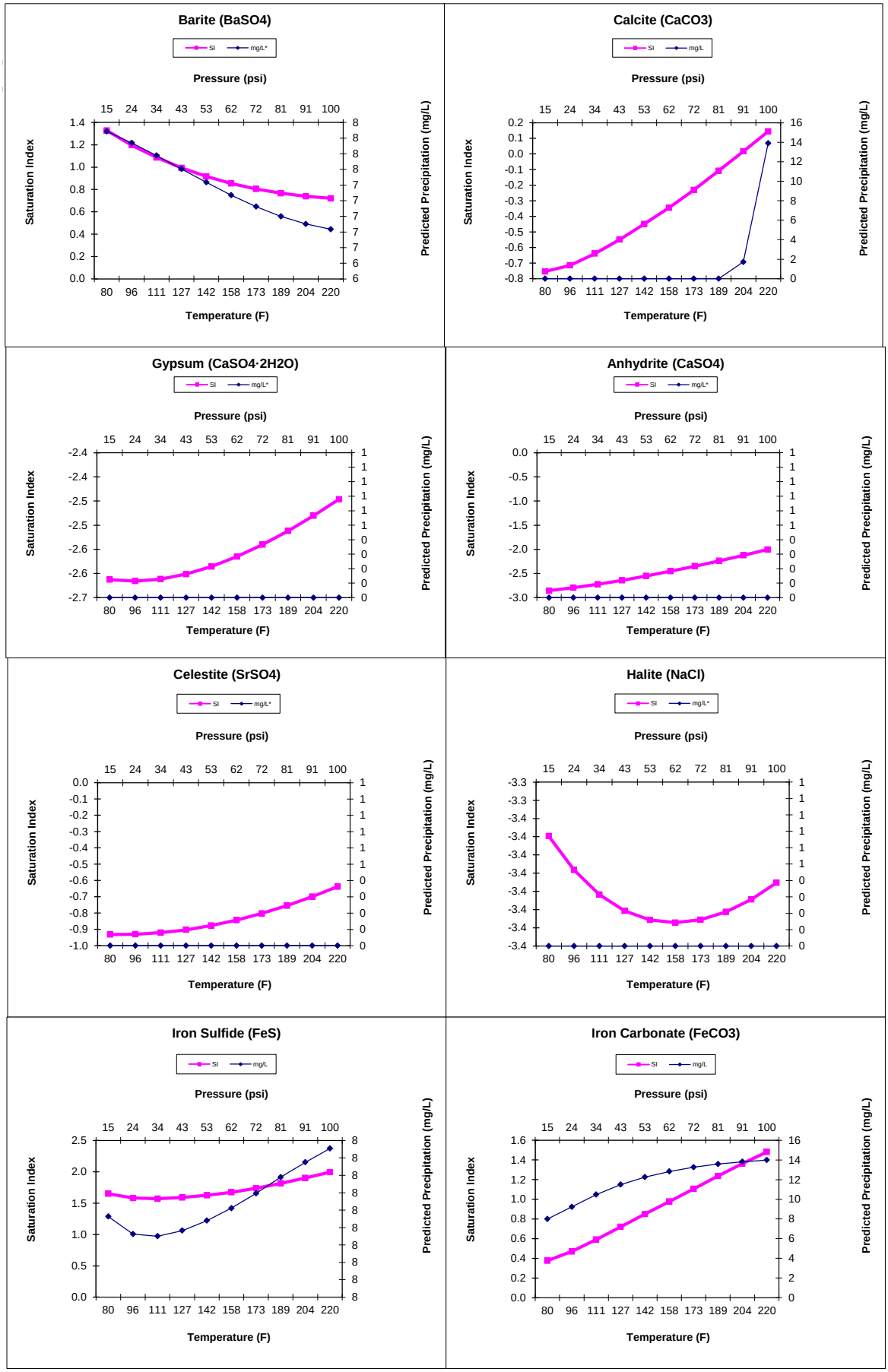
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 12-17D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12-4D Separator
District:	Four Corners	**Sample ID:**	201201036453
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 12-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	402.0	6.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	110.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23237
Density/Specific Gravity (g/cm³):	1.0133
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13600.0	383.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8813.0	383.5
Potassium (K^+):	57.9	1.5
Magnesium (Mg^{2+}):	19.3	1.6
Calcium (Ca^{2+}):	233.3	11.6
Strontium (Sr^{2+}):	21.2	0.5
Barium (Ba^{2+}):	33.9	0.5
Iron (Fe^{2+}):	6.7	0.2
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	711	N/A

ND = Not Determined

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)**
80°F	15 psi	1.53	19.067	-0.46	0.000	-2.32	0.000	-2.55	0.000
96°F	24 psi	1.40	18.715	-0.42	0.000	-2.32	0.000	-2.49	0.000
111°F	34 psi	1.29	18.329	-0.35	0.000	-2.32	0.000	-2.42	0.000
127°F	43 psi	1.20	17.924	-0.26	0.000	-2.31	0.000	-2.34	0.000
142°F	53 psi	1.12	17.519	-0.16	0.000	-2.30	0.000	-2.26	0.000
158°F	62 psi	1.05	17.131	-0.06	0.000	-2.28	0.000	-2.16	0.000
173°F	72 psi	0.99	16.773	0.05	4.230	-2.26	0.000	-2.06	0.000
189°F	81 psi	0.95	16.458	0.16	14.299	-2.24	0.000	-1.96	0.000
204°F	91 psi	0.92	16.193	0.28	23.788	-2.21	0.000	-1.85	0.000
220°F	100 psi	0.89	15.980	0.41	32.702	-2.19	0.000	-1.74	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)**
80°F	15 psi	-1.67	0.000	-2.73	0.000	0.49	1.055	-0.27	0.000
96°F	24 psi	-1.67	0.000	-2.75	0.000	0.43	0.959	-0.18	0.000
111°F	34 psi	-1.67	0.000	-2.76	0.000	0.43	0.963	-0.06	0.000
127°F	43 psi	-1.66	0.000	-2.77	0.000	0.47	1.015	0.06	0.628
142°F	53 psi	-1.64	0.000	-2.78	0.000	0.51	1.089	0.19	1.619
158°F	62 psi	-1.61	0.000	-2.78	0.000	0.57	1.174	0.31	2.370
173°F	72 psi	-1.58	0.000	-2.78	0.000	0.65	1.273	0.43	2.964
189°F	81 psi	-1.54	0.000	-2.77	0.000	0.73	1.373	0.55	3.417
204°F	91 psi	-1.50	0.000	-2.77	0.000	0.82	1.464	0.67	3.749
220°F	100 psi	-1.45	0.000	-2.76	0.000	0.92	1.546	0.78	3.996

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.

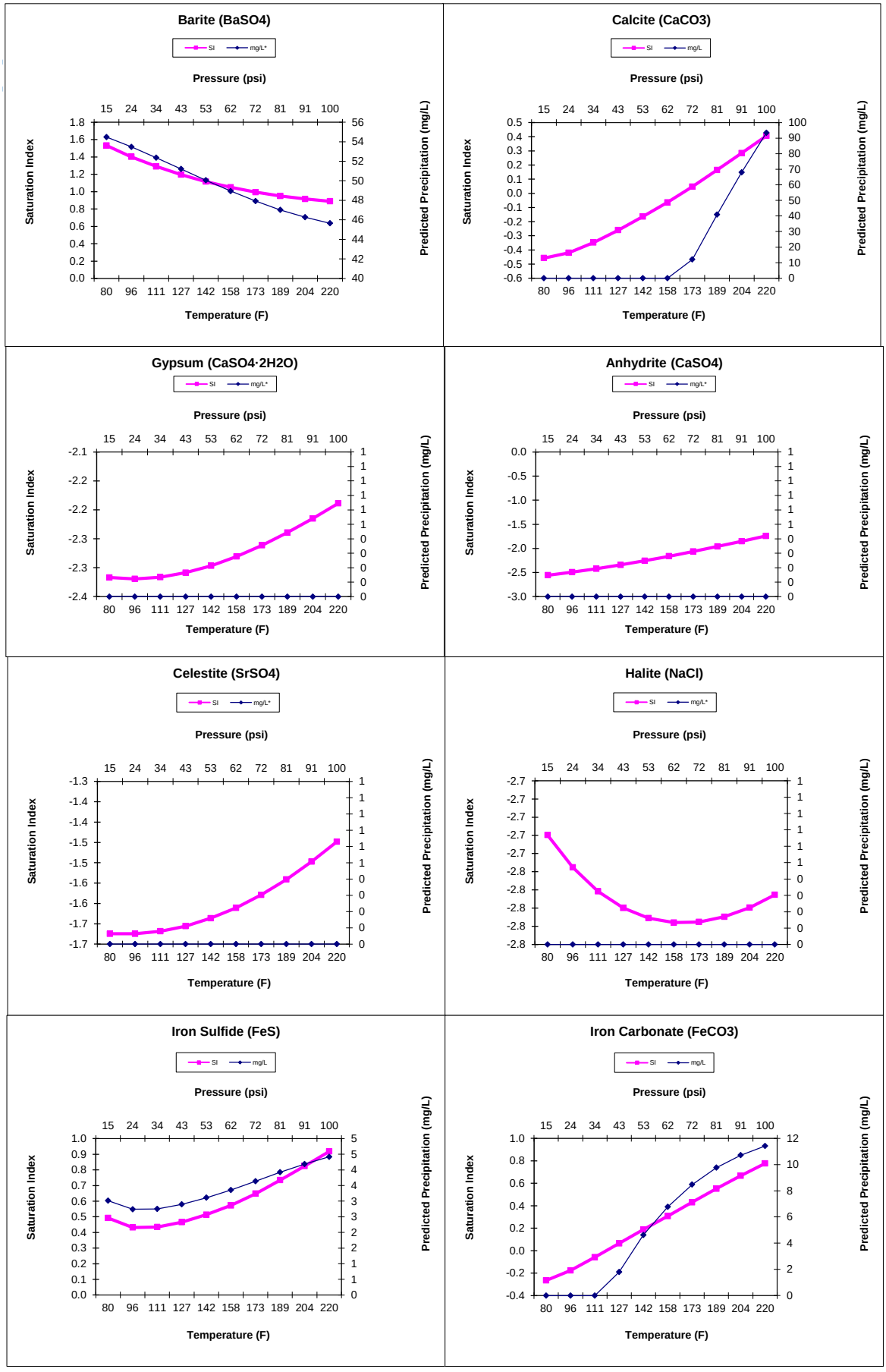
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 12-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12-8D Separator
District:	Four Corners	**Sample ID:**	201201035671
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 12-8D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	110.0
aqueous H_2S (ppm):	5.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	15522
Density/Specific Gravity (g/cm³):	1.0079
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9100.0	256.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	5897.0	256.6
Potassium (K^+):	41.0	1.0
Magnesium (Mg^{2+}):	4.0	0.3
Calcium (Ca^{2+}):	48.0	2.4
Strontium (Sr^{2+}):	5.0	0.1
Barium (Ba^{2+}):	7.0	0.1
Iron (Fe^{2+}):	4.0	0.1
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	147	N/A

ND = Not Determined

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)**
80°F	15 psi	1.03	3.737	-0.64	0.000	-2.84	0.000	-3.08	0.000
96°F	24 psi	0.90	3.590	-0.60	0.000	-2.84	0.000	-3.02	0.000
111°F	34 psi	0.79	3.425	-0.53	0.000	-2.84	0.000	-2.95	0.000
127°F	43 psi	0.69	3.251	-0.44	0.000	-2.83	0.000	-2.87	0.000
142°F	53 psi	0.62	3.075	-0.35	0.000	-2.82	0.000	-2.78	0.000
158°F	62 psi	0.55	2.906	-0.25	0.000	-2.80	0.000	-2.68	0.000
173°F	72 psi	0.50	2.752	-0.14	0.000	-2.78	0.000	-2.58	0.000
189°F	81 psi	0.46	2.618	-0.02	0.000	-2.75	0.000	-2.48	0.000
204°F	91 psi	0.43	2.509	0.10	4.420	-2.72	0.000	-2.36	0.000
220°F	100 psi	0.41	2.428	0.23	9.353	-2.69	0.000	-2.25	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)**
80°F	15 psi	-2.14	0.000	-3.05	0.000	1.76	2.145	0.03	0.187
96°F	24 psi	-2.14	0.000	-3.07	0.000	1.68	2.135	0.12	0.673
111°F	34 psi	-2.13	0.000	-3.08	0.000	1.67	2.132	0.24	1.179
127°F	43 psi	-2.12	0.000	-3.09	0.000	1.68	2.135	0.36	1.594
142°F	53 psi	-2.09	0.000	-3.10	0.000	1.71	2.139	0.49	1.912
158°F	62 psi	-2.06	0.000	-3.10	0.000	1.75	2.145	0.61	2.150
173°F	72 psi	-2.03	0.000	-3.10	0.000	1.81	2.153	0.73	2.333
189°F	81 psi	-1.98	0.000	-3.10	0.000	1.88	2.161	0.85	2.473
204°F	91 psi	-1.93	0.000	-3.09	0.000	1.96	2.168	0.97	2.576
220°F	100 psi	-1.88	0.000	-3.08	0.000	2.04	2.174	1.09	2.651

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.

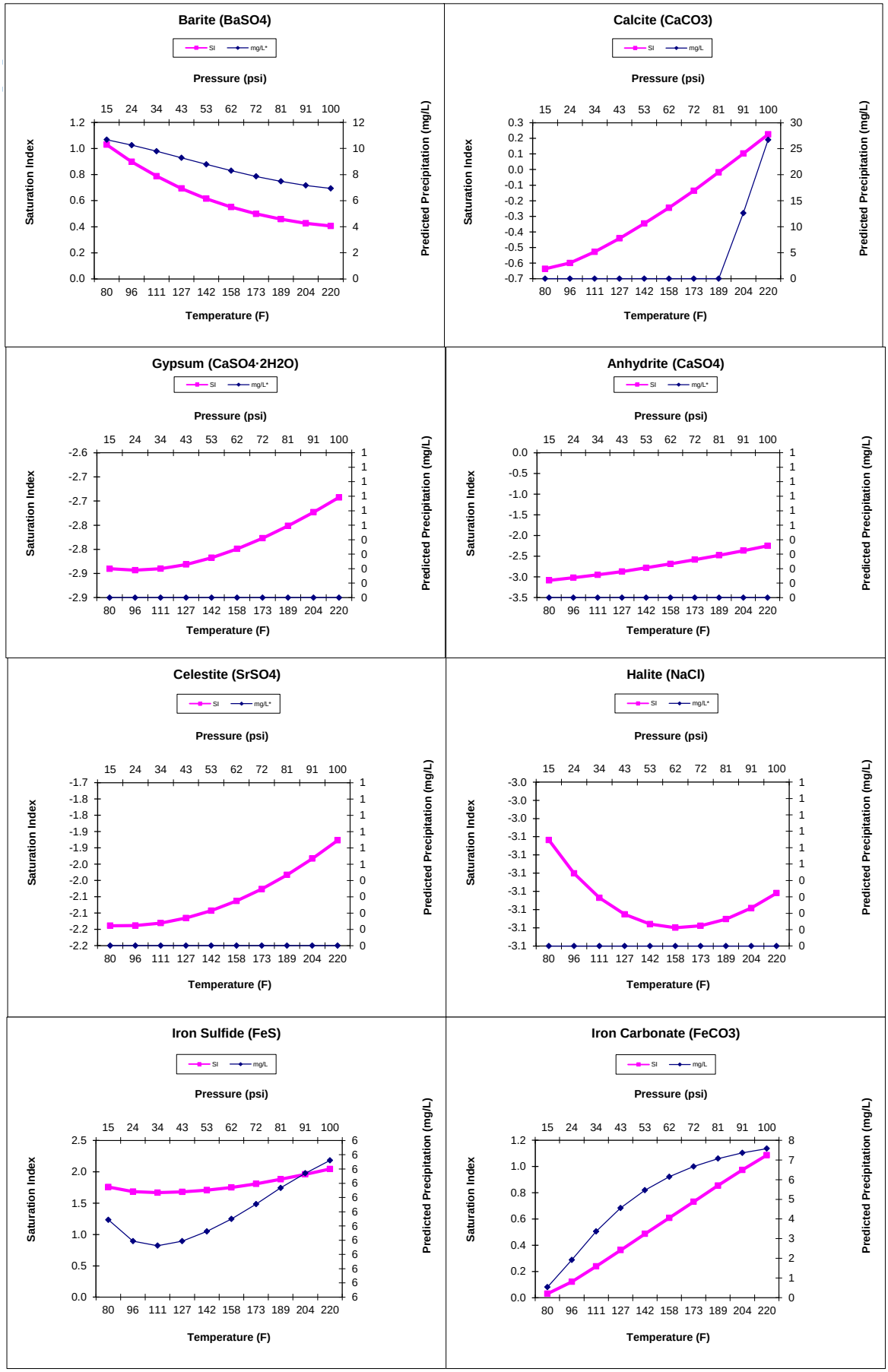
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 12-8D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13-7D Separator
District:	Four Corners	**Sample ID:**	201301002660
Sales Rep:	Sean Higgins	**Sample Date:**	1/28/2013
Lease:	Chevron	**Log Out Date:**	2/7/2013
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 13-7D Separator

Field Data

Initial Temperature (°F):	180
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	61.0	1.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	700.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16203
Density/Specific Gravity (g/cm³):	1.0085
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9600.0	270.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.96

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6221.0	270.7
Potassium (K^+):	51.1	1.3
Magnesium (Mg^{2+}):	22.6	1.9
Calcium (Ca^{2+}):	164.9	8.2
Strontium (Sr^{2+}):	14.7	0.3
Barium (Ba^{2+}):	15.9	0.2
Iron (Fe^{2+}):	0.5	0.0
Manganese (Mn^{2+}):	1.6	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	534	N/A

ND = Not Determined

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)**
80°F	15 psi	1.35	8.901	-1.19	0.000	-2.34	0.000	-2.58	0.000
91°F	24 psi	1.26	8.774	-1.18	0.000	-2.34	0.000	-2.54	0.000
102°F	34 psi	1.17	8.636	-1.14	0.000	-2.34	0.000	-2.49	0.000
113°F	43 psi	1.10	8.489	-1.09	0.000	-2.34	0.000	-2.44	0.000
124°F	53 psi	1.03	8.337	-1.03	0.000	-2.33	0.000	-2.38	0.000
136°F	62 psi	0.97	8.183	-0.96	0.000	-2.32	0.000	-2.32	0.000
147°F	72 psi	0.92	8.032	-0.88	0.000	-2.31	0.000	-2.25	0.000
158°F	81 psi	0.88	7.886	-0.80	0.000	-2.30	0.000	-2.18	0.000
169°F	91 psi	0.84	7.750	-0.72	0.000	-2.28	0.000	-2.11	0.000
180°F	100 psi	0.80	7.625	-0.64	0.000	-2.27	0.000	-2.04	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)**
80°F	15 psi	-1.70	0.000	-3.01	0.000	-0.30	0.000	-1.97	0.000
91°F	24 psi	-1.70	0.000	-3.02	0.000	-0.38	0.000	-1.93	0.000
102°F	34 psi	-1.70	0.000	-3.03	0.000	-0.40	0.000	-1.86	0.000
113°F	43 psi	-1.69	0.000	-3.04	0.000	-0.40	0.000	-1.78	0.000
124°F	53 psi	-1.68	0.000	-3.05	0.000	-0.38	0.000	-1.69	0.000
136°F	62 psi	-1.66	0.000	-3.05	0.000	-0.36	0.000	-1.60	0.000
147°F	72 psi	-1.65	0.000	-3.06	0.000	-0.31	0.000	-1.50	0.000
158°F	81 psi	-1.63	0.000	-3.06	0.000	-0.26	0.000	-1.41	0.000
169°F	91 psi	-1.60	0.000	-3.06	0.000	-0.20	0.000	-1.31	0.000
180°F	100 psi	-1.57	0.000	-3.06	0.000	-0.14	0.000	-1.22	0.000

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.

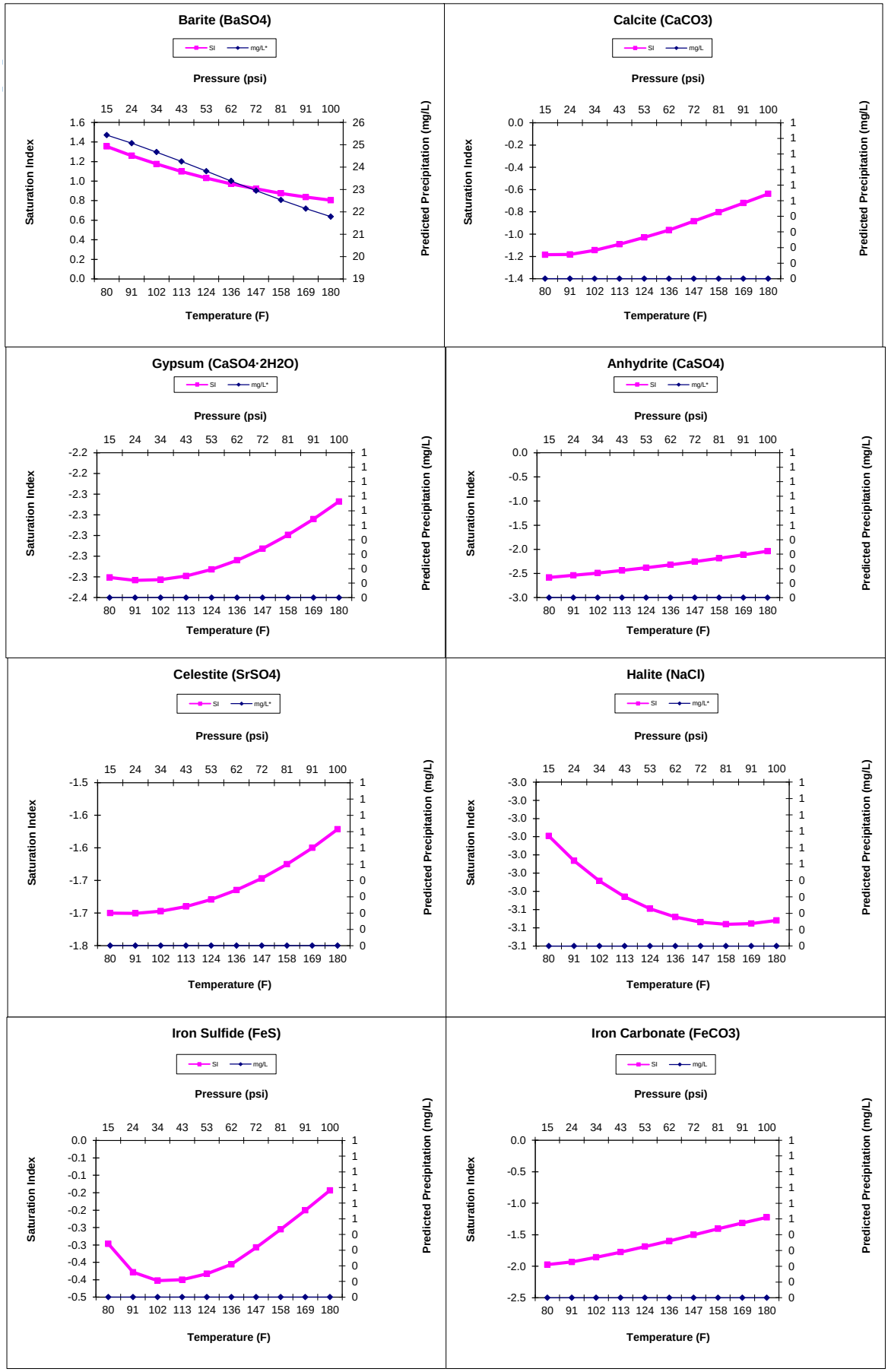
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41302 CAERUS OIL & GAS, Chevron, 13-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13A-7D Separator
District:	Four Corners	**Sample ID:**	201201035700
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 13A-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	439.0	7.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	110.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	13201
Density/Specific Gravity (g/cm³):	1.0064
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	7600.0	214.4
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	4925.0	214.3
Potassium (K^+):	41.0	1.0
Magnesium (Mg^{2+}):	11.0	0.9
Calcium (Ca^{2+}):	81.0	4.0
Strontium (Sr^{2+}):	11.0	0.3
Barium (Ba^{2+}):	19.0	0.3
Iron (Fe^{2+}):	24.0	0.9
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	274	N/A

ND = Not Determined

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)**
80°F	15 psi	1.52	10.847	-1.29	0.000	-2.56	0.000	-2.80	0.000
96°F	24 psi	1.39	10.691	-1.26	0.000	-2.56	0.000	-2.74	0.000
111°F	34 psi	1.28	10.517	-1.19	0.000	-2.56	0.000	-2.67	0.000
127°F	43 psi	1.19	10.334	-1.10	0.000	-2.55	0.000	-2.59	0.000
142°F	53 psi	1.11	10.151	-1.00	0.000	-2.53	0.000	-2.50	0.000
158°F	62 psi	1.05	9.977	-0.89	0.000	-2.51	0.000	-2.40	0.000
173°F	72 psi	1.00	9.820	-0.77	0.000	-2.49	0.000	-2.30	0.000
189°F	81 psi	0.96	9.686	-0.65	0.000	-2.46	0.000	-2.19	0.000
204°F	91 psi	0.93	9.579	-0.52	0.000	-2.43	0.000	-2.08	0.000
220°F	100 psi	0.91	9.501	-0.39	0.000	-2.40	0.000	-1.96	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)**
80°F	15 psi	-1.74	0.000	-3.20	0.000	0.22	0.810	-0.06	0.000
96°F	24 psi	-1.74	0.000	-3.22	0.000	0.16	0.618	0.02	0.668
111°F	34 psi	-1.73	0.000	-3.23	0.000	0.18	0.662	0.14	4.026
127°F	43 psi	-1.72	0.000	-3.24	0.000	0.22	0.810	0.27	6.984
142°F	53 psi	-1.69	0.000	-3.24	0.000	0.29	0.999	0.40	9.375
158°F	62 psi	-1.66	0.000	-3.25	0.000	0.38	1.221	0.53	11.330
173°F	72 psi	-1.62	0.000	-3.24	0.000	0.49	1.437	0.66	12.854
189°F	81 psi	-1.58	0.000	-3.24	0.000	0.60	1.618	0.79	13.974
204°F	91 psi	-1.52	0.000	-3.23	0.000	0.71	1.766	0.92	14.799
220°F	100 psi	-1.47	0.000	-3.22	0.000	0.83	1.886	1.04	15.411

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.

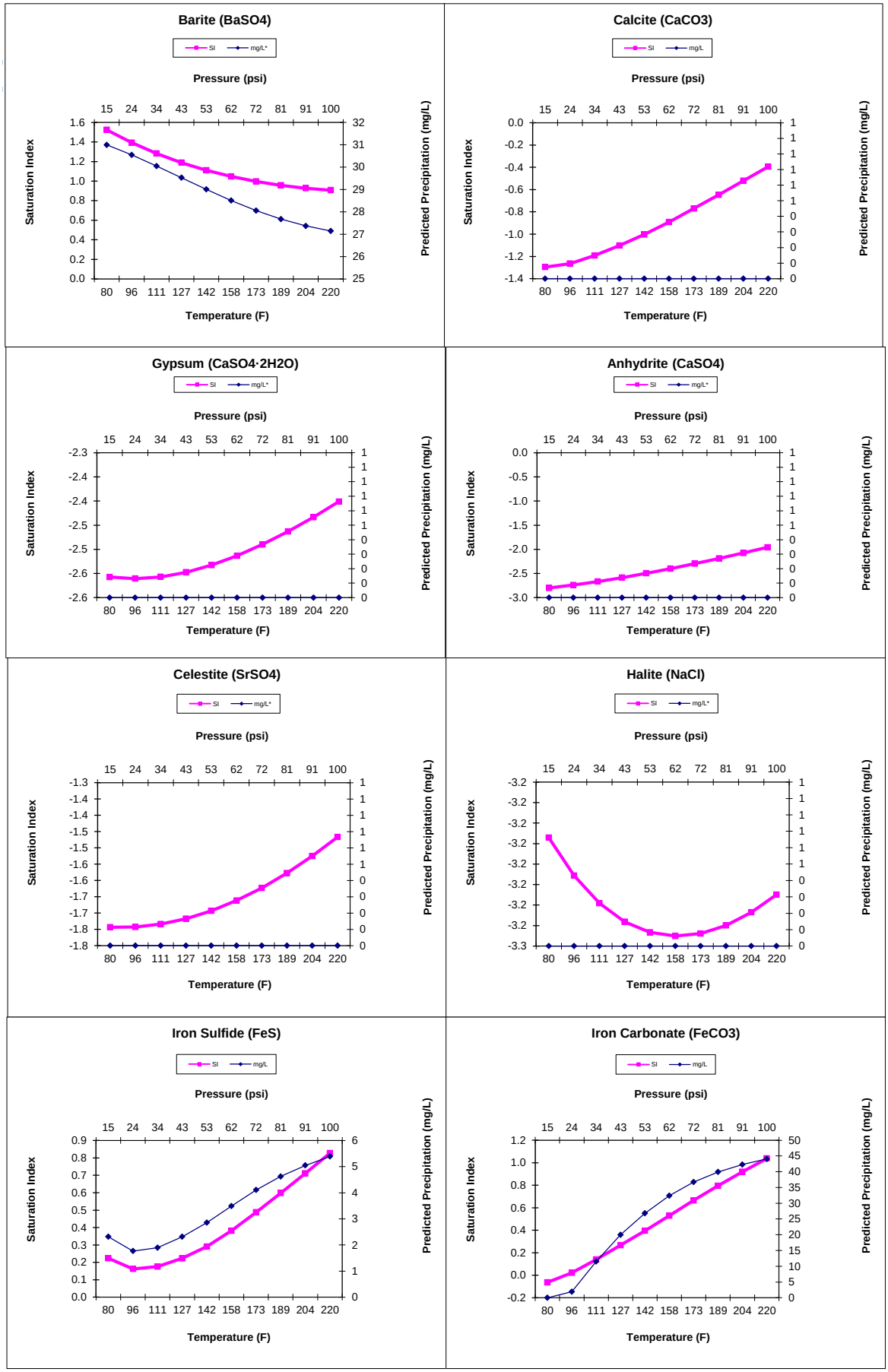
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 13A-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13D-17D Separator
District:	Four Corners	**Sample ID:**	201201035662
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 13D-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	292.0	4.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	65.0
aqueous H_2S (ppm):	5.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	9098
Density/Specific Gravity (g/cm³):	1.0034
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	5300.0	149.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	3434.0	149.4
Potassium (K^+):	6.0	0.2
Magnesium (Mg^{2+}):	1.0	0.1
Calcium (Ca^{2+}):	11.0	0.5
Strontium (Sr^{2+}):	0.1	0.0
Barium (Ba^{2+}):	2.0	0.0
Iron (Fe^{2+}):	2.0	0.1
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	33	N/A

ND = Not Determined

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)**
80°F	15 psi	0.70	0.947	-1.30	0.000	-3.29	0.000	-3.53	0.000
96°F	24 psi	0.57	0.863	-1.26	0.000	-3.29	0.000	-3.47	0.000
111°F	34 psi	0.46	0.769	-1.19	0.000	-3.28	0.000	-3.40	0.000
127°F	43 psi	0.37	0.670	-1.10	0.000	-3.27	0.000	-3.31	0.000
142°F	53 psi	0.29	0.573	-1.00	0.000	-3.26	0.000	-3.22	0.000
158°F	62 psi	0.23	0.481	-0.90	0.000	-3.24	0.000	-3.12	0.000
173°F	72 psi	0.18	0.399	-0.79	0.000	-3.21	0.000	-3.02	0.000
189°F	81 psi	0.14	0.331	-0.66	0.000	-3.18	0.000	-2.91	0.000
204°F	91 psi	0.12	0.279	-0.54	0.000	-3.15	0.000	-2.79	0.000
220°F	100 psi	0.10	0.244	-0.41	0.000	-3.11	0.000	-2.67	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)**
80°F	15 psi	-3.50	0.000	-3.48	0.000	1.56	1.065	-0.28	0.000
96°F	24 psi	-3.50	0.000	-3.50	0.000	1.49	1.059	-0.19	0.000
111°F	34 psi	-3.49	0.000	-3.52	0.000	1.48	1.058	-0.07	0.000
127°F	43 psi	-3.47	0.000	-3.52	0.000	1.49	1.060	0.06	0.181
142°F	53 psi	-3.44	0.000	-3.53	0.000	1.53	1.063	0.19	0.496
158°F	62 psi	-3.40	0.000	-3.53	0.000	1.58	1.067	0.31	0.733
173°F	72 psi	-3.36	0.000	-3.53	0.000	1.64	1.072	0.44	0.913
189°F	81 psi	-3.31	0.000	-3.52	0.000	1.72	1.077	0.57	1.050
204°F	91 psi	-3.25	0.000	-3.52	0.000	1.81	1.081	0.70	1.150
220°F	100 psi	-3.19	0.000	-3.51	0.000	1.90	1.085	0.82	1.222

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.

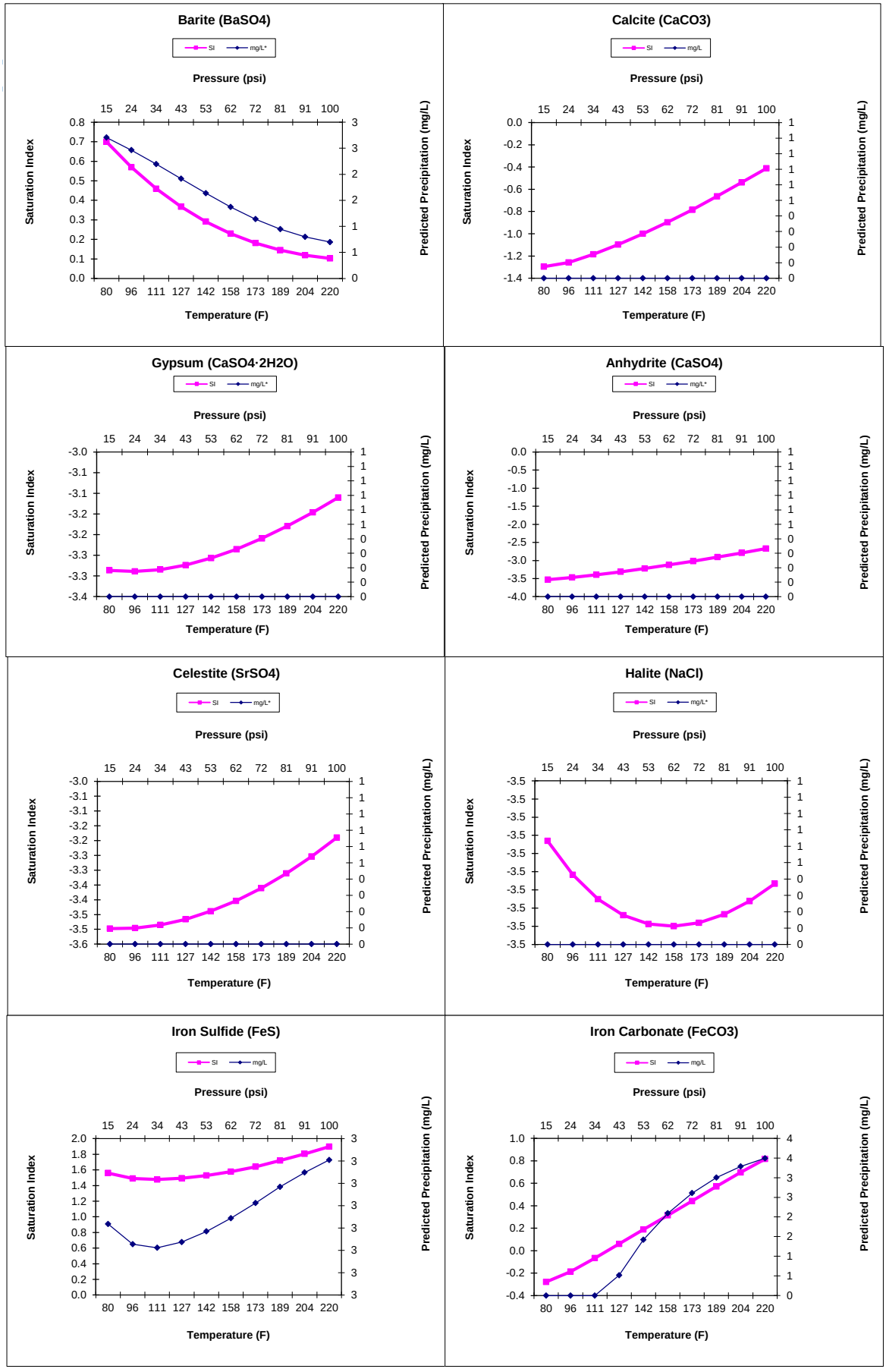
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 13D-17D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13D-7D Separator
District:	Four Corners	**Sample ID:**	201201035701
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 13D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	634.0	10.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	350.0
aqueous H_2S (ppm):	6.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	6315
Density/Specific Gravity (g/cm³):	1.0014
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	2780.0	78.4
Sulfate (SO_4^{2-}):	1050.0	21.9
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.38	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	1801.0	78.4
Potassium (K^+):	8.0	0.2
Magnesium (Mg^{2+}):	2.0	0.2
Calcium (Ca^{2+}):	19.0	0.9
Strontium (Sr^{2+}):	1.0	0.0
Barium (Ba^{2+}):	5.0	0.1
Iron (Fe^{2+}):	15.0	0.5
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	61	N/A

ND = Not Determined

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)**
80°F	15 psi	2.50	2.965	-0.68	0.000	-1.63	0.000	-1.88	0.000
96°F	24 psi	2.36	2.961	-0.64	0.000	-1.63	0.000	-1.82	0.000
111°F	34 psi	2.25	2.957	-0.56	0.000	-1.63	0.000	-1.74	0.000
127°F	43 psi	2.16	2.953	-0.47	0.000	-1.62	0.000	-1.66	0.000
142°F	53 psi	2.08	2.949	-0.37	0.000	-1.60	0.000	-1.57	0.000
158°F	62 psi	2.02	2.946	-0.27	0.000	-1.58	0.000	-1.47	0.000
173°F	72 psi	1.97	2.942	-0.15	0.000	-1.55	0.000	-1.36	0.000
189°F	81 psi	1.94	2.940	-0.03	0.000	-1.52	0.000	-1.25	0.000
204°F	91 psi	1.91	2.938	0.09	2.663	-1.49	0.000	-1.14	0.000
220°F	100 psi	1.90	2.936	0.22	5.683	-1.46	0.000	-1.02	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)**
80°F	15 psi	-1.25	0.000	-4.02	0.000	2.52	8.035	1.01	9.682
96°F	24 psi	-1.25	0.000	-4.04	0.000	2.46	8.005	1.11	9.916
111°F	34 psi	-1.24	0.000	-4.06	0.000	2.45	8.004	1.23	10.155
127°F	43 psi	-1.22	0.000	-4.06	0.000	2.47	8.016	1.36	10.346
142°F	53 psi	-1.19	0.000	-4.07	0.000	2.51	8.036	1.49	10.490
158°F	62 psi	-1.15	0.000	-4.07	0.000	2.56	8.060	1.63	10.594
173°F	72 psi	-1.11	0.000	-4.07	0.000	2.63	8.088	1.76	10.673
189°F	81 psi	-1.06	0.000	-4.06	0.000	2.72	8.116	1.90	10.732
204°F	91 psi	-1.00	0.000	-4.05	0.000	2.81	8.142	2.03	10.773
220°F	100 psi	-0.93	0.000	-4.04	0.000	2.91	8.165	2.15	10.803

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.

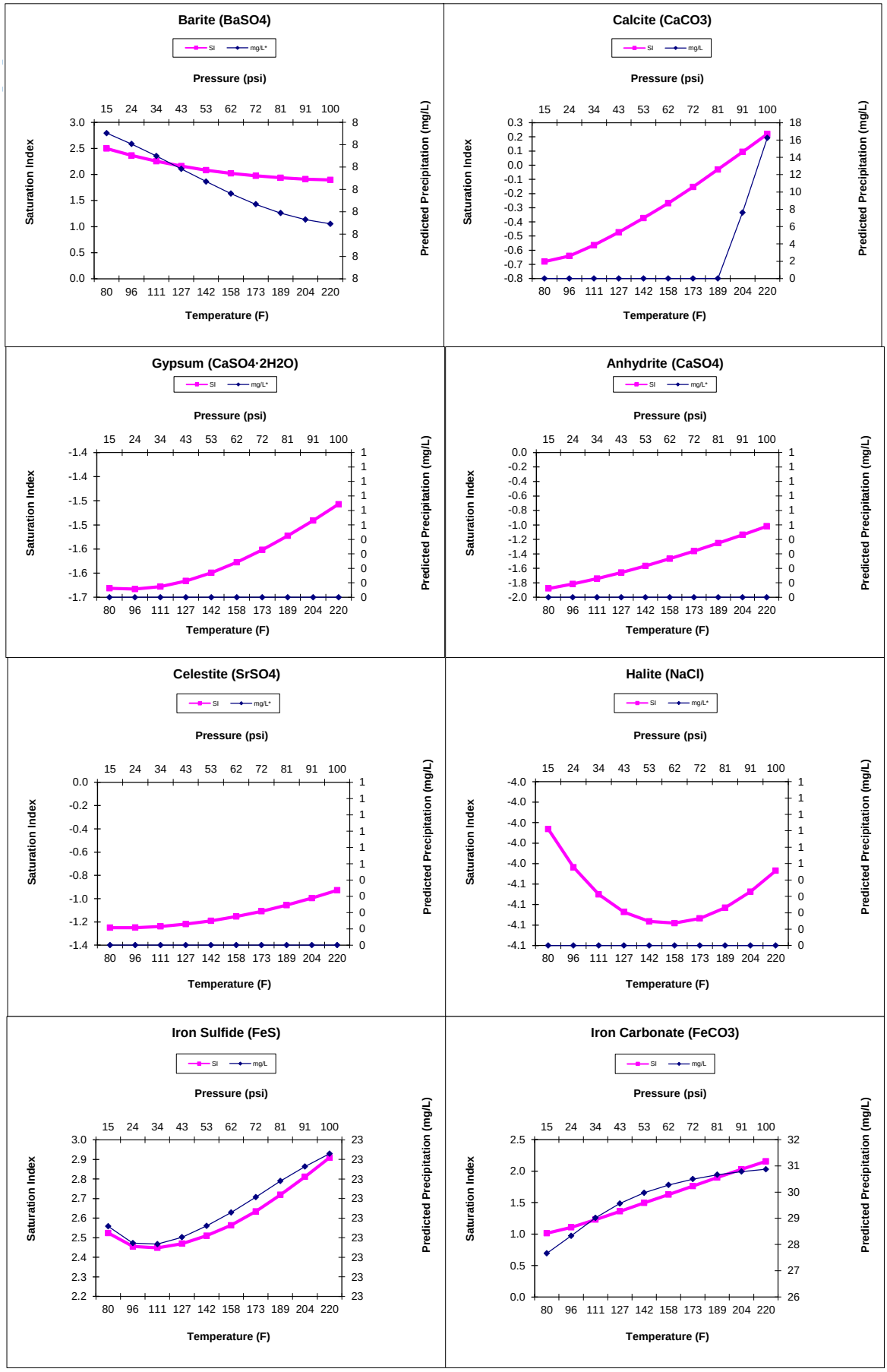
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 13D-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14A-17D Separator
District:	Four Corners	**Sample ID:**	201201035663
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 14A-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	463.0	7.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	4621
Density/Specific Gravity (g/cm^3):	1.0004
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	2470.0	69.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.10

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	1601.0	69.7
Potassium (K^+):	9.0	0.2
Magnesium (Mg^{2+}):	2.0	0.2
Calcium (Ca^{2+}):	21.0	1.0
Strontium (Sr^{2+}):	1.0	0.0
Barium (Ba^{2+}):	3.0	0.0
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	64	N/A

ND = Not Determined

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)**
80°F	15 psi	1.12	1.643	-1.69	0.000	-2.77	0.000	-3.02	0.000
96°F	24 psi	0.99	1.594	-1.66	0.000	-2.78	0.000	-2.96	0.000
111°F	34 psi	0.88	1.541	-1.58	0.000	-2.77	0.000	-2.88	0.000
127°F	43 psi	0.79	1.485	-1.49	0.000	-2.75	0.000	-2.80	0.000
142°F	53 psi	0.72	1.431	-1.39	0.000	-2.73	0.000	-2.70	0.000
158°F	62 psi	0.66	1.381	-1.26	0.000	-2.71	0.000	-2.60	0.000
173°F	72 psi	0.62	1.338	-1.13	0.000	-2.68	0.000	-2.49	0.000
189°F	81 psi	0.58	1.305	-1.00	0.000	-2.64	0.000	-2.37	0.000
204°F	91 psi	0.56	1.282	-0.87	0.000	-2.61	0.000	-2.25	0.000
220°F	100 psi	0.55	1.269	-0.74	0.000	-2.56	0.000	-2.13	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)**
80°F	15 psi	-2.42	0.000	-4.10	0.000	-0.63	0.000	-1.22	0.000
96°F	24 psi	-2.42	0.000	-4.12	0.000	-0.69	0.000	-1.13	0.000
111°F	34 psi	-2.40	0.000	-4.13	0.000	-0.68	0.000	-1.01	0.000
127°F	43 psi	-2.38	0.000	-4.14	0.000	-0.62	0.000	-0.87	0.000
142°F	53 psi	-2.35	0.000	-4.14	0.000	-0.55	0.000	-0.74	0.000
158°F	62 psi	-2.30	0.000	-4.14	0.000	-0.44	0.000	-0.59	0.000
173°F	72 psi	-2.26	0.000	-4.14	0.000	-0.32	0.000	-0.44	0.000
189°F	81 psi	-2.20	0.000	-4.13	0.000	-0.20	0.000	-0.30	0.000
204°F	91 psi	-2.13	0.000	-4.12	0.000	-0.07	0.000	-0.17	0.000
220°F	100 psi	-2.06	0.000	-4.11	0.000	0.06	0.062	-0.04	0.000

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.

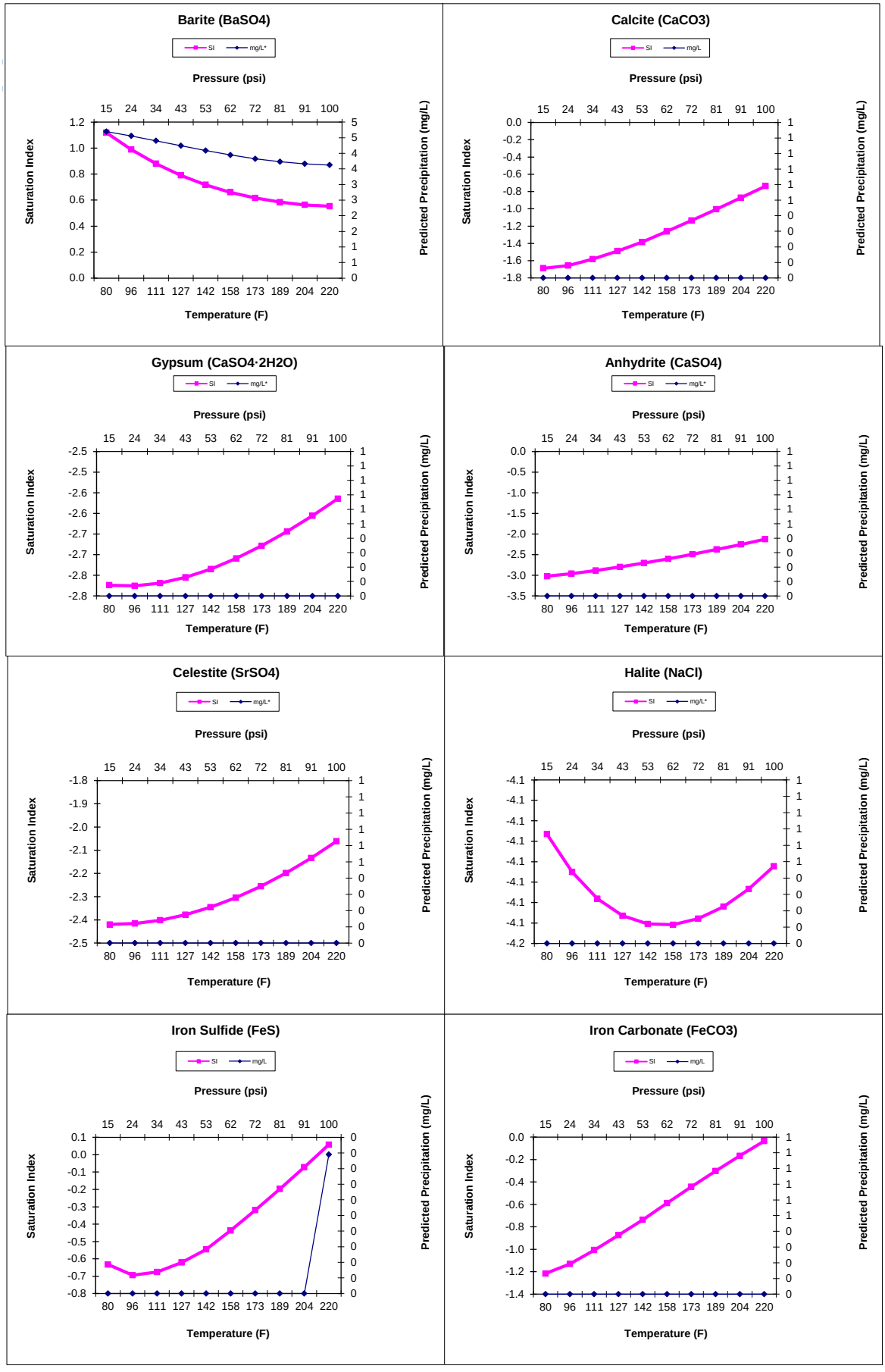
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 14A-17D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14A-7D Separator
District:	Four Corners	**Sample ID:**	201201035702
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 14A-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	793.0	13.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	450.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	2966
Density/Specific Gravity (g/cm³):	0.9991
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	1270.0	35.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.35	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	823.0	35.8
Potassium (K^+):	3.0	0.1
Magnesium (Mg^{2+}):	1.0	0.1
Calcium (Ca^{2+}):	12.0	0.6
Strontium (Sr^{2+}):	0.1	0.0
Barium (Ba^{2+}):	1.0	0.0
Iron (Fe^{2+}):	13.0	0.5
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	35	N/A

ND = Not Determined

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)**
80°F	15 psi	0.79	0.498	-0.61	0.000	-2.86	0.000	-3.11	0.000
96°F	24 psi	0.67	0.465	-0.56	0.000	-2.86	0.000	-3.04	0.000
111°F	34 psi	0.56	0.429	-0.48	0.000	-2.85	0.000	-2.97	0.000
127°F	43 psi	0.47	0.392	-0.39	0.000	-2.84	0.000	-2.88	0.000
142°F	53 psi	0.40	0.356	-0.28	0.000	-2.81	0.000	-2.78	0.000
158°F	62 psi	0.34	0.324	-0.17	0.000	-2.78	0.000	-2.68	0.000
173°F	72 psi	0.30	0.297	-0.04	0.000	-2.75	0.000	-2.56	0.000
189°F	81 psi	0.27	0.277	0.09	1.797	-2.71	0.000	-2.44	0.000
204°F	91 psi	0.26	0.264	0.23	3.957	-2.67	0.000	-2.32	0.000
220°F	100 psi	0.25	0.258	0.36	5.641	-2.63	0.000	-2.19	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)**
80°F	15 psi	-3.58	0.000	-4.64	0.000	-8.13	0.000	1.27	8.885
96°F	24 psi	-3.57	0.000	-4.66	0.000	-8.19	0.000	1.37	8.998
111°F	34 psi	-3.55	0.000	-4.67	0.000	-8.19	0.000	1.50	9.111
127°F	43 psi	-3.53	0.000	-4.68	0.000	-8.16	0.000	1.64	9.201
142°F	53 psi	-3.49	0.000	-4.68	0.000	-8.11	0.000	1.78	9.267
158°F	62 psi	-3.45	0.000	-4.68	0.000	-8.05	0.000	1.92	9.314
173°F	72 psi	-3.39	0.000	-4.68	0.000	-7.96	0.000	2.06	9.349
189°F	81 psi	-3.33	0.000	-4.67	0.000	-7.87	0.000	2.21	9.375
204°F	91 psi	-3.26	0.000	-4.66	0.000	-7.77	0.000	2.35	9.393
220°F	100 psi	-3.19	0.000	-4.65	0.000	-7.66	0.000	2.48	9.405

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.

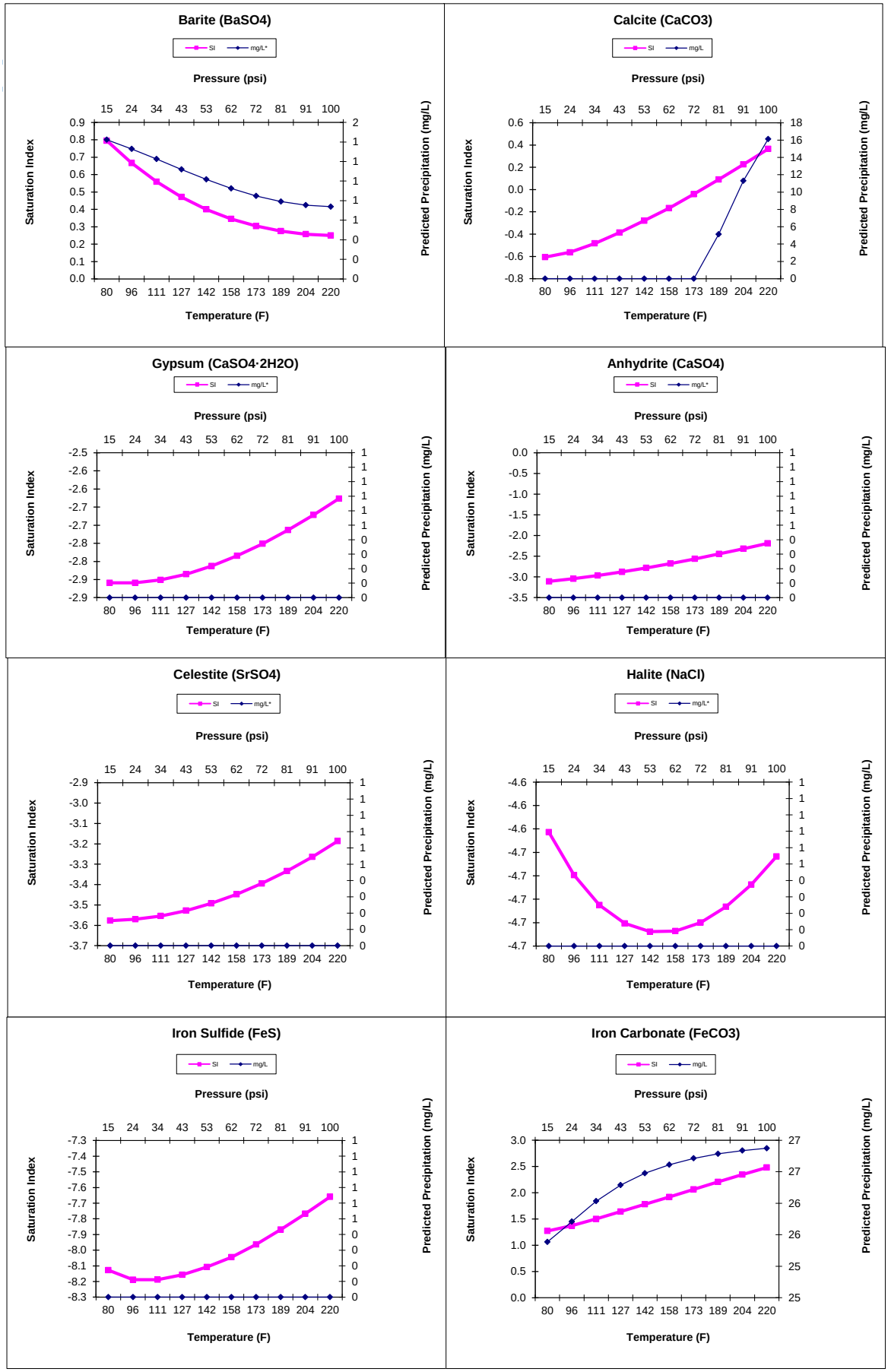
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 14A-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	1N-4D Separator
District:	Four Corners	**Sample ID:**	201201036467
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 1N-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	683.0	11.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	25016
Density/Specific Gravity (g/cm^3):	1.0144
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14500.0	409.0
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	9396.0	408.9
Potassium (K^+):	42.3	1.1
Magnesium (Mg^{2+}):	14.3	1.2
Calcium (Ca^{2+}):	138.6	6.9
Strontium (Sr^{2+}):	15.7	0.4
Barium (Ba^{2+}):	34.9	0.5
Iron (Fe^{2+}):	41.0	1.5
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	449	N/A

ND = Not Determined

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)**
80°F	15 psi	1.99	20.503	-0.25	0.000	-2.08	0.000	-2.32	0.000
96°F	24 psi	1.86	20.416	-0.22	0.000	-2.09	0.000	-2.26	0.000
111°F	34 psi	1.75	20.317	-0.14	0.000	-2.08	0.000	-2.19	0.000
127°F	43 psi	1.66	20.211	-0.06	0.000	-2.08	0.000	-2.11	0.000
142°F	53 psi	1.58	20.101	0.04	4.254	-2.06	0.000	-2.02	0.000
158°F	62 psi	1.51	19.992	0.14	14.532	-2.05	0.000	-1.93	0.000
173°F	72 psi	1.45	19.890	0.25	25.158	-2.03	0.000	-1.83	0.000
189°F	81 psi	1.41	19.797	0.37	35.655	-2.01	0.000	-1.73	0.000
204°F	91 psi	1.37	19.717	0.49	45.505	-1.99	0.000	-1.62	0.000
220°F	100 psi	1.35	19.651	0.61	54.712	-1.96	0.000	-1.51	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)**
80°F	15 psi	-1.35	0.000	-2.68	0.000	1.61	1.728	0.97	25.450
96°F	24 psi	-1.35	0.000	-2.70	0.000	1.55	1.720	1.06	26.214
111°F	34 psi	-1.35	0.000	-2.71	0.000	1.54	1.719	1.17	27.021
127°F	43 psi	-1.33	0.000	-2.72	0.000	1.56	1.722	1.30	27.679
142°F	53 psi	-1.31	0.000	-2.72	0.000	1.60	1.727	1.42	28.181
158°F	62 psi	-1.29	0.000	-2.73	0.000	1.65	1.732	1.54	28.555
173°F	72 psi	-1.26	0.000	-2.73	0.000	1.72	1.738	1.66	28.847
189°F	81 psi	-1.22	0.000	-2.72	0.000	1.80	1.745	1.78	29.067
204°F	91 psi	-1.18	0.000	-2.72	0.000	1.88	1.750	1.89	29.227
220°F	100 psi	-1.13	0.000	-2.71	0.000	1.97	1.755	2.00	29.345

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.

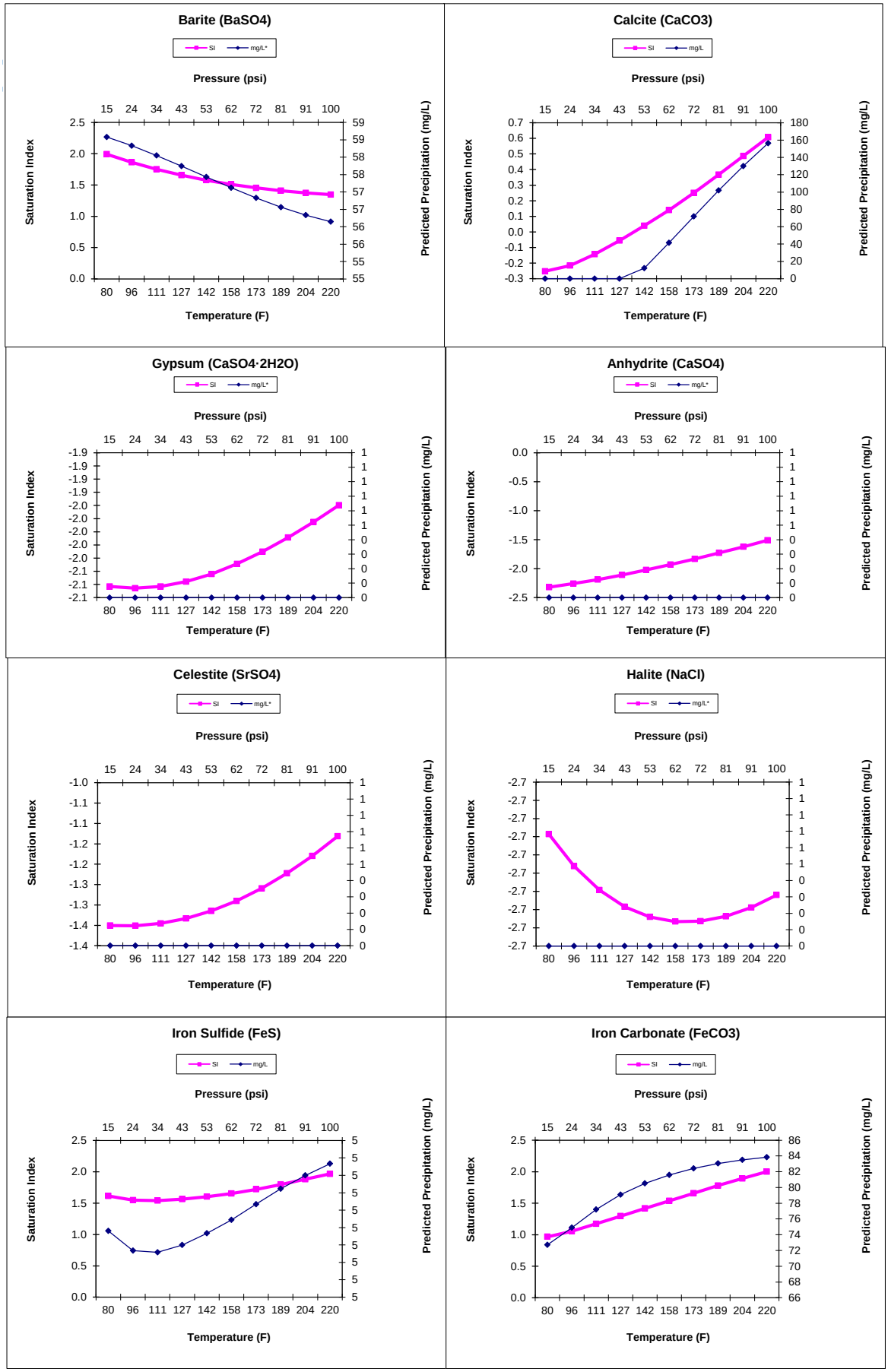
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 1N-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	21C-17D Separator
District:	Four Corners	**Sample ID:**	201201035670
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 21C-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	707.0	11.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	14578
Density/Specific Gravity (g/cm³):	1.0072
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8300.0	234.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.03	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5378.0	234.0
Potassium (K^+):	37.0	0.9
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	57.0	2.8
Strontium (Sr^{2+}):	8.0	0.2
Barium (Ba^{2+}):	20.0	0.3
Iron (Fe^{2+}):	12.0	0.4
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	203	N/A

ND = Not Determined

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)**
80°F	15 psi	1.51	11.395	-0.25	0.000	-2.73	0.000	-2.98	0.000
96°F	24 psi	1.38	11.223	-0.21	0.000	-2.74	0.000	-2.92	0.000
111°F	34 psi	1.27	11.031	-0.14	0.000	-2.73	0.000	-2.84	0.000
127°F	43 psi	1.17	10.829	-0.05	0.000	-2.73	0.000	-2.76	0.000
142°F	53 psi	1.10	10.627	0.05	3.288	-2.71	0.000	-2.67	0.000
158°F	62 psi	1.03	10.433	0.15	9.580	-2.69	0.000	-2.58	0.000
173°F	72 psi	0.98	10.258	0.27	15.770	-2.67	0.000	-2.48	0.000
189°F	81 psi	0.94	10.108	0.39	21.666	-2.64	0.000	-2.37	0.000
204°F	91 psi	0.91	9.987	0.51	26.875	-2.61	0.000	-2.26	0.000
220°F	100 psi	0.89	9.897	0.64	31.399	-2.58	0.000	-2.14	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)**
80°F	15 psi	-1.91	0.000	-3.13	0.000	1.58	1.467	0.85	7.365
96°F	24 psi	-1.91	0.000	-3.15	0.000	1.51	1.458	0.94	7.620
111°F	34 psi	-1.90	0.000	-3.16	0.000	1.50	1.456	1.06	7.882
127°F	43 psi	-1.89	0.000	-3.17	0.000	1.51	1.458	1.19	8.092
142°F	53 psi	-1.87	0.000	-3.17	0.000	1.55	1.463	1.32	8.249
158°F	62 psi	-1.83	0.000	-3.18	0.000	1.59	1.469	1.44	8.365
173°F	72 psi	-1.80	0.000	-3.17	0.000	1.65	1.475	1.57	8.453
189°F	81 psi	-1.75	0.000	-3.17	0.000	1.73	1.483	1.70	8.519
204°F	91 psi	-1.70	0.000	-3.16	0.000	1.81	1.489	1.82	8.567
220°F	100 psi	-1.64	0.000	-3.16	0.000	1.90	1.495	1.94	8.601

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.

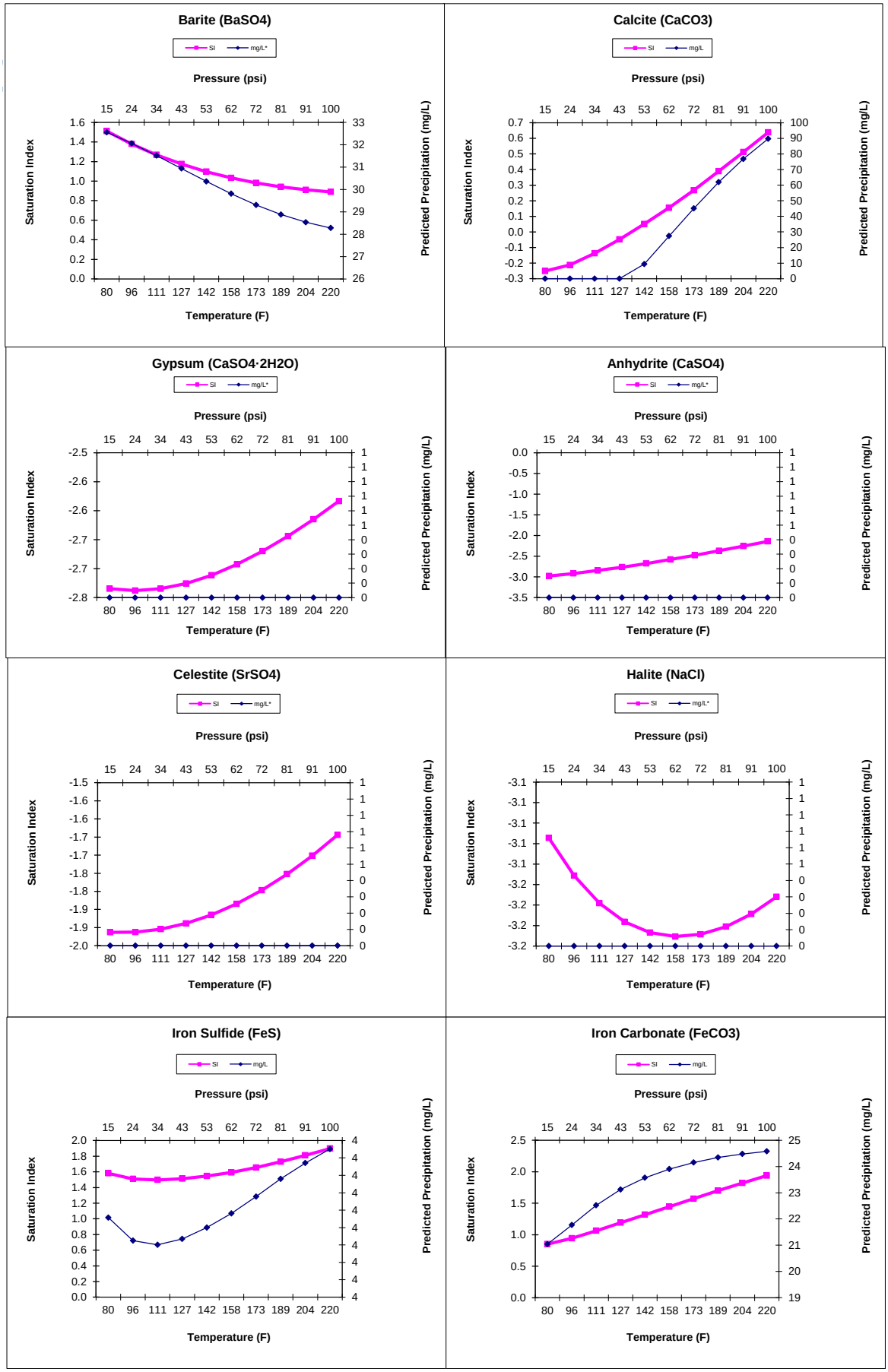
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 21C-17D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	21D-7D Separator
District:	Four Corners	**Sample ID:**	201201035703
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 21D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	165.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17726
Density/Specific Gravity (g/cm^3):	1.0094
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10300.0	290.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	6674.0	290.4
Potassium (K^+):	38.0	1.0
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	85.0	4.2
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	11.0	0.2
Iron (Fe^{2+}):	0.4	0.0
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	268	N/A

ND = Not Determined

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)**
80°F	15 psi	1.17	6.026	-0.22	0.000	-2.64	0.000	-2.88	0.000
96°F	24 psi	1.04	5.848	-0.18	0.000	-2.64	0.000	-2.82	0.000
111°F	34 psi	0.93	5.649	-0.11	0.000	-2.64	0.000	-2.75	0.000
127°F	43 psi	0.83	5.439	-0.02	0.000	-2.63	0.000	-2.67	0.000
142°F	53 psi	0.75	5.226	0.08	5.344	-2.62	0.000	-2.58	0.000
158°F	62 psi	0.69	5.021	0.18	12.094	-2.60	0.000	-2.48	0.000
173°F	72 psi	0.63	4.832	0.29	18.976	-2.58	0.000	-2.38	0.000
189°F	81 psi	0.59	4.668	0.41	25.915	-2.55	0.000	-2.28	0.000
204°F	91 psi	0.56	4.532	0.53	32.415	-2.53	0.000	-2.17	0.000
220°F	100 psi	0.54	4.427	0.65	38.449	-2.50	0.000	-2.05	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)**
80°F	15 psi	-1.93	0.000	-2.95	0.000	0.02	0.006	-0.84	0.000
96°F	24 psi	-1.93	0.000	-2.97	0.000	-0.06	0.000	-0.75	0.000
111°F	34 psi	-1.93	0.000	-2.98	0.000	-0.07	0.000	-0.63	0.000
127°F	43 psi	-1.91	0.000	-2.99	0.000	-0.06	0.000	-0.50	0.000
142°F	53 psi	-1.89	0.000	-3.00	0.000	-0.03	0.000	-0.38	0.000
158°F	62 psi	-1.86	0.000	-3.00	0.000	0.02	0.006	-0.25	0.000
173°F	72 psi	-1.83	0.000	-3.00	0.000	0.07	0.027	-0.13	0.000
189°F	81 psi	-1.79	0.000	-3.00	0.000	0.15	0.051	-0.01	0.000
204°F	91 psi	-1.74	0.000	-2.99	0.000	0.22	0.074	0.11	0.060
220°F	100 psi	-1.68	0.000	-2.98	0.000	0.31	0.094	0.23	0.106

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.

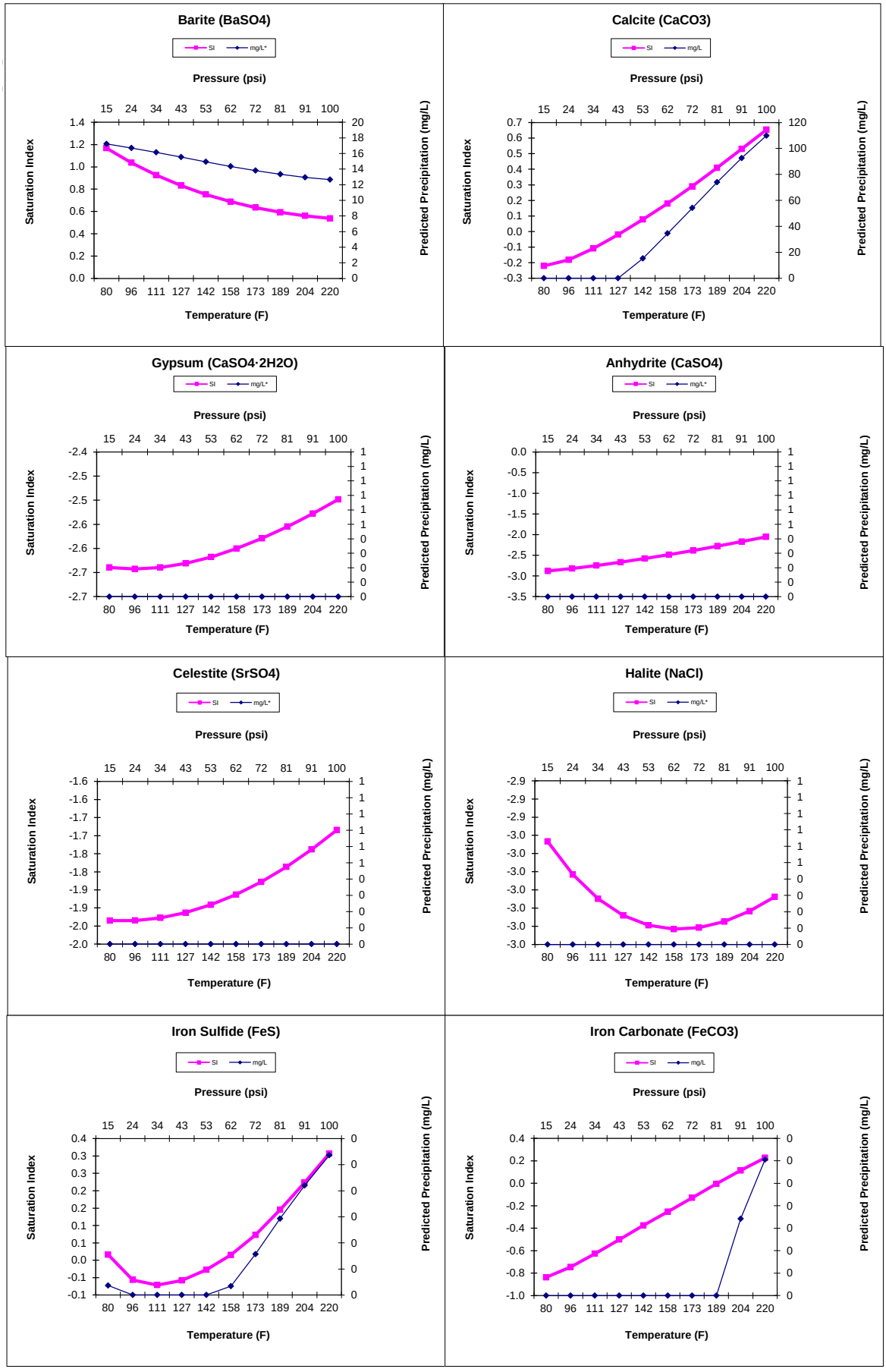
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 21D-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	22C-17D Separator
District:	Four Corners	**Sample ID:**	201201035667
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 22C-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	350.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	13833
Density/Specific Gravity (g/cm³):	1.0067
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8100.0	228.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5249.0	228.4
Potassium (K^+):	15.0	0.4
Magnesium (Mg^{2+}):	2.0	0.2
Calcium (Ca^{2+}):	42.0	2.1
Strontium (Sr^{2+}):	1.0	0.0
Barium (Ba^{2+}):	5.0	0.1
Iron (Fe^{2+}):	2.0	0.1
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	118	N/A

ND = Not Determined

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)**
80°F	15 psi	0.93	2.603	-0.67	0.000	-2.85	0.000	-3.10	0.000
96°F	24 psi	0.80	2.474	-0.63	0.000	-2.86	0.000	-3.04	0.000
111°F	34 psi	0.69	2.331	-0.55	0.000	-2.85	0.000	-2.96	0.000
127°F	43 psi	0.60	2.179	-0.46	0.000	-2.85	0.000	-2.88	0.000
142°F	53 psi	0.52	2.026	-0.36	0.000	-2.83	0.000	-2.79	0.000
158°F	62 psi	0.45	1.880	-0.26	0.000	-2.81	0.000	-2.70	0.000
173°F	72 psi	0.40	1.747	-0.15	0.000	-2.79	0.000	-2.60	0.000
189°F	81 psi	0.36	1.633	-0.03	0.000	-2.76	0.000	-2.49	0.000
204°F	91 psi	0.33	1.541	0.10	3.933	-2.73	0.000	-2.37	0.000
220°F	100 psi	0.31	1.474	0.22	8.634	-2.70	0.000	-2.26	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)**
80°F	15 psi	-2.79	0.000	-3.14	0.000	-9.23	0.000	-0.24	0.000
96°F	24 psi	-2.79	0.000	-3.16	0.000	-9.30	0.000	-0.15	0.000
111°F	34 psi	-2.79	0.000	-3.18	0.000	-9.31	0.000	-0.03	0.000
127°F	43 psi	-2.77	0.000	-3.19	0.000	-9.29	0.000	0.10	0.297
142°F	53 psi	-2.75	0.000	-3.19	0.000	-9.26	0.000	0.23	0.587
158°F	62 psi	-2.72	0.000	-3.19	0.000	-9.21	0.000	0.36	0.801
173°F	72 psi	-2.68	0.000	-3.19	0.000	-9.15	0.000	0.48	0.963
189°F	81 psi	-2.63	0.000	-3.19	0.000	-9.07	0.000	0.61	1.087
204°F	91 psi	-2.58	0.000	-3.18	0.000	-8.99	0.000	0.73	1.176
220°F	100 psi	-2.52	0.000	-3.17	0.000	-8.90	0.000	0.85	1.241

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.

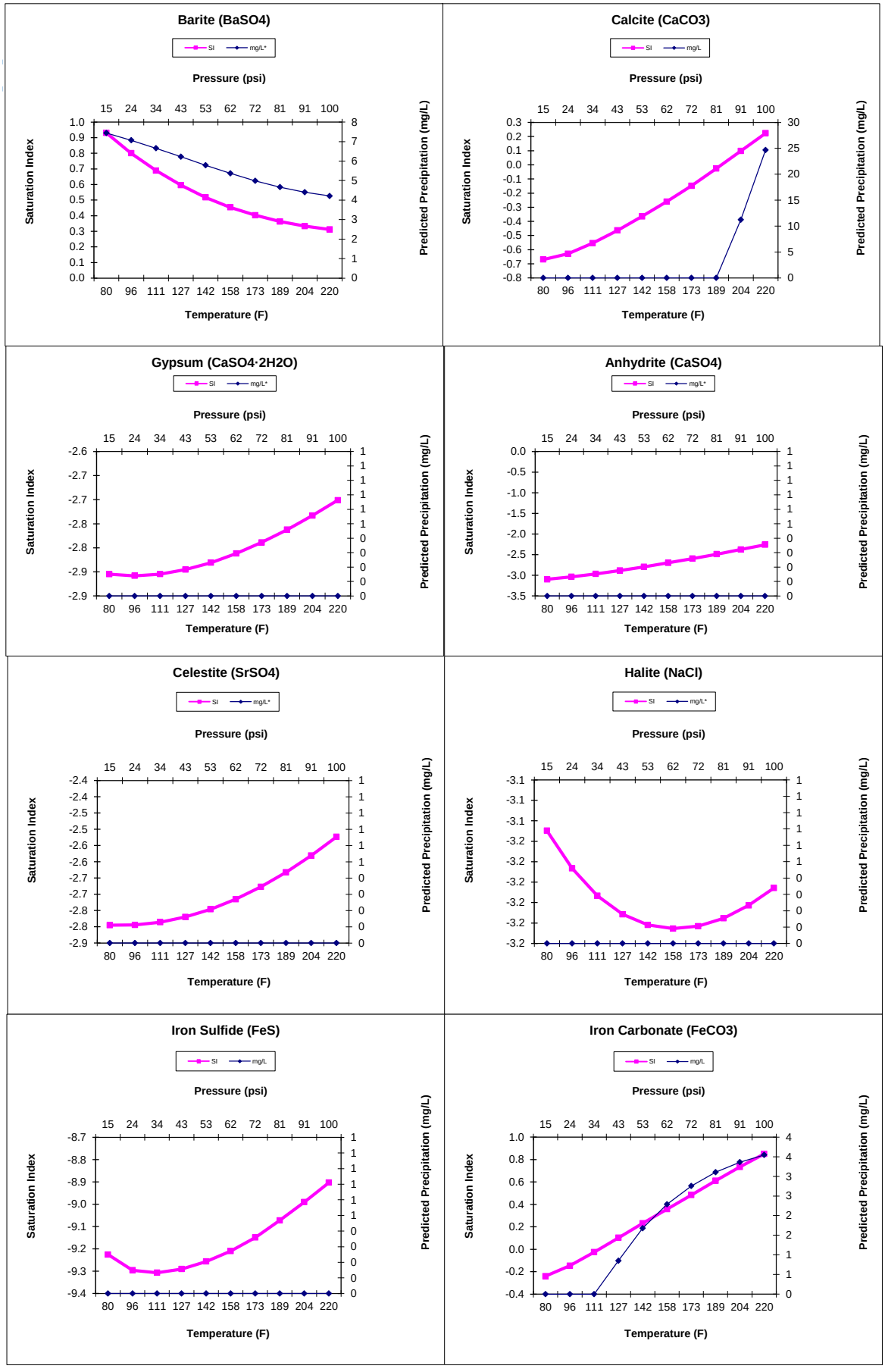
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 22C-17D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23-7D Separator
District:	Four Corners	**Sample ID:**	201201035698
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 23-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	200.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	7676
Density/Specific Gravity (g/cm³):	1.0024
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	4400.0	124.1
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.05

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	2851.0	124.1
Potassium (K^+):	2.0	0.1
Magnesium (Mg^{2+}):	1.0	0.1
Calcium (Ca^{2+}):	9.0	0.4
Strontium (Sr^{2+}):	0.1	0.0
Barium (Ba^{2+}):	2.0	0.0
Iron (Fe^{2+}):	6.0	0.2
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	28	N/A

ND = Not Determined

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)**
80°F	15 psi	1.06	1.085	-1.33	0.000	-3.02	0.000	-3.26	0.000
96°F	24 psi	0.93	1.049	-1.29	0.000	-3.02	0.000	-3.20	0.000
111°F	34 psi	0.82	1.008	-1.22	0.000	-3.01	0.000	-3.13	0.000
127°F	43 psi	0.73	0.965	-1.13	0.000	-3.00	0.000	-3.04	0.000
142°F	53 psi	0.65	0.923	-1.03	0.000	-2.98	0.000	-2.95	0.000
158°F	62 psi	0.59	0.883	-0.92	0.000	-2.96	0.000	-2.85	0.000
173°F	72 psi	0.55	0.848	-0.81	0.000	-2.93	0.000	-2.74	0.000
189°F	81 psi	0.51	0.820	-0.68	0.000	-2.90	0.000	-2.63	0.000
204°F	91 psi	0.49	0.798	-0.55	0.000	-2.87	0.000	-2.51	0.000
220°F	100 psi	0.47	0.784	-0.42	0.000	-2.83	0.000	-2.39	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)**
80°F	15 psi	-3.38	0.000	-3.63	0.000	1.80	3.118	0.25	1.803
96°F	24 psi	-3.38	0.000	-3.65	0.000	1.73	3.092	0.35	2.276
111°F	34 psi	-3.37	0.000	-3.66	0.000	1.72	3.089	0.47	2.766
127°F	43 psi	-3.35	0.000	-3.67	0.000	1.74	3.100	0.60	3.165
142°F	53 psi	-3.32	0.000	-3.68	0.000	1.78	3.116	0.73	3.468
158°F	62 psi	-3.28	0.000	-3.68	0.000	1.83	3.136	0.86	3.693
173°F	72 psi	-3.24	0.000	-3.68	0.000	1.90	3.159	0.99	3.863
189°F	81 psi	-3.19	0.000	-3.67	0.000	1.98	3.183	1.13	3.992
204°F	91 psi	-3.13	0.000	-3.66	0.000	2.07	3.205	1.26	4.085
220°F	100 psi	-3.06	0.000	-3.65	0.000	2.17	3.224	1.38	4.152

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.

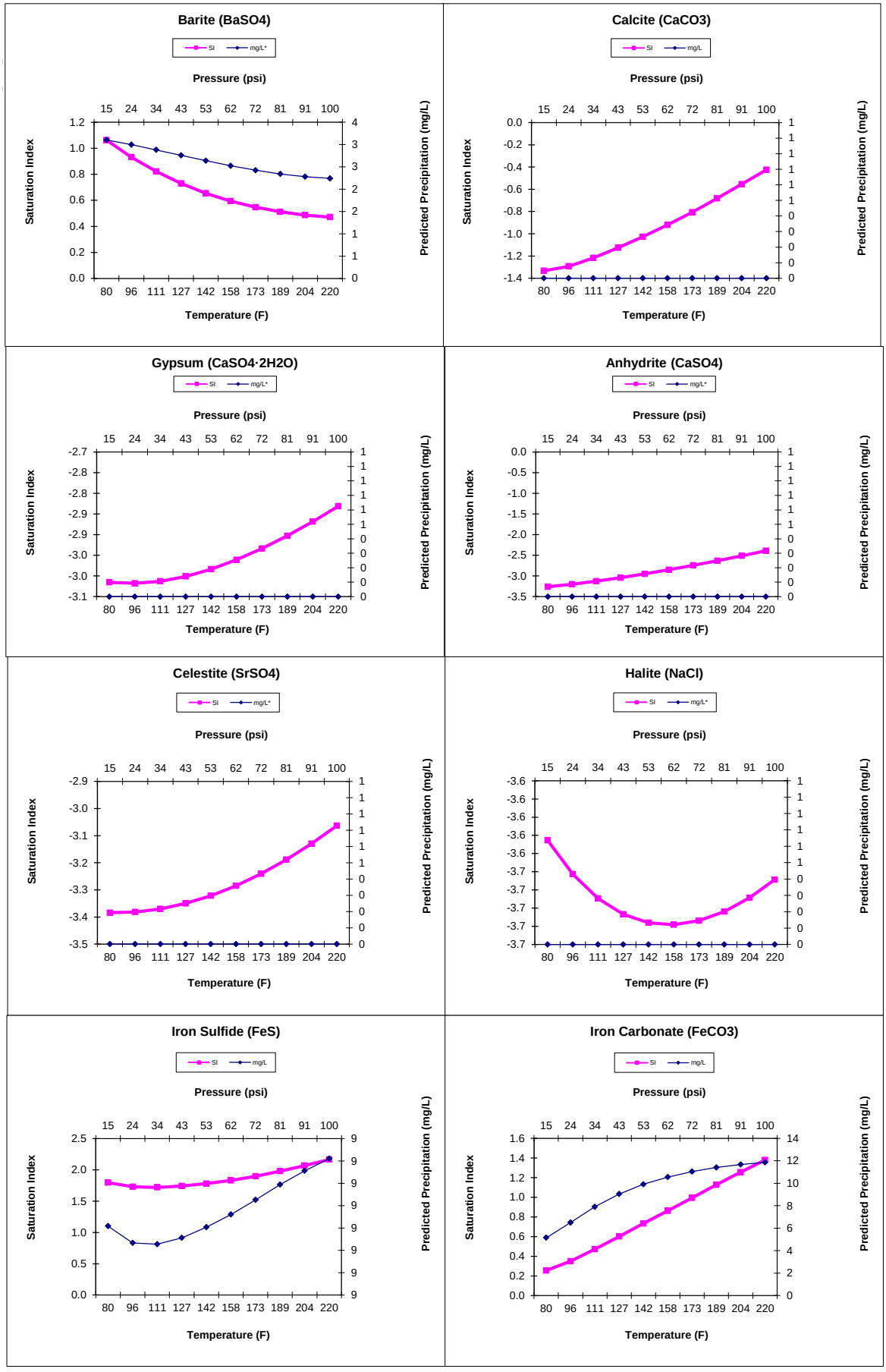
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 23-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23A-17D Separator
District:	Four Corners	**Sample ID:**	201201035668
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 23A-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	793.0	13.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	40.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	11798
Density/Specific Gravity (g/cm³):	1.0053
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	6580.0	185.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.05	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	4264.0	185.6
Potassium (K^+):	40.0	1.0
Magnesium (Mg^{2+}):	6.0	0.5
Calcium (Ca^{2+}):	39.0	1.9
Strontium (Sr^{2+}):	7.0	0.2
Barium (Ba^{2+}):	16.0	0.2
Iron (Fe^{2+}):	3.0	0.1
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	142	N/A

ND = Not Determined

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)**
80°F	15 psi	1.50	9.136	-0.33	0.000	-2.82	0.000	-3.06	0.000
96°F	24 psi	1.37	9.004	-0.29	0.000	-2.82	0.000	-3.00	0.000
111°F	34 psi	1.26	8.857	-0.22	0.000	-2.82	0.000	-2.93	0.000
127°F	43 psi	1.17	8.703	-0.12	0.000	-2.81	0.000	-2.85	0.000
142°F	53 psi	1.09	8.549	-0.03	0.000	-2.79	0.000	-2.76	0.000
158°F	62 psi	1.03	8.403	0.08	4.151	-2.77	0.000	-2.66	0.000
173°F	72 psi	0.98	8.272	0.19	9.470	-2.75	0.000	-2.55	0.000
189°F	81 psi	0.94	8.161	0.32	14.334	-2.72	0.000	-2.44	0.000
204°F	91 psi	0.91	8.074	0.44	18.465	-2.69	0.000	-2.33	0.000
220°F	100 psi	0.89	8.012	0.57	21.909	-2.65	0.000	-2.21	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)**
80°F	15 psi	-1.89	0.000	-3.31	0.000	1.02	1.090	0.35	1.196
96°F	24 psi	-1.89	0.000	-3.33	0.000	0.95	1.049	0.45	1.385
111°F	34 psi	-1.88	0.000	-3.35	0.000	0.94	1.043	0.57	1.577
127°F	43 psi	-1.86	0.000	-3.35	0.000	0.96	1.055	0.70	1.731
142°F	53 psi	-1.84	0.000	-3.36	0.000	0.99	1.076	0.83	1.846
158°F	62 psi	-1.81	0.000	-3.36	0.000	1.04	1.104	0.95	1.931
173°F	72 psi	-1.77	0.000	-3.36	0.000	1.11	1.139	1.08	1.995
189°F	81 psi	-1.72	0.000	-3.36	0.000	1.19	1.177	1.21	2.042
204°F	91 psi	-1.66	0.000	-3.35	0.000	1.27	1.215	1.34	2.076
220°F	100 psi	-1.60	0.000	-3.34	0.000	1.36	1.251	1.46	2.101

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.

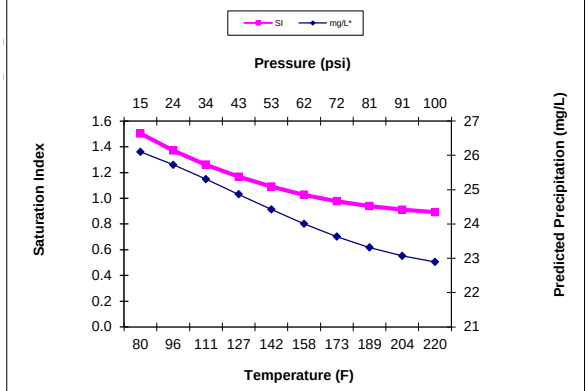
Calculate

ScaleSoftPitzer™ SSP2010

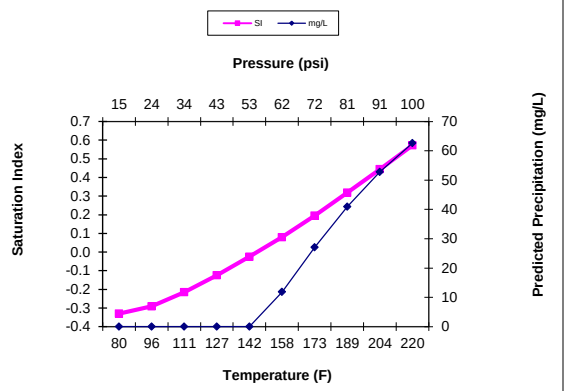
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 23A-17D Separator

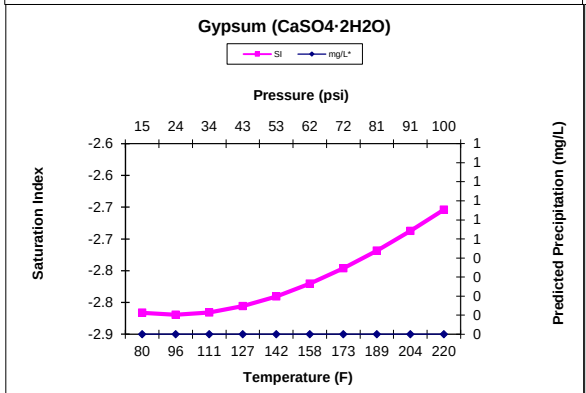
Barite (BaSO4)



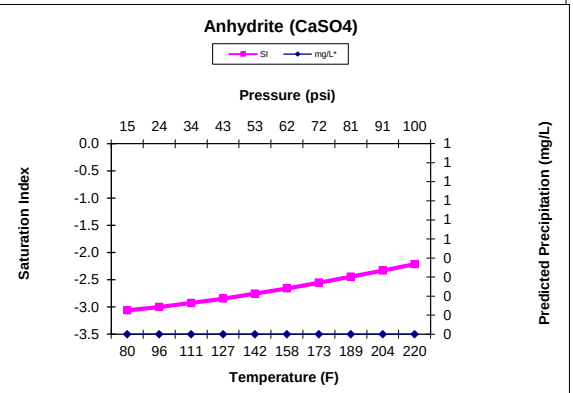
Calcite (CaCO3)



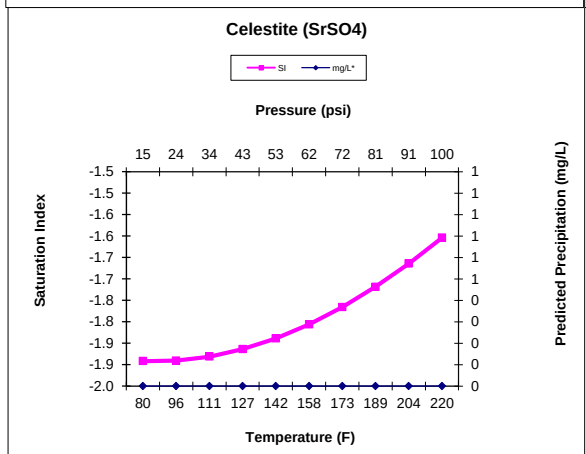
Gypsum (CaSO4·2H2O)



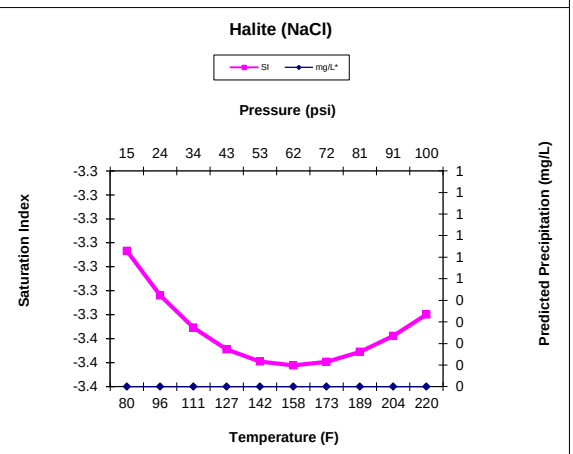
Anhydrite (CaSO4)



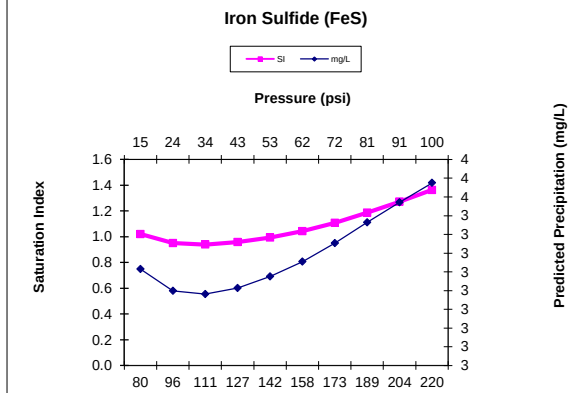
Celestite (SrSO4)



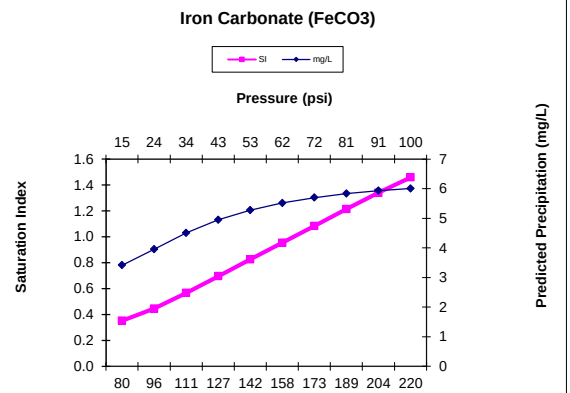
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23A-7D Separator
District:	Four Corners	**Sample ID:**	201201035704
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 23A-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	65.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17425
Density/Specific Gravity (g/cm³):	1.0092
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10100.0	284.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	6545.0	284.8
Potassium (K^+):	44.0	1.1
Magnesium (Mg^{2+}):	10.0	0.8
Calcium (Ca^{2+}):	96.0	4.8
Strontium (Sr^{2+}):	10.0	0.2
Barium (Ba^{2+}):	12.0	0.2
Iron (Fe^{2+}):	9.0	0.3
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	301	N/A

ND = Not Determined

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)**
80°F	15 psi	1.21	6.619	-0.17	0.000	-2.58	0.000	-2.82	0.000
96°F	24 psi	1.08	6.440	-0.13	0.000	-2.58	0.000	-2.76	0.000
111°F	34 psi	0.97	6.241	-0.05	0.000	-2.58	0.000	-2.69	0.000
127°F	43 psi	0.88	6.030	0.03	2.559	-2.57	0.000	-2.61	0.000
142°F	53 psi	0.80	5.817	0.13	9.463	-2.56	0.000	-2.52	0.000
158°F	62 psi	0.73	5.612	0.23	16.403	-2.54	0.000	-2.43	0.000
173°F	72 psi	0.68	5.424	0.34	23.496	-2.52	0.000	-2.33	0.000
189°F	81 psi	0.64	5.259	0.46	30.678	-2.50	0.000	-2.22	0.000
204°F	91 psi	0.61	5.124	0.58	37.439	-2.47	0.000	-2.11	0.000
220°F	100 psi	0.58	5.020	0.71	43.755	-2.44	0.000	-2.00	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)**
80°F	15 psi	-1.88	0.000	-2.97	0.000	1.59	2.159	0.56	4.606
96°F	24 psi	-1.88	0.000	-2.99	0.000	1.52	2.141	0.65	4.964
111°F	34 psi	-1.88	0.000	-3.00	0.000	1.50	2.137	0.77	5.333
127°F	43 psi	-1.86	0.000	-3.01	0.000	1.52	2.141	0.90	5.630
142°F	53 psi	-1.84	0.000	-3.02	0.000	1.55	2.150	1.02	5.855
158°F	62 psi	-1.81	0.000	-3.02	0.000	1.59	2.161	1.15	6.021
173°F	72 psi	-1.78	0.000	-3.02	0.000	1.65	2.174	1.27	6.147
189°F	81 psi	-1.73	0.000	-3.01	0.000	1.72	2.188	1.40	6.243
204°F	91 psi	-1.69	0.000	-3.01	0.000	1.80	2.201	1.51	6.313
220°F	100 psi	-1.63	0.000	-3.00	0.000	1.88	2.213	1.63	6.364

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.

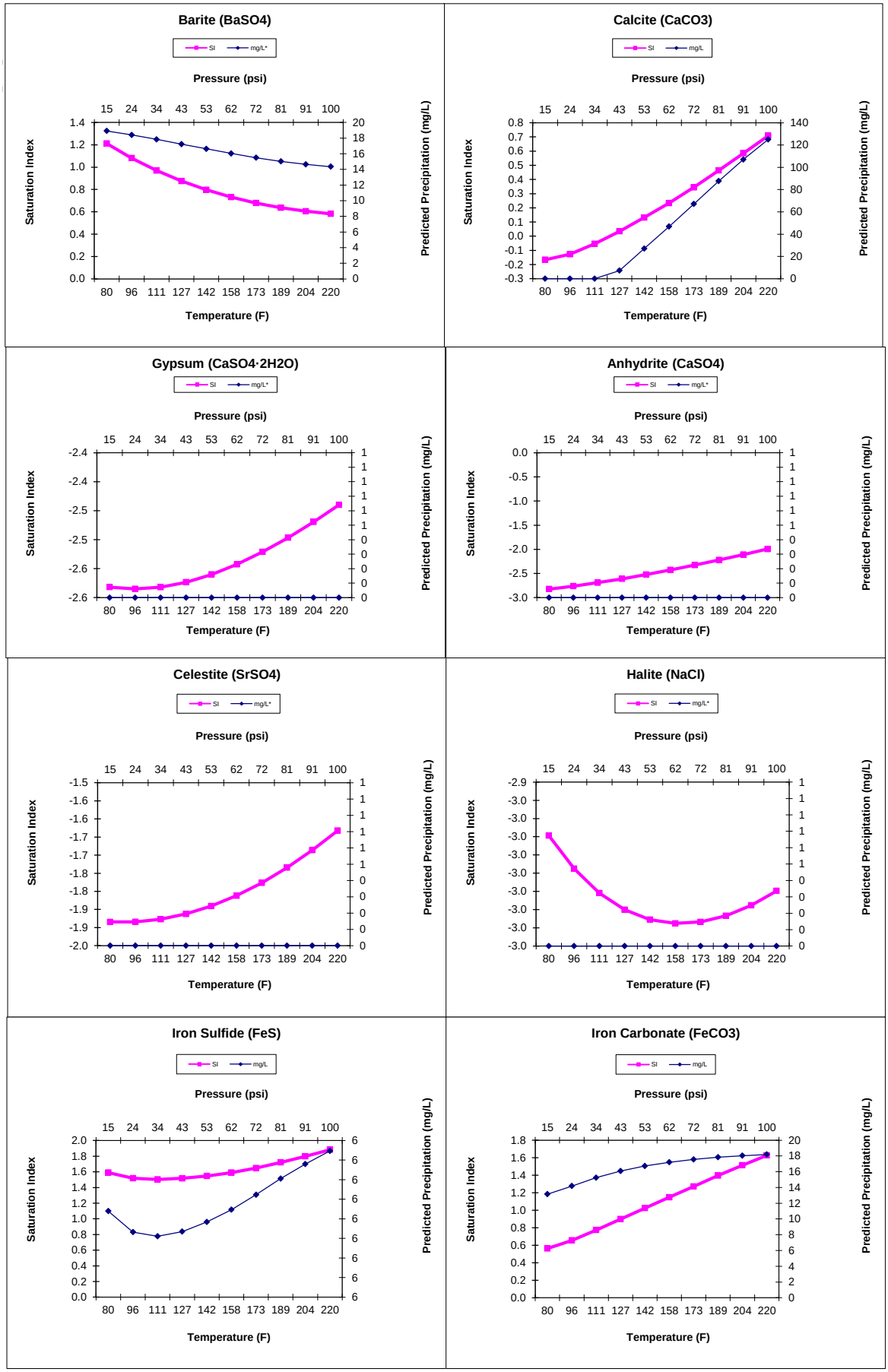
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 23A-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24D-17D Separator
District:	Four Corners	**Sample ID:**	201201035664
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 24D-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	122.0	2.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	11724
Density/Specific Gravity (g/cm³):	1.0053
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	7000.0	197.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	4536.0	197.4
Potassium (K^+):	2.0	0.1
Magnesium (Mg^{2+}):	1.0	0.1
Calcium (Ca^{2+}):	8.0	0.4
Strontium (Sr^{2+}):	-0.5	0.0
Barium (Ba^{2+}):	2.0	0.0
Iron (Fe^{2+}):	3.0	0.1
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	25	N/A

ND = Not Determined

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)**
80°F	15 psi	0.60	0.885	-1.86	0.000	-3.52	0.000	-3.76	0.000
96°F	24 psi	0.47	0.779	-1.82	0.000	-3.52	0.000	-3.70	0.000
111°F	34 psi	0.36	0.661	-1.75	0.000	-3.52	0.000	-3.63	0.000
127°F	43 psi	0.27	0.537	-1.66	0.000	-3.51	0.000	-3.55	0.000
142°F	53 psi	0.19	0.413	-1.56	0.000	-3.49	0.000	-3.46	0.000
158°F	62 psi	0.13	0.294	-1.46	0.000	-3.47	0.000	-3.36	0.000
173°F	72 psi	0.08	0.187	-1.35	0.000	-3.45	0.000	-3.26	0.000
189°F	81 psi	0.04	0.097	-1.23	0.000	-3.42	0.000	-3.15	0.000
204°F	91 psi	0.01	0.026	-1.11	0.000	-3.39	0.000	-3.03	0.000
220°F	100 psi	-0.01	0.000	-0.99	0.000	-3.36	0.000	-2.91	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)**
80°F	15 psi		0.000	-3.26	0.000	1.24	1.440	-0.55	0.000
96°F	24 psi		0.000	-3.28	0.000	1.17	1.409	-0.46	0.000
111°F	34 psi		0.000	-3.29	0.000	1.16	1.404	-0.34	0.000
127°F	43 psi		0.000	-3.30	0.000	1.17	1.413	-0.21	0.000
142°F	53 psi		0.000	-3.31	0.000	1.20	1.429	-0.09	0.000
158°F	62 psi		0.000	-3.31	0.000	1.25	1.450	0.04	0.157
173°F	72 psi		0.000	-3.31	0.000	1.31	1.474	0.16	0.608
189°F	81 psi		0.000	-3.30	0.000	1.38	1.501	0.29	0.972
204°F	91 psi		0.000	-3.30	0.000	1.47	1.525	0.41	1.247
220°F	100 psi		0.000	-3.29	0.000	1.55	1.547	0.52	1.453

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.

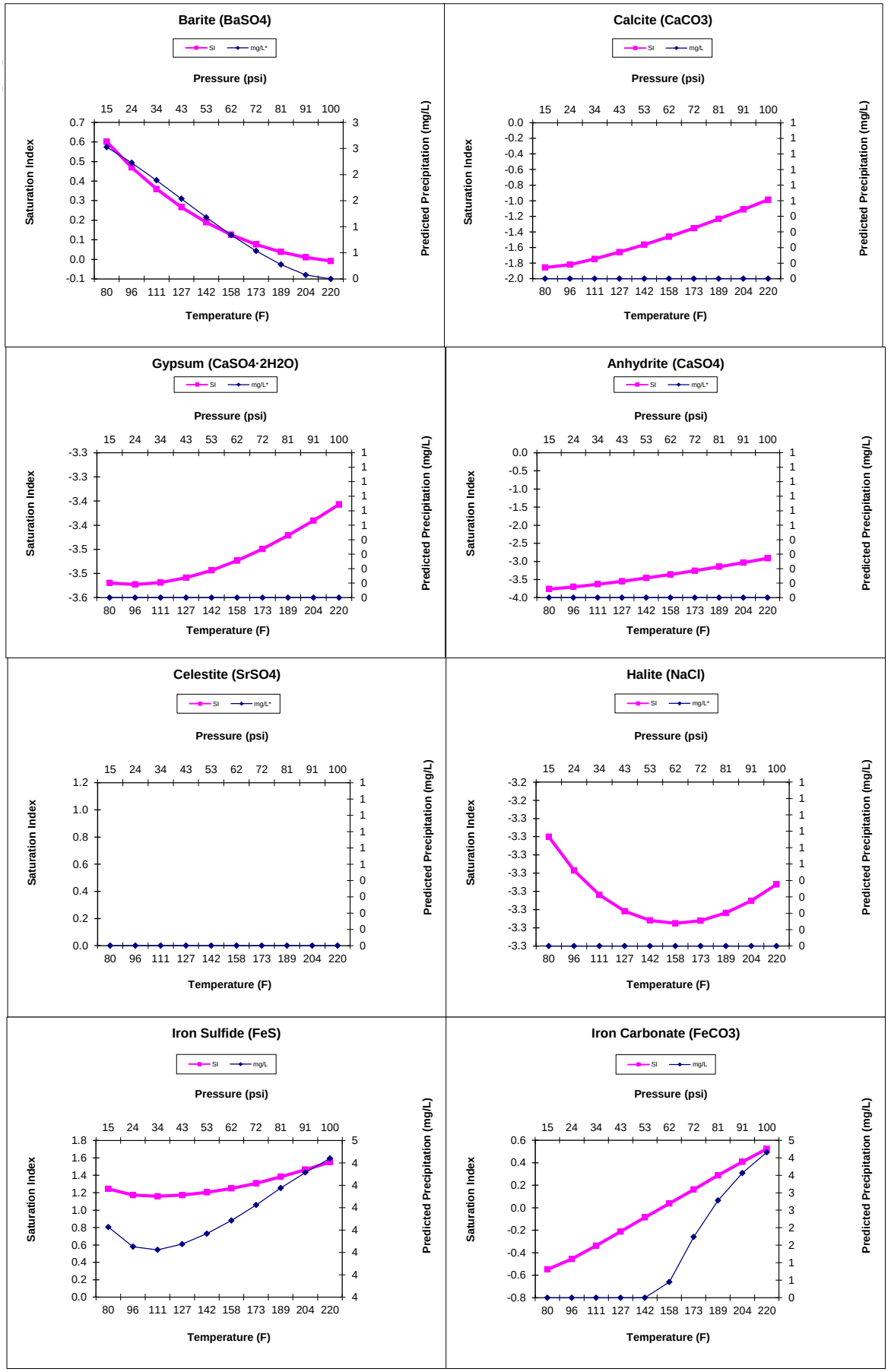
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 24D-17D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	2A-4D Separator
District:	Four Corners	**Sample ID:**	201201036524
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 2A-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:	
pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	33870
Density/Specific Gravity (g/cm^3):	1.0204
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	20100.0	567.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	13025.0	566.8
Potassium (K^+):	46.6	1.2
Magnesium (Mg^{2+}):	15.3	1.3
Calcium (Ca^{2+}):	133.5	6.7
Strontium (Sr^{2+}):	20.4	0.5
Barium (Ba^{2+}):	25.9	0.4
Iron (Fe^{2+}):	25.6	0.9
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	439	N/A

ND = Not Determined

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)**
80°F	15 psi	1.26	14.098	-0.91	0.000	-2.69	0.000	-2.93	0.000
96°F	24 psi	1.13	13.684	-0.87	0.000	-2.70	0.000	-2.86	0.000
111°F	34 psi	1.02	13.224	-0.80	0.000	-2.69	0.000	-2.79	0.000
127°F	43 psi	0.92	12.738	-0.71	0.000	-2.69	0.000	-2.72	0.000
142°F	53 psi	0.84	12.243	-0.62	0.000	-2.68	0.000	-2.63	0.000
158°F	62 psi	0.77	11.760	-0.52	0.000	-2.66	0.000	-2.54	0.000
173°F	72 psi	0.71	11.305	-0.41	0.000	-2.65	0.000	-2.44	0.000
189°F	81 psi	0.66	10.892	-0.30	0.000	-2.63	0.000	-2.34	0.000
204°F	91 psi	0.63	10.530	-0.18	0.000	-2.61	0.000	-2.24	0.000
220°F	100 psi	0.59	10.225	-0.06	0.000	-2.59	0.000	-2.13	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)**
80°F	15 psi	-1.82	0.000	-2.41	0.000	0.73	1.662	0.09	2.876
96°F	24 psi	-1.82	0.000	-2.43	0.000	0.67	1.596	0.18	5.213
111°F	34 psi	-1.82	0.000	-2.44	0.000	0.67	1.600	0.29	7.843
127°F	43 psi	-1.81	0.000	-2.45	0.000	0.70	1.637	0.41	10.117
142°F	53 psi	-1.79	0.000	-2.45	0.000	0.75	1.688	0.53	11.940
158°F	62 psi	-1.77	0.000	-2.46	0.000	0.81	1.743	0.65	13.359
173°F	72 psi	-1.75	0.000	-2.46	0.000	0.89	1.806	0.77	14.525
189°F	81 psi	-1.72	0.000	-2.45	0.000	0.98	1.864	0.88	15.421
204°F	91 psi	-1.68	0.000	-2.45	0.000	1.07	1.912	0.99	16.091
220°F	100 psi	-1.64	0.000	-2.44	0.000	1.16	1.954	1.09	16.596

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.

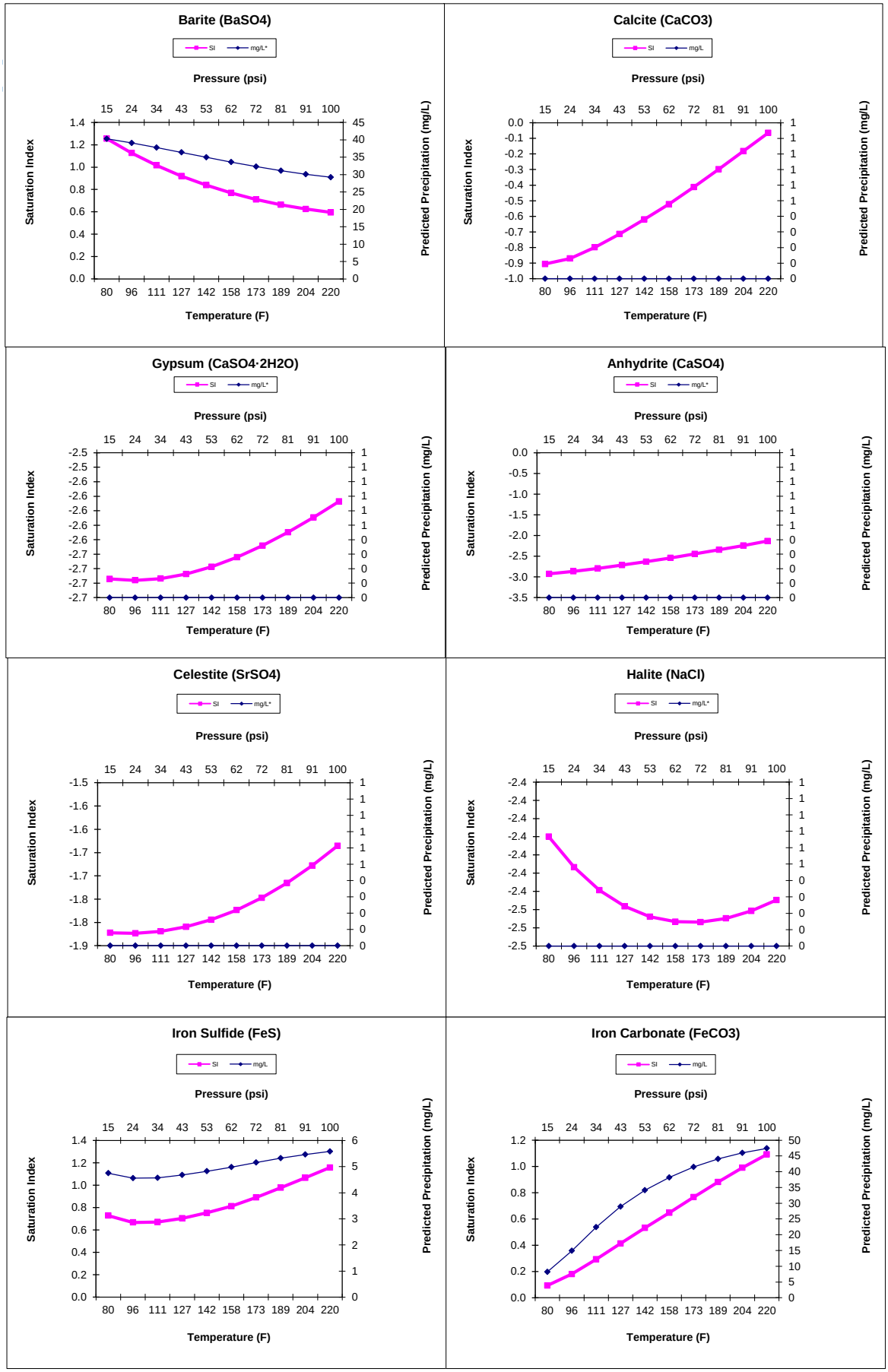
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 2A-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	2B-4D Separator
District:	Four Corners	**Sample ID:**	201201036459
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 2B-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	265.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	34529
Density/Specific Gravity (g/cm^3):	1.0209
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	20500.0	578.3
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	13284.0	578.1
Potassium (K^+):	49.4	1.3
Magnesium (Mg^{2+}):	14.0	1.2
Calcium (Ca^{2+}):	149.0	7.4
Strontium (Sr^{2+}):	16.2	0.4
Barium (Ba^{2+}):	31.9	0.5
Iron (Fe^{2+}):	6.9	0.2
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	472	N/A

ND = Not Determined

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)**
80°F	15 psi	1.34	17.472	-0.96	0.000	-2.65	0.000	-2.89	0.000
96°F	24 psi	1.21	17.002	-0.93	0.000	-2.66	0.000	-2.82	0.000
111°F	34 psi	1.10	16.483	-0.85	0.000	-2.65	0.000	-2.75	0.000
127°F	43 psi	1.00	15.938	-0.77	0.000	-2.65	0.000	-2.67	0.000
142°F	53 psi	0.92	15.387	-0.68	0.000	-2.64	0.000	-2.59	0.000
158°F	62 psi	0.85	14.852	-0.58	0.000	-2.62	0.000	-2.50	0.000
173°F	72 psi	0.79	14.350	-0.47	0.000	-2.61	0.000	-2.40	0.000
189°F	81 psi	0.75	13.895	-0.35	0.000	-2.59	0.000	-2.30	0.000
204°F	91 psi	0.71	13.497	-0.24	0.000	-2.57	0.000	-2.20	0.000
220°F	100 psi	0.68	13.162	-0.12	0.000	-2.55	0.000	-2.09	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)**
80°F	15 psi	-1.93	0.000	-2.39	0.000	-0.01	0.000	-0.58	0.000
96°F	24 psi	-1.93	0.000	-2.41	0.000	-0.07	0.000	-0.49	0.000
111°F	34 psi	-1.93	0.000	-2.42	0.000	-0.07	0.000	-0.38	0.000
127°F	43 psi	-1.92	0.000	-2.43	0.000	-0.03	0.000	-0.26	0.000
142°F	53 psi	-1.90	0.000	-2.44	0.000	0.02	0.054	-0.14	0.000
158°F	62 psi	-1.88	0.000	-2.44	0.000	0.08	0.237	-0.03	0.000
173°F	72 psi	-1.85	0.000	-2.44	0.000	0.16	0.465	0.09	0.906
189°F	81 psi	-1.82	0.000	-2.44	0.000	0.25	0.683	0.21	1.816
204°F	91 psi	-1.79	0.000	-2.43	0.000	0.34	0.883	0.32	2.496
220°F	100 psi	-1.74	0.000	-2.43	0.000	0.44	1.066	0.42	3.008

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.

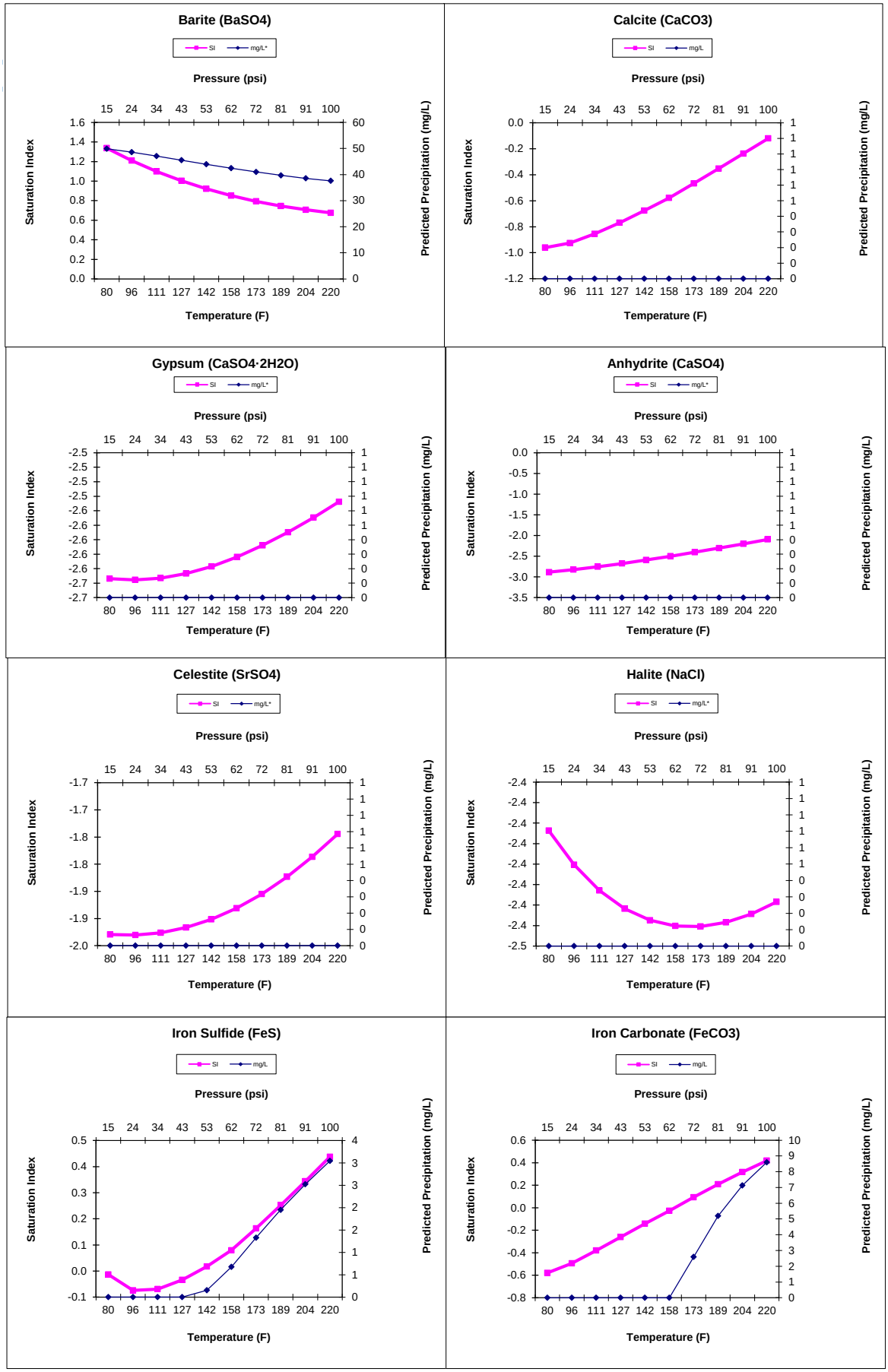
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 2B-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	2C-4D Separator
District:	Four Corners	**Sample ID:**	201201036460
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 2C-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	976.0	16.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19842
Density/Specific Gravity (g/cm^3):	1.0109
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11300.0	318.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7322.0	318.6
Potassium (K^+):	28.7	0.7
Magnesium (Mg^{2+}):	11.8	1.0
Calcium (Ca^{2+}):	121.6	6.1
Strontium (Sr^{2+}):	10.0	0.2
Barium (Ba^{2+}):	13.5	0.2
Iron (Fe^{2+}):	8.0	0.3
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	374	N/A

ND = Not Determined

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)**
80°F	15 psi	1.21	7.404	-0.32	0.000	-2.52	0.000	-2.76	0.000
96°F	24 psi	1.08	7.198	-0.28	0.000	-2.52	0.000	-2.70	0.000
111°F	34 psi	0.96	6.968	-0.21	0.000	-2.52	0.000	-2.63	0.000
127°F	43 psi	0.87	6.724	-0.12	0.000	-2.51	0.000	-2.55	0.000
142°F	53 psi	0.79	6.477	-0.03	0.000	-2.50	0.000	-2.46	0.000
158°F	62 psi	0.72	6.238	0.07	9.392	-2.48	0.000	-2.36	0.000
173°F	72 psi	0.67	6.017	0.19	23.049	-2.46	0.000	-2.26	0.000
189°F	81 psi	0.63	5.823	0.31	35.502	-2.44	0.000	-2.16	0.000
204°F	91 psi	0.60	5.661	0.43	46.766	-2.41	0.000	-2.05	0.000
220°F	100 psi	0.57	5.534	0.56	56.857	-2.38	0.000	-1.94	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)**
80°F	15 psi	-1.93	0.000	-2.88	0.000	0.82	2.084	0.28	2.737
96°F	24 psi	-1.93	0.000	-2.90	0.000	0.75	1.986	0.37	3.283
111°F	34 psi	-1.93	0.000	-2.91	0.000	0.76	1.990	0.49	3.873
127°F	43 psi	-1.91	0.000	-2.92	0.000	0.79	2.041	0.61	4.352
142°F	53 psi	-1.89	0.000	-2.93	0.000	0.84	2.114	0.74	4.715
158°F	62 psi	-1.86	0.000	-2.93	0.000	0.90	2.200	0.86	4.985
173°F	72 psi	-1.83	0.000	-2.93	0.000	0.99	2.304	0.99	5.200
189°F	81 psi	-1.79	0.000	-2.92	0.000	1.08	2.401	1.12	5.352
204°F	91 psi	-1.74	0.000	-2.92	0.000	1.17	2.488	1.23	5.463
220°F	100 psi	-1.69	0.000	-2.91	0.000	1.27	2.565	1.35	5.544

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.

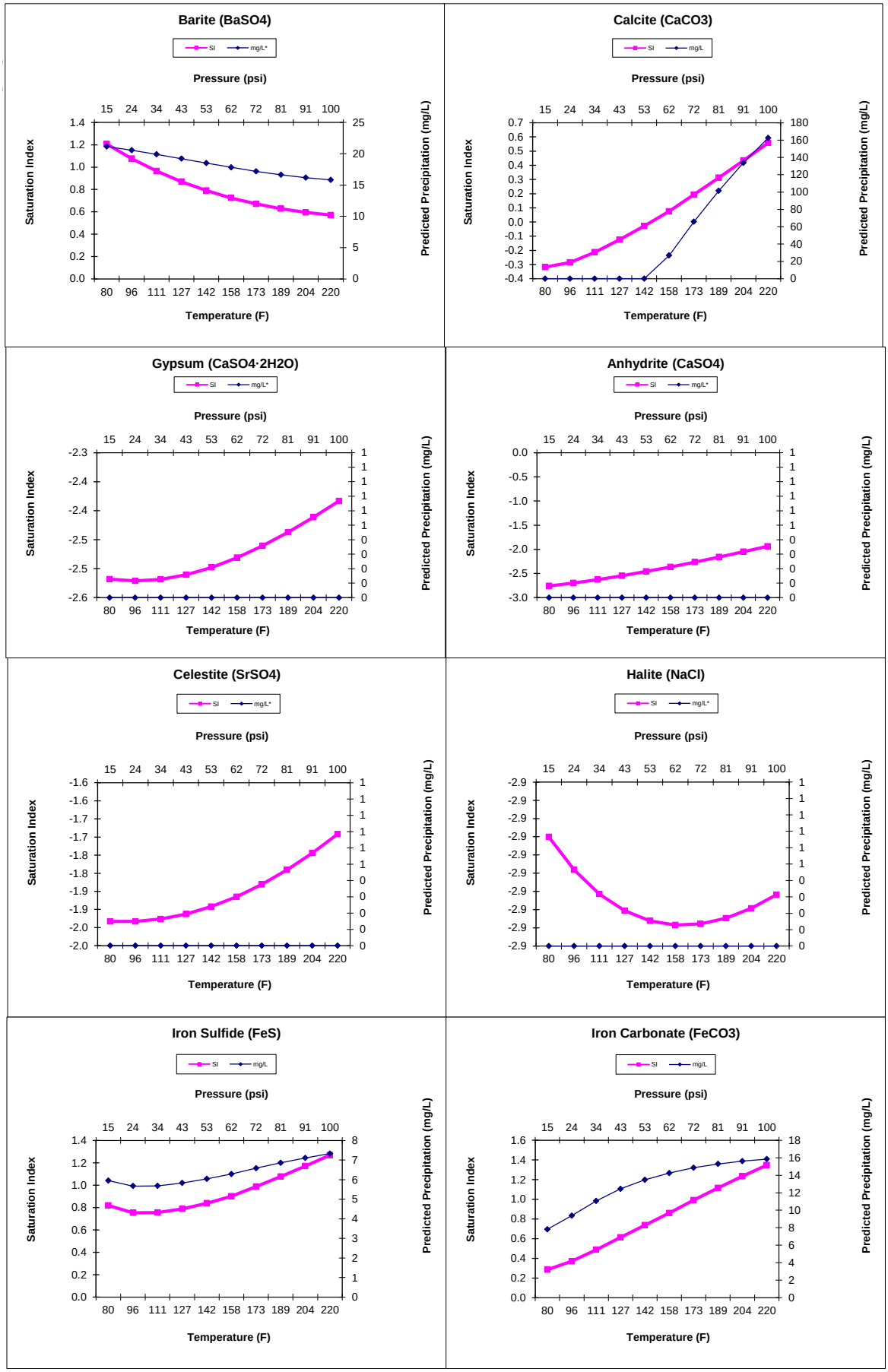
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 2C-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	2D-4D Separator
District:	Four Corners	**Sample ID:**	201201036461
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 2D-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	256.0	4.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	175.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19860
Density/Specific Gravity (g/cm³):	1.0110
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11700.0	330.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7582.0	329.9
Potassium (K^+):	50.0	1.3
Magnesium (Mg^{2+}):	13.1	1.1
Calcium (Ca^{2+}):	168.7	8.4
Strontium (Sr^{2+}):	16.3	0.4
Barium (Ba^{2+}):	17.4	0.3
Iron (Fe^{2+}):	5.8	0.2
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	507	N/A

ND = Not Determined

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)**
80°F	15 psi	1.31	9.691	-1.08	0.000	-2.40	0.000	-2.64	0.000
96°F	24 psi	1.18	9.470	-1.04	0.000	-2.40	0.000	-2.58	0.000
111°F	34 psi	1.07	9.223	-0.97	0.000	-2.40	0.000	-2.51	0.000
127°F	43 psi	0.98	8.961	-0.88	0.000	-2.39	0.000	-2.43	0.000
142°F	53 psi	0.90	8.697	-0.78	0.000	-2.38	0.000	-2.34	0.000
158°F	62 psi	0.83	8.442	-0.68	0.000	-2.36	0.000	-2.24	0.000
173°F	72 psi	0.78	8.206	-0.57	0.000	-2.34	0.000	-2.14	0.000
189°F	81 psi	0.73	7.999	-0.45	0.000	-2.32	0.000	-2.04	0.000
204°F	91 psi	0.70	7.825	-0.33	0.000	-2.29	0.000	-1.93	0.000
220°F	100 psi	0.68	7.689	-0.20	0.000	-2.26	0.000	-1.82	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)**
80°F	15 psi	-1.73	0.000	-2.85	0.000	-0.08	0.000	-0.81	0.000
96°F	24 psi	-1.73	0.000	-2.87	0.000	-0.14	0.000	-0.72	0.000
111°F	34 psi	-1.72	0.000	-2.88	0.000	-0.13	0.000	-0.60	0.000
127°F	43 psi	-1.70	0.000	-2.89	0.000	-0.09	0.000	-0.48	0.000
142°F	53 psi	-1.68	0.000	-2.90	0.000	-0.03	0.000	-0.35	0.000
158°F	62 psi	-1.66	0.000	-2.90	0.000	0.04	0.123	-0.23	0.000
173°F	72 psi	-1.62	0.000	-2.90	0.000	0.13	0.358	-0.10	0.000
189°F	81 psi	-1.58	0.000	-2.90	0.000	0.23	0.591	0.02	0.162
204°F	91 psi	-1.54	0.000	-2.89	0.000	0.33	0.805	0.14	1.056
220°F	100 psi	-1.49	0.000	-2.88	0.000	0.44	1.000	0.25	1.735

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.

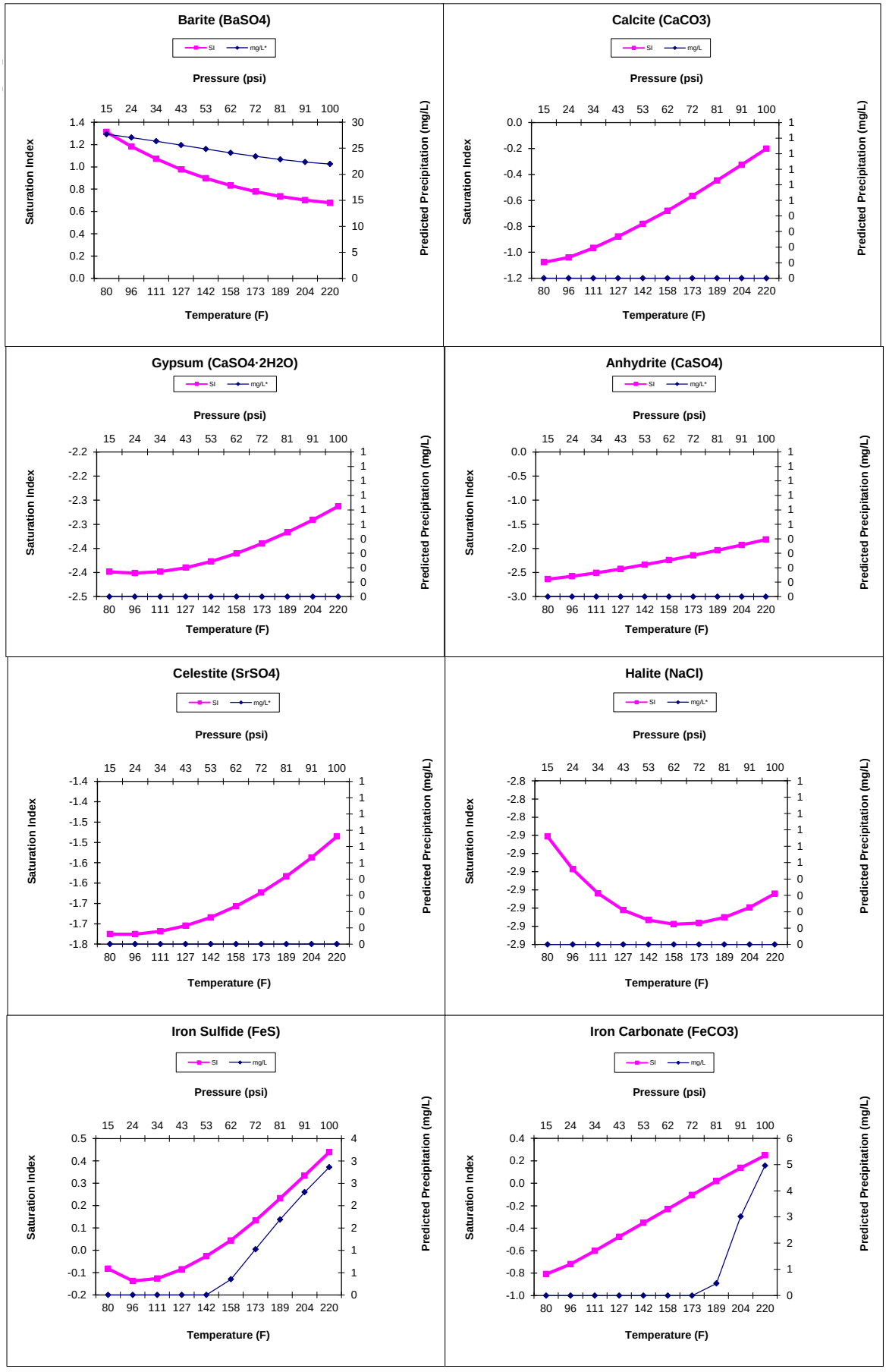
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 2D-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	2E-4D Separator
District:	Four Corners	**Sample ID:**	201201036462
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 2E-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	130.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20781
Density/Specific Gravity (g/cm³):	1.0116
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12200.0	344.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7906.0	344.0
Potassium (K^+):	57.0	1.5
Magnesium (Mg^{2+}):	17.0	1.4
Calcium (Ca^{2+}):	175.3	8.7
Strontium (Sr^{2+}):	18.4	0.4
Barium (Ba^{2+}):	45.7	0.7
Iron (Fe^{2+}):	6.8	0.2
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	563	N/A

ND = Not Determined

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)**
80°F	15 psi	1.71	25.811	-0.79	0.000	-2.40	0.000	-2.64	0.000
96°F	24 psi	1.58	25.388	-0.75	0.000	-2.40	0.000	-2.58	0.000
111°F	34 psi	1.47	24.932	-0.68	0.000	-2.40	0.000	-2.50	0.000
127°F	43 psi	1.38	24.463	-0.59	0.000	-2.39	0.000	-2.43	0.000
142°F	53 psi	1.30	24.003	-0.49	0.000	-2.38	0.000	-2.34	0.000
158°F	62 psi	1.23	23.569	-0.39	0.000	-2.36	0.000	-2.24	0.000
173°F	72 psi	1.18	23.177	-0.28	0.000	-2.34	0.000	-2.14	0.000
189°F	81 psi	1.13	22.837	-0.16	0.000	-2.32	0.000	-2.04	0.000
204°F	91 psi	1.10	22.556	-0.04	0.000	-2.29	0.000	-1.93	0.000
220°F	100 psi	1.07	22.337	0.08	5.638	-2.26	0.000	-1.82	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)**
80°F	15 psi	-1.69	0.000	-2.82	0.000	0.33	0.798	-0.47	0.000
96°F	24 psi	-1.69	0.000	-2.84	0.000	0.27	0.682	-0.38	0.000
111°F	34 psi	-1.68	0.000	-2.85	0.000	0.28	0.695	-0.26	0.000
127°F	43 psi	-1.67	0.000	-2.86	0.000	0.32	0.769	-0.14	0.000
142°F	53 psi	-1.65	0.000	-2.86	0.000	0.37	0.872	-0.02	0.000
158°F	62 psi	-1.62	0.000	-2.87	0.000	0.43	0.988	0.11	0.975
173°F	72 psi	-1.59	0.000	-2.86	0.000	0.51	1.121	0.23	1.889
189°F	81 psi	-1.55	0.000	-2.86	0.000	0.60	1.256	0.35	2.596
204°F	91 psi	-1.50	0.000	-2.86	0.000	0.70	1.378	0.47	3.121
220°F	100 psi	-1.45	0.000	-2.85	0.000	0.80	1.488	0.58	3.513

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.

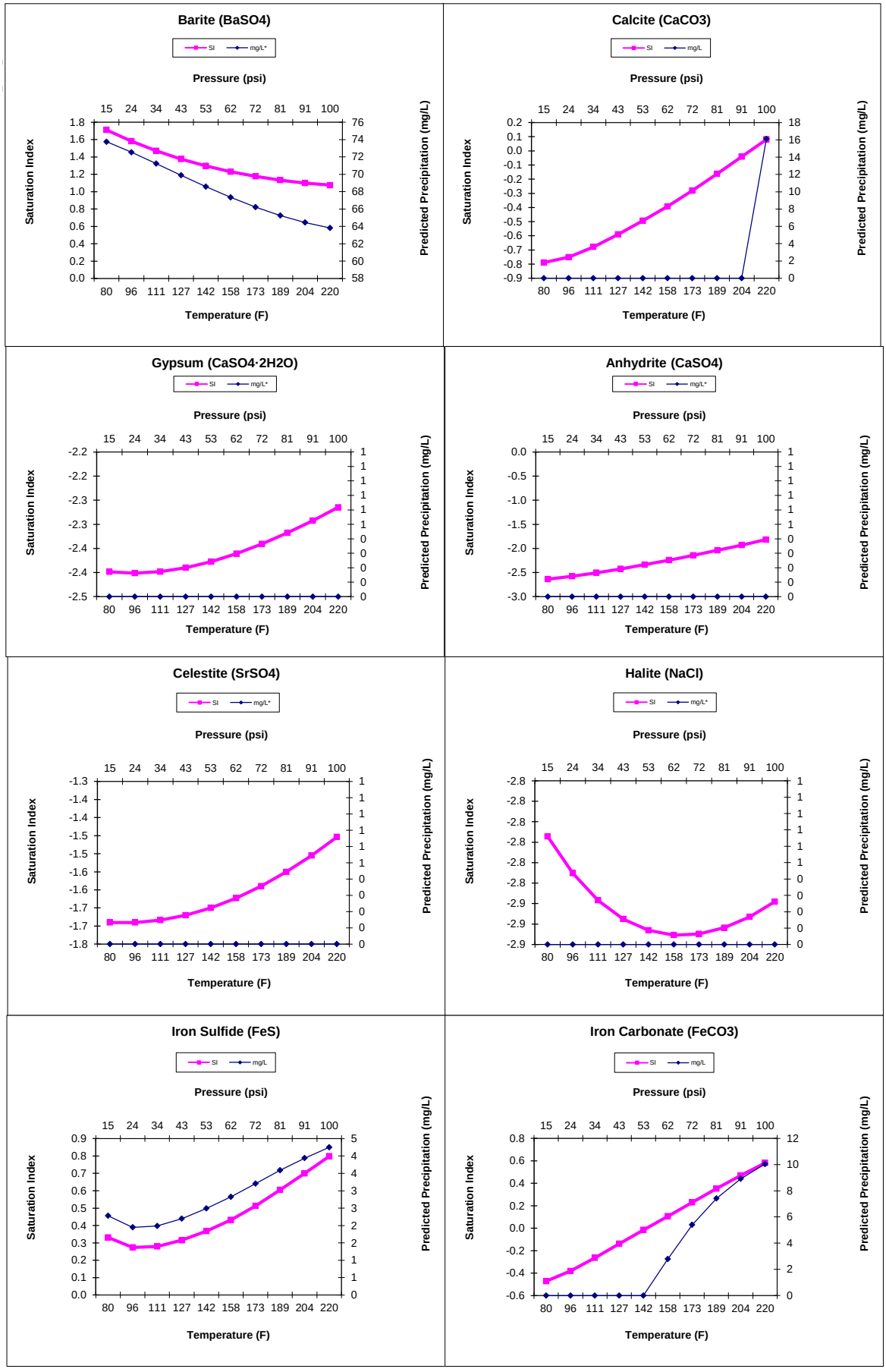
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 2E-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	2F-4D Separator
District:	Four Corners	**Sample ID:**	201201036452
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 2F-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.8

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	341.0	5.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	110.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	26375
Density/Specific Gravity (g/cm^3):	1.0155
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15500.0	437.2
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.97	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	10044.0	437.1
Potassium (K^+):	43.1	1.1
Magnesium (Mg^{2+}):	24.6	2.0
Calcium (Ca^{2+}):	302.3	15.1
Strontium (Sr^{2+}):	22.8	0.5
Barium (Ba^{2+}):	29.0	0.4
Iron (Fe^{2+}):	17.2	0.6
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	904	N/A

ND = Not Determined

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)**
80°F	15 psi	1.41	16.163	-0.13	0.000	-2.26	0.000	-2.49	0.000
96°F	24 psi	1.28	15.805	-0.10	0.000	-2.26	0.000	-2.43	0.000
111°F	34 psi	1.17	15.410	-0.02	0.000	-2.26	0.000	-2.36	0.000
127°F	43 psi	1.07	14.994	0.06	4.493	-2.25	0.000	-2.28	0.000
142°F	53 psi	0.99	14.575	0.16	11.056	-2.24	0.000	-2.19	0.000
158°F	62 psi	0.92	14.170	0.25	17.649	-2.22	0.000	-2.10	0.000
173°F	72 psi	0.87	13.794	0.36	24.381	-2.20	0.000	-2.00	0.000
189°F	81 psi	0.82	13.458	0.48	31.247	-2.18	0.000	-1.90	0.000
204°F	91 psi	0.79	13.171	0.59	37.732	-2.16	0.000	-1.80	0.000
220°F	100 psi	0.76	12.936	0.71	43.827	-2.13	0.000	-1.69	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)**
80°F	15 psi	-1.69	0.000	-2.62	0.000	1.52	2.407	0.34	5.951
96°F	24 psi	-1.69	0.000	-2.64	0.000	1.45	2.389	0.43	7.023
111°F	34 psi	-1.69	0.000	-2.65	0.000	1.44	2.386	0.55	8.177
127°F	43 psi	-1.67	0.000	-2.66	0.000	1.46	2.392	0.67	9.147
142°F	53 psi	-1.66	0.000	-2.67	0.000	1.49	2.402	0.79	9.907
158°F	62 psi	-1.63	0.000	-2.67	0.000	1.54	2.413	0.91	10.486
173°F	72 psi	-1.60	0.000	-2.67	0.000	1.59	2.427	1.03	10.939
189°F	81 psi	-1.57	0.000	-2.67	0.000	1.67	2.441	1.14	11.294
204°F	91 psi	-1.52	0.000	-2.66	0.000	1.74	2.454	1.26	11.556
220°F	100 psi	-1.48	0.000	-2.66	0.000	1.82	2.465	1.36	11.751

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.

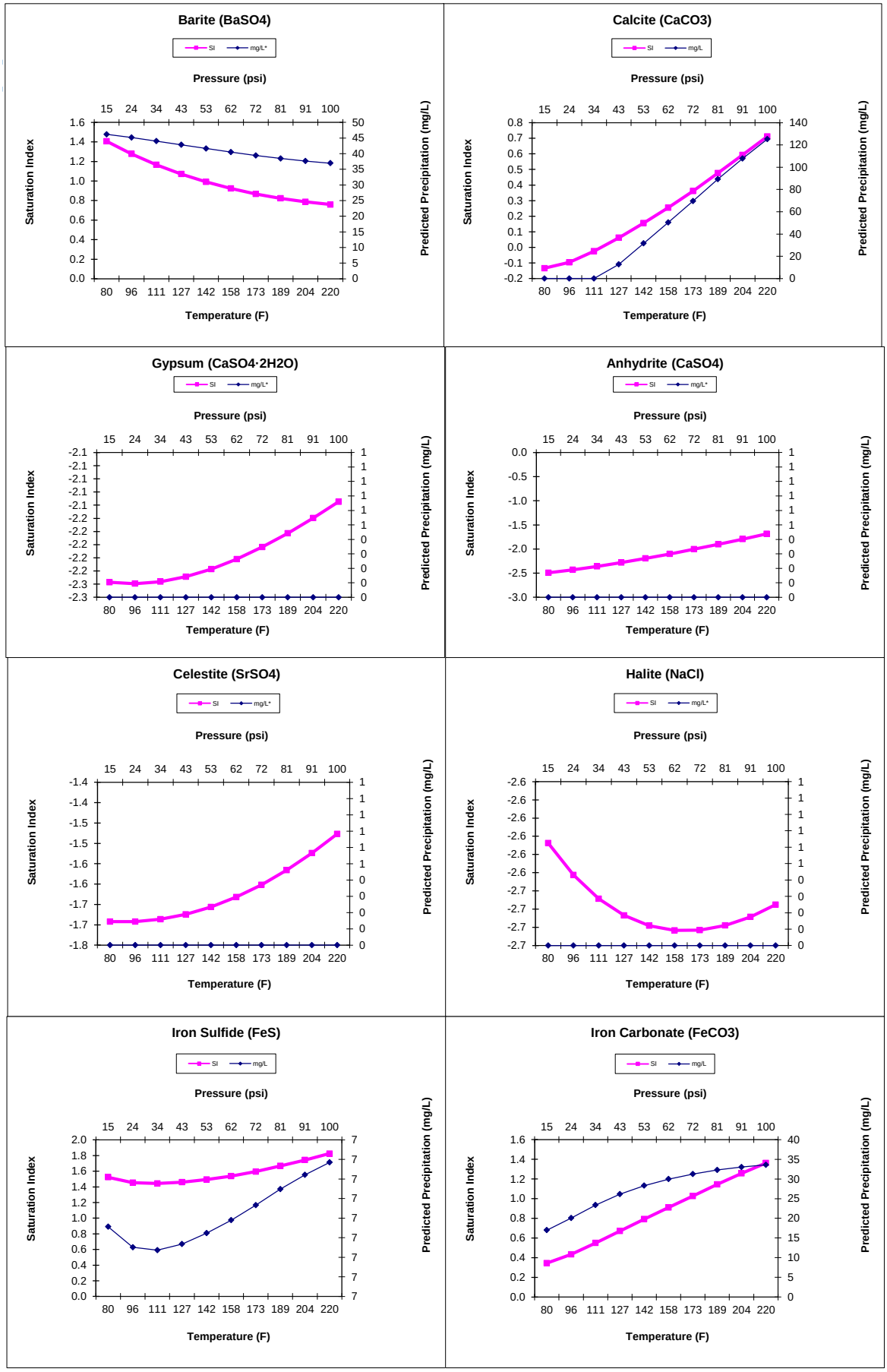
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 2F-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32A-7D Separator
District:	Four Corners	**Sample ID:**	201201035705
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 32A-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	463.0	7.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	3.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21120
Density/Specific Gravity (g/cm³):	1.0118
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12200.0	344.1
Sulfate (SO_4^{2-}):	300.0	6.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	7906.0	344.0
Potassium (K^+):	36.0	0.9
Magnesium (Mg^{2+}):	11.0	0.9
Calcium (Ca^{2+}):	170.0	8.5
Strontium (Sr^{2+}):	13.0	0.3
Barium (Ba^{2+}):	16.0	0.2
Iron (Fe^{2+}):	4.0	0.1
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	497	N/A

ND = Not Determined

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)**
80°F	15 psi	2.03	9.424	-0.03	0.000	-1.64	0.000	-1.88	0.000
96°F	24 psi	1.90	9.392	0.01	0.866	-1.64	0.000	-1.81	0.000
111°F	34 psi	1.78	9.355	0.08	6.382	-1.64	0.000	-1.74	0.000
127°F	43 psi	1.69	9.315	0.17	12.858	-1.63	0.000	-1.66	0.000
142°F	53 psi	1.61	9.275	0.26	19.722	-1.62	0.000	-1.58	0.000
158°F	62 psi	1.54	9.235	0.36	26.706	-1.60	0.000	-1.48	0.000
173°F	72 psi	1.49	9.198	0.47	33.914	-1.58	0.000	-1.38	0.000
189°F	81 psi	1.45	9.164	0.59	41.382	-1.56	0.000	-1.28	0.000
204°F	91 psi	1.41	9.136	0.71	48.553	-1.53	0.000	-1.17	0.000
220°F	100 psi	1.39	9.113	0.83	55.413	-1.50	0.000	-1.06	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)**
80°F	15 psi	-1.07	0.000	-2.82	0.000	1.57	2.098	0.09	0.501
96°F	24 psi	-1.07	0.000	-2.84	0.000	1.49	2.079	0.18	0.933
111°F	34 psi	-1.07	0.000	-2.85	0.000	1.48	2.074	0.29	1.382
127°F	43 psi	-1.05	0.000	-2.86	0.000	1.49	2.077	0.41	1.748
142°F	53 psi	-1.03	0.000	-2.86	0.000	1.51	2.085	0.54	2.027
158°F	62 psi	-1.01	0.000	-2.87	0.000	1.55	2.095	0.66	2.235
173°F	72 psi	-0.97	0.000	-2.87	0.000	1.60	2.107	0.78	2.394
189°F	81 psi	-0.93	0.000	-2.86	0.000	1.67	2.121	0.90	2.517
204°F	91 psi	-0.89	0.000	-2.86	0.000	1.75	2.134	1.01	2.606
220°F	100 psi	-0.84	0.000	-2.85	0.000	1.83	2.146	1.12	2.672

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.

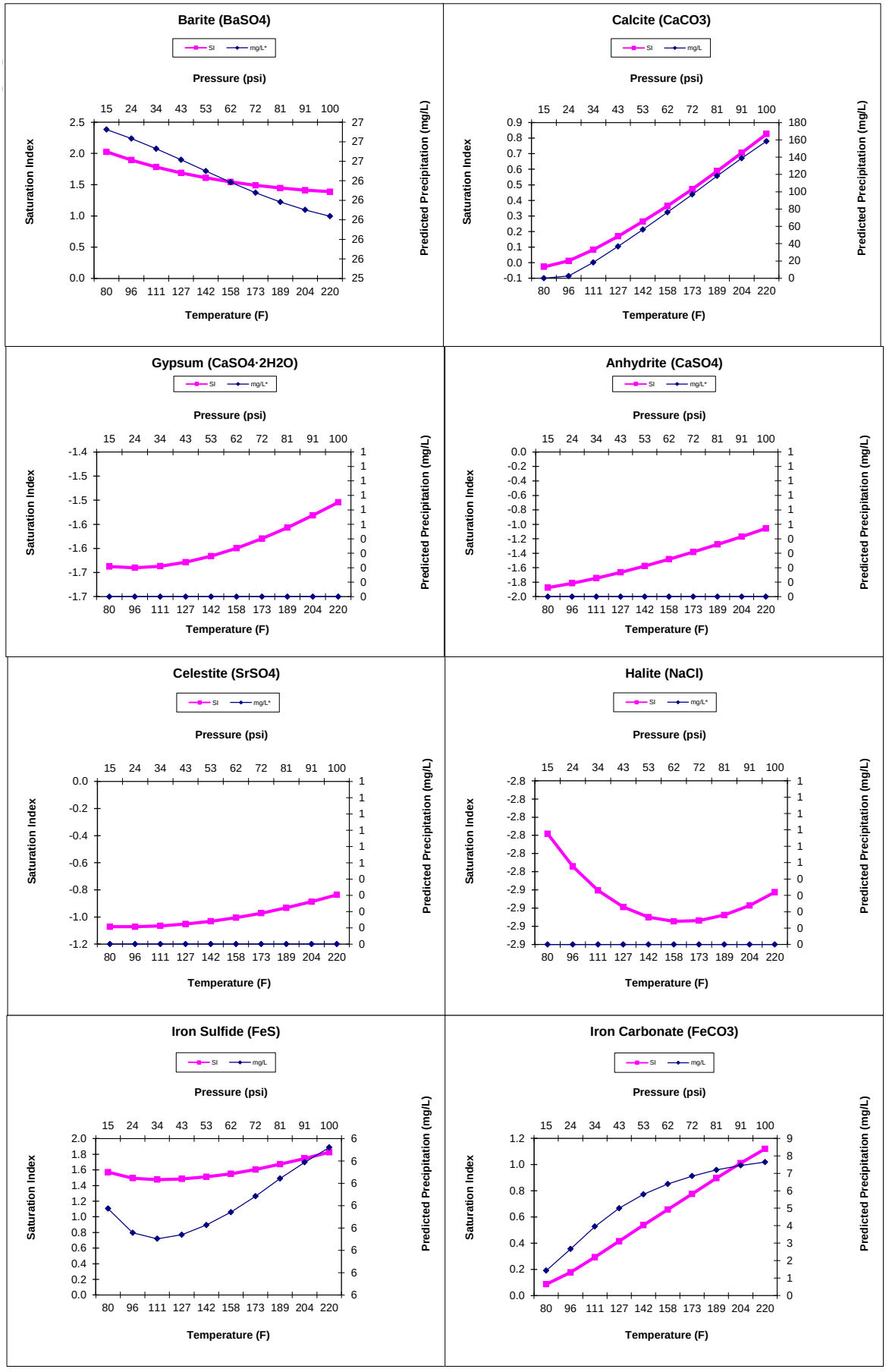
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 32A-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32B-7D Separator
District:	Four Corners	**Sample ID:**	201201035706
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 32B-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	160.0
aqueous H_2S (ppm):	3.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16178
Density/Specific Gravity (g/cm³):	1.0087
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9200.0	259.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.92

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5962.0	259.4
Potassium (K^+):	32.0	0.8
Magnesium (Mg^{2+}):	13.0	1.1
Calcium (Ca^{2+}):	526.0	26.2
Strontium (Sr^{2+}):	29.0	0.7
Barium (Ba^{2+}):	39.0	0.6
Iron (Fe^{2+}):	21.0	0.8
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1430	N/A

ND = Not Determined

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)**
80°F	15 psi	1.72	22.269	0.31	18.722	-1.86	0.000	-2.10	0.000
96°F	24 psi	1.59	21.965	0.34	20.796	-1.86	0.000	-2.04	0.000
111°F	34 psi	1.48	21.633	0.42	24.726	-1.86	0.000	-1.97	0.000
127°F	43 psi	1.39	21.288	0.50	29.269	-1.85	0.000	-1.89	0.000
142°F	53 psi	1.31	20.946	0.60	33.982	-1.83	0.000	-1.80	0.000
158°F	62 psi	1.24	20.622	0.70	38.660	-1.82	0.000	-1.70	0.000
173°F	72 psi	1.19	20.328	0.80	43.333	-1.79	0.000	-1.60	0.000
189°F	81 psi	1.15	20.073	0.92	48.041	-1.77	0.000	-1.49	0.000
204°F	91 psi	1.12	19.862	1.04	52.405	-1.74	0.000	-1.38	0.000
220°F	100 psi	1.09	19.698	1.16	56.426	-1.72	0.000	-1.27	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)**
80°F	15 psi	-1.43	0.000	-3.05	0.000	2.29	5.248	0.65	10.575
96°F	24 psi	-1.43	0.000	-3.07	0.000	2.22	5.237	0.74	11.361
111°F	34 psi	-1.42	0.000	-3.08	0.000	2.20	5.235	0.86	12.202
127°F	43 psi	-1.41	0.000	-3.09	0.000	2.21	5.238	0.98	12.906
142°F	53 psi	-1.38	0.000	-3.10	0.000	2.24	5.244	1.11	13.457
158°F	62 psi	-1.35	0.000	-3.10	0.000	2.28	5.251	1.23	13.876
173°F	72 psi	-1.32	0.000	-3.10	0.000	2.34	5.259	1.35	14.200
189°F	81 psi	-1.28	0.000	-3.09	0.000	2.41	5.267	1.47	14.453
204°F	91 psi	-1.23	0.000	-3.09	0.000	2.49	5.275	1.59	14.638
220°F	100 psi	-1.17	0.000	-3.08	0.000	2.57	5.282	1.70	14.776

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.

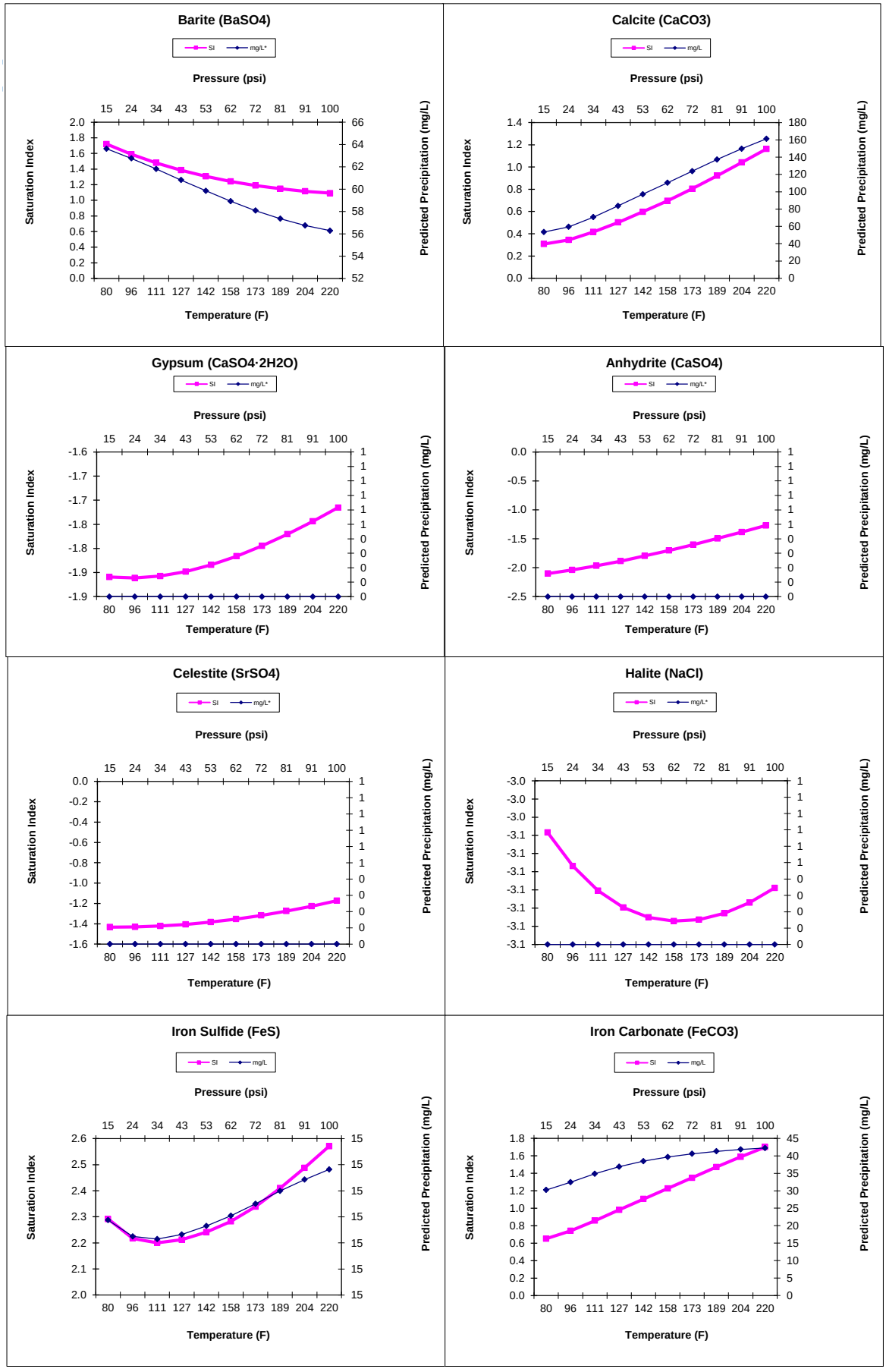
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 32B-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32D-7D Separator
District:	Four Corners	**Sample ID:**	201201035707
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 32D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	451.0	7.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	65.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	14543
Density/Specific Gravity (g/cm^3):	1.0073
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8400.0	237.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5443.0	236.9
Potassium (K^+):	33.0	0.8
Magnesium (Mg^{2+}):	10.0	0.8
Calcium (Ca^{2+}):	125.0	6.2
Strontium (Sr^{2+}):	11.0	0.3
Barium (Ba^{2+}):	19.0	0.3
Iron (Fe^{2+}):	0.2	0.0
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	380	N/A

ND = Not Determined

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)**
80°F	15 psi	1.48	10.803	-0.12	0.000	-2.41	0.000	-2.65	0.000
96°F	24 psi	1.35	10.632	-0.08	0.000	-2.41	0.000	-2.59	0.000
111°F	34 psi	1.24	10.442	-0.01	0.000	-2.41	0.000	-2.52	0.000
127°F	43 psi	1.15	10.242	0.08	5.883	-2.40	0.000	-2.43	0.000
142°F	53 psi	1.07	10.041	0.18	12.512	-2.38	0.000	-2.35	0.000
158°F	62 psi	1.01	9.849	0.28	19.250	-2.36	0.000	-2.25	0.000
173°F	72 psi	0.95	9.674	0.39	26.204	-2.34	0.000	-2.15	0.000
189°F	81 psi	0.91	9.524	0.51	33.359	-2.31	0.000	-2.04	0.000
204°F	91 psi	0.88	9.402	0.64	40.212	-2.29	0.000	-1.93	0.000
220°F	100 psi	0.86	9.312	0.76	46.745	-2.26	0.000	-1.81	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)**
80°F	15 psi	-1.78	0.000	-3.12	0.000	0.20	0.037	-1.20	0.000
96°F	24 psi	-1.78	0.000	-3.14	0.000	0.13	0.025	-1.11	0.000
111°F	34 psi	-1.77	0.000	-3.15	0.000	0.12	0.023	-0.99	0.000
127°F	43 psi	-1.76	0.000	-3.16	0.000	0.13	0.026	-0.86	0.000
142°F	53 psi	-1.73	0.000	-3.16	0.000	0.16	0.031	-0.74	0.000
158°F	62 psi	-1.70	0.000	-3.17	0.000	0.21	0.037	-0.61	0.000
173°F	72 psi	-1.66	0.000	-3.16	0.000	0.27	0.045	-0.49	0.000
189°F	81 psi	-1.62	0.000	-3.16	0.000	0.34	0.054	-0.36	0.000
204°F	91 psi	-1.57	0.000	-3.15	0.000	0.42	0.061	-0.24	0.000
220°F	100 psi	-1.51	0.000	-3.15	0.000	0.51	0.068	-0.13	0.000

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.

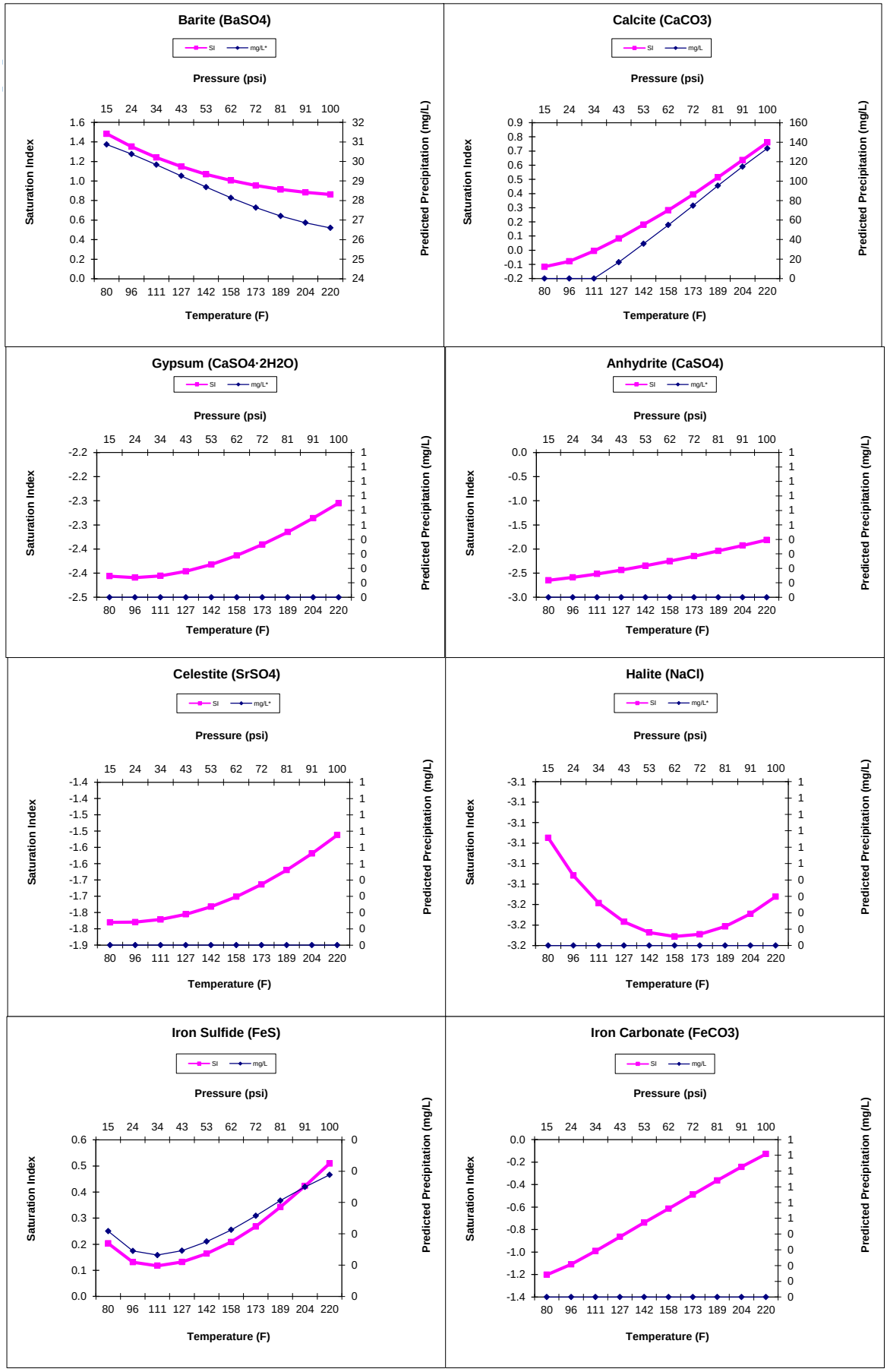
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 32D-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	33B-7D Separator
District:	Four Corners	**Sample ID:**	201201035708
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 33B-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	275.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19334
Density/Specific Gravity (g/cm³):	1.0106
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11400.0	321.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio: 0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7387.0	321.5
Potassium (K^+):	26.0	0.7
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	125.0	6.2
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	22.0	0.3
Iron (Fe^{2+}):	0.4	0.0
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	376	N/A

ND = Not Determined

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)**
80°F	15 psi	1.43	12.399	-0.33	0.000	-2.51	0.000	-2.75	0.000
96°F	24 psi	1.30	12.166	-0.29	0.000	-2.52	0.000	-2.69	0.000
111°F	34 psi	1.19	11.907	-0.22	0.000	-2.51	0.000	-2.62	0.000
127°F	43 psi	1.09	11.634	-0.14	0.000	-2.51	0.000	-2.54	0.000
142°F	53 psi	1.01	11.358	-0.04	0.000	-2.49	0.000	-2.45	0.000
158°F	62 psi	0.95	11.093	0.06	3.018	-2.48	0.000	-2.36	0.000
173°F	72 psi	0.90	10.849	0.16	8.506	-2.45	0.000	-2.26	0.000
189°F	81 psi	0.85	10.635	0.28	14.273	-2.43	0.000	-2.15	0.000
204°F	91 psi	0.82	10.457	0.40	19.883	-2.41	0.000	-2.04	0.000
220°F	100 psi	0.80	10.318	0.52	25.309	-2.38	0.000	-1.93	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)**
80°F	15 psi	-1.97	0.000	-2.87	0.000	0.47	0.132	-1.13	0.000
96°F	24 psi	-1.97	0.000	-2.89	0.000	0.39	0.119	-1.04	0.000
111°F	34 psi	-1.96	0.000	-2.90	0.000	0.38	0.115	-0.92	0.000
127°F	43 psi	-1.95	0.000	-2.91	0.000	0.39	0.117	-0.80	0.000
142°F	53 psi	-1.93	0.000	-2.92	0.000	0.41	0.123	-0.67	0.000
158°F	62 psi	-1.90	0.000	-2.92	0.000	0.45	0.129	-0.56	0.000
173°F	72 psi	-1.87	0.000	-2.92	0.000	0.51	0.138	-0.44	0.000
189°F	81 psi	-1.83	0.000	-2.92	0.000	0.58	0.148	-0.31	0.000
204°F	91 psi	-1.78	0.000	-2.91	0.000	0.65	0.156	-0.20	0.000
220°F	100 psi	-1.73	0.000	-2.90	0.000	0.73	0.164	-0.09	0.000

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.

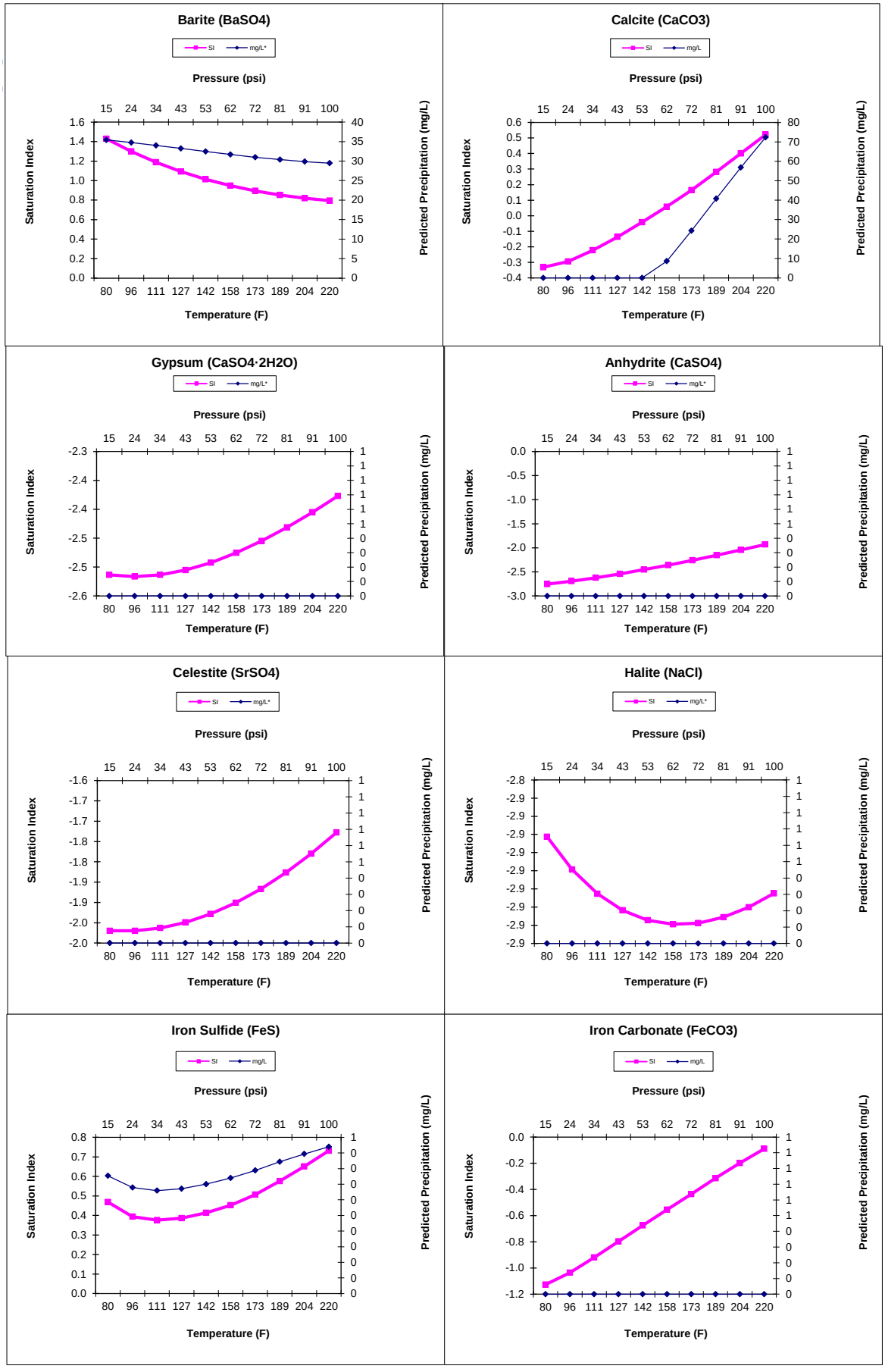
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 33B-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	33D-7D Separator
District:	Four Corners	**Sample ID:**	201201035709
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 33D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20108
Density/Specific Gravity (g/cm³):	1.0111
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11800.0	332.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7646.0	332.7
Potassium (K^+):	31.0	0.8
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	115.0	5.7
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	20.0	0.3
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	349	N/A

ND = Not Determined

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)**
80°F	15 psi	1.37	11.211	-0.22	0.000	-2.56	0.000	-2.80	0.000
96°F	24 psi	1.24	10.979	-0.18	0.000	-2.56	0.000	-2.74	0.000
111°F	34 psi	1.13	10.720	-0.11	0.000	-2.56	0.000	-2.67	0.000
127°F	43 psi	1.04	10.446	-0.03	0.000	-2.55	0.000	-2.59	0.000
142°F	53 psi	0.96	10.170	0.07	4.546	-2.54	0.000	-2.50	0.000
158°F	62 psi	0.89	9.903	0.17	10.915	-2.52	0.000	-2.41	0.000
173°F	72 psi	0.84	9.657	0.28	17.527	-2.50	0.000	-2.31	0.000
189°F	81 psi	0.79	9.441	0.39	24.389	-2.48	0.000	-2.20	0.000
204°F	91 psi	0.76	9.260	0.51	31.001	-2.45	0.000	-2.09	0.000
220°F	100 psi	0.74	9.118	0.63	37.341	-2.43	0.000	-1.98	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)**
80°F	15 psi	-1.98	0.000	-2.84	0.000	0.91	0.474	-0.54	0.000
96°F	24 psi	-1.98	0.000	-2.86	0.000	0.83	0.460	-0.45	0.000
111°F	34 psi	-1.98	0.000	-2.88	0.000	0.82	0.456	-0.33	0.000
127°F	43 psi	-1.96	0.000	-2.88	0.000	0.83	0.458	-0.21	0.000
142°F	53 psi	-1.94	0.000	-2.89	0.000	0.85	0.464	-0.09	0.000
158°F	62 psi	-1.92	0.000	-2.89	0.000	0.89	0.471	0.03	0.050
173°F	72 psi	-1.88	0.000	-2.89	0.000	0.95	0.481	0.15	0.212
189°F	81 psi	-1.84	0.000	-2.89	0.000	1.02	0.491	0.27	0.336
204°F	91 psi	-1.80	0.000	-2.88	0.000	1.09	0.500	0.39	0.427
220°F	100 psi	-1.74	0.000	-2.88	0.000	1.17	0.509	0.50	0.493

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.

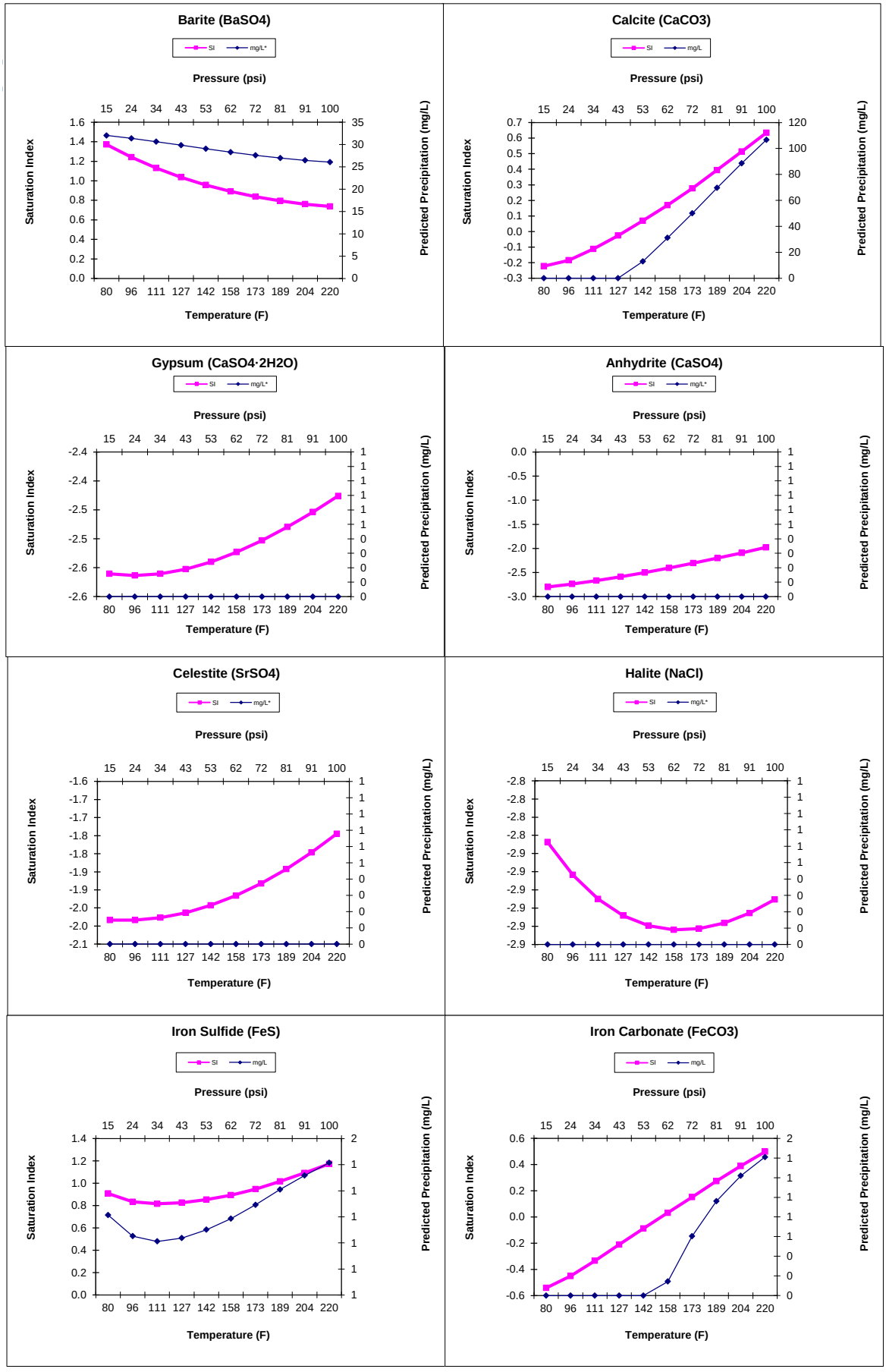
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 33D-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	3F-17D Separator
District:	Four Corners	**Sample ID:**	201201035666
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 3F-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	8.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	488.0	8.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	8477
Density/Specific Gravity (g/cm³):	1.0031
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	4720.0	133.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.02	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	3059.0	133.1
Potassium (K^+):	31.0	0.8
Magnesium (Mg^{2+}):	4.0	0.3
Calcium (Ca^{2+}):	51.0	2.5
Strontium (Sr^{2+}):	5.0	0.1
Barium (Ba^{2+}):	12.0	0.2
Iron (Fe^{2+}):	57.0	2.0
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	158	N/A

ND = Not Determined

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)**
80°F	15 psi	1.50	6.866	0.61	17.238	-2.60	0.000	-2.85	0.000
96°F	24 psi	1.36	6.771	0.65	18.359	-2.60	0.000	-2.79	0.000
111°F	34 psi	1.25	6.666	0.71	20.386	-2.60	0.000	-2.71	0.000
127°F	43 psi	1.16	6.557	0.79	22.759	-2.59	0.000	-2.63	0.000
142°F	53 psi	1.09	6.448	0.88	25.255	-2.57	0.000	-2.54	0.000
158°F	62 psi	1.02	6.346	0.97	27.748	-2.55	0.000	-2.44	0.000
173°F	72 psi	0.98	6.255	1.07	30.214	-2.52	0.000	-2.33	0.000
189°F	81 psi	0.94	6.181	1.17	32.652	-2.49	0.000	-2.22	0.000
204°F	91 psi	0.91	6.124	1.28	34.837	-2.46	0.000	-2.10	0.000
220°F	100 psi	0.90	6.086	1.38	36.749	-2.42	0.000	-1.98	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)**
80°F	15 psi	-1.93	0.000	-3.58	0.000	3.48	1.002	2.43	40.586
96°F	24 psi	-1.93	0.000	-3.60	0.000	3.38	1.002	2.53	40.741
111°F	34 psi	-1.92	0.000	-3.61	0.000	3.33	1.002	2.64	40.898
127°F	43 psi	-1.90	0.000	-3.62	0.000	3.30	1.002	2.76	41.024
142°F	53 psi	-1.87	0.000	-3.63	0.000	3.30	1.002	2.88	41.118
158°F	62 psi	-1.84	0.000	-3.63	0.000	3.31	1.002	2.99	41.187
173°F	72 psi	-1.79	0.000	-3.62	0.000	3.33	1.002	3.11	41.238
189°F	81 psi	-1.74	0.000	-3.62	0.000	3.37	1.002	3.22	41.277
204°F	91 psi	-1.68	0.000	-3.61	0.000	3.42	1.002	3.32	41.305
220°F	100 psi	-1.62	0.000	-3.60	0.000	3.48	1.002	3.42	41.325

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.

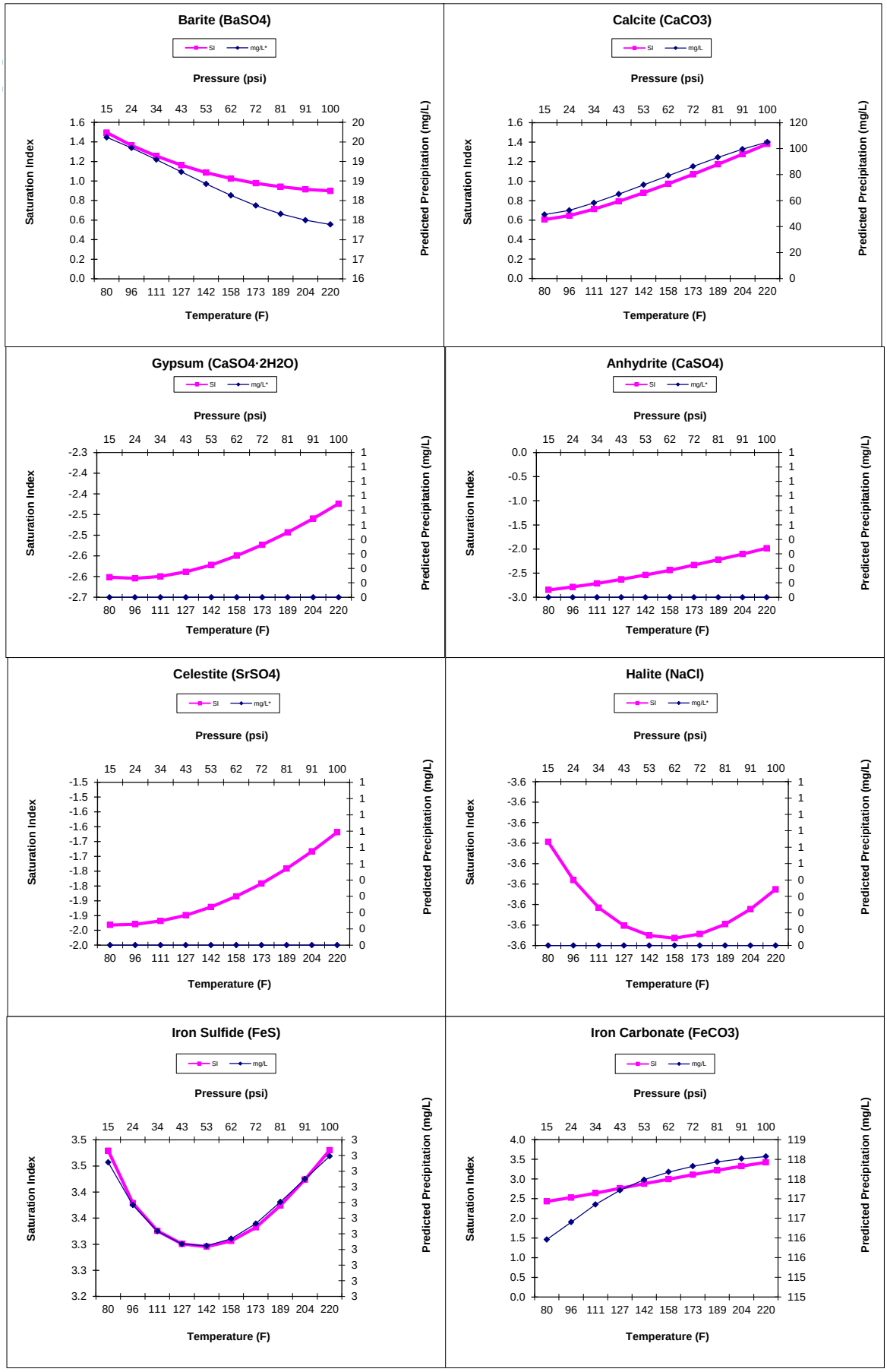
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 3F-17D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41-7D Separator
District:	Four Corners	**Sample ID:**	201201035674
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 41-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:	
pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	548.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	14476
Density/Specific Gravity (g/cm³):	1.0072
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8300.0	234.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	5378.0	234.0
Potassium (K^+):	47.0	1.2
Magnesium (Mg^{2+}):	13.0	1.1
Calcium (Ca^{2+}):	106.0	5.3
Strontium (Sr^{2+}):	12.0	0.3
Barium (Ba^{2+}):	21.0	0.3
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	348	N/A

ND = Not Determined

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)**
80°F	15 psi	1.53	11.978	-0.10	0.000	-2.47	0.000	-2.71	0.000
96°F	24 psi	1.40	11.802	-0.06	0.000	-2.47	0.000	-2.65	0.000
111°F	34 psi	1.29	11.606	0.01	1.141	-2.47	0.000	-2.58	0.000
127°F	43 psi	1.19	11.400	0.10	7.891	-2.46	0.000	-2.50	0.000
142°F	53 psi	1.12	11.194	0.20	14.967	-2.45	0.000	-2.41	0.000
158°F	62 psi	1.05	10.997	0.31	22.079	-2.43	0.000	-2.32	0.000
173°F	72 psi	1.00	10.819	0.42	29.344	-2.41	0.000	-2.21	0.000
189°F	81 psi	0.96	10.666	0.54	36.697	-2.38	0.000	-2.11	0.000
204°F	91 psi	0.93	10.542	0.66	43.625	-2.35	0.000	-1.99	0.000
220°F	100 psi	0.91	10.450	0.79	50.107	-2.32	0.000	-1.88	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)**
80°F	15 psi	-1.74	0.000	-3.13	0.000	0.66	0.403	-0.36	0.000
96°F	24 psi	-1.74	0.000	-3.15	0.000	0.59	0.379	-0.27	0.000
111°F	34 psi	-1.73	0.000	-3.16	0.000	0.58	0.374	-0.15	0.000
127°F	43 psi	-1.71	0.000	-3.17	0.000	0.59	0.380	-0.02	0.000
142°F	53 psi	-1.69	0.000	-3.17	0.000	0.62	0.391	0.11	0.159
158°F	62 psi	-1.66	0.000	-3.18	0.000	0.67	0.406	0.23	0.300
173°F	72 psi	-1.62	0.000	-3.17	0.000	0.73	0.424	0.36	0.407
189°F	81 psi	-1.58	0.000	-3.17	0.000	0.81	0.443	0.49	0.487
204°F	91 psi	-1.53	0.000	-3.16	0.000	0.89	0.461	0.61	0.545
220°F	100 psi	-1.47	0.000	-3.16	0.000	0.97	0.476	0.72	0.588

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.

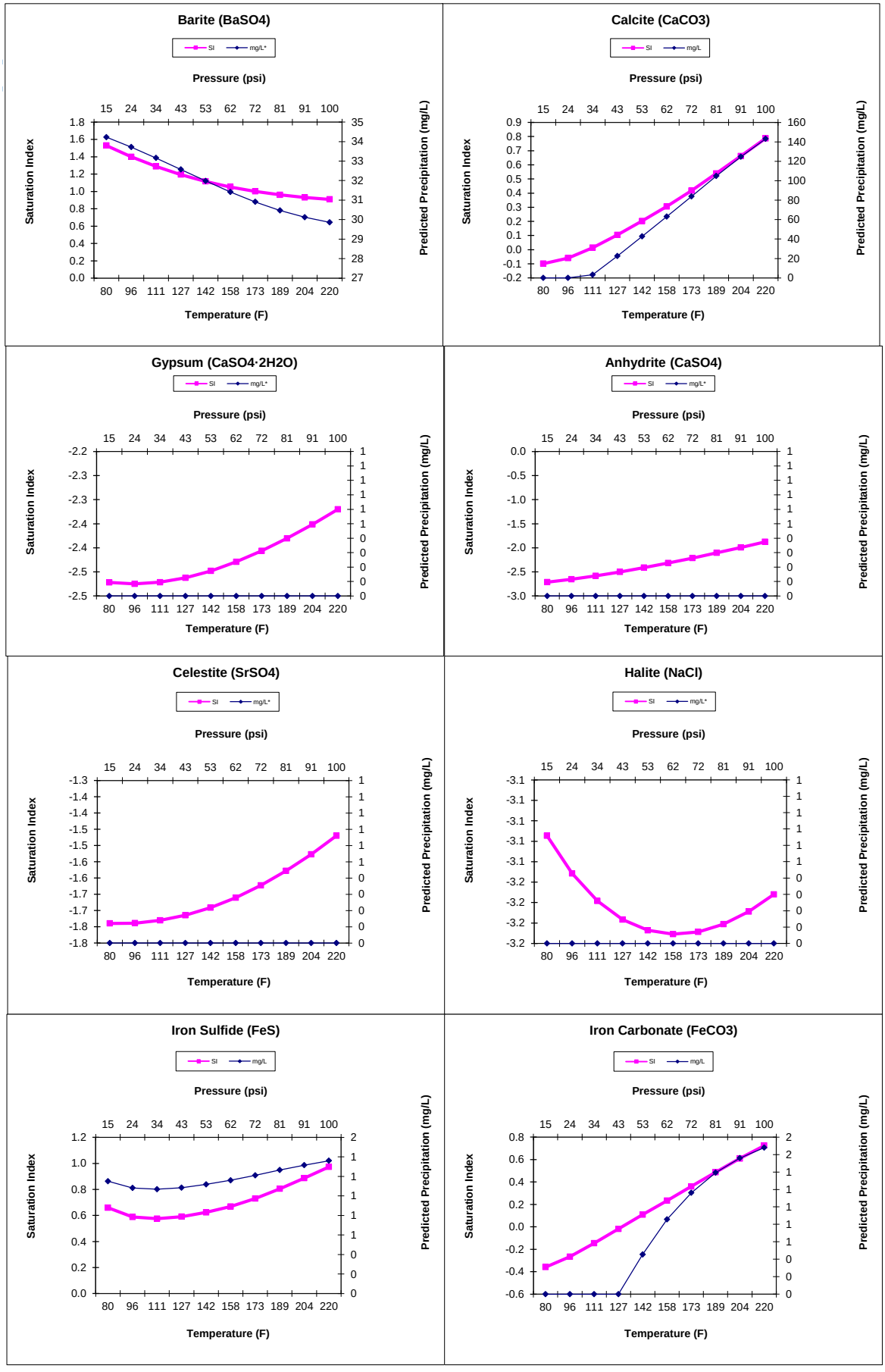
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 41-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41A-7D Separator
District:	Four Corners	**Sample ID:**	201201035697
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 41A-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	488.0	8.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	190.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16300
Density/Specific Gravity (g/cm^3):	1.0085
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9400.0	265.2
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6091.0	265.1
Potassium (K^+):	43.0	1.1
Magnesium (Mg^{2+}):	13.0	1.1
Calcium (Ca^{2+}):	127.0	6.3
Strontium (Sr^{2+}):	13.0	0.3
Barium (Ba^{2+}):	22.0	0.3
Iron (Fe^{2+}):	2.0	0.1
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	402	N/A

ND = Not Determined

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)**
80°F	15 psi	1.80	12.842	-0.09	0.000	-2.14	0.000	-2.38	0.000
96°F	24 psi	1.67	12.757	-0.05	0.000	-2.14	0.000	-2.32	0.000
111°F	34 psi	1.56	12.661	0.02	1.458	-2.14	0.000	-2.25	0.000
127°F	43 psi	1.46	12.559	0.11	7.982	-2.13	0.000	-2.17	0.000
142°F	53 psi	1.39	12.455	0.20	14.879	-2.12	0.000	-2.08	0.000
158°F	62 psi	1.32	12.355	0.31	21.876	-2.10	0.000	-1.98	0.000
173°F	72 psi	1.27	12.262	0.42	29.087	-2.08	0.000	-1.88	0.000
189°F	81 psi	1.23	12.181	0.54	36.497	-2.05	0.000	-1.78	0.000
204°F	91 psi	1.20	12.115	0.66	43.580	-2.02	0.000	-1.66	0.000
220°F	100 psi	1.17	12.064	0.78	50.321	-1.99	0.000	-1.55	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)**
80°F	15 psi	-1.45	0.000	-3.03	0.000	1.24	1.017	-0.14	0.000
96°F	24 psi	-1.45	0.000	-3.05	0.000	1.16	1.002	-0.05	0.000
111°F	34 psi	-1.44	0.000	-3.06	0.000	1.15	0.999	0.07	0.212
127°F	43 psi	-1.43	0.000	-3.07	0.000	1.16	1.002	0.20	0.517
142°F	53 psi	-1.40	0.000	-3.07	0.000	1.19	1.009	0.32	0.749
158°F	62 psi	-1.37	0.000	-3.08	0.000	1.24	1.018	0.44	0.920
173°F	72 psi	-1.34	0.000	-3.08	0.000	1.29	1.028	0.57	1.051
189°F	81 psi	-1.29	0.000	-3.07	0.000	1.37	1.039	0.69	1.150
204°F	91 psi	-1.25	0.000	-3.07	0.000	1.45	1.050	0.81	1.223
220°F	100 psi	-1.19	0.000	-3.06	0.000	1.53	1.059	0.92	1.275

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.

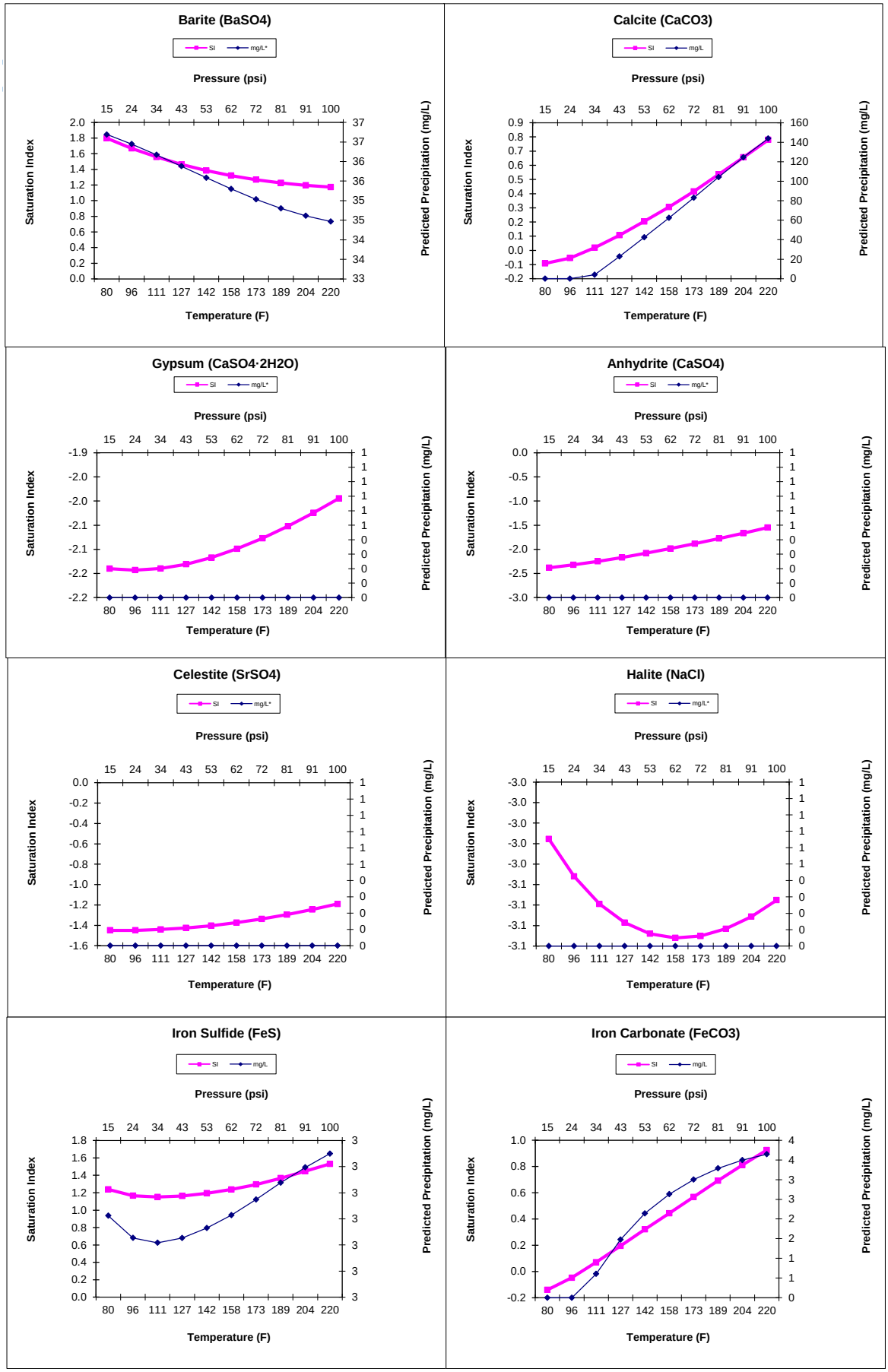
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 41A-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41C-7D Separator
District:	Four Corners	**Sample ID:**	201201035673
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 41C-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	280.0	4.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	90.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	18543
Density/Specific Gravity (g/cm^3):	1.0100
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10900.0	307.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7063.0	307.4
Potassium (K^+):	44.0	1.1
Magnesium (Mg^{2+}):	13.0	1.1
Calcium (Ca^{2+}):	162.0	8.1
Strontium (Sr^{2+}):	12.0	0.3
Barium (Ba^{2+}):	18.0	0.3
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	485	N/A

ND = Not Determined

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)**
80°F	15 psi	1.36	10.089	-0.25	0.000	-2.39	0.000	-2.63	0.000
96°F	24 psi	1.23	9.879	-0.21	0.000	-2.39	0.000	-2.57	0.000
111°F	34 psi	1.12	9.645	-0.14	0.000	-2.39	0.000	-2.50	0.000
127°F	43 psi	1.02	9.397	-0.05	0.000	-2.38	0.000	-2.42	0.000
142°F	53 psi	0.94	9.147	0.04	2.279	-2.37	0.000	-2.33	0.000
158°F	62 psi	0.88	8.907	0.15	7.349	-2.35	0.000	-2.23	0.000
173°F	72 psi	0.82	8.686	0.25	12.630	-2.33	0.000	-2.13	0.000
189°F	81 psi	0.78	8.492	0.37	18.155	-2.31	0.000	-2.03	0.000
204°F	91 psi	0.75	8.331	0.49	23.498	-2.28	0.000	-1.92	0.000
220°F	100 psi	0.72	8.206	0.61	28.630	-2.25	0.000	-1.81	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)**
80°F	15 psi	-1.83	0.000	-2.91	0.000	0.60	0.381	-0.73	0.000
96°F	24 psi	-1.83	0.000	-2.93	0.000	0.53	0.353	-0.63	0.000
111°F	34 psi	-1.83	0.000	-2.94	0.000	0.51	0.347	-0.52	0.000
127°F	43 psi	-1.81	0.000	-2.95	0.000	0.52	0.352	-0.39	0.000
142°F	53 psi	-1.79	0.000	-2.95	0.000	0.55	0.363	-0.27	0.000
158°F	62 psi	-1.76	0.000	-2.96	0.000	0.59	0.379	-0.15	0.000
173°F	72 psi	-1.73	0.000	-2.96	0.000	0.65	0.398	-0.03	0.000
189°F	81 psi	-1.69	0.000	-2.95	0.000	0.72	0.419	0.10	0.141
204°F	91 psi	-1.64	0.000	-2.95	0.000	0.79	0.439	0.21	0.277
220°F	100 psi	-1.59	0.000	-2.94	0.000	0.87	0.457	0.32	0.377

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.

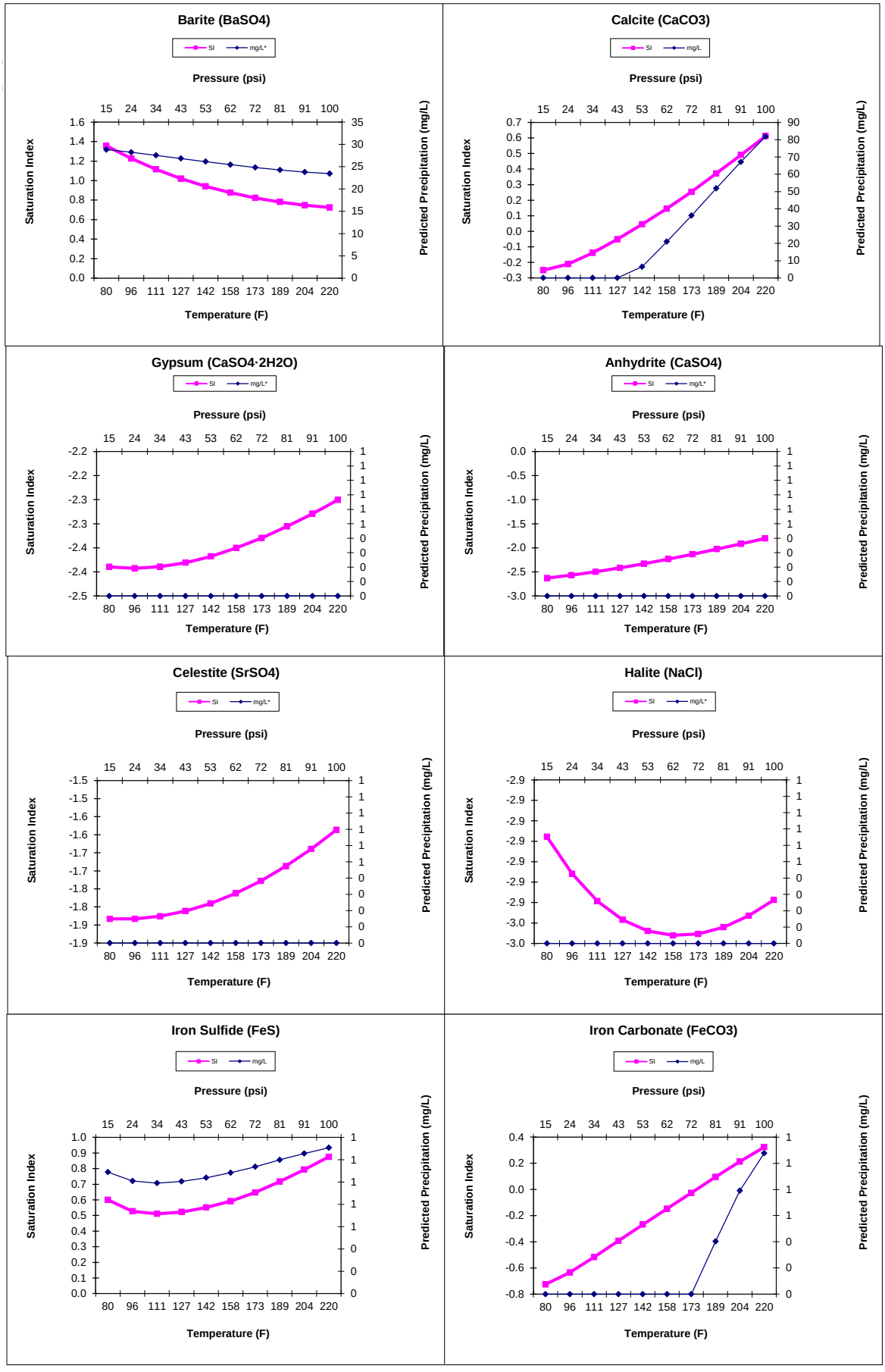
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 41C-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41D-7D Separator
District:	Four Corners	**Sample ID:**	201201035672
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 41D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	512.0	8.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	5.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21100
Density/Specific Gravity (g/cm³):	1.0117
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12400.0	349.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio: 1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8035.0	349.7
Potassium (K^+):	33.0	0.8
Magnesium (Mg^{2+}):	4.0	0.3
Calcium (Ca^{2+}):	44.0	2.2
Strontium (Sr^{2+}):	5.0	0.1
Barium (Ba^{2+}):	12.0	0.2
Iron (Fe^{2+}):	5.0	0.2
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	141	N/A

ND = Not Determined

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)**
80°F	15 psi	1.14	6.521	-0.56	0.000	-2.99	0.000	-3.23	0.000
96°F	24 psi	1.01	6.310	-0.53	0.000	-2.99	0.000	-3.17	0.000
111°F	34 psi	0.89	6.074	-0.46	0.000	-2.99	0.000	-3.10	0.000
127°F	43 psi	0.80	5.823	-0.37	0.000	-2.98	0.000	-3.02	0.000
142°F	53 psi	0.72	5.569	-0.28	0.000	-2.97	0.000	-2.93	0.000
158°F	62 psi	0.65	5.322	-0.18	0.000	-2.95	0.000	-2.84	0.000
173°F	72 psi	0.60	5.094	-0.07	0.000	-2.93	0.000	-2.74	0.000
189°F	81 psi	0.56	4.892	0.05	2.188	-2.91	0.000	-2.63	0.000
204°F	91 psi	0.52	4.722	0.16	7.568	-2.88	0.000	-2.52	0.000
220°F	100 psi	0.50	4.588	0.28	12.496	-2.86	0.000	-2.41	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)**
80°F	15 psi	-2.25	0.000	-2.80	0.000	1.88	2.696	0.24	1.465
96°F	24 psi	-2.25	0.000	-2.82	0.000	1.80	2.685	0.33	1.855
111°F	34 psi	-2.25	0.000	-2.83	0.000	1.78	2.682	0.44	2.260
127°F	43 psi	-2.23	0.000	-2.84	0.000	1.79	2.684	0.56	2.589
142°F	53 psi	-2.21	0.000	-2.85	0.000	1.82	2.688	0.68	2.840
158°F	62 psi	-2.19	0.000	-2.85	0.000	1.85	2.694	0.80	3.027
173°F	72 psi	-2.15	0.000	-2.85	0.000	1.91	2.701	0.92	3.171
189°F	81 psi	-2.11	0.000	-2.85	0.000	1.98	2.709	1.04	3.281
204°F	91 psi	-2.07	0.000	-2.84	0.000	2.05	2.716	1.16	3.362
220°F	100 psi	-2.02	0.000	-2.84	0.000	2.13	2.723	1.27	3.421

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.

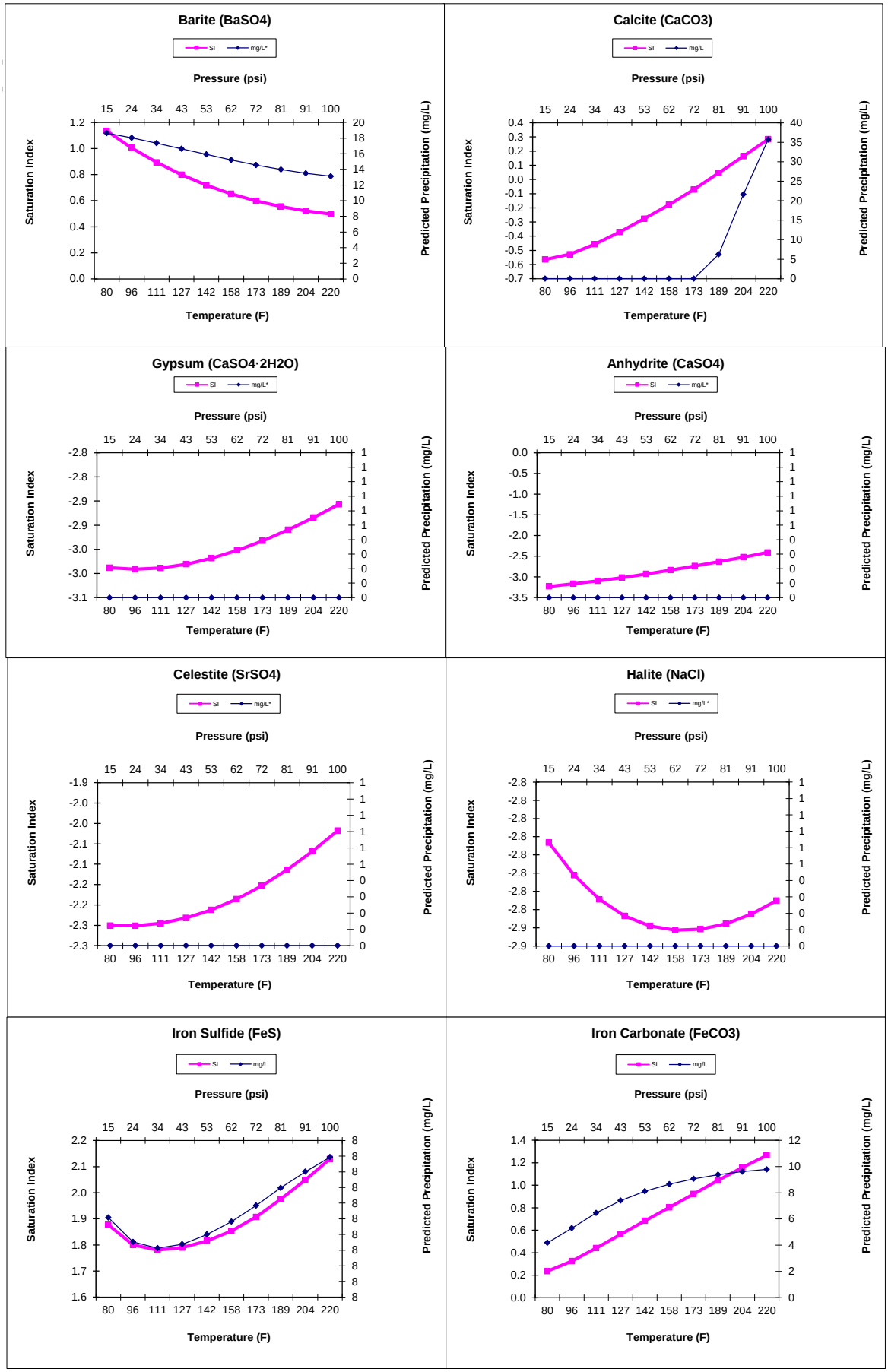
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 41D-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41D-8D Separator
District:	Four Corners	**Sample ID:**	201201036525
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 41D-8D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	510.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20701
Density/Specific Gravity (g/cm³):	1.0114
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12200.0	344.1
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.02	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7906.0	344.0
Potassium (K^+):	14.9	0.4
Magnesium (Mg^{2+}):	2.2	0.2
Calcium (Ca^{2+}):	26.1	1.3
Strontium (Sr^{2+}):	1.3	0.0
Barium (Ba^{2+}):	0.8	0.0
Iron (Fe^{2+}):	22.9	0.8
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	76	N/A

ND = Not Determined

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)**
80°F	15 psi	0.26	0.213	-1.36	0.000	-2.91	0.000	-3.15	0.000
96°F	24 psi	0.13	0.123	-1.32	0.000	-2.91	0.000	-3.09	0.000
111°F	34 psi	0.02	0.022	-1.25	0.000	-2.91	0.000	-3.02	0.000
127°F	43 psi	-0.07	0.000	-1.16	0.000	-2.90	0.000	-2.94	0.000
142°F	53 psi	-0.15	0.000	-1.06	0.000	-2.89	0.000	-2.85	0.000
158°F	62 psi	-0.22	0.000	-0.96	0.000	-2.87	0.000	-2.76	0.000
173°F	72 psi	-0.27	0.000	-0.85	0.000	-2.85	0.000	-2.66	0.000
189°F	81 psi	-0.32	0.000	-0.73	0.000	-2.83	0.000	-2.55	0.000
204°F	91 psi	-0.35	0.000	-0.61	0.000	-2.80	0.000	-2.44	0.000
220°F	100 psi	-0.38	0.000	-0.48	0.000	-2.78	0.000	-2.33	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)**
80°F	15 psi	-2.52	0.000	-2.82	0.000	-8.95	0.000	0.32	7.649
96°F	24 psi	-2.53	0.000	-2.83	0.000	-9.01	0.000	0.41	9.143
111°F	34 psi	-2.52	0.000	-2.85	0.000	-9.01	0.000	0.53	10.765
127°F	43 psi	-2.51	0.000	-2.86	0.000	-8.98	0.000	0.66	12.128
142°F	53 psi	-2.49	0.000	-2.86	0.000	-8.93	0.000	0.78	13.192
158°F	62 psi	-2.46	0.000	-2.86	0.000	-8.87	0.000	0.90	14.000
173°F	72 psi	-2.43	0.000	-2.86	0.000	-8.79	0.000	1.03	14.638
189°F	81 psi	-2.39	0.000	-2.86	0.000	-8.70	0.000	1.15	15.123
204°F	91 psi	-2.34	0.000	-2.86	0.000	-8.61	0.000	1.27	15.478
220°F	100 psi	-2.29	0.000	-2.85	0.000	-8.51	0.000	1.38	15.741

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.

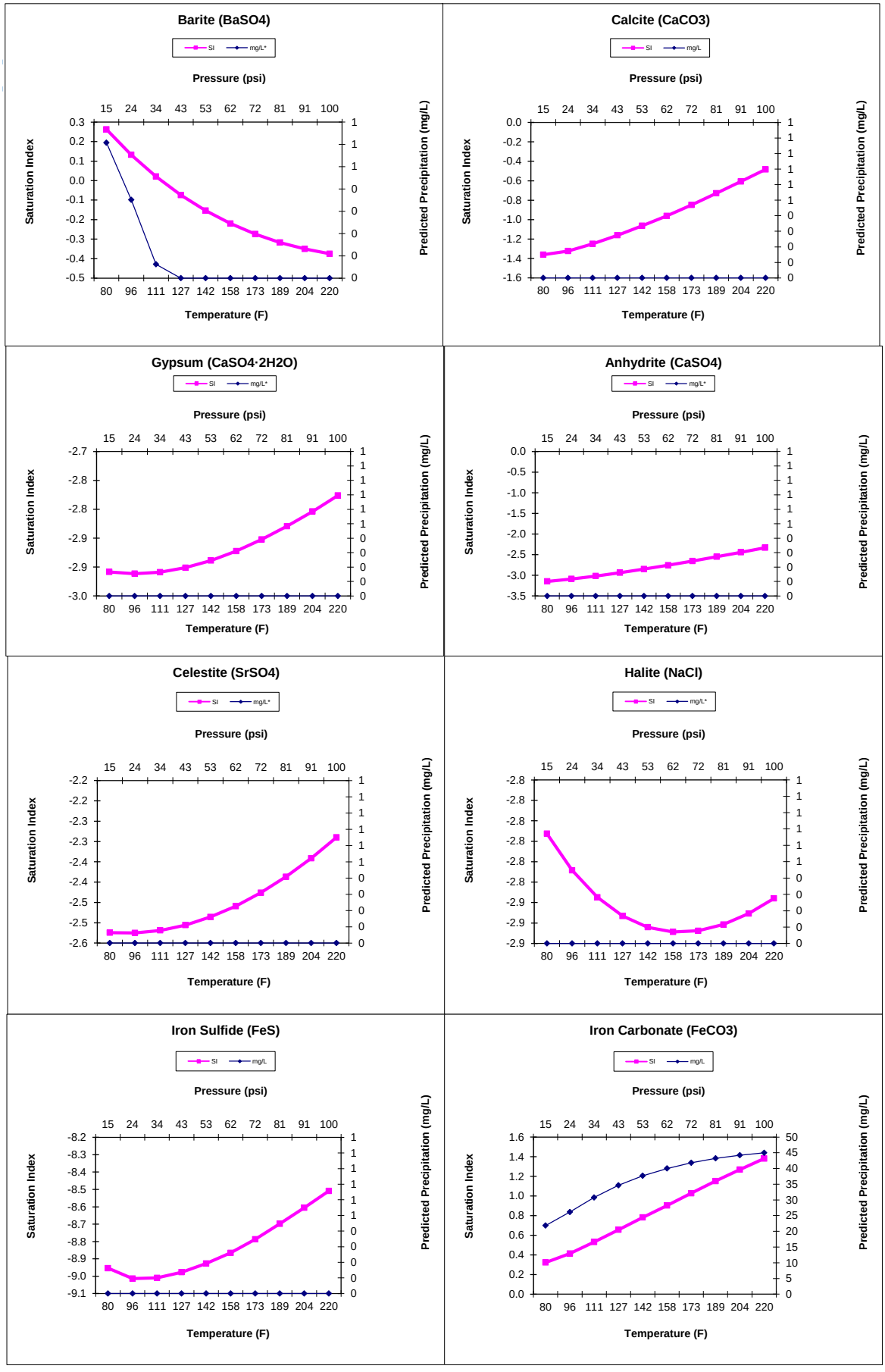
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 41D-8D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42-5D Separator
District:	Four Corners	**Sample ID:**	201201036454
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 42-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.6

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	292.0	4.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	14671
Density/Specific Gravity (g/cm³):	1.0074
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8600.0	242.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5573.0	242.5
Potassium (K^+):	26.1	0.7
Magnesium (Mg^{2+}):	7.2	0.6
Calcium (Ca^{2+}):	103.7	5.2
Strontium (Sr^{2+}):	7.2	0.2
Barium (Ba^{2+}):	10.7	0.2
Iron (Fe^{2+}):	0.3	0.0
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	305	N/A

ND = Not Determined

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)**
80°F	15 psi	1.23	5.925	-0.79	0.000	-2.49	0.000	-2.73	0.000
96°F	24 psi	1.10	5.775	-0.75	0.000	-2.50	0.000	-2.67	0.000
111°F	34 psi	0.99	5.608	-0.68	0.000	-2.49	0.000	-2.60	0.000
127°F	43 psi	0.90	5.432	-0.59	0.000	-2.48	0.000	-2.52	0.000
142°F	53 psi	0.82	5.254	-0.49	0.000	-2.47	0.000	-2.43	0.000
158°F	62 psi	0.75	5.084	-0.39	0.000	-2.45	0.000	-2.34	0.000
173°F	72 psi	0.70	4.929	-0.28	0.000	-2.43	0.000	-2.23	0.000
189°F	81 psi	0.66	4.796	-0.16	0.000	-2.40	0.000	-2.13	0.000
204°F	91 psi	0.63	4.687	-0.04	0.000	-2.37	0.000	-2.01	0.000
220°F	100 psi	0.61	4.606	0.09	5.097	-2.34	0.000	-1.90	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)**
80°F	15 psi	-1.96	0.000	-3.10	0.000	-0.26	0.000	-1.67	0.000
96°F	24 psi	-1.96	0.000	-3.12	0.000	-0.32	0.000	-1.57	0.000
111°F	34 psi	-1.96	0.000	-3.13	0.000	-0.32	0.000	-1.45	0.000
127°F	43 psi	-1.94	0.000	-3.14	0.000	-0.29	0.000	-1.33	0.000
142°F	53 psi	-1.92	0.000	-3.14	0.000	-0.24	0.000	-1.20	0.000
158°F	62 psi	-1.89	0.000	-3.15	0.000	-0.18	0.000	-1.08	0.000
173°F	72 psi	-1.85	0.000	-3.14	0.000	-0.10	0.000	-0.95	0.000
189°F	81 psi	-1.81	0.000	-3.14	0.000	-0.01	0.000	-0.83	0.000
204°F	91 psi	-1.75	0.000	-3.13	0.000	0.08	0.023	-0.71	0.000
220°F	100 psi	-1.70	0.000	-3.13	0.000	0.18	0.045	-0.59	0.000

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.

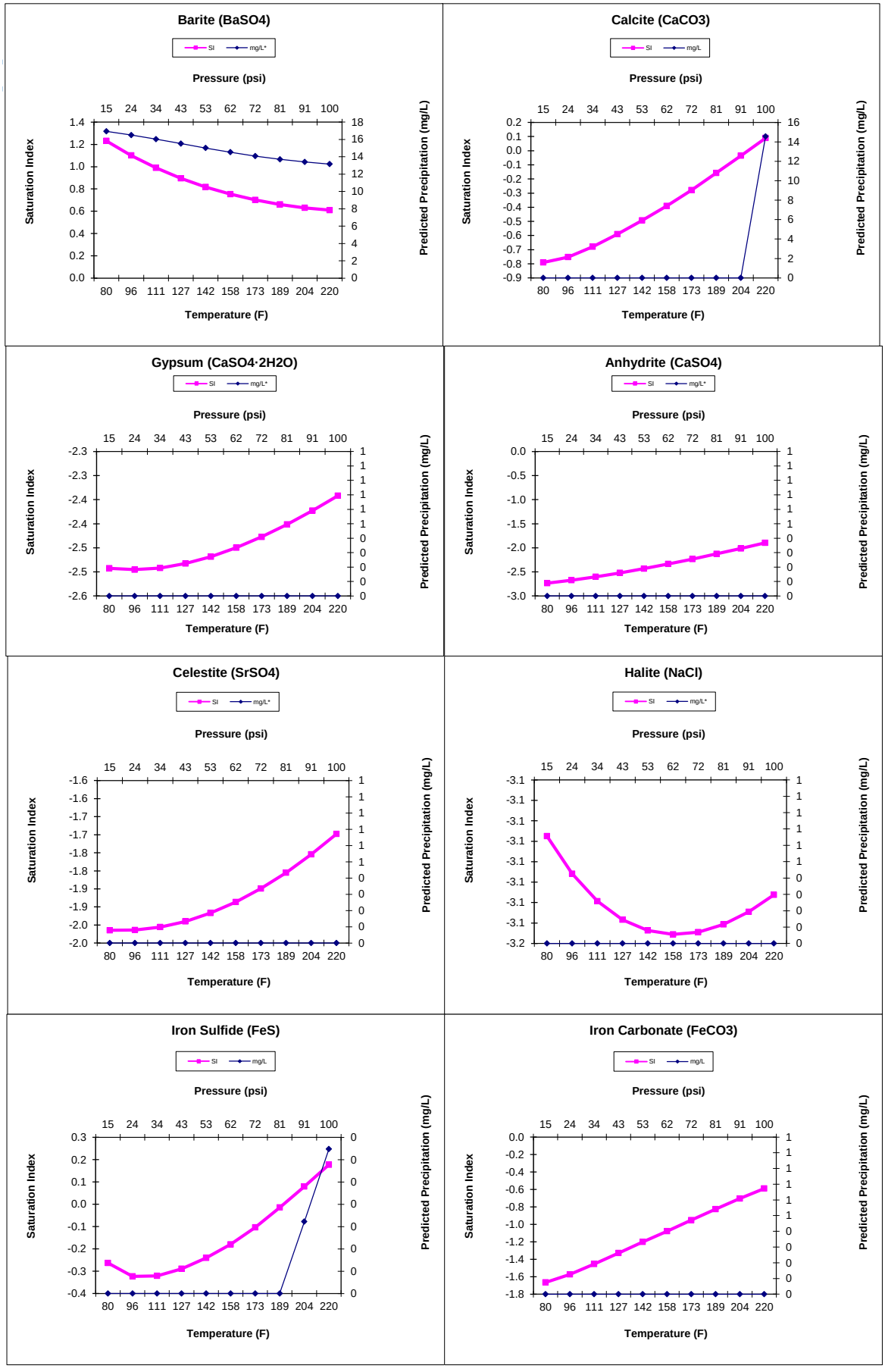
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 42-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42-7D Separator
District:	Four Corners	**Sample ID:**	201201035696
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 42-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	250.0
aqueous H_2S (ppm):	6.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	7207
Density/Specific Gravity (g/cm³):	1.0022
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	4030.0	113.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.04

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	2611.0	113.6
Potassium (K^+):	33.0	0.8
Magnesium (Mg^{2+}):	3.0	0.2
Calcium (Ca^{2+}):	37.0	1.8
Strontium (Sr^{2+}):	4.0	0.1
Barium (Ba^{2+}):	8.0	0.1
Iron (Fe^{2+}):	4.0	0.1
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	115	N/A

ND = Not Determined

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)**
80°F	15 psi	1.39	4.540	-1.55	0.000	-2.68	0.000	-2.92	0.000
96°F	24 psi	1.26	4.463	-1.52	0.000	-2.68	0.000	-2.86	0.000
111°F	34 psi	1.15	4.379	-1.45	0.000	-2.68	0.000	-2.79	0.000
127°F	43 psi	1.05	4.291	-1.36	0.000	-2.66	0.000	-2.71	0.000
142°F	53 psi	0.98	4.205	-1.26	0.000	-2.65	0.000	-2.61	0.000
158°F	62 psi	0.92	4.124	-1.14	0.000	-2.62	0.000	-2.51	0.000
173°F	72 psi	0.87	4.053	-1.01	0.000	-2.60	0.000	-2.41	0.000
189°F	81 psi	0.84	3.995	-0.89	0.000	-2.56	0.000	-2.29	0.000
204°F	91 psi	0.81	3.952	-0.76	0.000	-2.53	0.000	-2.17	0.000
220°F	100 psi	0.80	3.924	-0.63	0.000	-2.49	0.000	-2.05	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)**
80°F	15 psi	-1.97	0.000	-3.70	0.000	0.29	0.963	-0.74	0.000
96°F	24 psi	-1.96	0.000	-3.72	0.000	0.23	0.801	-0.65	0.000
111°F	34 psi	-1.95	0.000	-3.74	0.000	0.25	0.847	-0.53	0.000
127°F	43 psi	-1.93	0.000	-3.74	0.000	0.30	0.983	-0.40	0.000
142°F	53 psi	-1.90	0.000	-3.75	0.000	0.37	1.152	-0.27	0.000
158°F	62 psi	-1.86	0.000	-3.75	0.000	0.47	1.350	-0.13	0.000
173°F	72 psi	-1.82	0.000	-3.75	0.000	0.58	1.533	0.01	0.073
189°F	81 psi	-1.77	0.000	-3.74	0.000	0.70	1.683	0.15	0.809
204°F	91 psi	-1.71	0.000	-3.73	0.000	0.82	1.805	0.28	1.341
220°F	100 psi	-1.64	0.000	-3.72	0.000	0.94	1.901	0.40	1.728

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.

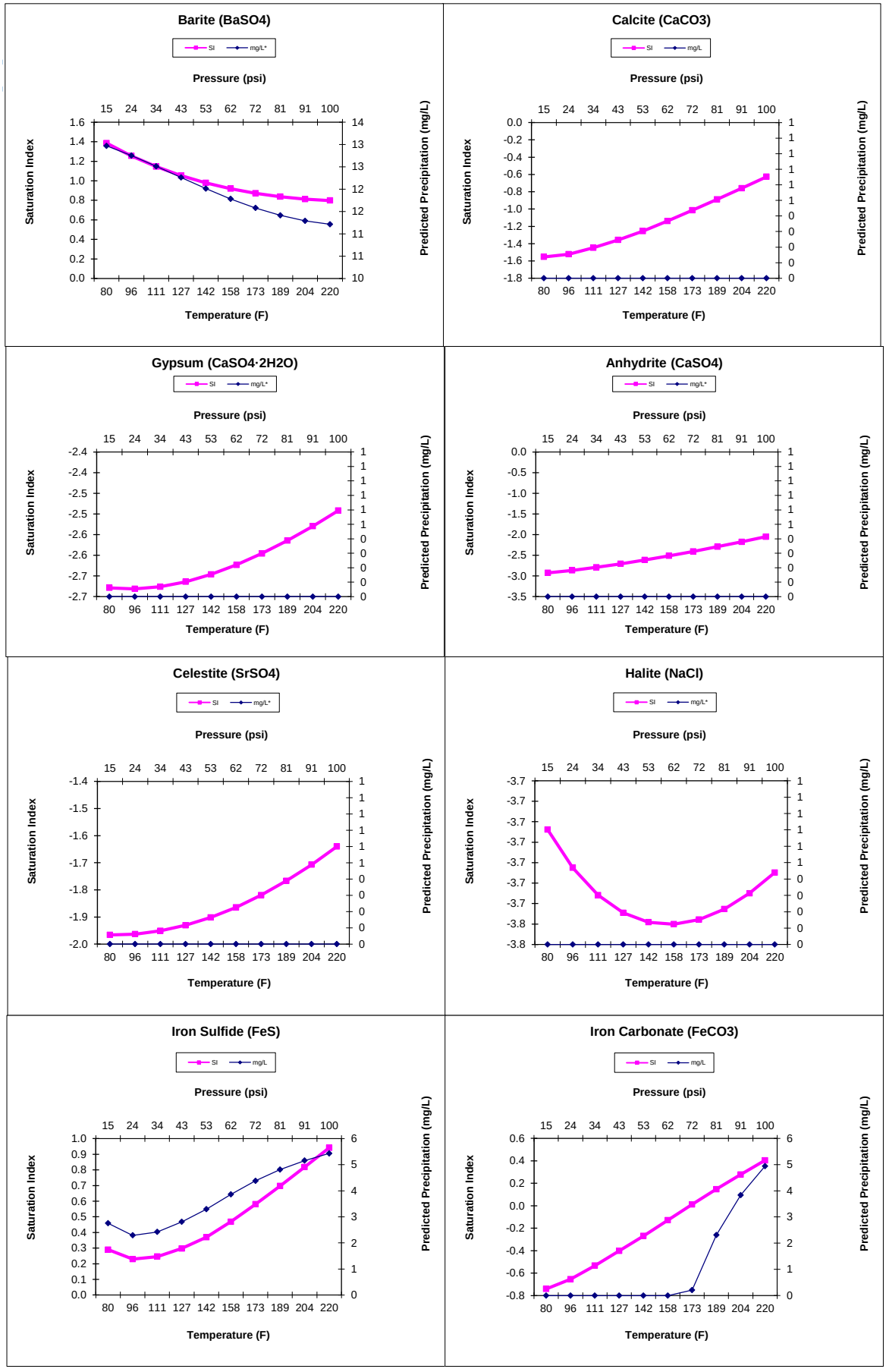
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 42-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42-8 Separator
District:	Four Corners	**Sample ID:**	201201036465
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 42-8 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	649.0	10.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	680.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	15879
Density/Specific Gravity (g/cm³):	1.0082
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8900.0	251.1
Sulfate (SO_4^{2-}):	400.0	8.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.05

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5767.0	251.0
Potassium (K^+):	32.7	0.8
Magnesium (Mg^{2+}):	7.0	0.6
Calcium (Ca^{2+}):	70.5	3.5
Strontium (Sr^{2+}):	8.1	0.2
Barium (Ba^{2+}):	13.5	0.2
Iron (Fe^{2+}):	30.3	1.1
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	224	N/A

ND = Not Determined

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)**
80°F	15 psi	2.20	7.996	-0.91	0.000	-1.78	0.000	-2.02	0.000
96°F	24 psi	2.07	7.978	-0.88	0.000	-1.78	0.000	-1.96	0.000
111°F	34 psi	1.96	7.957	-0.80	0.000	-1.78	0.000	-1.89	0.000
127°F	43 psi	1.86	7.935	-0.71	0.000	-1.77	0.000	-1.81	0.000
142°F	53 psi	1.78	7.912	-0.62	0.000	-1.76	0.000	-1.72	0.000
158°F	62 psi	1.72	7.891	-0.51	0.000	-1.74	0.000	-1.62	0.000
173°F	72 psi	1.67	7.871	-0.39	0.000	-1.72	0.000	-1.52	0.000
189°F	81 psi	1.63	7.853	-0.27	0.000	-1.69	0.000	-1.42	0.000
204°F	91 psi	1.60	7.839	-0.14	0.000	-1.66	0.000	-1.30	0.000
220°F	100 psi	1.57	7.828	-0.02	0.000	-1.63	0.000	-1.19	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)**
80°F	15 psi	-1.05	0.000	-3.07	0.000	-9.13	0.000	0.49	13.779
96°F	24 psi	-1.05	0.000	-3.09	0.000	-9.19	0.000	0.58	15.162
111°F	34 psi	-1.04	0.000	-3.11	0.000	-9.19	0.000	0.70	16.698
127°F	43 psi	-1.02	0.000	-3.12	0.000	-9.14	0.000	0.82	17.975
142°F	53 psi	-1.00	0.000	-3.12	0.000	-9.09	0.000	0.95	18.958
158°F	62 psi	-0.97	0.000	-3.12	0.000	-9.01	0.000	1.08	19.703
173°F	72 psi	-0.94	0.000	-3.12	0.000	-8.91	0.000	1.21	20.292
189°F	81 psi	-0.89	0.000	-3.12	0.000	-8.81	0.000	1.34	20.714
204°F	91 psi	-0.84	0.000	-3.11	0.000	-8.71	0.000	1.46	21.019
220°F	100 psi	-0.79	0.000	-3.10	0.000	-8.60	0.000	1.58	21.242

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.

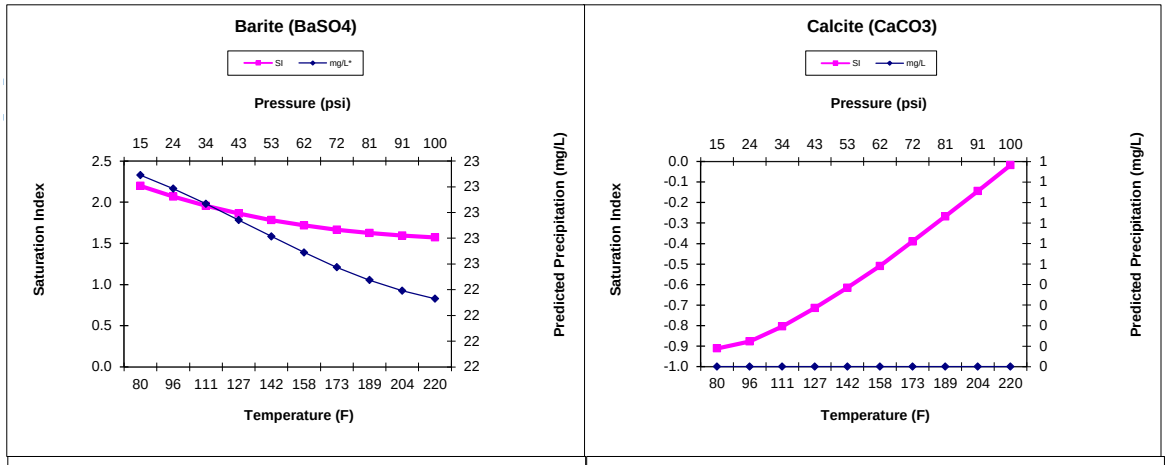
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

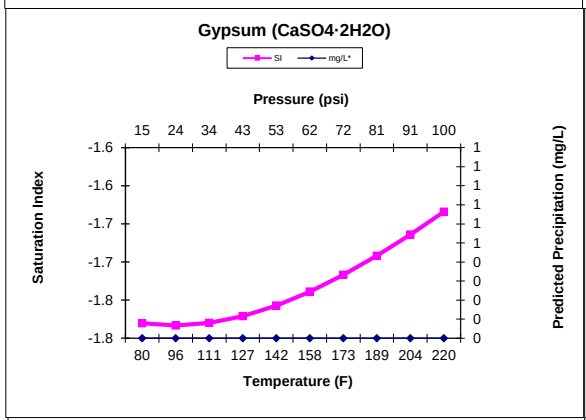
Calculate

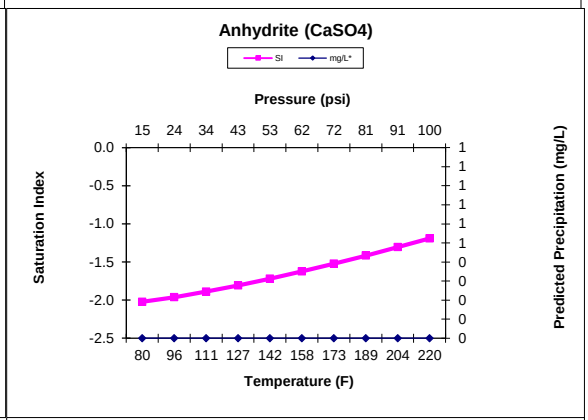
ScaleSoftPitzer™ SSP2010

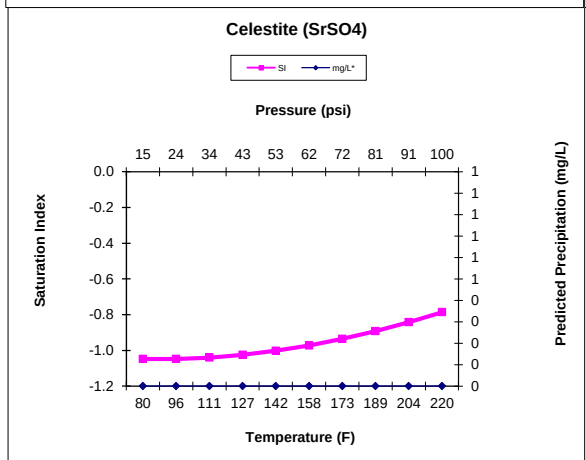
Comments: _____

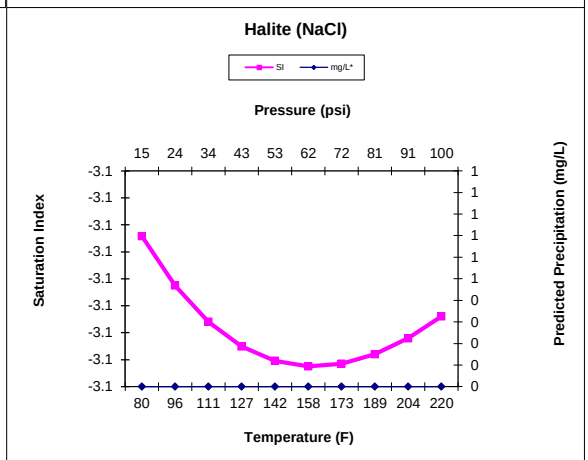
Sample ID: 41212 CAERUS OIL & GAS, Chevron, 42-8 Separator

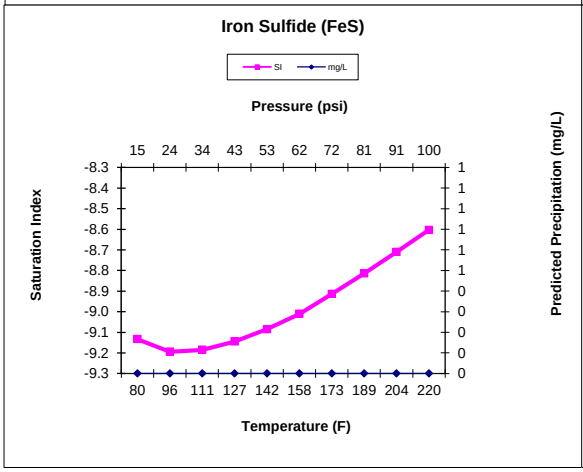


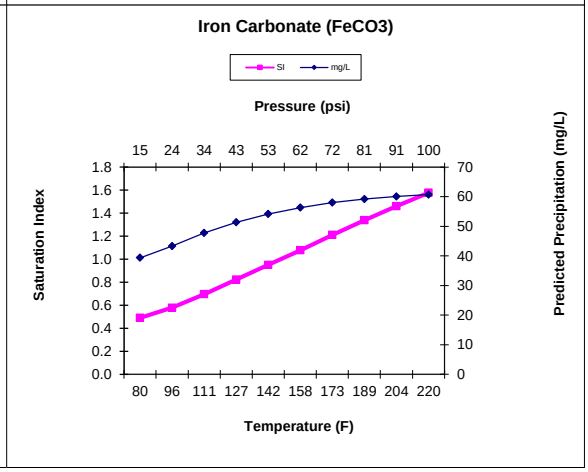












Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42A-8D Separator
District:	Four Corners	**Sample ID:**	201201036449
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 42A-8D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	390.0	6.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	610.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	8601
Density/Specific Gravity (g/cm^3):	1.0032
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	4700.0	132.6
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	3196.0	139.1
Potassium (K^+):	12.0	0.3
Magnesium (Mg^{2+}):	4.4	0.4
Calcium (Ca^{2+}):	35.9	1.8
Strontium (Sr^{2+}):	6.7	0.2
Barium (Ba^{2+}):	30.3	0.4
Iron (Fe^{2+}):	25.6	0.9
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	137	N/A

ND = Not Determined

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)**
80°F	15 psi	2.49	17.940	-1.44	0.000	-2.16	0.000	-2.41	0.000
96°F	24 psi	2.36	17.917	-1.41	0.000	-2.17	0.000	-2.35	0.000
111°F	34 psi	2.25	17.891	-1.33	0.000	-2.16	0.000	-2.27	0.000
127°F	43 psi	2.15	17.864	-1.24	0.000	-2.15	0.000	-2.19	0.000
142°F	53 psi	2.08	17.837	-1.14	0.000	-2.13	0.000	-2.10	0.000
158°F	62 psi	2.02	17.812	-1.03	0.000	-2.11	0.000	-2.00	0.000
173°F	72 psi	1.97	17.789	-0.91	0.000	-2.09	0.000	-1.89	0.000
189°F	81 psi	1.93	17.770	-0.78	0.000	-2.06	0.000	-1.78	0.000
204°F	91 psi	1.91	17.756	-0.65	0.000	-2.02	0.000	-1.67	0.000
220°F	100 psi	1.89	17.746	-0.52	0.000	-1.99	0.000	-1.55	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)**
80°F	15 psi	-1.21	0.000	-3.56	0.000	0.83	2.646	0.18	5.182
96°F	24 psi	-1.21	0.000	-3.58	0.000	0.77	2.567	0.27	7.309
111°F	34 psi	-1.20	0.000	-3.60	0.000	0.79	2.591	0.39	9.711
127°F	43 psi	-1.18	0.000	-3.60	0.000	0.84	2.661	0.52	11.777
142°F	53 psi	-1.15	0.000	-3.61	0.000	0.90	2.747	0.66	13.416
158°F	62 psi	-1.12	0.000	-3.61	0.000	0.98	2.835	0.79	14.674
173°F	72 psi	-1.07	0.000	-3.61	0.000	1.09	2.931	0.93	15.696
189°F	81 psi	-1.02	0.000	-3.60	0.000	1.20	3.010	1.06	16.437
204°F	91 psi	-0.96	0.000	-3.60	0.000	1.32	3.073	1.19	16.977
220°F	100 psi	-0.90	0.000	-3.59	0.000	1.43	3.124	1.31	17.371

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.

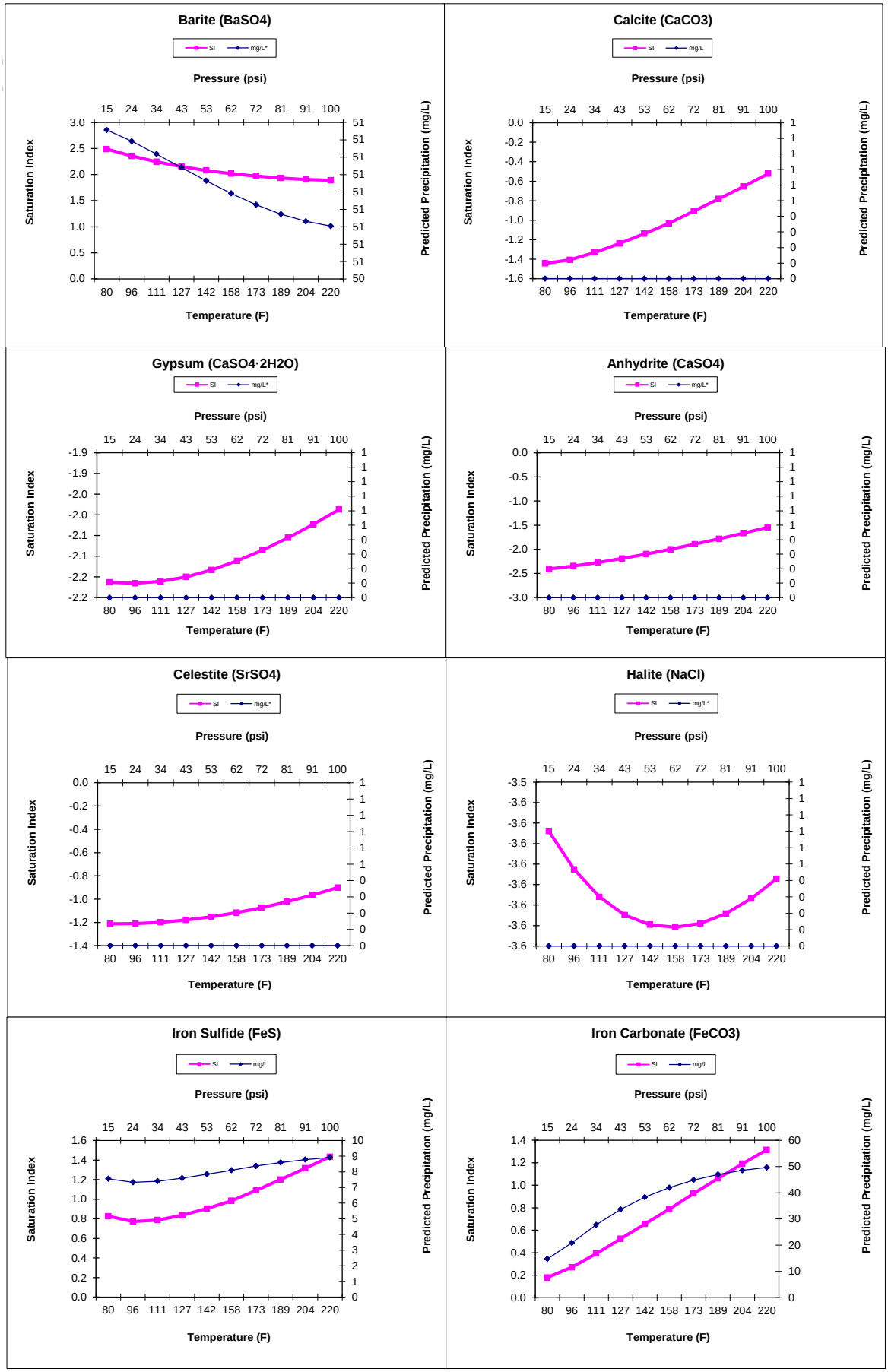
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 42A-8D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42D-8 Separator
District:	Four Corners	**Sample ID:**	201201036466
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 42D-8 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	274.0	4.5
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	350.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17624
Density/Specific Gravity (g/cm³):	1.0094
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10300.0	290.6
Sulfate (SO_4^{2-}):	250.0	5.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6674.0	290.4
Potassium (K^+):	16.3	0.4
Magnesium (Mg^{2+}):	4.1	0.3
Calcium (Ca^{2+}):	61.1	3.0
Strontium (Sr^{2+}):	5.5	0.1
Barium (Ba^{2+}):	8.6	0.1
Iron (Fe^{2+}):	30.2	1.1
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	182	N/A

ND = Not Determined

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)**
80°F	15 psi	1.76	5.036	-1.27	0.000	-2.09	0.000	-2.33	0.000
96°F	24 psi	1.63	5.004	-1.23	0.000	-2.09	0.000	-2.27	0.000
111°F	34 psi	1.52	4.968	-1.16	0.000	-2.09	0.000	-2.20	0.000
127°F	43 psi	1.42	4.929	-1.07	0.000	-2.08	0.000	-2.12	0.000
142°F	53 psi	1.34	4.890	-0.97	0.000	-2.07	0.000	-2.03	0.000
158°F	62 psi	1.28	4.851	-0.87	0.000	-2.05	0.000	-1.94	0.000
173°F	72 psi	1.23	4.816	-0.75	0.000	-2.03	0.000	-1.84	0.000
189°F	81 psi	1.18	4.784	-0.63	0.000	-2.01	0.000	-1.73	0.000
204°F	91 psi	1.15	4.758	-0.51	0.000	-1.98	0.000	-1.62	0.000
220°F	100 psi	1.13	4.738	-0.38	0.000	-1.95	0.000	-1.51	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)**
80°F	15 psi	-1.45	0.000	-2.95	0.000	-9.01	0.000	0.16	4.780
96°F	24 psi	-1.45	0.000	-2.97	0.000	-9.06	0.000	0.25	7.140
111°F	34 psi	-1.44	0.000	-2.99	0.000	-9.06	0.000	0.37	9.840
127°F	43 psi	-1.43	0.000	-2.99	0.000	-9.02	0.000	0.50	12.261
142°F	53 psi	-1.41	0.000	-3.00	0.000	-8.96	0.000	0.62	14.276
158°F	62 psi	-1.38	0.000	-3.00	0.000	-8.90	0.000	0.75	15.896
173°F	72 psi	-1.34	0.000	-3.00	0.000	-8.81	0.000	0.87	17.234
189°F	81 psi	-1.30	0.000	-3.00	0.000	-8.72	0.000	1.00	18.300
204°F	91 psi	-1.25	0.000	-2.99	0.000	-8.62	0.000	1.12	19.109
220°F	100 psi	-1.20	0.000	-2.98	0.000	-8.52	0.000	1.23	19.723

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.

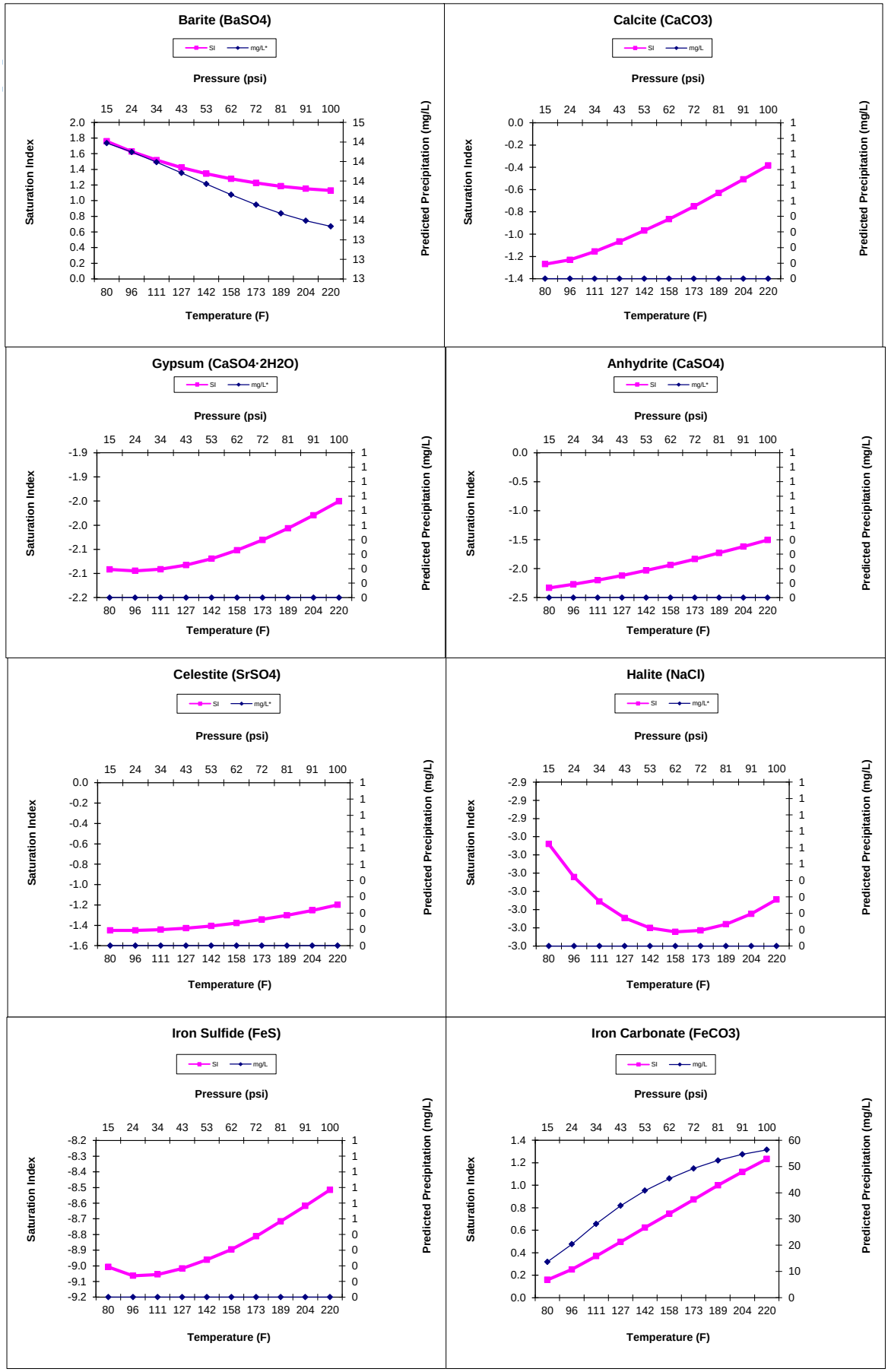
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 42D-8 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44D-5D Separator
District:	Four Corners	**Sample ID:**	201201036451
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 44D-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	463.0	7.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	460.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16042
Density/Specific Gravity (g/cm³):	1.0083
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9300.0	262.3
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	6026.0	262.2
Potassium (K^+):	34.8	0.9
Magnesium (Mg^{2+}):	9.6	0.8
Calcium (Ca^{2+}):	78.5	3.9
Strontium (Sr^{2+}):	7.9	0.2
Barium (Ba^{2+}):	17.5	0.3
Iron (Fe^{2+}):	4.3	0.2
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	258	N/A

ND = Not Determined

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)**
80°F	15 psi	1.71	10.191	-0.92	0.000	-2.34	0.000	-2.58	0.000
96°F	24 psi	1.58	10.111	-0.88	0.000	-2.34	0.000	-2.52	0.000
111°F	34 psi	1.47	10.021	-0.80	0.000	-2.34	0.000	-2.45	0.000
127°F	43 psi	1.38	9.924	-0.71	0.000	-2.33	0.000	-2.37	0.000
142°F	53 psi	1.30	9.827	-0.62	0.000	-2.32	0.000	-2.28	0.000
158°F	62 psi	1.23	9.732	-0.51	0.000	-2.30	0.000	-2.18	0.000
173°F	72 psi	1.18	9.645	-0.40	0.000	-2.28	0.000	-2.08	0.000
189°F	81 psi	1.14	9.569	-0.27	0.000	-2.25	0.000	-1.97	0.000
204°F	91 psi	1.11	9.507	-0.15	0.000	-2.22	0.000	-1.86	0.000
220°F	100 psi	1.09	9.460	-0.02	0.000	-2.19	0.000	-1.75	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)**
80°F	15 psi	-1.66	0.000	-3.04	0.000	-9.82	0.000	-0.42	0.000
96°F	24 psi	-1.66	0.000	-3.05	0.000	-9.88	0.000	-0.33	0.000
111°F	34 psi	-1.65	0.000	-3.07	0.000	-9.87	0.000	-0.21	0.000
127°F	43 psi	-1.63	0.000	-3.08	0.000	-9.83	0.000	-0.08	0.000
142°F	53 psi	-1.61	0.000	-3.08	0.000	-9.77	0.000	0.04	0.297
158°F	62 psi	-1.58	0.000	-3.08	0.000	-9.71	0.000	0.17	0.988
173°F	72 psi	-1.55	0.000	-3.08	0.000	-9.62	0.000	0.30	1.535
189°F	81 psi	-1.50	0.000	-3.08	0.000	-9.52	0.000	0.43	1.938
204°F	91 psi	-1.45	0.000	-3.07	0.000	-9.42	0.000	0.55	2.231
220°F	100 psi	-1.40	0.000	-3.07	0.000	-9.32	0.000	0.67	2.445

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.

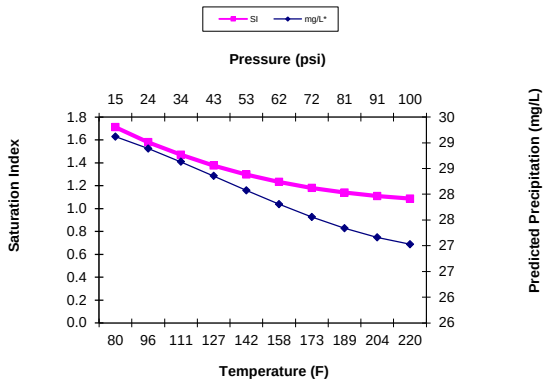
Calculate

ScaleSoftPitzer™ SSP2010

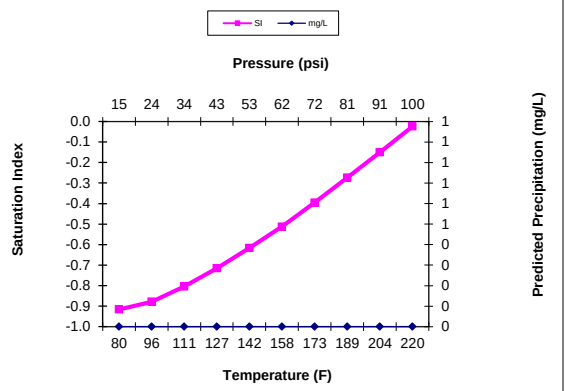
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 44D-5D Separator

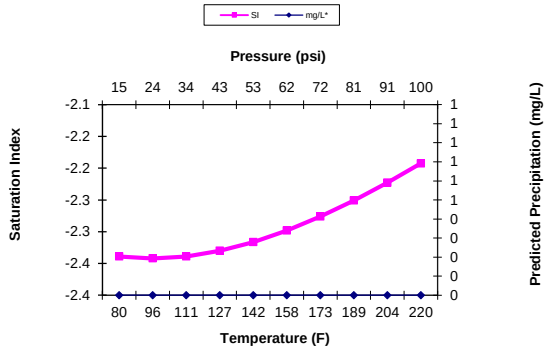
Barite (BaSO4)



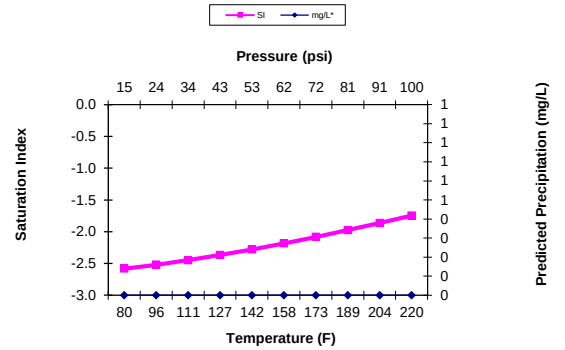
Calcite (CaCO3)



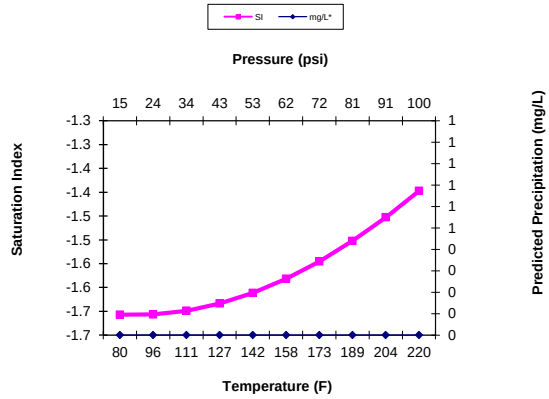
Gypsum (CaSO4·2H2O)



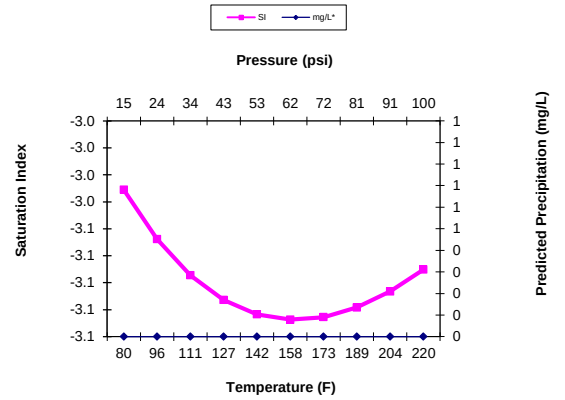
Anhydrite (CaSO4)



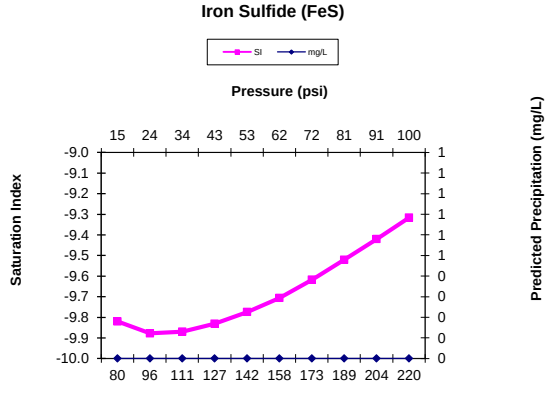
Celestite (SrSO4)



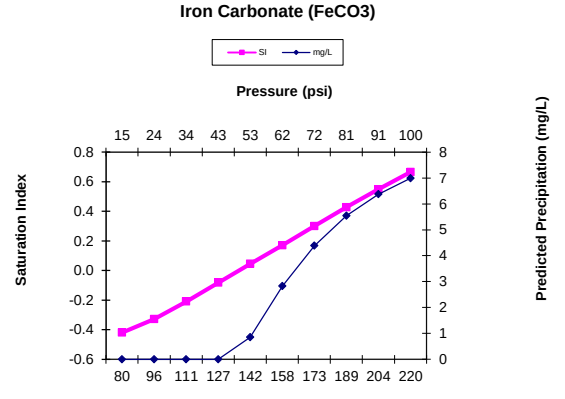
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8B-5D Separator
District:	Four Corners	**Sample ID:**	201201036463
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8B-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	341.0	5.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	130.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19614
Density/Specific Gravity (g/cm^3):	1.0108
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11500.0	324.4
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7452.0	324.3
Potassium (K^+):	52.4	1.3
Magnesium (Mg^{2+}):	12.1	1.0
Calcium (Ca^{2+}):	153.7	7.7
Strontium (Sr^{2+}):	15.3	0.3
Barium (Ba^{2+}):	30.2	0.4
Iron (Fe^{2+}):	7.2	0.3
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	474	N/A

ND = Not Determined

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)**
80°F	15 psi	1.56	17.126	-0.49	0.000	-2.43	0.000	-2.67	0.000
96°F	24 psi	1.43	16.848	-0.45	0.000	-2.43	0.000	-2.61	0.000
111°F	34 psi	1.32	16.541	-0.38	0.000	-2.43	0.000	-2.54	0.000
127°F	43 psi	1.22	16.218	-0.29	0.000	-2.42	0.000	-2.46	0.000
142°F	53 psi	1.14	15.895	-0.19	0.000	-2.41	0.000	-2.37	0.000
158°F	62 psi	1.08	15.585	-0.09	0.000	-2.39	0.000	-2.28	0.000
173°F	72 psi	1.02	15.301	0.02	1.296	-2.37	0.000	-2.18	0.000
189°F	81 psi	0.98	15.053	0.14	9.216	-2.35	0.000	-2.07	0.000
204°F	91 psi	0.95	14.847	0.26	16.778	-2.32	0.000	-1.96	0.000
220°F	100 psi	0.92	14.686	0.38	23.970	-2.30	0.000	-1.85	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)**
80°F	15 psi	-1.75	0.000	-2.86	0.000	0.85	1.382	-0.08	0.000
96°F	24 psi	-1.75	0.000	-2.88	0.000	0.79	1.330	0.01	0.113
111°F	34 psi	-1.74	0.000	-2.90	0.000	0.79	1.328	0.13	1.239
127°F	43 psi	-1.73	0.000	-2.91	0.000	0.81	1.351	0.25	2.178
142°F	53 psi	-1.71	0.000	-2.91	0.000	0.85	1.387	0.38	2.908
158°F	62 psi	-1.68	0.000	-2.91	0.000	0.91	1.428	0.50	3.459
173°F	72 psi	-1.65	0.000	-2.91	0.000	0.98	1.475	0.62	3.888
189°F	81 psi	-1.61	0.000	-2.91	0.000	1.06	1.523	0.75	4.219
204°F	91 psi	-1.56	0.000	-2.90	0.000	1.14	1.567	0.86	4.461
220°F	100 psi	-1.51	0.000	-2.90	0.000	1.23	1.606	0.98	4.639

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.

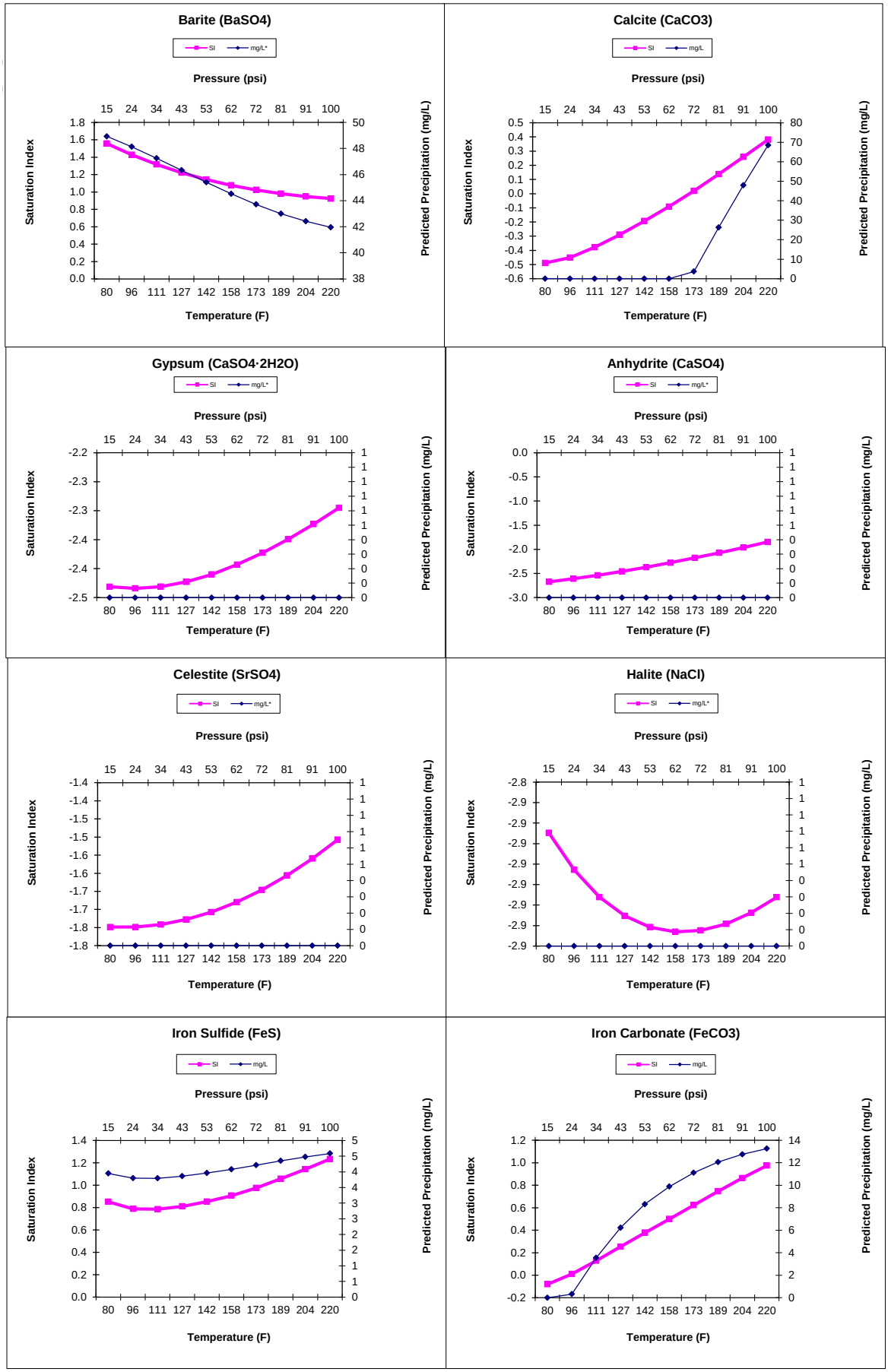
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8B-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8C-5D Separator
District:	Four Corners	**Sample ID:**	201201036464
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8C-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	329.0	5.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	65.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24726
Density/Specific Gravity (g/cm³):	1.0143
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14600.0	411.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9461.0	411.7
Potassium (K^+):	47.8	1.2
Magnesium (Mg^{2+}):	15.1	1.2
Calcium (Ca^{2+}):	163.7	8.2
Strontium (Sr^{2+}):	16.9	0.4
Barium (Ba^{2+}):	36.2	0.5
Iron (Fe^{2+}):	5.9	0.2
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	517	N/A

ND = Not Determined

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)**
80°F	15 psi	1.54	20.315	-0.71	0.000	-2.49	0.000	-2.73	0.000
96°F	24 psi	1.41	19.928	-0.67	0.000	-2.49	0.000	-2.67	0.000
111°F	34 psi	1.30	19.504	-0.60	0.000	-2.49	0.000	-2.60	0.000
127°F	43 psi	1.20	19.061	-0.51	0.000	-2.48	0.000	-2.52	0.000
142°F	53 psi	1.12	18.618	-0.41	0.000	-2.47	0.000	-2.43	0.000
158°F	62 psi	1.05	18.194	-0.31	0.000	-2.46	0.000	-2.34	0.000
173°F	72 psi	1.00	17.803	-0.21	0.000	-2.44	0.000	-2.24	0.000
189°F	81 psi	0.95	17.458	-0.09	0.000	-2.42	0.000	-2.14	0.000
204°F	91 psi	0.92	17.167	0.03	2.186	-2.39	0.000	-2.03	0.000
220°F	100 psi	0.89	16.932	0.15	10.439	-2.37	0.000	-1.92	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)**
80°F	15 psi	-1.79	0.000	-2.67	0.000	0.60	1.507	-0.42	0.000
96°F	24 psi	-1.79	0.000	-2.69	0.000	0.54	1.397	-0.34	0.000
111°F	34 psi	-1.78	0.000	-2.70	0.000	0.55	1.401	-0.22	0.000
127°F	43 psi	-1.77	0.000	-2.71	0.000	0.58	1.458	-0.10	0.000
142°F	53 psi	-1.75	0.000	-2.72	0.000	0.62	1.543	0.03	0.227
158°F	62 psi	-1.73	0.000	-2.72	0.000	0.68	1.641	0.14	1.135
173°F	72 psi	-1.70	0.000	-2.72	0.000	0.75	1.756	0.26	1.857
189°F	81 psi	-1.66	0.000	-2.72	0.000	0.84	1.879	0.38	2.418
204°F	91 psi	-1.62	0.000	-2.71	0.000	0.93	1.995	0.50	2.833
220°F	100 psi	-1.57	0.000	-2.70	0.000	1.02	2.103	0.61	3.144

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.

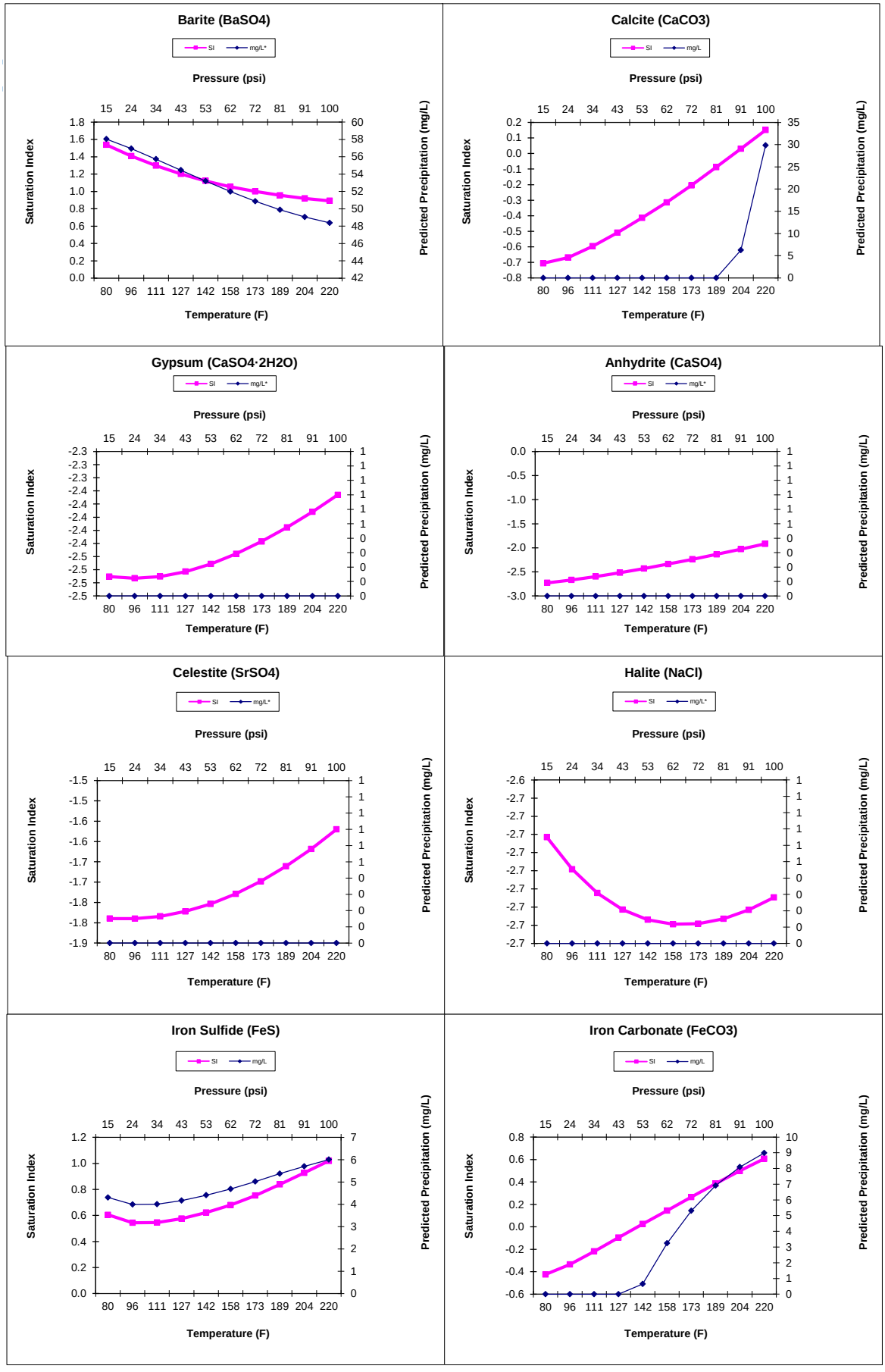
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8C-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8D-5D Separator
District:	Four Corners	**Sample ID:**	201201036455
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8D-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	219.0	3.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	200.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	29602
Density/Specific Gravity (g/cm³):	1.0176
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	17600.0	496.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.98	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	11405.0	496.3
Potassium (K^+):	46.9	1.2
Magnesium (Mg^{2+}):	17.6	1.4
Calcium (Ca^{2+}):	210.6	10.5
Strontium (Sr^{2+}):	15.8	0.4
Barium (Ba^{2+}):	16.5	0.2
Iron (Fe^{2+}):	19.9	0.7
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	629	N/A

ND = Not Determined

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)**
80°F	15 psi	1.12	8.889	-0.99	0.000	-2.45	0.000	-2.69	0.000
96°F	24 psi	0.99	8.573	-0.96	0.000	-2.46	0.000	-2.63	0.000
111°F	34 psi	0.88	8.222	-0.88	0.000	-2.45	0.000	-2.56	0.000
127°F	43 psi	0.78	7.847	-0.80	0.000	-2.45	0.000	-2.48	0.000
142°F	53 psi	0.70	7.464	-0.70	0.000	-2.44	0.000	-2.39	0.000
158°F	62 psi	0.63	7.090	-0.61	0.000	-2.42	0.000	-2.30	0.000
173°F	72 psi	0.58	6.738	-0.50	0.000	-2.40	0.000	-2.20	0.000
189°F	81 psi	0.53	6.419	-0.38	0.000	-2.38	0.000	-2.10	0.000
204°F	91 psi	0.49	6.142	-0.27	0.000	-2.36	0.000	-2.00	0.000
220°F	100 psi	0.46	5.912	-0.15	0.000	-2.34	0.000	-1.89	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)**
80°F	15 psi	-1.89	0.000	-2.52	0.000	0.78	2.431	-0.31	0.000
96°F	24 psi	-1.89	0.000	-2.54	0.000	0.72	2.337	-0.22	0.000
111°F	34 psi	-1.88	0.000	-2.55	0.000	0.73	2.348	-0.10	0.000
127°F	43 psi	-1.87	0.000	-2.56	0.000	0.76	2.407	0.02	0.368
142°F	53 psi	-1.86	0.000	-2.56	0.000	0.81	2.487	0.14	2.887
158°F	62 psi	-1.83	0.000	-2.57	0.000	0.87	2.574	0.25	4.982
173°F	72 psi	-1.81	0.000	-2.57	0.000	0.95	2.669	0.37	6.780
189°F	81 psi	-1.77	0.000	-2.56	0.000	1.04	2.761	0.49	8.280
204°F	91 psi	-1.73	0.000	-2.56	0.000	1.13	2.841	0.60	9.464
220°F	100 psi	-1.69	0.000	-2.55	0.000	1.22	2.908	0.70	10.398

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.

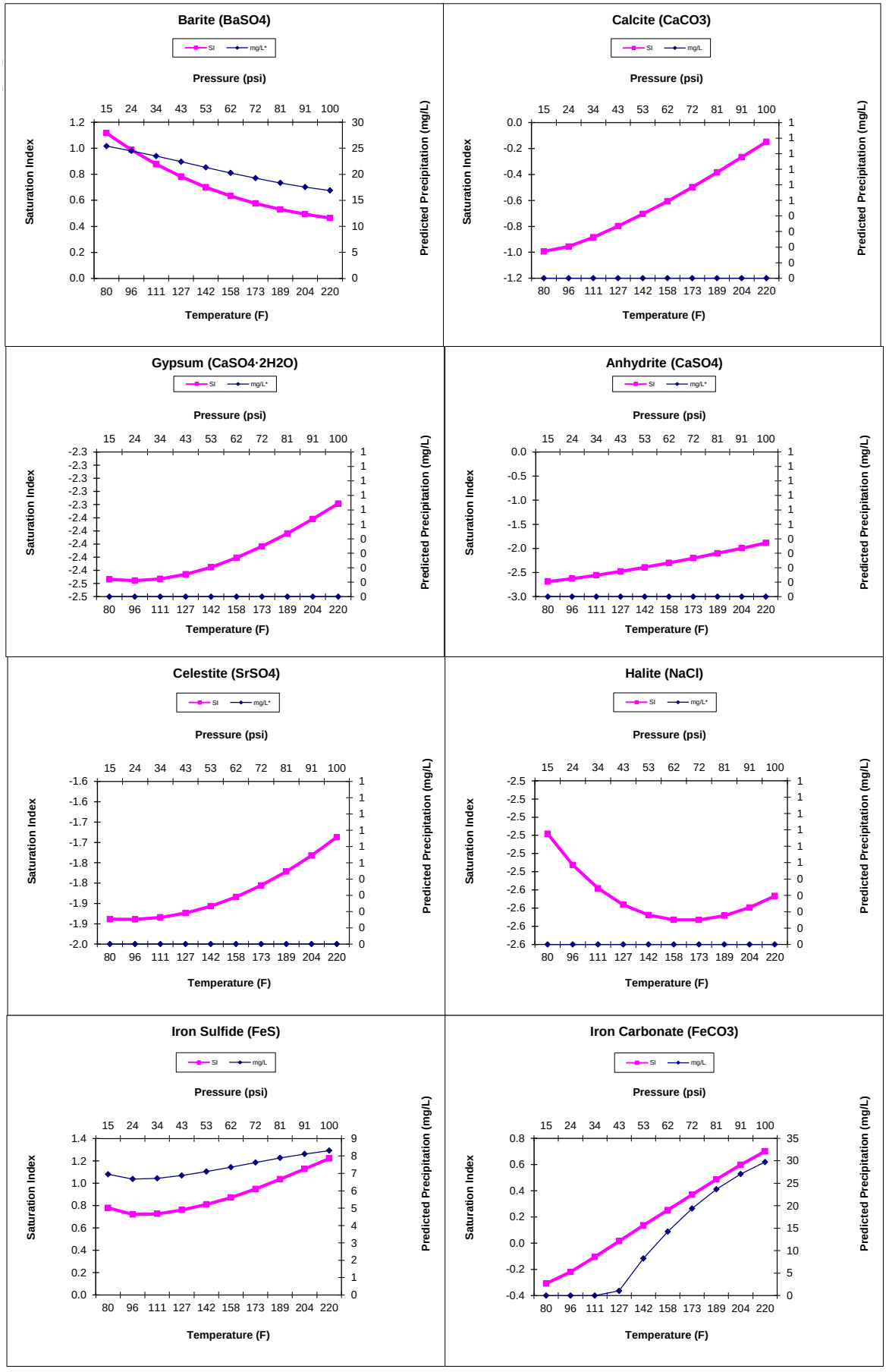
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8D-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8E-5D Separator
District:	Four Corners	**Sample ID:**	201201036456
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8E-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	317.0	5.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17264
Density/Specific Gravity (g/cm^3):	1.0093
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10000.0	282.1
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.97

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6480.0	282.0
Potassium (K^+):	55.7	1.4
Magnesium (Mg^{2+}):	14.2	1.2
Calcium (Ca^{2+}):	257.6	12.9
Strontium (Sr^{2+}):	16.0	0.4
Barium (Ba^{2+}):	7.1	0.1
Iron (Fe^{2+}):	16.2	0.6
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	726	N/A

ND = Not Determined

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)**
80°F	15 psi	1.27	3.970	-0.68	0.000	-1.87	0.000	-2.11	0.000
96°F	24 psi	1.14	3.888	-0.64	0.000	-1.87	0.000	-2.05	0.000
111°F	34 psi	1.03	3.796	-0.57	0.000	-1.87	0.000	-1.98	0.000
127°F	43 psi	0.94	3.698	-0.48	0.000	-1.86	0.000	-1.90	0.000
142°F	53 psi	0.86	3.597	-0.39	0.000	-1.85	0.000	-1.81	0.000
158°F	62 psi	0.79	3.500	-0.28	0.000	-1.83	0.000	-1.71	0.000
173°F	72 psi	0.74	3.410	-0.17	0.000	-1.81	0.000	-1.61	0.000
189°F	81 psi	0.70	3.330	-0.05	0.000	-1.78	0.000	-1.51	0.000
204°F	91 psi	0.67	3.263	0.08	5.896	-1.76	0.000	-1.40	0.000
220°F	100 psi	0.64	3.212	0.20	14.957	-1.73	0.000	-1.28	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)**
80°F	15 psi	-1.39	0.000	-2.98	0.000	0.55	1.388	-0.14	0.000
96°F	24 psi	-1.39	0.000	-3.00	0.000	0.49	1.299	-0.05	0.000
111°F	34 psi	-1.38	0.000	-3.01	0.000	0.50	1.316	0.07	1.359
127°F	43 psi	-1.37	0.000	-3.02	0.000	0.54	1.381	0.19	3.599
142°F	53 psi	-1.35	0.000	-3.03	0.000	0.60	1.467	0.32	5.414
158°F	62 psi	-1.32	0.000	-3.03	0.000	0.67	1.557	0.44	6.836
173°F	72 psi	-1.28	0.000	-3.03	0.000	0.76	1.656	0.57	7.997
189°F	81 psi	-1.24	0.000	-3.02	0.000	0.86	1.747	0.69	8.889
204°F	91 psi	-1.19	0.000	-3.02	0.000	0.96	1.824	0.81	9.553
220°F	100 psi	-1.14	0.000	-3.01	0.000	1.07	1.887	0.93	10.049

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.

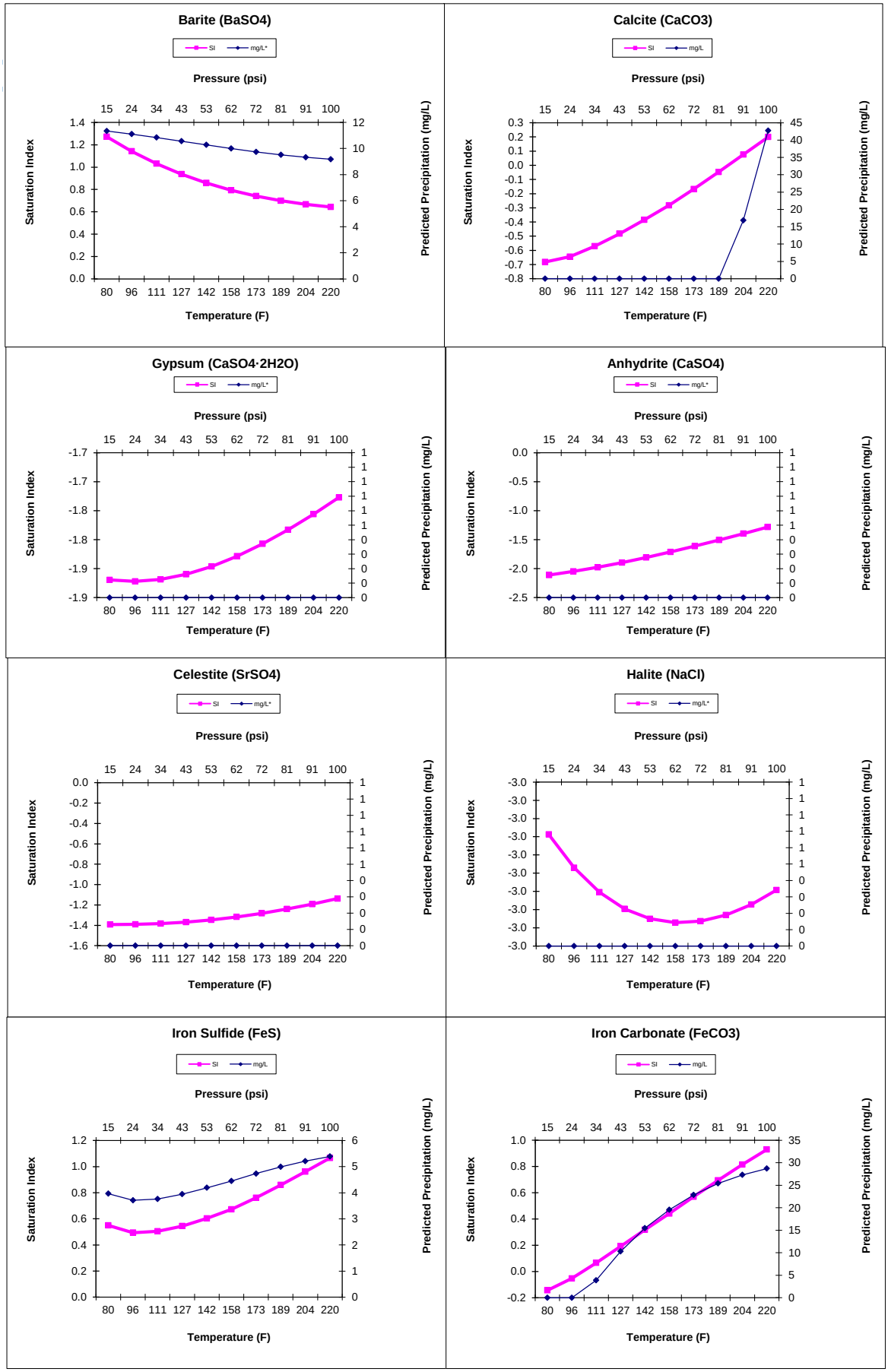
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8E-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8F-5D Separator
District:	Four Corners	**Sample ID:**	201201036457
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8F-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	317.0	5.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21848
Density/Specific Gravity (g/cm³):	1.0124
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12800.0	361.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.97	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8294.0	360.9
Potassium (K^+):	40.5	1.0
Magnesium (Mg^{2+}):	15.3	1.3
Calcium (Ca^{2+}):	280.3	14.0
Strontium (Sr^{2+}):	19.1	0.4
Barium (Ba^{2+}):	22.9	0.3
Iron (Fe^{2+}):	8.4	0.3
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	802	N/A

ND = Not Determined

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)**
80°F	15 psi	1.38	12.801	-0.68	0.000	-2.22	0.000	-2.46	0.000
96°F	24 psi	1.26	12.532	-0.64	0.000	-2.22	0.000	-2.40	0.000
111°F	34 psi	1.14	12.233	-0.57	0.000	-2.22	0.000	-2.32	0.000
127°F	43 psi	1.05	11.917	-0.48	0.000	-2.21	0.000	-2.24	0.000
142°F	53 psi	0.97	11.598	-0.38	0.000	-2.20	0.000	-2.16	0.000
158°F	62 psi	0.90	11.291	-0.28	0.000	-2.18	0.000	-2.06	0.000
173°F	72 psi	0.85	11.006	-0.17	0.000	-2.16	0.000	-1.96	0.000
189°F	81 psi	0.81	10.753	-0.05	0.000	-2.14	0.000	-1.86	0.000
204°F	91 psi	0.77	10.540	0.07	5.528	-2.11	0.000	-1.75	0.000
220°F	100 psi	0.75	10.370	0.19	14.530	-2.09	0.000	-1.64	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)**
80°F	15 psi	-1.70	0.000	-2.78	0.000	0.25	0.690	-0.47	0.000
96°F	24 psi	-1.70	0.000	-2.80	0.000	0.19	0.551	-0.38	0.000
111°F	34 psi	-1.69	0.000	-2.81	0.000	0.20	0.572	-0.26	0.000
127°F	43 psi	-1.68	0.000	-2.82	0.000	0.24	0.665	-0.14	0.000
142°F	53 psi	-1.66	0.000	-2.82	0.000	0.29	0.793	-0.01	0.000
158°F	62 psi	-1.63	0.000	-2.83	0.000	0.36	0.934	0.11	1.213
173°F	72 psi	-1.60	0.000	-2.83	0.000	0.44	1.098	0.23	2.342
189°F	81 psi	-1.56	0.000	-2.82	0.000	0.54	1.258	0.35	3.213
204°F	91 psi	-1.52	0.000	-2.82	0.000	0.64	1.401	0.47	3.863
220°F	100 psi	-1.47	0.000	-2.81	0.000	0.74	1.527	0.58	4.351

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.

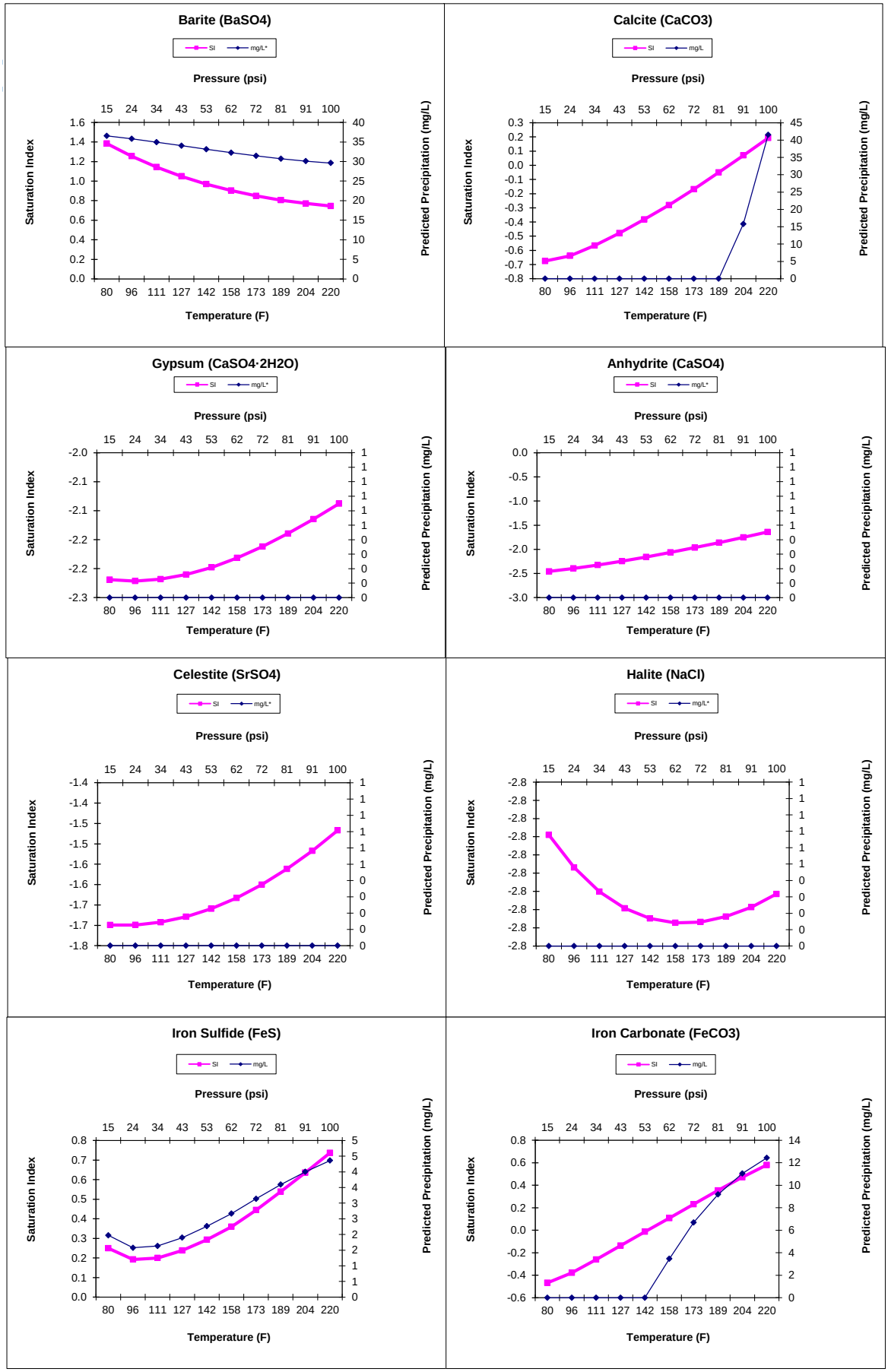
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8F-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8H-5D Separator
District:	Four Corners	**Sample ID:**	201201036458
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8H-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.8

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	244.0	4.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	70.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21790
Density/Specific Gravity (g/cm³):	1.0124
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12800.0	361.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.97

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8294.0	360.9
Potassium (K^+):	57.1	1.5
Magnesium (Mg^{2+}):	17.0	1.4
Calcium (Ca^{2+}):	295.0	14.7
Strontium (Sr^{2+}):	18.5	0.4
Barium (Ba^{2+}):	14.0	0.2
Iron (Fe^{2+}):	0.1	0.0
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	839	N/A

ND = Not Determined

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)**
80°F	15 psi	1.17	7.644	-0.27	0.000	-2.20	0.000	-2.44	0.000
96°F	24 psi	1.04	7.412	-0.23	0.000	-2.20	0.000	-2.38	0.000
111°F	34 psi	0.93	7.155	-0.16	0.000	-2.20	0.000	-2.30	0.000
127°F	43 psi	0.84	6.881	-0.07	0.000	-2.19	0.000	-2.22	0.000
142°F	53 psi	0.76	6.603	0.02	1.214	-2.18	0.000	-2.14	0.000
158°F	62 psi	0.69	6.334	0.12	6.519	-2.16	0.000	-2.04	0.000
173°F	72 psi	0.64	6.084	0.23	11.946	-2.14	0.000	-1.94	0.000
189°F	81 psi	0.59	5.861	0.35	17.495	-2.12	0.000	-1.84	0.000
204°F	91 psi	0.56	5.673	0.47	22.742	-2.09	0.000	-1.73	0.000
220°F	100 psi	0.53	5.522	0.59	27.672	-2.07	0.000	-1.62	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)**
80°F	15 psi	-1.71	0.000	-2.78	0.000	-0.84	0.000	-1.97	0.000
96°F	24 psi	-1.71	0.000	-2.80	0.000	-0.91	0.000	-1.88	0.000
111°F	34 psi	-1.71	0.000	-2.81	0.000	-0.92	0.000	-1.77	0.000
127°F	43 psi	-1.69	0.000	-2.82	0.000	-0.90	0.000	-1.64	0.000
142°F	53 psi	-1.67	0.000	-2.82	0.000	-0.86	0.000	-1.52	0.000
158°F	62 psi	-1.65	0.000	-2.83	0.000	-0.81	0.000	-1.40	0.000
173°F	72 psi	-1.61	0.000	-2.83	0.000	-0.75	0.000	-1.28	0.000
189°F	81 psi	-1.57	0.000	-2.82	0.000	-0.68	0.000	-1.16	0.000
204°F	91 psi	-1.53	0.000	-2.82	0.000	-0.60	0.000	-1.05	0.000
220°F	100 psi	-1.48	0.000	-2.81	0.000	-0.51	0.000	-0.94	0.000

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.

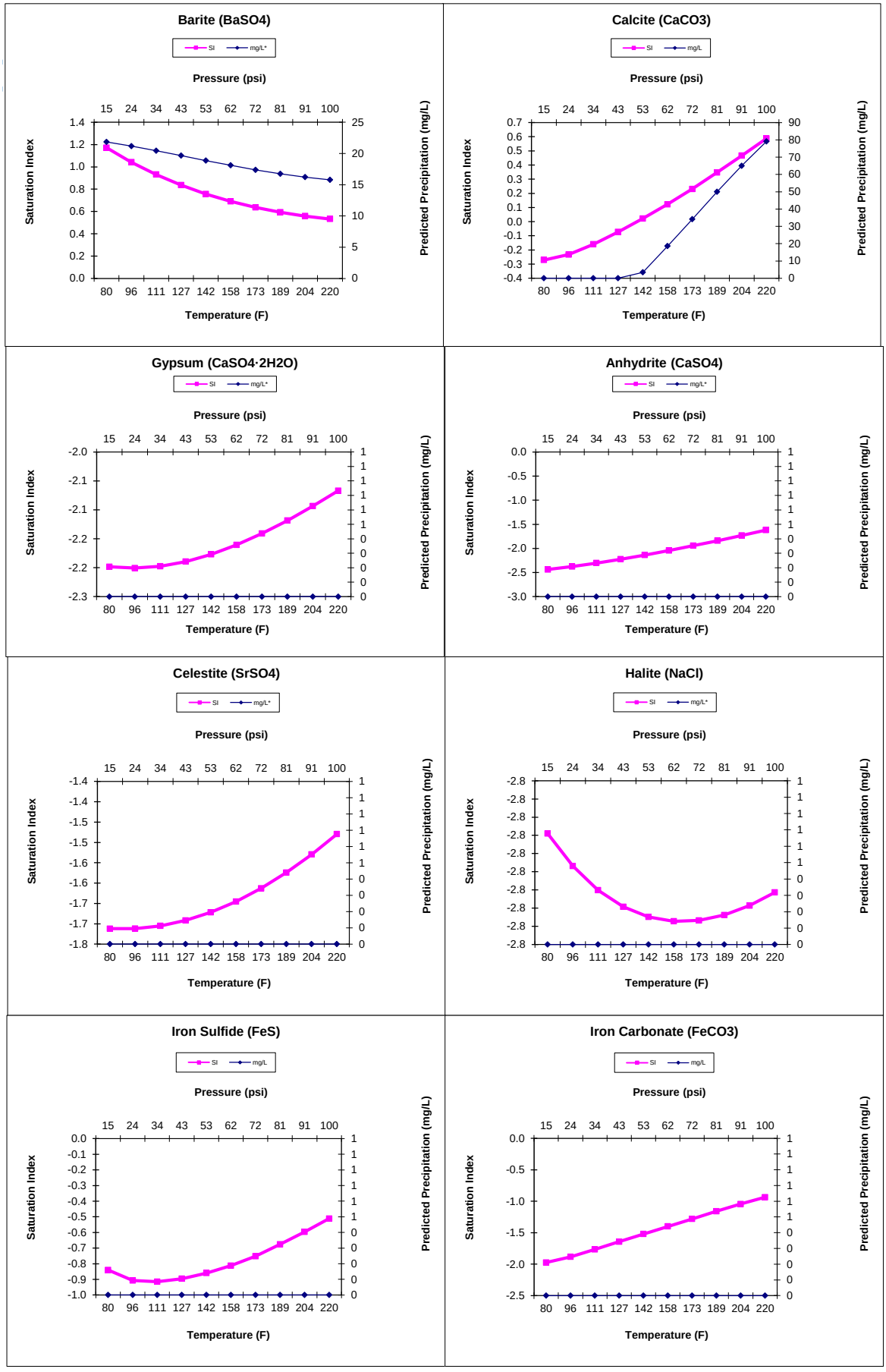
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8H-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8I-5D Separator
District:	Four Corners	**Sample ID:**	201201036468
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8I-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	512.0	8.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	27081
Density/Specific Gravity (g/cm³):	1.0159
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15900.0	448.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	10303.0	448.3
Potassium (K^+):	53.4	1.4
Magnesium (Mg^{2+}):	19.0	1.6
Calcium (Ca^{2+}):	177.9	8.9
Strontium (Sr^{2+}):	19.5	0.4
Barium (Ba^{2+}):	39.9	0.6
Iron (Fe^{2+}):	6.2	0.2
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	574	N/A

ND = Not Determined

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)**
80°F	15 psi	1.54	22.312	-0.48	0.000	-2.49	0.000	-2.72	0.000
96°F	24 psi	1.41	21.856	-0.45	0.000	-2.49	0.000	-2.66	0.000
111°F	34 psi	1.30	21.360	-0.37	0.000	-2.49	0.000	-2.59	0.000
127°F	43 psi	1.20	20.845	-0.29	0.000	-2.48	0.000	-2.51	0.000
142°F	53 psi	1.12	20.333	-0.19	0.000	-2.47	0.000	-2.42	0.000
158°F	62 psi	1.06	19.843	-0.09	0.000	-2.45	0.000	-2.33	0.000
173°F	72 psi	1.00	19.392	0.02	1.734	-2.43	0.000	-2.23	0.000
189°F	81 psi	0.96	18.993	0.13	13.136	-2.41	0.000	-2.13	0.000
204°F	91 psi	0.92	18.654	0.25	23.920	-2.39	0.000	-2.03	0.000
220°F	100 psi	0.89	18.378	0.37	34.104	-2.37	0.000	-1.92	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)**
80°F	15 psi	-1.76	0.000	-2.60	0.000	0.46	0.983	-0.21	0.000
96°F	24 psi	-1.76	0.000	-2.62	0.000	0.40	0.881	-0.12	0.000
111°F	34 psi	-1.76	0.000	-2.63	0.000	0.40	0.882	0.00	0.000
127°F	43 psi	-1.75	0.000	-2.64	0.000	0.43	0.932	0.12	1.013
142°F	53 psi	-1.73	0.000	-2.65	0.000	0.47	1.006	0.24	1.830
158°F	62 psi	-1.70	0.000	-2.65	0.000	0.53	1.091	0.36	2.445
173°F	72 psi	-1.67	0.000	-2.65	0.000	0.60	1.193	0.48	2.931
189°F	81 psi	-1.64	0.000	-2.65	0.000	0.69	1.297	0.60	3.298
204°F	91 psi	-1.60	0.000	-2.64	0.000	0.77	1.392	0.71	3.567
220°F	100 psi	-1.55	0.000	-2.64	0.000	0.87	1.479	0.82	3.766

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.

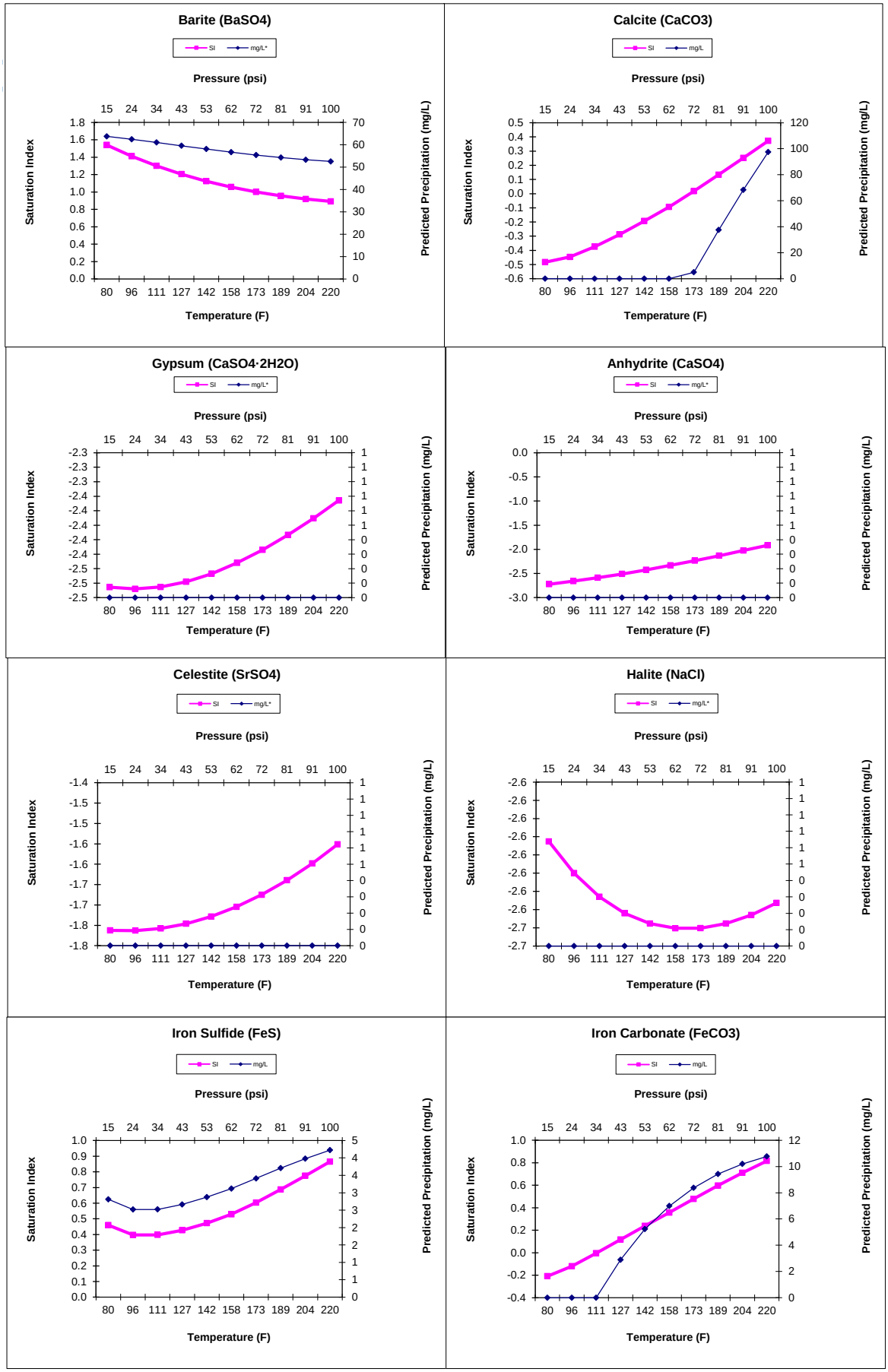
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8I-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8K-5D Separator
District:	Four Corners	**Sample ID:**	201201036470
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8K-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:	
pH at time of sampling:	6.6

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	85.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	25379
Density/Specific Gravity (g/cm³):	1.0147
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15000.0	423.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9720.0	423.0
Potassium (K^+):	46.0	1.2
Magnesium (Mg^{2+}):	14.3	1.2
Calcium (Ca^{2+}):	134.4	6.7
Strontium (Sr^{2+}):	14.2	0.3
Barium (Ba^{2+}):	32.4	0.5
Iron (Fe^{2+}):	1.4	0.1
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	435	N/A

ND = Not Determined

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)**
80°F	15 psi	1.48	18.149	-0.65	0.000	-2.58	0.000	-2.82	0.000
96°F	24 psi	1.35	17.785	-0.61	0.000	-2.59	0.000	-2.76	0.000
111°F	34 psi	1.24	17.384	-0.54	0.000	-2.58	0.000	-2.69	0.000
127°F	43 psi	1.14	16.963	-0.45	0.000	-2.58	0.000	-2.61	0.000
142°F	53 psi	1.06	16.541	-0.36	0.000	-2.56	0.000	-2.52	0.000
158°F	62 psi	1.00	16.134	-0.26	0.000	-2.55	0.000	-2.43	0.000
173°F	72 psi	0.94	15.758	-0.15	0.000	-2.53	0.000	-2.33	0.000
189°F	81 psi	0.90	15.424	-0.03	0.000	-2.51	0.000	-2.23	0.000
204°F	91 psi	0.86	15.141	0.09	6.030	-2.49	0.000	-2.12	0.000
220°F	100 psi	0.83	14.912	0.21	14.063	-2.46	0.000	-2.01	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)**
80°F	15 psi	-1.87	0.000	-2.65	0.000	0.28	0.327	-0.89	0.000
96°F	24 psi	-1.87	0.000	-2.67	0.000	0.21	0.265	-0.81	0.000
111°F	34 psi	-1.87	0.000	-2.68	0.000	0.21	0.263	-0.69	0.000
127°F	43 psi	-1.86	0.000	-2.69	0.000	0.24	0.289	-0.57	0.000
142°F	53 psi	-1.84	0.000	-2.69	0.000	0.28	0.330	-0.45	0.000
158°F	62 psi	-1.81	0.000	-2.70	0.000	0.33	0.377	-0.33	0.000
173°F	72 psi	-1.78	0.000	-2.70	0.000	0.40	0.430	-0.21	0.000
189°F	81 psi	-1.75	0.000	-2.69	0.000	0.48	0.486	-0.09	0.000
204°F	91 psi	-1.70	0.000	-2.69	0.000	0.57	0.535	0.02	0.055
220°F	100 psi	-1.66	0.000	-2.68	0.000	0.65	0.579	0.13	0.267

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.

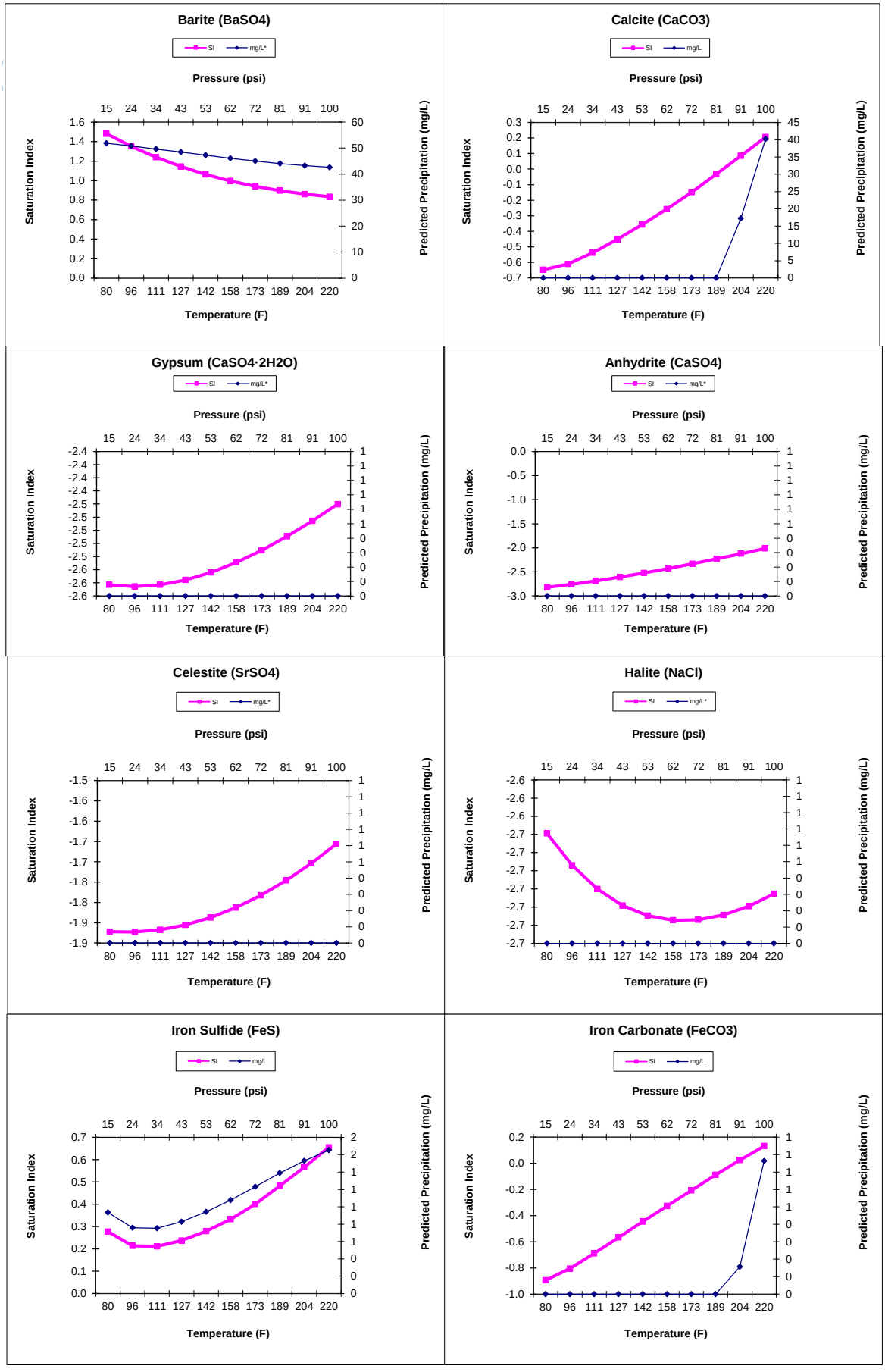
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8K-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	8L-5D Separator
District:	Four Corners	**Sample ID:**	201201036469
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 8L-5D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	4.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22287
Density/Specific Gravity (g/cm³):	1.0126
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13100.0	369.5
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8489.0	369.4
Potassium (K^+):	45.1	1.2
Magnesium (Mg^{2+}):	17.1	1.4
Calcium (Ca^{2+}):	186.3	9.3
Strontium (Sr^{2+}):	16.0	0.4
Barium (Ba^{2+}):	19.1	0.3
Iron (Fe^{2+}):	9.5	0.3
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	568	N/A

ND = Not Determined

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)**
80°F	15 psi	1.60	11.006	-0.77	0.000	-2.10	0.000	-2.34	0.000
96°F	24 psi	1.47	10.894	-0.74	0.000	-2.10	0.000	-2.27	0.000
111°F	34 psi	1.36	10.767	-0.67	0.000	-2.10	0.000	-2.20	0.000
127°F	43 psi	1.27	10.631	-0.58	0.000	-2.09	0.000	-2.12	0.000
142°F	53 psi	1.19	10.491	-0.49	0.000	-2.08	0.000	-2.04	0.000
158°F	62 psi	1.12	10.354	-0.39	0.000	-2.06	0.000	-1.94	0.000
173°F	72 psi	1.07	10.225	-0.28	0.000	-2.04	0.000	-1.84	0.000
189°F	81 psi	1.02	10.110	-0.16	0.000	-2.02	0.000	-1.74	0.000
204°F	91 psi	0.99	10.012	-0.04	0.000	-1.99	0.000	-1.63	0.000
220°F	100 psi	0.96	9.932	0.08	5.491	-1.97	0.000	-1.52	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)**
80°F	15 psi	-1.48	0.000	-2.76	0.000	1.12	4.353	-0.34	0.000
96°F	24 psi	-1.48	0.000	-2.78	0.000	1.07	4.253	-0.25	0.000
111°F	34 psi	-1.47	0.000	-2.79	0.000	1.07	4.264	-0.14	0.000
127°F	43 psi	-1.46	0.000	-2.80	0.000	1.10	4.325	-0.01	0.000
142°F	53 psi	-1.44	0.000	-2.81	0.000	1.15	4.410	0.11	1.352
158°F	62 psi	-1.41	0.000	-2.81	0.000	1.21	4.504	0.23	2.556
173°F	72 psi	-1.38	0.000	-2.81	0.000	1.29	4.609	0.35	3.532
189°F	81 psi	-1.34	0.000	-2.80	0.000	1.38	4.712	0.47	4.295
204°F	91 psi	-1.30	0.000	-2.80	0.000	1.47	4.802	0.58	4.865
220°F	100 psi	-1.25	0.000	-2.79	0.000	1.57	4.879	0.69	5.295

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.

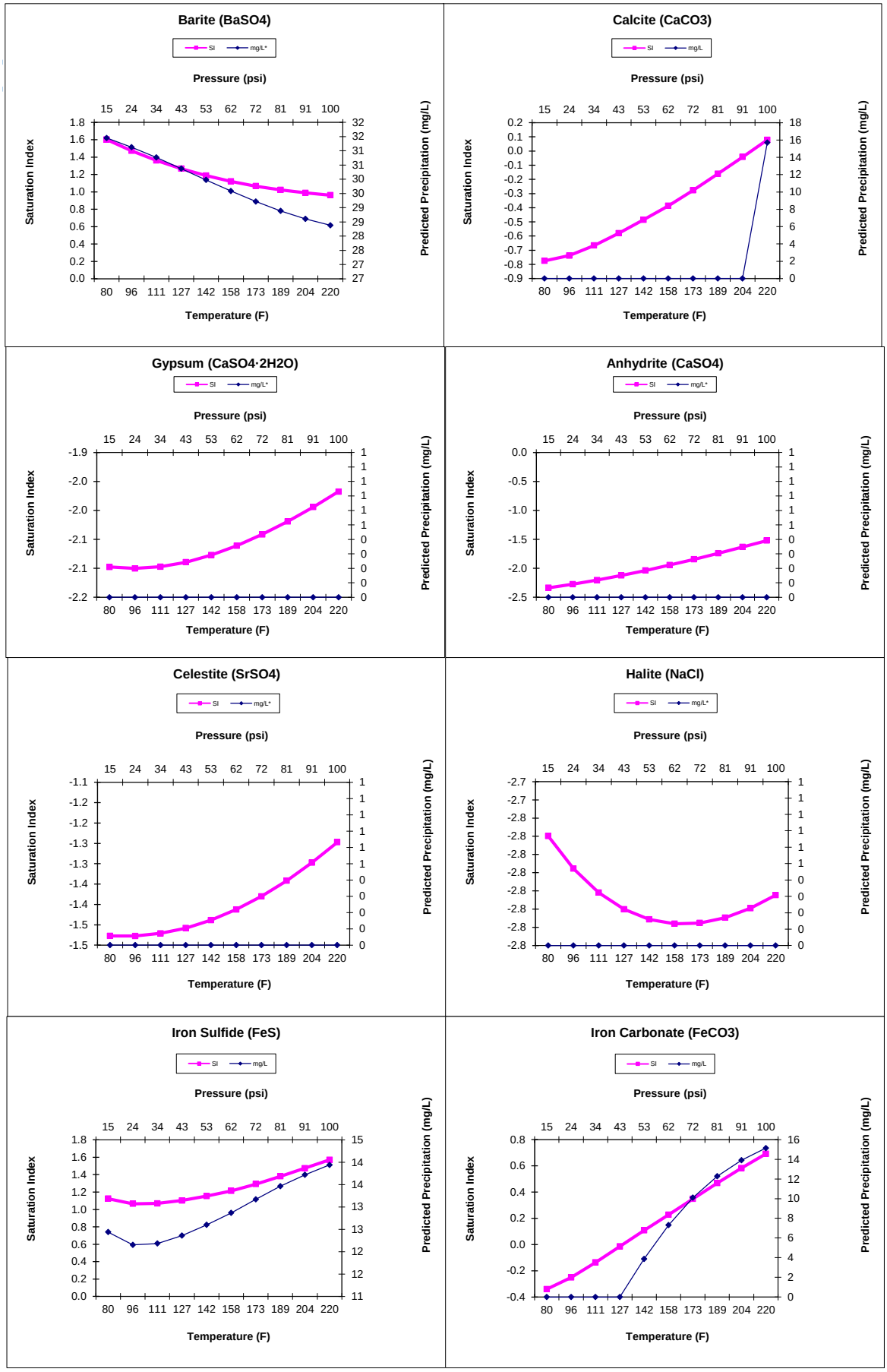
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 8L-5D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11A-18D Separator
District:	Four Corners	**Sample ID:**	201201036475
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11A-18D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.6

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	732.0	12.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	190.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	36921
Density/Specific Gravity (g/cm³):	1.0225
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	21700.0	612.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	14062.0	611.9
Potassium (K^+):	54.4	1.4
Magnesium (Mg^{2+}):	19.9	1.6
Calcium (Ca^{2+}):	157.7	7.9
Strontium (Sr^{2+}):	24.3	0.6
Barium (Ba^{2+}):	103.2	1.5
Iron (Fe^{2+}):	16.8	0.6
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	579	N/A

ND = Not Determined

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)**
80°F	15 psi	1.82	40.602	-0.30	0.000	-2.65	0.000	-2.88	0.000
96°F	24 psi	1.69	40.017	-0.27	0.000	-2.65	0.000	-2.82	0.000
111°F	34 psi	1.58	39.381	-0.20	0.000	-2.65	0.000	-2.75	0.000
127°F	43 psi	1.48	38.721	-0.11	0.000	-2.64	0.000	-2.67	0.000
142°F	53 psi	1.40	38.061	-0.02	0.000	-2.63	0.000	-2.59	0.000
158°F	62 psi	1.33	37.424	0.08	9.026	-2.62	0.000	-2.50	0.000
173°F	72 psi	1.27	36.830	0.18	20.961	-2.61	0.000	-2.40	0.000
189°F	81 psi	1.22	36.294	0.30	32.689	-2.59	0.000	-2.30	0.000
204°F	91 psi	1.18	35.826	0.41	43.723	-2.57	0.000	-2.20	0.000
220°F	100 psi	1.15	35.429	0.53	54.082	-2.55	0.000	-2.09	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)**
80°F	15 psi	-1.78	0.000	-2.35	0.000	1.45	4.313	0.45	7.581
96°F	24 psi	-1.78	0.000	-2.36	0.000	1.38	4.261	0.54	8.385
111°F	34 psi	-1.78	0.000	-2.38	0.000	1.38	4.257	0.65	9.238
127°F	43 psi	-1.77	0.000	-2.39	0.000	1.40	4.274	0.77	9.934
142°F	53 psi	-1.75	0.000	-2.39	0.000	1.43	4.303	0.89	10.466
158°F	62 psi	-1.73	0.000	-2.39	0.000	1.48	4.336	1.00	10.864
173°F	72 psi	-1.71	0.000	-2.39	0.000	1.55	4.377	1.12	11.178
189°F	81 psi	-1.68	0.000	-2.39	0.000	1.62	4.417	1.23	11.415
204°F	91 psi	-1.64	0.000	-2.39	0.000	1.70	4.452	1.34	11.589
220°F	100 psi	-1.60	0.000	-2.38	0.000	1.78	4.484	1.44	11.719

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.

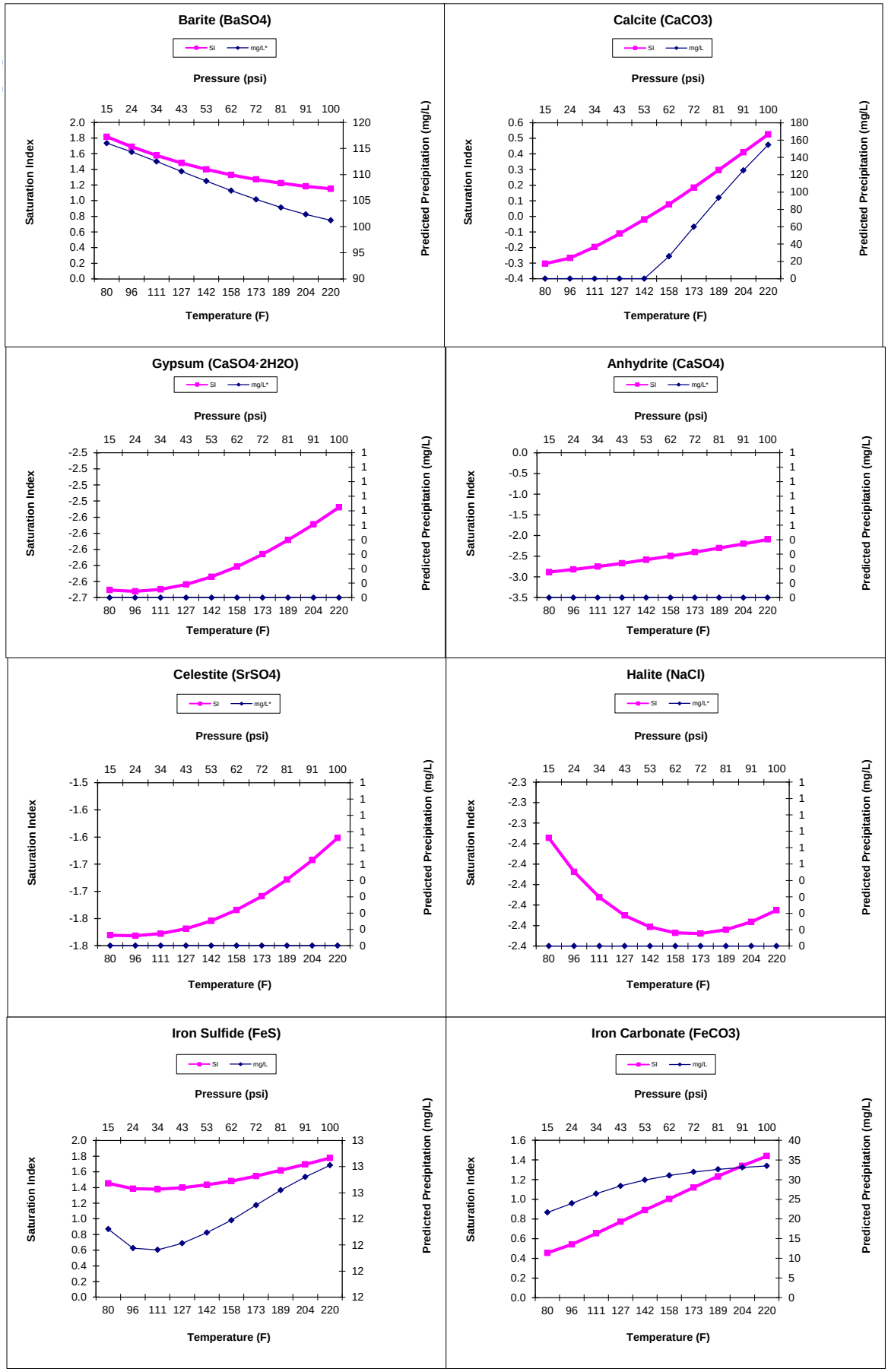
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11A-18D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11A-24D Separator
District:	Four Corners	**Sample ID:**	201201035722
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11A-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	75.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20021
Density/Specific Gravity (g/cm^3):	1.0110
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11700.0	330.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	7582.0	329.9
Potassium (K^+):	24.0	0.6
Magnesium (Mg^{2+}):	5.0	0.4
Calcium (Ca^{2+}):	63.0	3.1
Strontium (Sr^{2+}):	6.0	0.1
Barium (Ba^{2+}):	28.0	0.4
Iron (Fe^{2+}):	14.0	0.5
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	205	N/A

ND = Not Determined

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)**
80°F	15 psi	1.52	15.860	-0.37	0.000	-2.81	0.000	-3.05	0.000
96°F	24 psi	1.39	15.593	-0.33	0.000	-2.82	0.000	-2.99	0.000
111°F	34 psi	1.28	15.297	-0.25	0.000	-2.81	0.000	-2.92	0.000
127°F	43 psi	1.19	14.985	-0.17	0.000	-2.81	0.000	-2.84	0.000
142°F	53 psi	1.11	14.671	-0.07	0.000	-2.79	0.000	-2.75	0.000
158°F	62 psi	1.04	14.370	0.03	1.926	-2.78	0.000	-2.66	0.000
173°F	72 psi	0.99	14.094	0.14	8.300	-2.76	0.000	-2.56	0.000
189°F	81 psi	0.95	13.852	0.26	14.675	-2.73	0.000	-2.46	0.000
204°F	91 psi	0.91	13.651	0.38	20.588	-2.71	0.000	-2.35	0.000
220°F	100 psi	0.89	13.495	0.50	26.009	-2.68	0.000	-2.23	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)**
80°F	15 psi	-2.15	0.000	-2.85	0.000	1.59	1.457	0.73	8.009
96°F	24 psi	-2.15	0.000	-2.87	0.000	1.52	1.448	0.82	8.406
111°F	34 psi	-2.15	0.000	-2.88	0.000	1.50	1.446	0.94	8.815
127°F	43 psi	-2.13	0.000	-2.89	0.000	1.51	1.447	1.07	9.146
142°F	53 psi	-2.11	0.000	-2.90	0.000	1.54	1.451	1.19	9.397
158°F	62 psi	-2.09	0.000	-2.90	0.000	1.58	1.456	1.31	9.582
173°F	72 psi	-2.05	0.000	-2.90	0.000	1.64	1.462	1.43	9.724
189°F	81 psi	-2.01	0.000	-2.89	0.000	1.71	1.469	1.56	9.832
204°F	91 psi	-1.97	0.000	-2.89	0.000	1.79	1.475	1.67	9.910
220°F	100 psi	-1.92	0.000	-2.88	0.000	1.87	1.480	1.78	9.968

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.

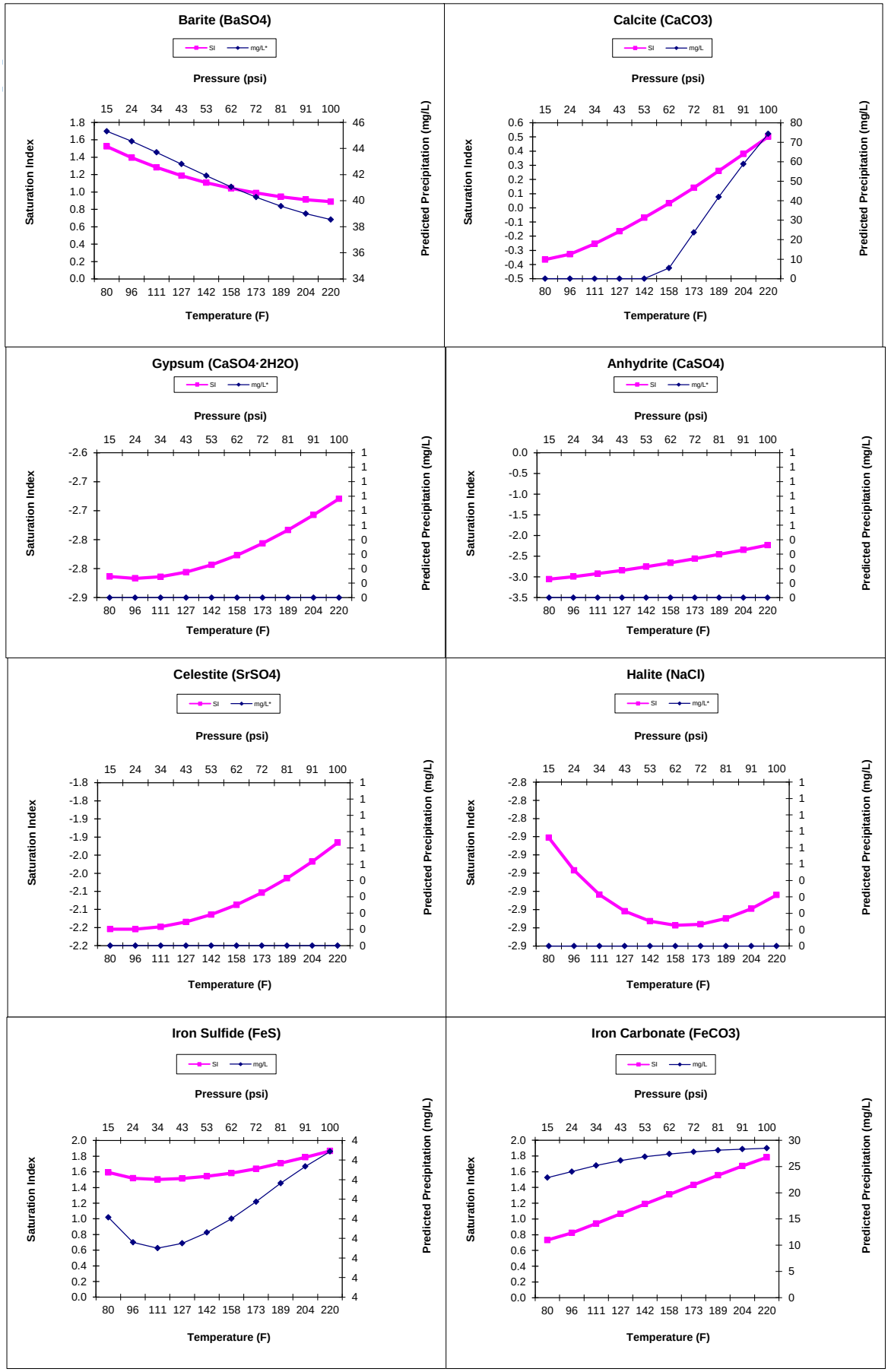
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11A-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11B-24D Separator
District:	Four Corners	**Sample ID:**	201201035723
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11B-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	732.0	12.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	85.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16877
Density/Specific Gravity (g/cm³):	1.0088
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9700.0	273.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6286.0	273.5
Potassium (K^+):	19.0	0.5
Magnesium (Mg^{2+}):	6.0	0.5
Calcium (Ca^{2+}):	67.0	3.3
Strontium (Sr^{2+}):	5.0	0.1
Barium (Ba^{2+}):	11.0	0.2
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	206	N/A

ND = Not Determined

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)**
80°F	15 psi	1.19	6.052	-0.19	0.000	-2.72	0.000	-2.96	0.000
96°F	24 psi	1.06	5.883	-0.15	0.000	-2.72	0.000	-2.90	0.000
111°F	34 psi	0.95	5.694	-0.08	0.000	-2.72	0.000	-2.83	0.000
127°F	43 psi	0.85	5.493	0.01	0.914	-2.71	0.000	-2.75	0.000
142°F	53 psi	0.78	5.291	0.11	7.693	-2.70	0.000	-2.66	0.000
158°F	62 psi	0.71	5.097	0.21	14.296	-2.68	0.000	-2.56	0.000
173°F	72 psi	0.66	4.919	0.32	20.829	-2.66	0.000	-2.46	0.000
189°F	81 psi	0.62	4.763	0.44	27.110	-2.63	0.000	-2.36	0.000
204°F	91 psi	0.59	4.636	0.56	32.709	-2.60	0.000	-2.24	0.000
220°F	100 psi	0.56	4.539	0.69	37.620	-2.57	0.000	-2.13	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)**
80°F	15 psi	-2.17	0.000	-3.00	0.000	0.88	0.468	-0.24	0.000
96°F	24 psi	-2.17	0.000	-3.02	0.000	0.81	0.453	-0.15	0.000
111°F	34 psi	-2.16	0.000	-3.03	0.000	0.80	0.450	-0.03	0.000
127°F	43 psi	-2.15	0.000	-3.04	0.000	0.81	0.453	0.10	0.142
142°F	53 psi	-2.13	0.000	-3.05	0.000	0.84	0.460	0.22	0.288
158°F	62 psi	-2.10	0.000	-3.05	0.000	0.88	0.468	0.34	0.396
173°F	72 psi	-2.06	0.000	-3.05	0.000	0.94	0.478	0.47	0.478
189°F	81 psi	-2.02	0.000	-3.05	0.000	1.02	0.489	0.59	0.540
204°F	91 psi	-1.97	0.000	-3.04	0.000	1.09	0.500	0.71	0.585
220°F	100 psi	-1.91	0.000	-3.03	0.000	1.18	0.509	0.83	0.617

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.

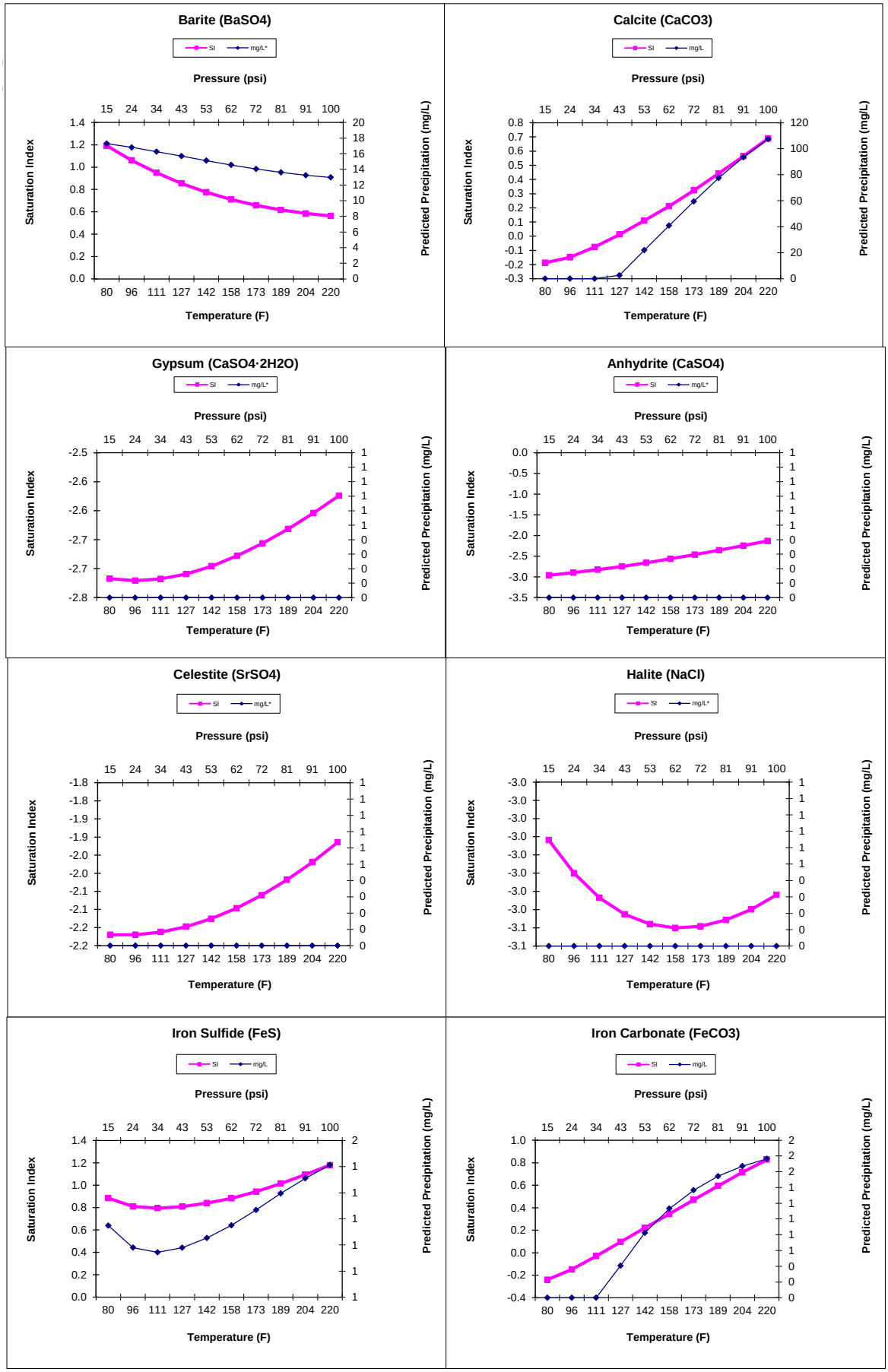
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11B-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11B-25 Separator
District:	Four Corners	**Sample ID:**	201201036511
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11B-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	732.0	12.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	75.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	34903
Density/Specific Gravity (g/cm³):	1.0210
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	20600.0	581.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	13349.0	580.9
Potassium (K^+):	48.2	1.2
Magnesium (Mg^{2+}):	14.3	1.2
Calcium (Ca^{2+}):	90.8	4.5
Strontium (Sr^{2+}):	10.4	0.2
Barium (Ba^{2+}):	6.8	0.1
Iron (Fe^{2+}):	1.2	0.0
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	303	N/A

ND = Not Determined

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)**
80°F	15 psi	0.66	3.100	0.35	20.731	-2.86	0.000	-3.10	0.000
96°F	24 psi	0.54	2.785	0.39	22.861	-2.87	0.000	-3.03	0.000
111°F	34 psi	0.42	2.432	0.46	26.766	-2.86	0.000	-2.96	0.000
127°F	43 psi	0.33	2.052	0.54	31.290	-2.86	0.000	-2.89	0.000
142°F	53 psi	0.25	1.661	0.63	36.012	-2.85	0.000	-2.80	0.000
158°F	62 psi	0.18	1.274	0.72	40.727	-2.84	0.000	-2.71	0.000
173°F	72 psi	0.12	0.905	0.81	45.433	-2.82	0.000	-2.62	0.000
189°F	81 psi	0.07	0.567	0.92	50.220	-2.80	0.000	-2.52	0.000
204°F	91 psi	0.03	0.267	1.02	54.627	-2.78	0.000	-2.41	0.000
220°F	100 psi	0.00	0.012	1.13	58.630	-2.76	0.000	-2.31	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)**
80°F	15 psi	-2.13	0.000	-2.39	0.000	1.27	0.604	0.21	0.327
96°F	24 psi	-2.13	0.000	-2.41	0.000	1.17	0.591	0.30	0.426
111°F	34 psi	-2.12	0.000	-2.42	0.000	1.12	0.583	0.41	0.525
127°F	43 psi	-2.11	0.000	-2.43	0.000	1.10	0.580	0.52	0.605
142°F	53 psi	-2.10	0.000	-2.43	0.000	1.09	0.579	0.63	0.666
158°F	62 psi	-2.08	0.000	-2.44	0.000	1.10	0.581	0.74	0.711
173°F	72 psi	-2.05	0.000	-2.44	0.000	1.13	0.585	0.85	0.745
189°F	81 psi	-2.02	0.000	-2.43	0.000	1.17	0.591	0.95	0.772
204°F	91 psi	-1.98	0.000	-2.43	0.000	1.21	0.598	1.05	0.792
220°F	100 psi	-1.94	0.000	-2.42	0.000	1.27	0.605	1.14	0.807

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.

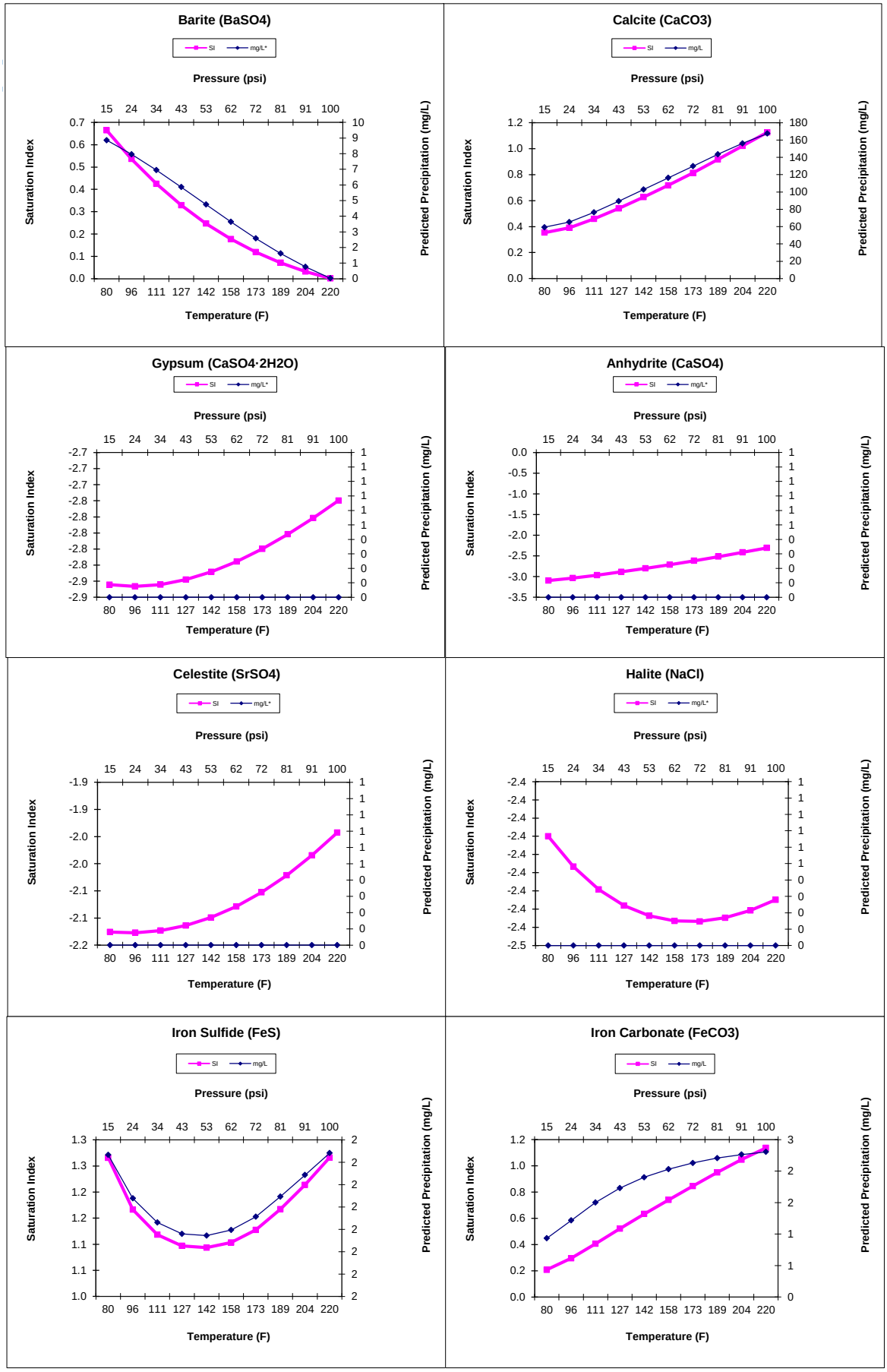
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11B-25 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11B-36D Separator
District:	Four Corners	**Sample ID:**	201201036503
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11B-36D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	390.0	6.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	450.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	25293
Density/Specific Gravity (g/cm³):	1.0146
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15000.0	423.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	9720.0	423.0
Potassium (K^+):	9.0	0.2
Magnesium (Mg^{2+}):	4.5	0.4
Calcium (Ca^{2+}):	50.0	2.5
Strontium (Sr^{2+}):	6.3	0.1
Barium (Ba^{2+}):	19.8	0.3
Iron (Fe^{2+}):	41.9	1.5
Manganese (Mn^{2+}):	1.7	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	165	N/A

ND = Not Determined

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)**
80°F	15 psi	1.27	10.943	-1.24	0.000	-3.01	0.000	-3.24	0.000
96°F	24 psi	1.14	10.658	-1.21	0.000	-3.01	0.000	-3.18	0.000
111°F	34 psi	1.03	10.341	-1.13	0.000	-3.01	0.000	-3.11	0.000
127°F	43 psi	0.94	10.005	-1.05	0.000	-3.00	0.000	-3.03	0.000
142°F	53 psi	0.86	9.663	-0.95	0.000	-2.99	0.000	-2.95	0.000
158°F	62 psi	0.79	9.331	-0.85	0.000	-2.97	0.000	-2.85	0.000
173°F	72 psi	0.73	9.021	-0.74	0.000	-2.95	0.000	-2.76	0.000
189°F	81 psi	0.69	8.744	-0.62	0.000	-2.93	0.000	-2.65	0.000
204°F	91 psi	0.65	8.508	-0.50	0.000	-2.91	0.000	-2.55	0.000
220°F	100 psi	0.63	8.316	-0.38	0.000	-2.88	0.000	-2.44	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)**
80°F	15 psi	-2.22	0.000	-2.65	0.000	1.30	2.884	0.41	14.822
96°F	24 psi	-2.22	0.000	-2.67	0.000	1.24	2.856	0.50	17.106
111°F	34 psi	-2.22	0.000	-2.68	0.000	1.24	2.859	0.61	19.685
127°F	43 psi	-2.20	0.000	-2.69	0.000	1.28	2.875	0.74	21.939
142°F	53 psi	-2.19	0.000	-2.69	0.000	1.33	2.897	0.86	23.766
158°F	62 psi	-2.16	0.000	-2.70	0.000	1.39	2.920	0.98	25.201
173°F	72 psi	-2.13	0.000	-2.70	0.000	1.47	2.946	1.10	26.372
189°F	81 psi	-2.09	0.000	-2.69	0.000	1.56	2.970	1.22	27.286
204°F	91 psi	-2.05	0.000	-2.69	0.000	1.65	2.990	1.33	27.971
220°F	100 psi	-2.00	0.000	-2.68	0.000	1.74	3.006	1.44	28.487

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.

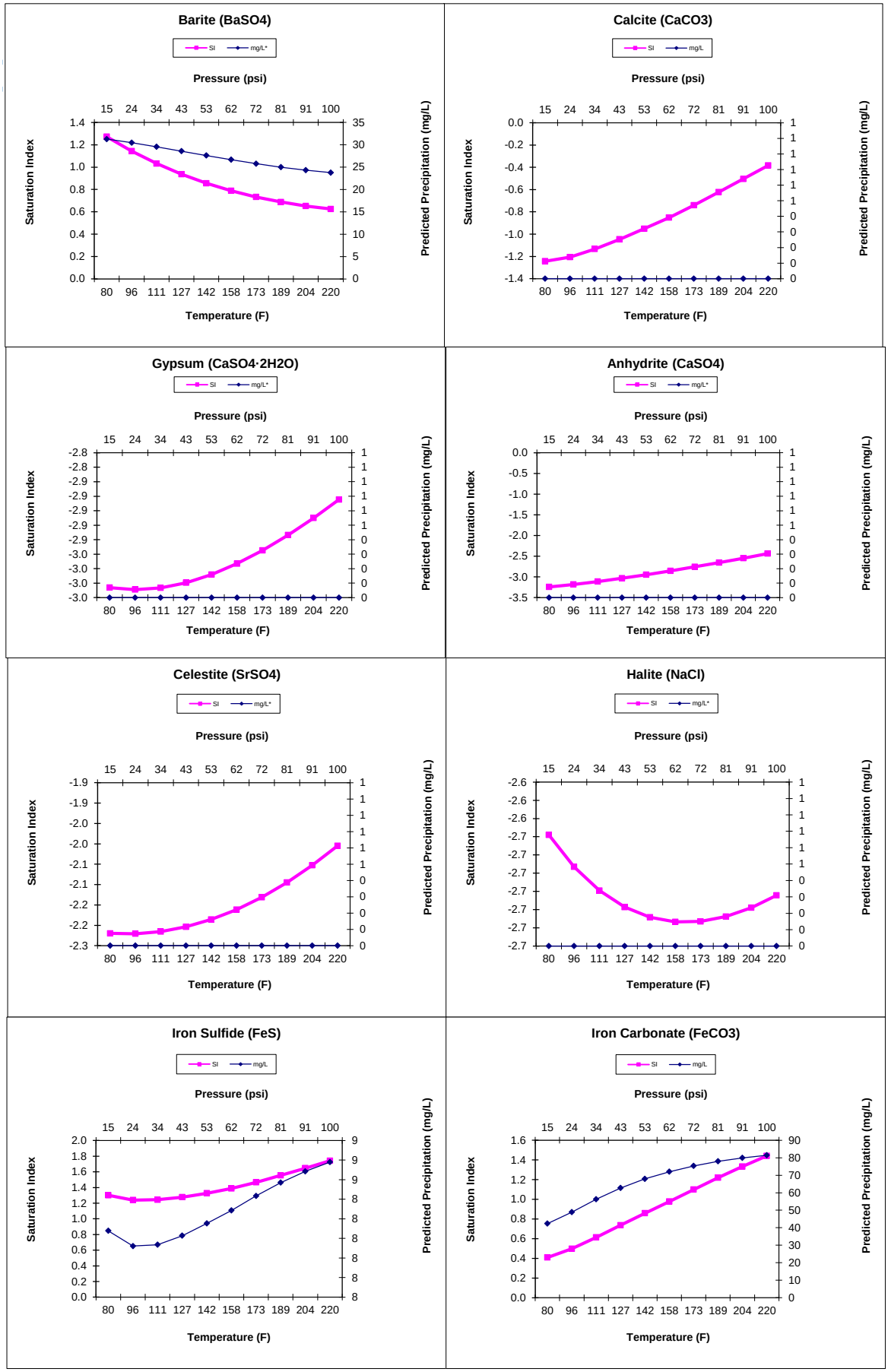
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11B-36D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11C-18D Separator
District:	Four Corners	**Sample ID:**	201201036476
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11C-18D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	915.0	15.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	450.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	34794
Density/Specific Gravity (g/cm³):	1.0210
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	20200.0	569.8
Sulfate (SO_4^{2-}):	250.0	5.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	13090.0	569.6
Potassium (K^+):	35.1	0.9
Magnesium (Mg^{2+}):	21.1	1.7
Calcium (Ca^{2+}):	167.3	8.3
Strontium (Sr^{2+}):	13.7	0.3
Barium (Ba^{2+}):	42.8	0.6
Iron (Fe^{2+}):	58.8	2.1
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	552	N/A

ND = Not Determined

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)**
80°F	15 psi	2.16	25.252	-0.07	0.000	-1.90	0.000	-2.14	0.000
96°F	24 psi	2.03	25.183	-0.03	0.000	-1.90	0.000	-2.07	0.000
111°F	34 psi	1.92	25.104	0.04	5.146	-1.90	0.000	-2.00	0.000
127°F	43 psi	1.82	25.018	0.12	16.412	-1.90	0.000	-1.92	0.000
142°F	53 psi	1.74	24.928	0.22	27.976	-1.89	0.000	-1.84	0.000
158°F	62 psi	1.67	24.838	0.31	39.368	-1.87	0.000	-1.75	0.000
173°F	72 psi	1.61	24.750	0.42	51.107	-1.86	0.000	-1.65	0.000
189°F	81 psi	1.56	24.669	0.54	62.559	-1.84	0.000	-1.55	0.000
204°F	91 psi	1.53	24.596	0.65	73.192	-1.82	0.000	-1.45	0.000
220°F	100 psi	1.50	24.533	0.77	83.020	-1.80	0.000	-1.34	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)**
80°F	15 psi	-1.31	0.000	-2.41	0.000	-8.24	0.000	1.22	39.034
96°F	24 psi	-1.31	0.000	-2.42	0.000	-8.31	0.000	1.31	39.673
111°F	34 psi	-1.31	0.000	-2.44	0.000	-8.32	0.000	1.42	40.351
127°F	43 psi	-1.30	0.000	-2.45	0.000	-8.30	0.000	1.54	40.902
142°F	53 psi	-1.28	0.000	-2.45	0.000	-8.26	0.000	1.66	41.321
158°F	62 psi	-1.26	0.000	-2.45	0.000	-8.22	0.000	1.77	41.632
173°F	72 psi	-1.24	0.000	-2.45	0.000	-8.16	0.000	1.89	41.877
189°F	81 psi	-1.20	0.000	-2.45	0.000	-8.09	0.000	2.01	42.062
204°F	91 psi	-1.17	0.000	-2.45	0.000	-8.01	0.000	2.11	42.196
220°F	100 psi	-1.13	0.000	-2.44	0.000	-7.93	0.000	2.22	42.296

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.

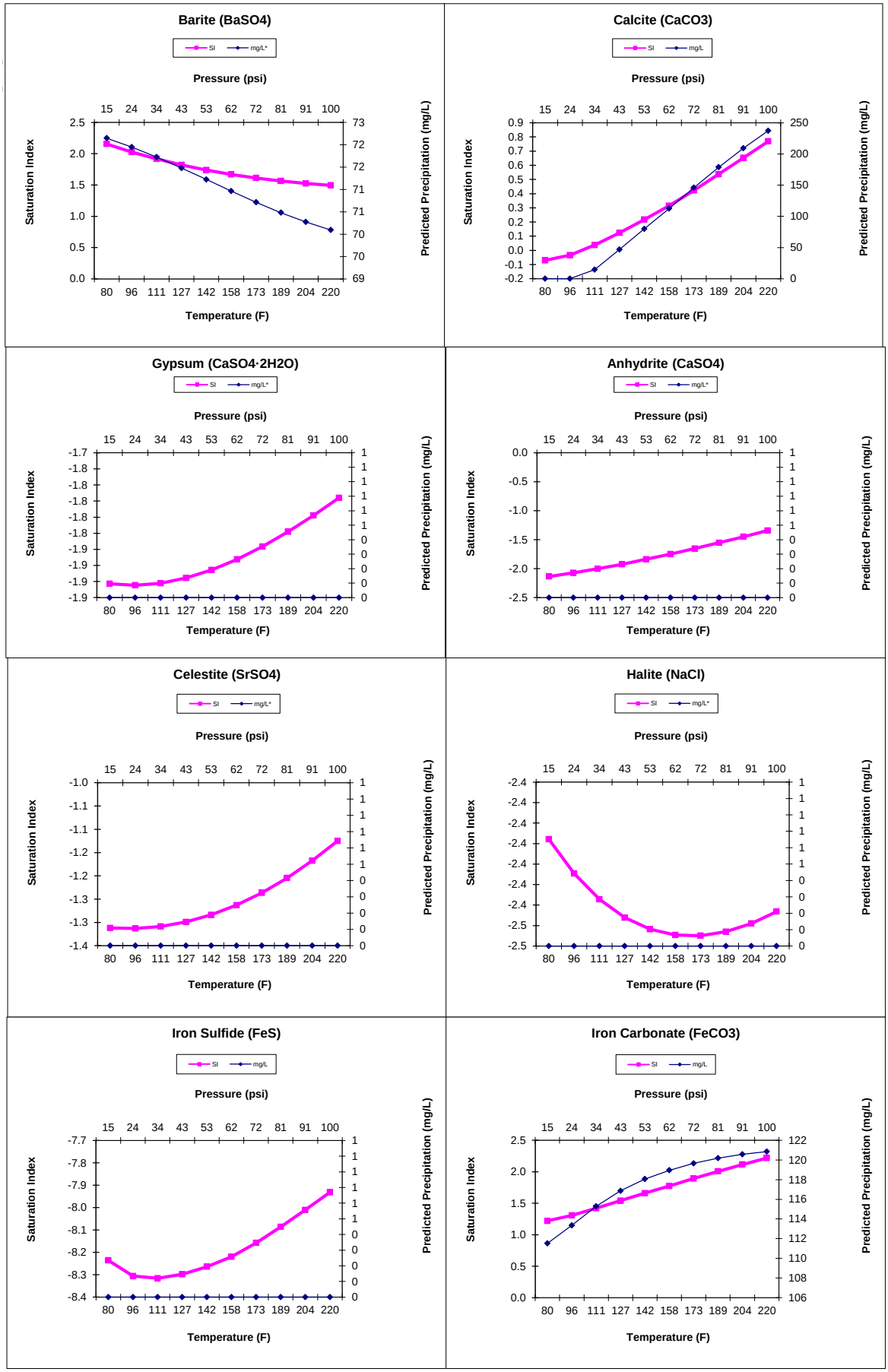
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11C-18D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11C-24D Separator
District:	Four Corners	**Sample ID:**	201201035724
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11C-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	780.0	12.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17754
Density/Specific Gravity (g/cm^3):	1.0094
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10200.0	287.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6610.0	287.6
Potassium (K^+):	19.0	0.5
Magnesium (Mg^{2+}):	6.0	0.5
Calcium (Ca^{2+}):	68.0	3.4
Strontium (Sr^{2+}):	6.0	0.1
Barium (Ba^{2+}):	15.0	0.2
Iron (Fe^{2+}):	0.3	0.0
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	212	N/A

ND = Not Determined

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)**
80°F	15 psi	1.30	8.372	-0.16	0.000	-2.73	0.000	-2.97	0.000
96°F	24 psi	1.17	8.183	-0.12	0.000	-2.73	0.000	-2.91	0.000
111°F	34 psi	1.06	7.972	-0.05	0.000	-2.73	0.000	-2.84	0.000
127°F	43 psi	0.97	7.749	0.04	2.936	-2.72	0.000	-2.76	0.000
142°F	53 psi	0.89	7.523	0.14	9.768	-2.71	0.000	-2.67	0.000
158°F	62 psi	0.82	7.306	0.24	16.393	-2.69	0.000	-2.57	0.000
173°F	72 psi	0.77	7.107	0.35	22.918	-2.67	0.000	-2.47	0.000
189°F	81 psi	0.73	6.934	0.47	29.149	-2.64	0.000	-2.37	0.000
204°F	91 psi	0.70	6.790	0.59	34.666	-2.62	0.000	-2.26	0.000
220°F	100 psi	0.67	6.680	0.71	39.470	-2.59	0.000	-2.14	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)**
80°F	15 psi	-2.11	0.000	-2.96	0.000	0.39	0.087	-0.79	0.000
96°F	24 psi	-2.11	0.000	-2.98	0.000	0.32	0.076	-0.70	0.000
111°F	34 psi	-2.10	0.000	-2.99	0.000	0.30	0.073	-0.58	0.000
127°F	43 psi	-2.09	0.000	-3.00	0.000	0.32	0.076	-0.45	0.000
142°F	53 psi	-2.07	0.000	-3.01	0.000	0.35	0.080	-0.33	0.000
158°F	62 psi	-2.04	0.000	-3.01	0.000	0.39	0.087	-0.20	0.000
173°F	72 psi	-2.00	0.000	-3.01	0.000	0.45	0.094	-0.08	0.000
189°F	81 psi	-1.96	0.000	-3.01	0.000	0.52	0.103	0.04	0.019
204°F	91 psi	-1.91	0.000	-3.00	0.000	0.60	0.110	0.16	0.061
220°F	100 psi	-1.86	0.000	-2.99	0.000	0.68	0.117	0.28	0.092

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.

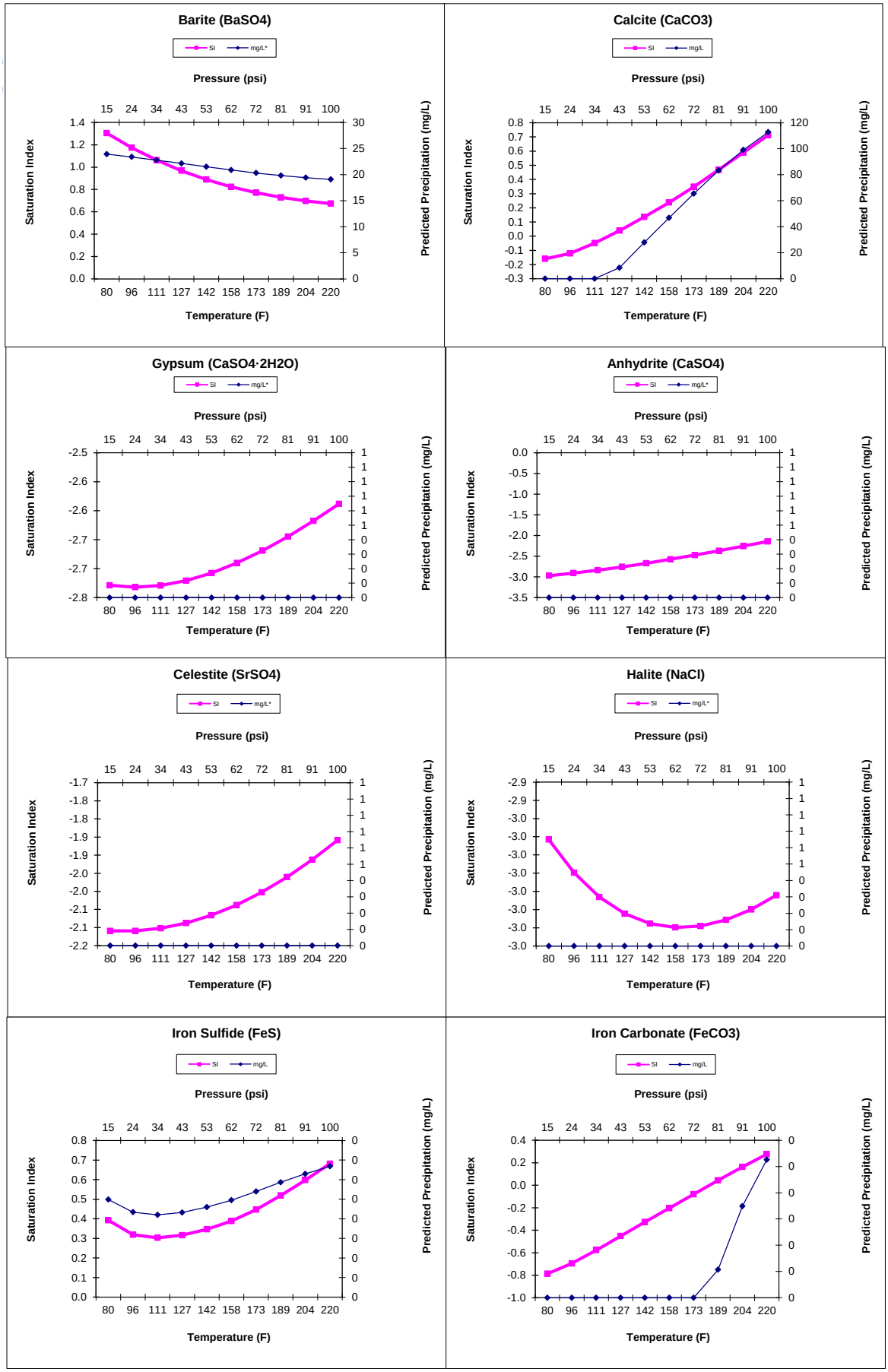
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11C-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11D-24D Separator
District:	Four Corners	**Sample ID:**	201201035725
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	230.0
aqueous H_2S (ppm):	4.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16718
Density/Specific Gravity (g/cm^3):	1.0089
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9600.0	270.8
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	6221.0	270.7
Potassium (K^+):	24.0	0.6
Magnesium (Mg^{2+}):	7.0	0.6
Calcium (Ca^{2+}):	96.0	4.8
Strontium (Sr^{2+}):	8.0	0.2
Barium (Ba^{2+}):	17.0	0.2
Iron (Fe^{2+}):	46.0	1.6
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	290	N/A

ND = Not Determined

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)**
80°F	15 psi	1.85	9.958	-1.16	0.000	-2.09	0.000	-2.33	0.000
96°F	24 psi	1.72	9.905	-1.13	0.000	-2.10	0.000	-2.27	0.000
111°F	34 psi	1.61	9.844	-1.06	0.000	-2.09	0.000	-2.20	0.000
127°F	43 psi	1.52	9.779	-0.97	0.000	-2.08	0.000	-2.12	0.000
142°F	53 psi	1.44	9.713	-0.87	0.000	-2.07	0.000	-2.03	0.000
158°F	62 psi	1.37	9.649	-0.76	0.000	-2.05	0.000	-1.94	0.000
173°F	72 psi	1.32	9.590	-0.64	0.000	-2.03	0.000	-1.84	0.000
189°F	81 psi	1.28	9.538	-0.52	0.000	-2.01	0.000	-1.73	0.000
204°F	91 psi	1.25	9.495	-0.40	0.000	-1.98	0.000	-1.62	0.000
220°F	100 psi	1.23	9.462	-0.27	0.000	-1.95	0.000	-1.50	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)**
80°F	15 psi	-1.49	0.000	-3.01	0.000	1.15	9.036	0.28	13.129
96°F	24 psi	-1.49	0.000	-3.03	0.000	1.08	8.839	0.36	15.953
111°F	34 psi	-1.49	0.000	-3.04	0.000	1.09	8.871	0.48	19.424
127°F	43 psi	-1.47	0.000	-3.05	0.000	1.14	9.005	0.61	22.489
142°F	53 psi	-1.45	0.000	-3.06	0.000	1.20	9.178	0.73	24.963
158°F	62 psi	-1.42	0.000	-3.06	0.000	1.29	9.394	0.87	27.036
173°F	72 psi	-1.38	0.000	-3.06	0.000	1.40	9.589	1.00	28.604
189°F	81 psi	-1.34	0.000	-3.05	0.000	1.50	9.752	1.12	29.756
204°F	91 psi	-1.29	0.000	-3.05	0.000	1.61	9.885	1.24	30.608
220°F	100 psi	-1.24	0.000	-3.04	0.000	1.72	9.992	1.36	31.241

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.

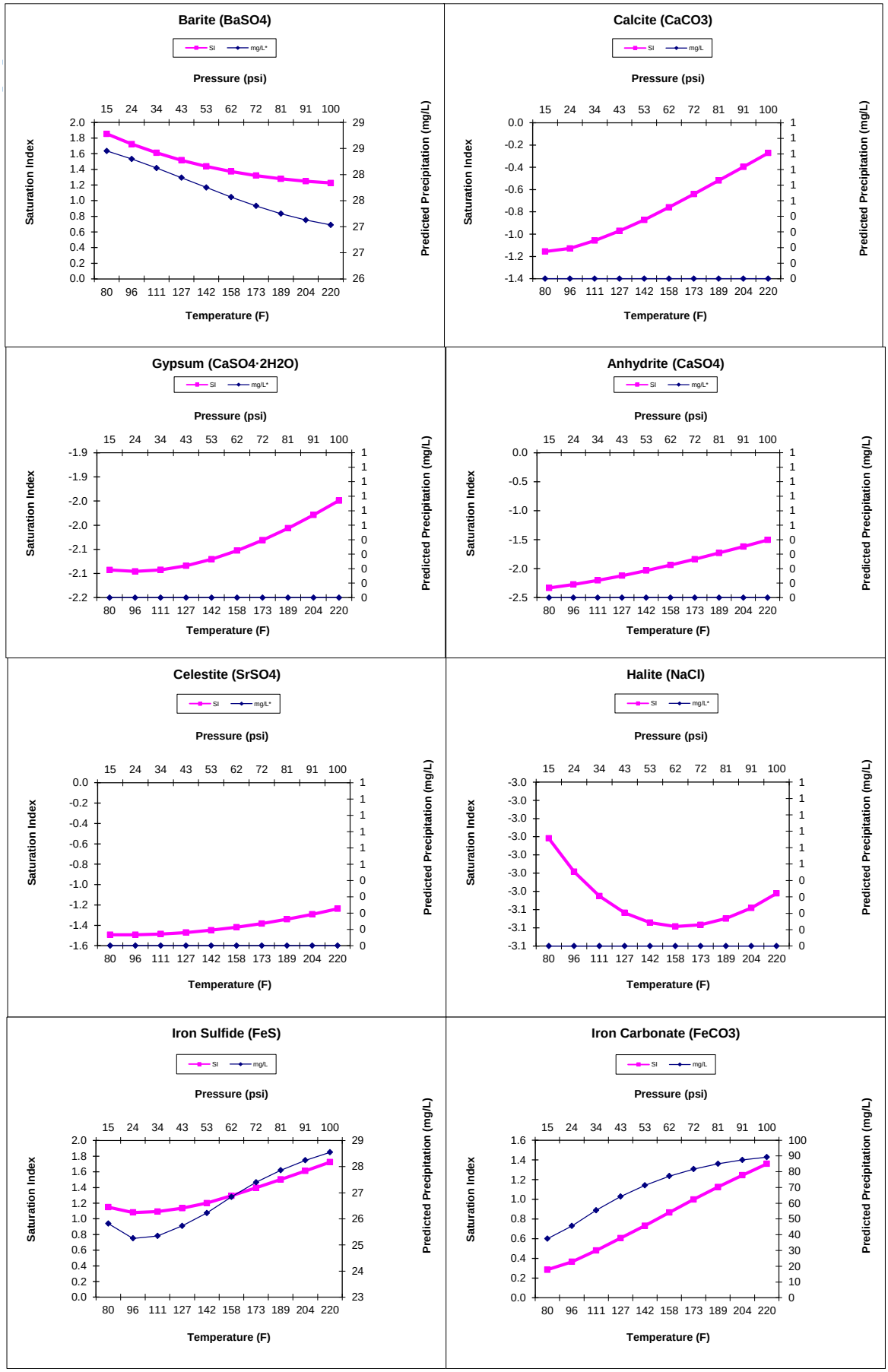
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11D-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11D-36D Separator
District:	Four Corners	**Sample ID:**	201201036504
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11D-36D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	200.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	40174
Density/Specific Gravity (g/cm³):	1.0245
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	24000.0	677.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	15552.0	676.8
Potassium (K^+):	20.5	0.5
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	91.6	4.6
Strontium (Sr^{2+}):	11.4	0.3
Barium (Ba^{2+}):	9.5	0.1
Iron (Fe^{2+}):	1.2	0.0
Manganese (Mn^{2+}):	2.1	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	286	N/A

ND = Not Determined

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)**
80°F	15 psi	0.74	4.490	-0.88	0.000	-2.92	0.000	-3.15	0.000
96°F	24 psi	0.62	4.119	-0.84	0.000	-2.92	0.000	-3.09	0.000
111°F	34 psi	0.51	3.703	-0.77	0.000	-2.92	0.000	-3.01	0.000
127°F	43 psi	0.41	3.255	-0.69	0.000	-2.91	0.000	-2.94	0.000
142°F	53 psi	0.33	2.792	-0.60	0.000	-2.90	0.000	-2.85	0.000
158°F	62 psi	0.26	2.332	-0.50	0.000	-2.89	0.000	-2.76	0.000
173°F	72 psi	0.20	1.891	-0.40	0.000	-2.88	0.000	-2.67	0.000
189°F	81 psi	0.15	1.482	-0.28	0.000	-2.86	0.000	-2.57	0.000
204°F	91 psi	0.11	1.115	-0.17	0.000	-2.84	0.000	-2.47	0.000
220°F	100 psi	0.07	0.796	-0.06	0.000	-2.82	0.000	-2.37	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)**
80°F	15 psi	-2.14	0.000	-2.26	0.000	-0.11	0.000	-1.07	0.000
96°F	24 psi	-2.14	0.000	-2.28	0.000	-0.17	0.000	-0.99	0.000
111°F	34 psi	-2.13	0.000	-2.29	0.000	-0.18	0.000	-0.87	0.000
127°F	43 psi	-2.13	0.000	-2.30	0.000	-0.15	0.000	-0.75	0.000
142°F	53 psi	-2.11	0.000	-2.31	0.000	-0.11	0.000	-0.64	0.000
158°F	62 psi	-2.09	0.000	-2.31	0.000	-0.06	0.000	-0.53	0.000
173°F	72 psi	-2.07	0.000	-2.31	0.000	0.00	0.000	-0.41	0.000
189°F	81 psi	-2.04	0.000	-2.31	0.000	0.08	0.084	-0.30	0.000
204°F	91 psi	-2.01	0.000	-2.30	0.000	0.15	0.162	-0.20	0.000
220°F	100 psi	-1.97	0.000	-2.30	0.000	0.23	0.233	-0.10	0.000

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.

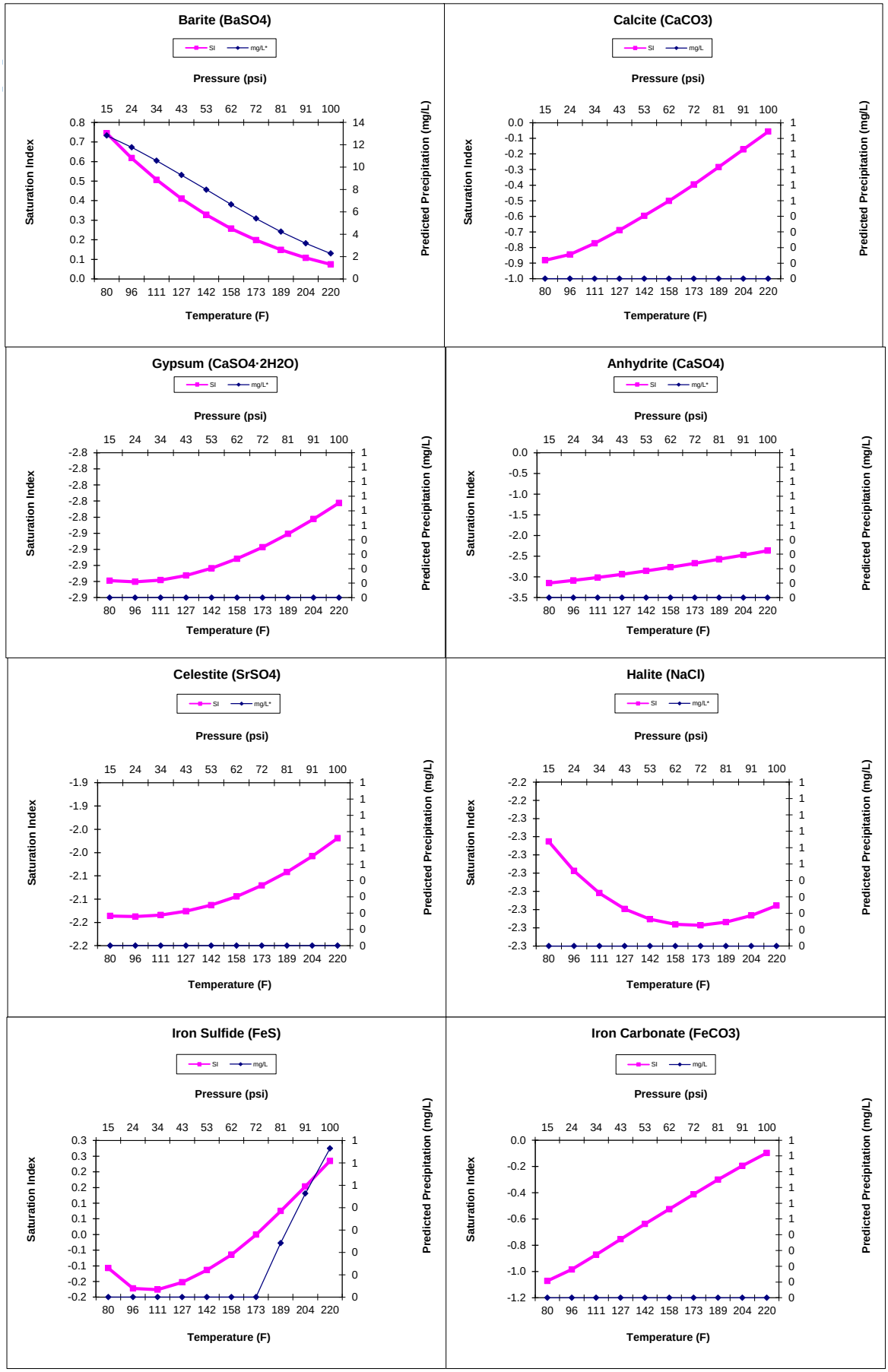
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11D-36D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11D-7D Separator
District:	Four Corners	**Sample ID:**	201201036491
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 11D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	793.0	13.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	600.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	34545
Density/Specific Gravity (g/cm³):	1.0208
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	19900.0	561.4
Sulfate (SO_4^{2-}):	900.0	18.7
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.05

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	12571.0	547.0
Potassium (K^+):	48.0	1.2
Magnesium (Mg^{2+}):	29.5	2.4
Calcium (Ca^{2+}):	236.4	11.8
Strontium (Sr^{2+}):	19.1	0.4
Barium (Ba^{2+}):	8.0	0.1
Iron (Fe^{2+}):	39.7	1.4
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	740	N/A

ND = Not Determined

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)**
80°F	15 psi	1.98	4.715	-0.18	0.000	-1.20	0.000	-1.43	0.000
96°F	24 psi	1.85	4.698	-0.15	0.000	-1.20	0.000	-1.37	0.000
111°F	34 psi	1.74	4.678	-0.07	0.000	-1.20	0.000	-1.30	0.000
127°F	43 psi	1.65	4.657	0.01	1.805	-1.19	0.000	-1.22	0.000
142°F	53 psi	1.57	4.635	0.11	15.497	-1.18	0.000	-1.13	0.000
158°F	62 psi	1.50	4.613	0.20	29.036	-1.17	0.000	-1.04	0.000
173°F	72 psi	1.44	4.591	0.32	43.323	-1.15	0.000	-0.95	0.000
189°F	81 psi	1.39	4.572	0.43	57.098	-1.13	0.000	-0.85	0.000
204°F	91 psi	1.36	4.554	0.55	70.041	-1.11	0.000	-0.74	0.000
220°F	100 psi	1.33	4.539	0.67	82.192	-1.09	0.000	-0.63	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)**
80°F	15 psi	-0.62	0.000	-2.43	0.000	-8.72	0.000	0.78	22.880
96°F	24 psi	-0.62	0.000	-2.45	0.000	-8.79	0.000	0.86	23.888
111°F	34 psi	-0.61	0.000	-2.46	0.000	-8.79	0.000	0.98	24.978
127°F	43 psi	-0.60	0.000	-2.47	0.000	-8.77	0.000	1.10	25.875
142°F	53 psi	-0.59	0.000	-2.48	0.000	-8.73	0.000	1.22	26.561
158°F	62 psi	-0.56	0.000	-2.48	0.000	-8.67	0.000	1.33	27.075
173°F	72 psi	-0.54	0.000	-2.48	0.000	-8.60	0.000	1.45	27.487
189°F	81 psi	-0.50	0.000	-2.48	0.000	-8.52	0.000	1.57	27.792
204°F	91 psi	-0.46	0.000	-2.48	0.000	-8.44	0.000	1.68	28.015
220°F	100 psi	-0.42	0.000	-2.47	0.000	-8.35	0.000	1.78	28.181

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.

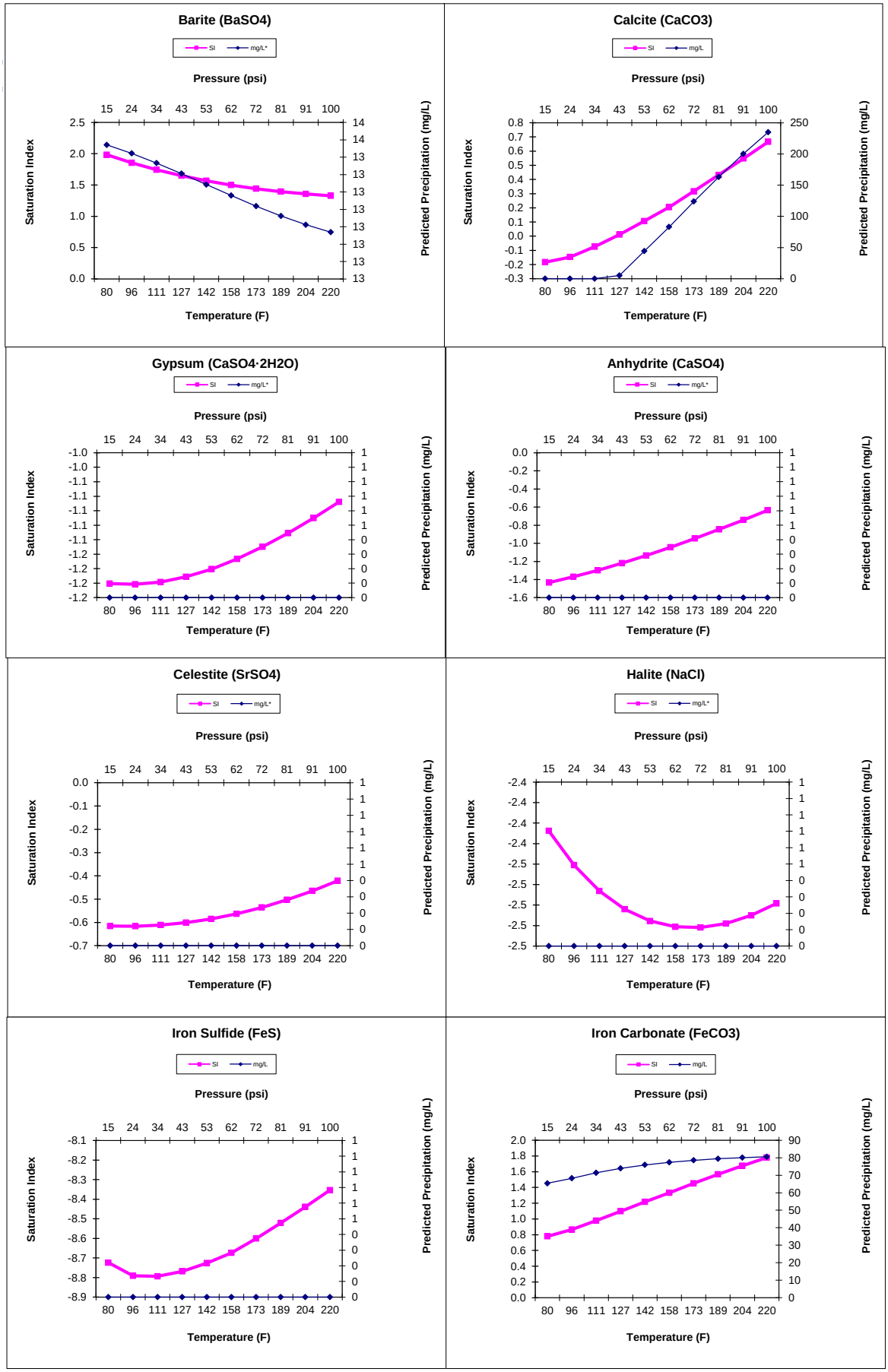
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 11D-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12A-18D Separator
District:	Four Corners	**Sample ID:**	201201036477
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 12A-18D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1415.0	23.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	35419
Density/Specific Gravity (g/cm^3):	1.0213
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	20300.0	572.6
Sulfate (SO_4^{2-}):	400.0	8.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.04

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	13154.0	572.4
Potassium (K^+):	33.9	0.9
Magnesium (Mg^{2+}):	12.7	1.0
Calcium (Ca^{2+}):	79.7	4.0
Strontium (Sr^{2+}):	7.1	0.2
Barium (Ba^{2+}):	5.6	0.1
Iron (Fe^{2+}):	10.4	0.4
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	264	N/A

ND = Not Determined

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)**
80°F	15 psi	1.48	3.236	0.10	9.978	-2.01	0.000	-2.24	0.000
96°F	24 psi	1.35	3.197	0.14	13.366	-2.01	0.000	-2.18	0.000
111°F	34 psi	1.24	3.153	0.21	19.527	-2.01	0.000	-2.11	0.000
127°F	43 psi	1.14	3.104	0.30	26.226	-2.01	0.000	-2.03	0.000
142°F	53 psi	1.06	3.054	0.39	32.704	-2.00	0.000	-1.95	0.000
158°F	62 psi	0.99	3.003	0.48	38.658	-1.98	0.000	-1.86	0.000
173°F	72 psi	0.93	2.953	0.59	44.255	-1.97	0.000	-1.76	0.000
189°F	81 psi	0.88	2.907	0.70	49.273	-1.95	0.000	-1.66	0.000
204°F	91 psi	0.84	2.866	0.82	53.461	-1.93	0.000	-1.56	0.000
220°F	100 psi	0.81	2.830	0.93	56.912	-1.91	0.000	-1.45	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)**
80°F	15 psi	-1.40	0.000	-2.40	0.000	1.47	1.405	0.99	6.749
96°F	24 psi	-1.40	0.000	-2.42	0.000	1.39	1.392	1.08	6.896
111°F	34 psi	-1.39	0.000	-2.43	0.000	1.37	1.388	1.19	7.048
127°F	43 psi	-1.39	0.000	-2.44	0.000	1.37	1.388	1.31	7.170
142°F	53 psi	-1.37	0.000	-2.45	0.000	1.39	1.392	1.43	7.263
158°F	62 psi	-1.35	0.000	-2.45	0.000	1.42	1.397	1.54	7.331
173°F	72 psi	-1.32	0.000	-2.45	0.000	1.47	1.405	1.66	7.384
189°F	81 psi	-1.29	0.000	-2.45	0.000	1.53	1.414	1.77	7.424
204°F	91 psi	-1.25	0.000	-2.45	0.000	1.60	1.422	1.88	7.454
220°F	100 psi	-1.21	0.000	-2.44	0.000	1.67	1.429	1.98	7.475

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.

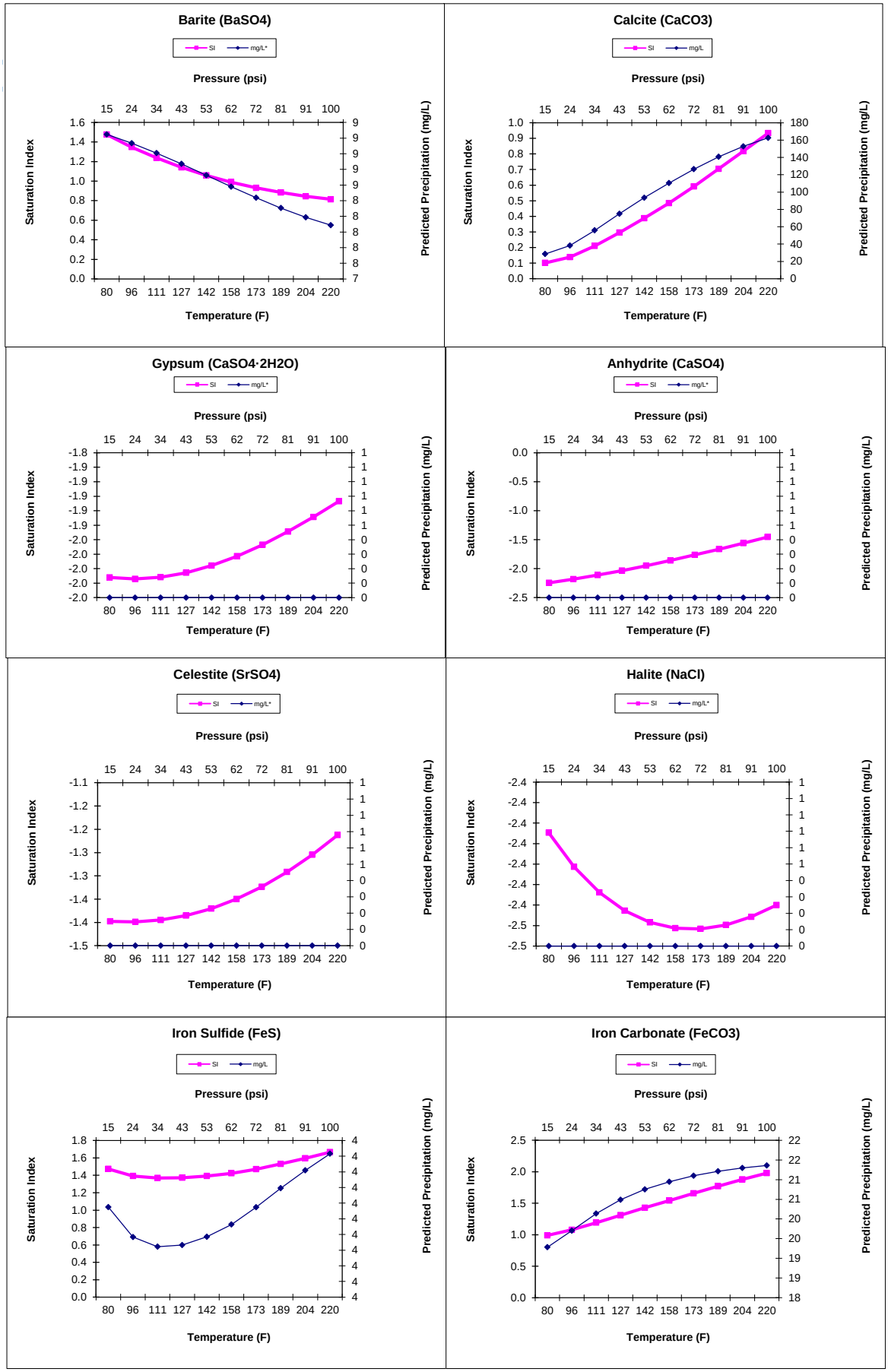
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 12A-18D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12A-24D Separator
District:	Four Corners	**Sample ID:**	201201035717
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 12A-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	524.0	8.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	40263
Density/Specific Gravity (g/cm³):	1.0246
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	23900.0	674.2
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	15487.0	673.9
Potassium (K^+):	47.0	1.2
Magnesium (Mg^{2+}):	18.0	1.5
Calcium (Ca^{2+}):	196.0	9.8
Strontium (Sr^{2+}):	17.0	0.4
Barium (Ba^{2+}):	20.0	0.3
Iron (Fe^{2+}):	4.0	0.1
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	598	N/A

ND = Not Determined

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)**
80°F	15 psi	1.06	10.534	0.03	2.825	-2.59	0.000	-2.82	0.000
96°F	24 psi	0.94	10.095	0.07	5.918	-2.59	0.000	-2.76	0.000
111°F	34 psi	0.83	9.606	0.14	11.693	-2.59	0.000	-2.69	0.000
127°F	43 psi	0.73	9.084	0.22	18.433	-2.59	0.000	-2.61	0.000
142°F	53 psi	0.65	8.550	0.31	25.547	-2.58	0.000	-2.53	0.000
158°F	62 psi	0.58	8.023	0.41	32.771	-2.56	0.000	-2.44	0.000
173°F	72 psi	0.52	7.519	0.51	40.214	-2.55	0.000	-2.34	0.000
189°F	81 psi	0.47	7.055	0.62	48.003	-2.53	0.000	-2.25	0.000
204°F	91 psi	0.43	6.641	0.73	55.502	-2.52	0.000	-2.14	0.000
220°F	100 psi	0.40	6.283	0.84	62.704	-2.50	0.000	-2.04	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)**
80°F	15 psi	-1.97	0.000	-2.27	0.000	1.38	1.988	0.06	0.334
96°F	24 psi	-1.97	0.000	-2.28	0.000	1.30	1.950	0.14	0.785
111°F	34 psi	-1.97	0.000	-2.30	0.000	1.27	1.938	0.26	1.252
127°F	43 psi	-1.96	0.000	-2.30	0.000	1.27	1.939	0.37	1.632
142°F	53 psi	-1.94	0.000	-2.31	0.000	1.29	1.948	0.49	1.923
158°F	62 psi	-1.93	0.000	-2.31	0.000	1.31	1.962	0.60	2.140
173°F	72 psi	-1.90	0.000	-2.31	0.000	1.35	1.982	0.71	2.308
189°F	81 psi	-1.87	0.000	-2.31	0.000	1.41	2.006	0.82	2.440
204°F	91 psi	-1.84	0.000	-2.31	0.000	1.47	2.029	0.92	2.537
220°F	100 psi	-1.80	0.000	-2.30	0.000	1.54	2.052	1.01	2.609

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.

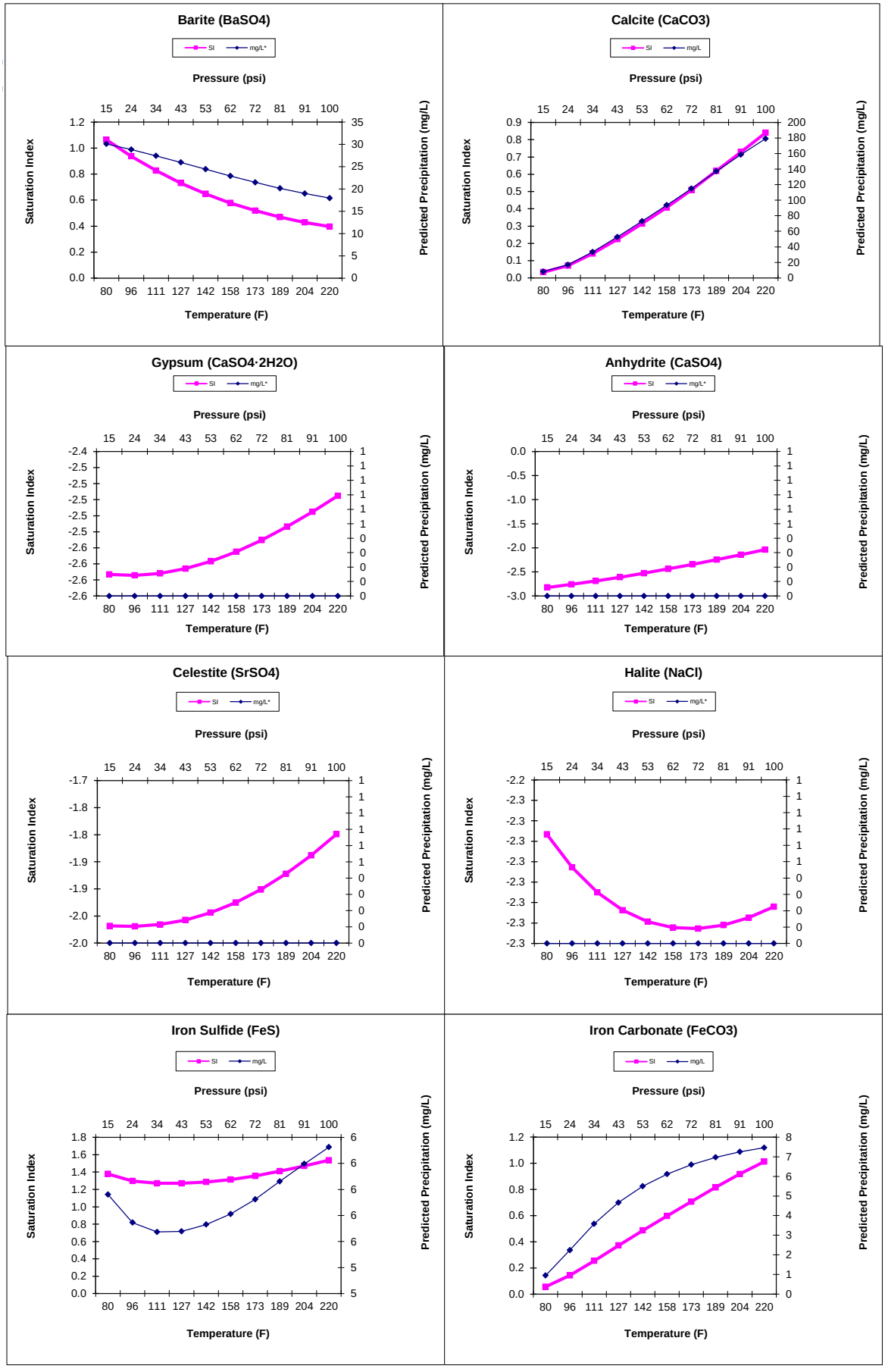
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 12A-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12A-36D Separator
District:	Four Corners	**Sample ID:**	201201034115
Sales Rep:	Sean Higgins	**Sample Date:**	10/29/2012
Lease:	Puckett	**Log Out Date:**	11/15/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 12A-36D Separator

Field Data

Initial Temperature (°F):	200
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	793.0	13.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	0.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	12639
Density/Specific Gravity (g/cm³):	1.0060
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	7000.0	197.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	4536.0	197.4
Potassium (K^+):	24.0	0.6
Magnesium (Mg^{2+}):	18.0	1.5
Calcium (Ca^{2+}):	173.0	8.6
Strontium (Sr^{2+}):	20.0	0.5
Barium (Ba^{2+}):	21.0	0.3
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	3.0	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	545	N/A

ND = Not Determined

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)**
80°F	15 psi	1.58	12.031	0.30	33.201	-2.21	0.000	-2.45	0.000
93°F	24 psi	1.46	11.897	0.32	35.241	-2.21	0.000	-2.40	0.000
107°F	34 psi	1.37	11.749	0.38	40.944	-2.21	0.000	-2.34	0.000
120°F	43 psi	1.28	11.592	0.45	47.956	-2.20	0.000	-2.28	0.000
133°F	53 psi	1.21	11.433	0.53	55.458	-2.19	0.000	-2.20	0.000
147°F	62 psi	1.15	11.277	0.62	63.079	-2.18	0.000	-2.12	0.000
160°F	72 psi	1.09	11.129	0.72	71.309	-2.16	0.000	-2.04	0.000
173°F	81 psi	1.05	10.995	0.82	79.380	-2.14	0.000	-1.95	0.000
187°F	91 psi	1.02	10.877	0.92	87.018	-2.12	0.000	-1.86	0.000
200°F	100 psi	0.99	10.780	1.03	94.214	-2.09	0.000	-1.76	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)**
80°F	15 psi	-1.48	0.000	-3.27	0.000	0.83	0.454	-0.15	0.000
93°F	24 psi	-1.48	0.000	-3.28	0.000	0.75	0.435	-0.08	0.000
107°F	34 psi	-1.47	0.000	-3.29	0.000	0.73	0.430	0.02	0.033
120°F	43 psi	-1.46	0.000	-3.30	0.000	0.73	0.432	0.13	0.185
133°F	53 psi	-1.44	0.000	-3.31	0.000	0.76	0.438	0.24	0.305
147°F	62 psi	-1.42	0.000	-3.31	0.000	0.79	0.446	0.35	0.399
160°F	72 psi	-1.39	0.000	-3.31	0.000	0.85	0.458	0.47	0.476
173°F	81 psi	-1.35	0.000	-3.31	0.000	0.91	0.470	0.58	0.534
187°F	91 psi	-1.31	0.000	-3.31	0.000	0.97	0.481	0.69	0.577
200°F	100 psi	-1.27	0.000	-3.30	0.000	1.04	0.491	0.80	0.610

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.

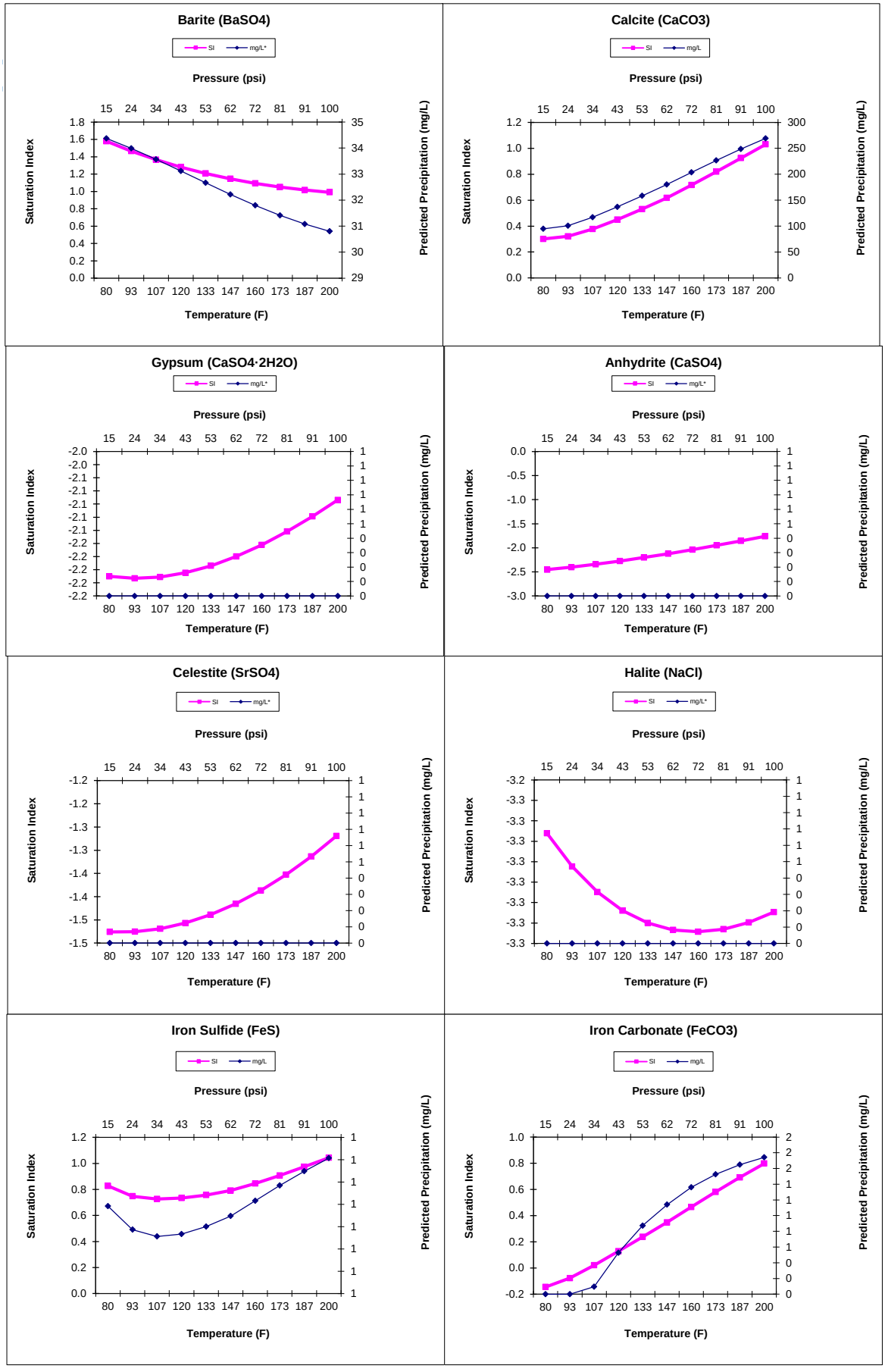
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41211 CAERUS OIL & GAS, Puckett, 12A-36D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12B-24D Separator
District:	Four Corners	**Sample ID:**	201201035718
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 12B-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	561.0	9.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	95.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20298
Density/Specific Gravity (g/cm³):	1.0112
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11800.0	332.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7646.0	332.7
Potassium (K^+):	36.0	0.9
Magnesium (Mg^{2+}):	15.0	1.2
Calcium (Ca^{2+}):	159.0	7.9
Strontium (Sr^{2+}):	13.0	0.3
Barium (Ba^{2+}):	18.0	0.3
Iron (Fe^{2+}):	0.0	0.0
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	487	N/A

ND = Not Determined

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)**
80°F	15 psi	1.32	10.036	0.04	3.441	-2.42	0.000	-2.66	0.000
96°F	24 psi	1.19	9.808	0.08	6.716	-2.43	0.000	-2.60	0.000
111°F	34 psi	1.08	9.554	0.15	12.888	-2.42	0.000	-2.53	0.000
127°F	43 psi	0.98	9.285	0.24	20.098	-2.42	0.000	-2.45	0.000
142°F	53 psi	0.90	9.013	0.33	27.695	-2.40	0.000	-2.36	0.000
158°F	62 psi	0.84	8.751	0.43	35.381	-2.39	0.000	-2.27	0.000
173°F	72 psi	0.78	8.508	0.54	43.282	-2.37	0.000	-2.17	0.000
189°F	81 psi	0.74	8.295	0.66	51.409	-2.34	0.000	-2.06	0.000
204°F	91 psi	0.71	8.116	0.78	59.174	-2.32	0.000	-1.96	0.000
220°F	100 psi	0.68	7.976	0.90	66.566	-2.29	0.000	-1.84	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)**
80°F	15 psi	-1.83	0.000	-2.84	0.000	-1.16	0.000	-2.41	0.000
96°F	24 psi	-1.83	0.000	-2.86	0.000	-1.23	0.000	-2.32	0.000
111°F	34 psi	-1.82	0.000	-2.88	0.000	-1.25	0.000	-2.20	0.000
127°F	43 psi	-1.81	0.000	-2.88	0.000	-1.24	0.000	-2.08	0.000
142°F	53 psi	-1.79	0.000	-2.89	0.000	-1.21	0.000	-1.96	0.000
158°F	62 psi	-1.76	0.000	-2.89	0.000	-1.17	0.000	-1.84	0.000
173°F	72 psi	-1.73	0.000	-2.89	0.000	-1.12	0.000	-1.71	0.000
189°F	81 psi	-1.69	0.000	-2.89	0.000	-1.05	0.000	-1.59	0.000
204°F	91 psi	-1.64	0.000	-2.88	0.000	-0.97	0.000	-1.48	0.000
220°F	100 psi	-1.59	0.000	-2.88	0.000	-0.89	0.000	-1.37	0.000

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.

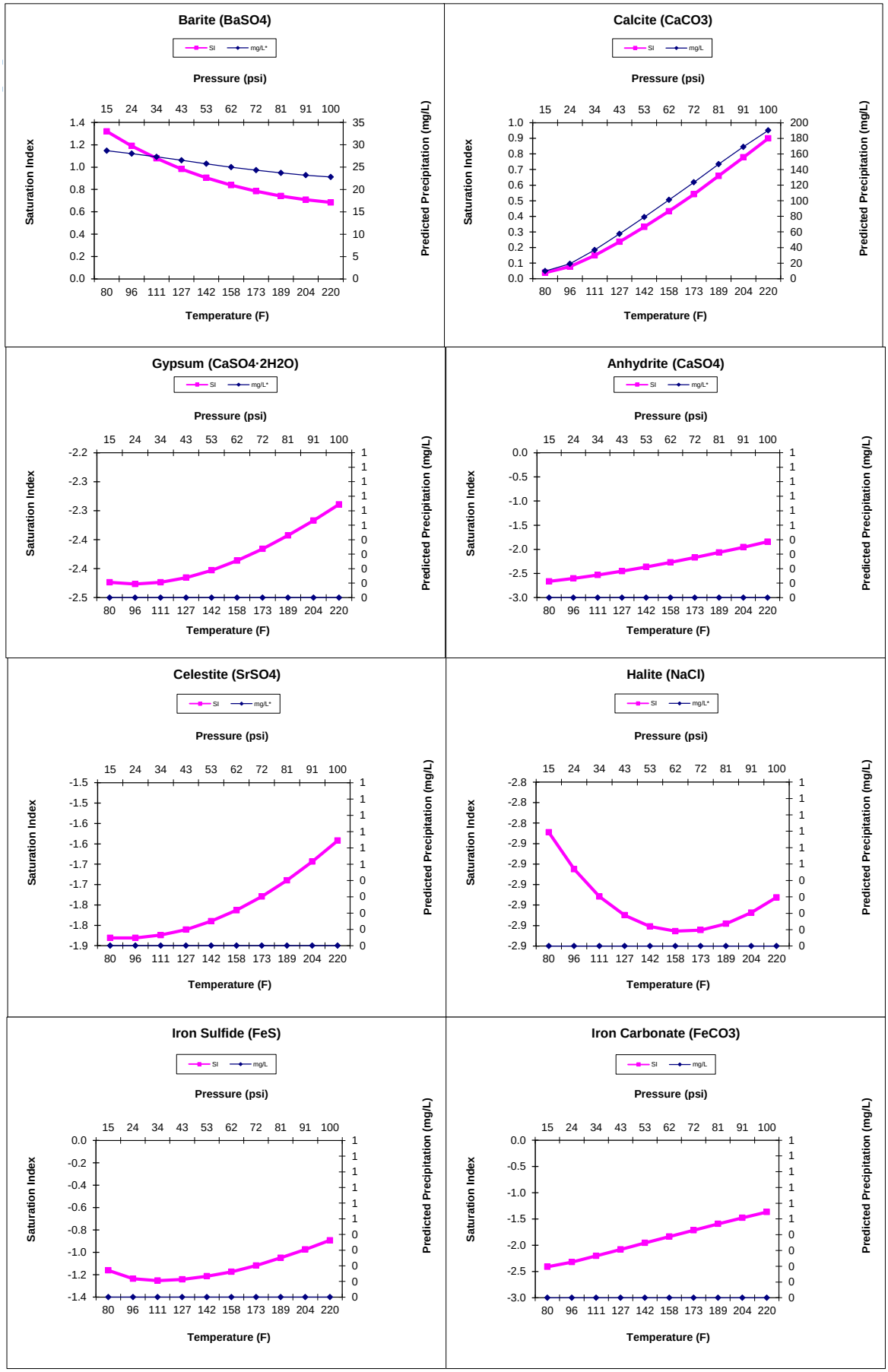
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 12B-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12B-31D Separator
District:	Four Corners	**Sample ID:**	201201037393
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 12B-31D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	927.0	15.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	38341
Density/Specific Gravity (g/cm³):	1.0233
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	22600.0	637.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	14645.0	637.3
Potassium (K^+):	30.2	0.8
Magnesium (Mg^{2+}):	7.4	0.6
Calcium (Ca^{2+}):	53.7	2.7
Strontium (Sr^{2+}):	7.0	0.2
Barium (Ba^{2+}):	14.6	0.2
Iron (Fe^{2+}):	6.0	0.2
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	183	N/A

ND = Not Determined

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)**
80°F	15 psi	0.96	7.541	-0.56	0.000	-3.12	0.000	-3.35	0.000
96°F	24 psi	0.83	7.157	-0.53	0.000	-3.12	0.000	-3.29	0.000
111°F	34 psi	0.72	6.728	-0.46	0.000	-3.12	0.000	-3.22	0.000
127°F	43 psi	0.62	6.268	-0.37	0.000	-3.12	0.000	-3.14	0.000
142°F	53 psi	0.54	5.796	-0.28	0.000	-3.11	0.000	-3.06	0.000
158°F	62 psi	0.47	5.328	-0.18	0.000	-3.09	0.000	-2.97	0.000
173°F	72 psi	0.41	4.882	-0.08	0.000	-3.08	0.000	-2.87	0.000
189°F	81 psi	0.36	4.470	0.04	2.591	-3.06	0.000	-2.78	0.000
204°F	91 psi	0.32	4.104	0.15	10.141	-3.04	0.000	-2.67	0.000
220°F	100 psi	0.29	3.789	0.26	16.766	-3.02	0.000	-2.57	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)**
80°F	15 psi	-2.33	0.000	-2.31	0.000	0.95	1.905	0.22	1.669
96°F	24 psi	-2.33	0.000	-2.33	0.000	0.88	1.824	0.30	2.139
111°F	34 psi	-2.33	0.000	-2.34	0.000	0.87	1.811	0.42	2.632
127°F	43 psi	-2.32	0.000	-2.35	0.000	0.88	1.831	0.54	3.031
142°F	53 psi	-2.30	0.000	-2.36	0.000	0.91	1.869	0.65	3.333
158°F	62 psi	-2.28	0.000	-2.36	0.000	0.96	1.916	0.77	3.558
173°F	72 psi	-2.26	0.000	-2.36	0.000	1.02	1.978	0.88	3.735
189°F	81 psi	-2.23	0.000	-2.36	0.000	1.09	2.045	0.99	3.868
204°F	91 psi	-2.20	0.000	-2.35	0.000	1.16	2.109	1.10	3.966
220°F	100 psi	-2.16	0.000	-2.35	0.000	1.24	2.170	1.20	4.039

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.

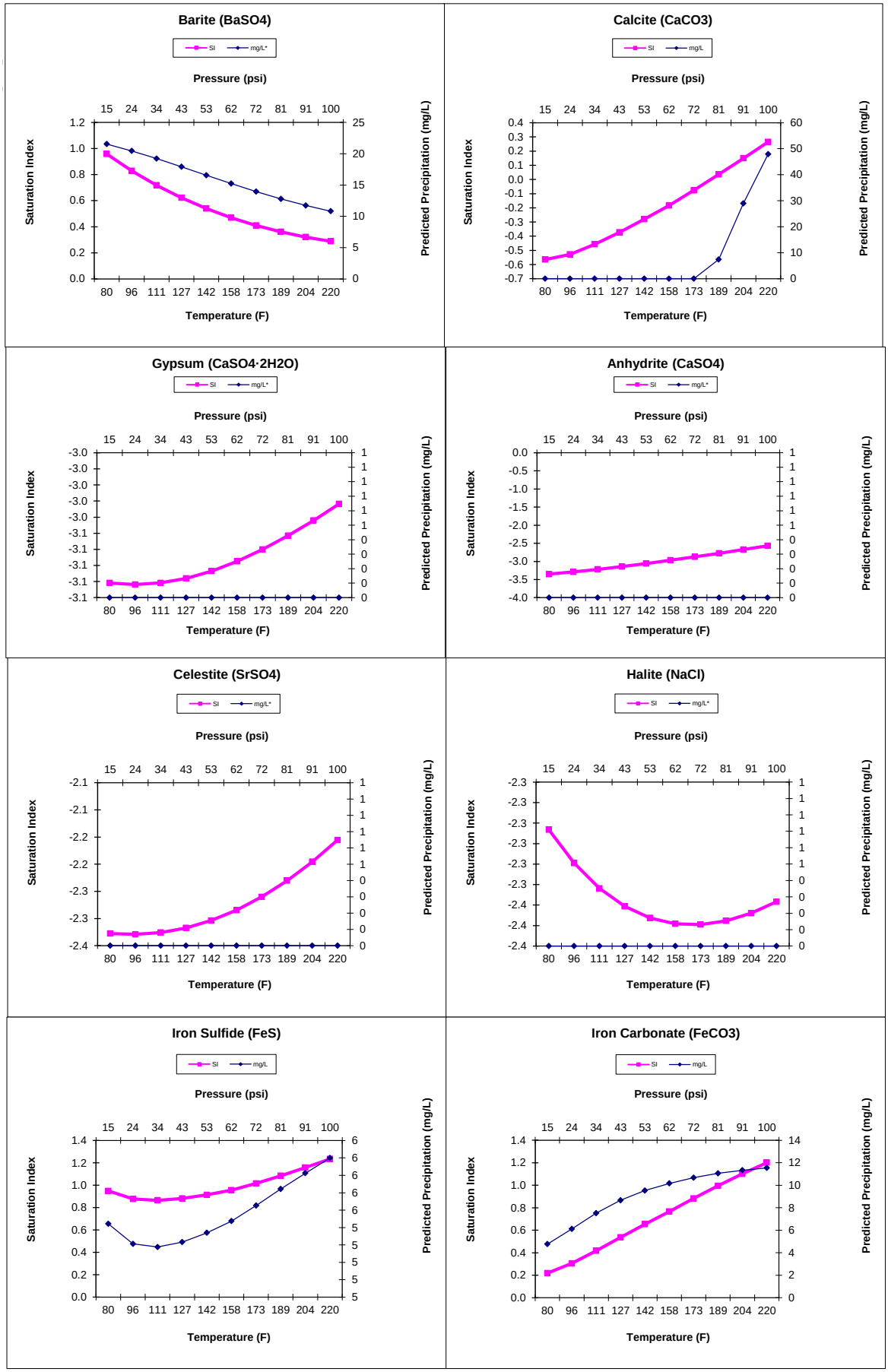
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 12B-31D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	Puckett 12B-36D Separator
District:	Four Corners	**Sample ID:**	201201034116
Sales Rep:	Sean Higgins	**Sample Date:**	10/29/2012
Lease:	Puckett	**Log Out Date:**	11/15/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, Puckett 12B-36D Separator

Field Data

Initial Temperature (°F):	200
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	854.0	14.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	0.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	14305
Density/Specific Gravity (g/cm^3):	1.0071
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	8000.0	225.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	mg/L	meq/L
Sodium (Na^+):	5184.0	225.6
Potassium (K^+):	27.0	0.7
Magnesium (Mg^{2+}):	14.0	1.2
Calcium (Ca^{2+}):	148.0	7.4
Strontium (Sr^{2+}):	15.0	0.3
Barium (Ba^{2+}):	10.0	0.1
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	2.0	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	452	N/A

ND = Not Determined

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)
80°F	15 psi	1.21	5.527	0.25	27.152	-2.32	0.000	-2.56	0.000
93°F	24 psi	1.10	5.403	0.27	29.146	-2.32	0.000	-2.51	0.000
107°F	34 psi	1.00	5.267	0.32	34.754	-2.32	0.000	-2.45	0.000
120°F	43 psi	0.91	5.121	0.40	41.625	-2.31	0.000	-2.38	0.000
133°F	53 psi	0.84	4.973	0.48	48.936	-2.30	0.000	-2.31	0.000
147°F	62 psi	0.78	4.826	0.56	56.314	-2.29	0.000	-2.23	0.000
160°F	72 psi	0.72	4.687	0.66	64.237	-2.27	0.000	-2.15	0.000
173°F	81 psi	0.68	4.559	0.76	71.909	-2.25	0.000	-2.06	0.000
187°F	91 psi	0.65	4.446	0.87	79.075	-2.23	0.000	-1.97	0.000
200°F	100 psi	0.62	4.352	0.97	85.724	-2.21	0.000	-1.87	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)
80°F	15 psi	-1.64	0.000	-3.16	0.000	0.99	0.488	-0.13	0.000
93°F	24 psi	-1.64	0.000	-3.17	0.000	0.91	0.475	-0.06	0.000
107°F	34 psi	-1.64	0.000	-3.19	0.000	0.89	0.472	0.03	0.054
120°F	43 psi	-1.62	0.000	-3.20	0.000	0.90	0.473	0.14	0.200
133°F	53 psi	-1.61	0.000	-3.20	0.000	0.92	0.476	0.25	0.316
147°F	62 psi	-1.58	0.000	-3.21	0.000	0.95	0.482	0.36	0.406
160°F	72 psi	-1.56	0.000	-3.21	0.000	1.00	0.489	0.47	0.481
173°F	81 psi	-1.52	0.000	-3.21	0.000	1.06	0.497	0.59	0.537
187°F	91 psi	-1.49	0.000	-3.20	0.000	1.13	0.505	0.70	0.579
200°F	100 psi	-1.44	0.000	-3.20	0.000	1.20	0.511	0.80	0.611

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.

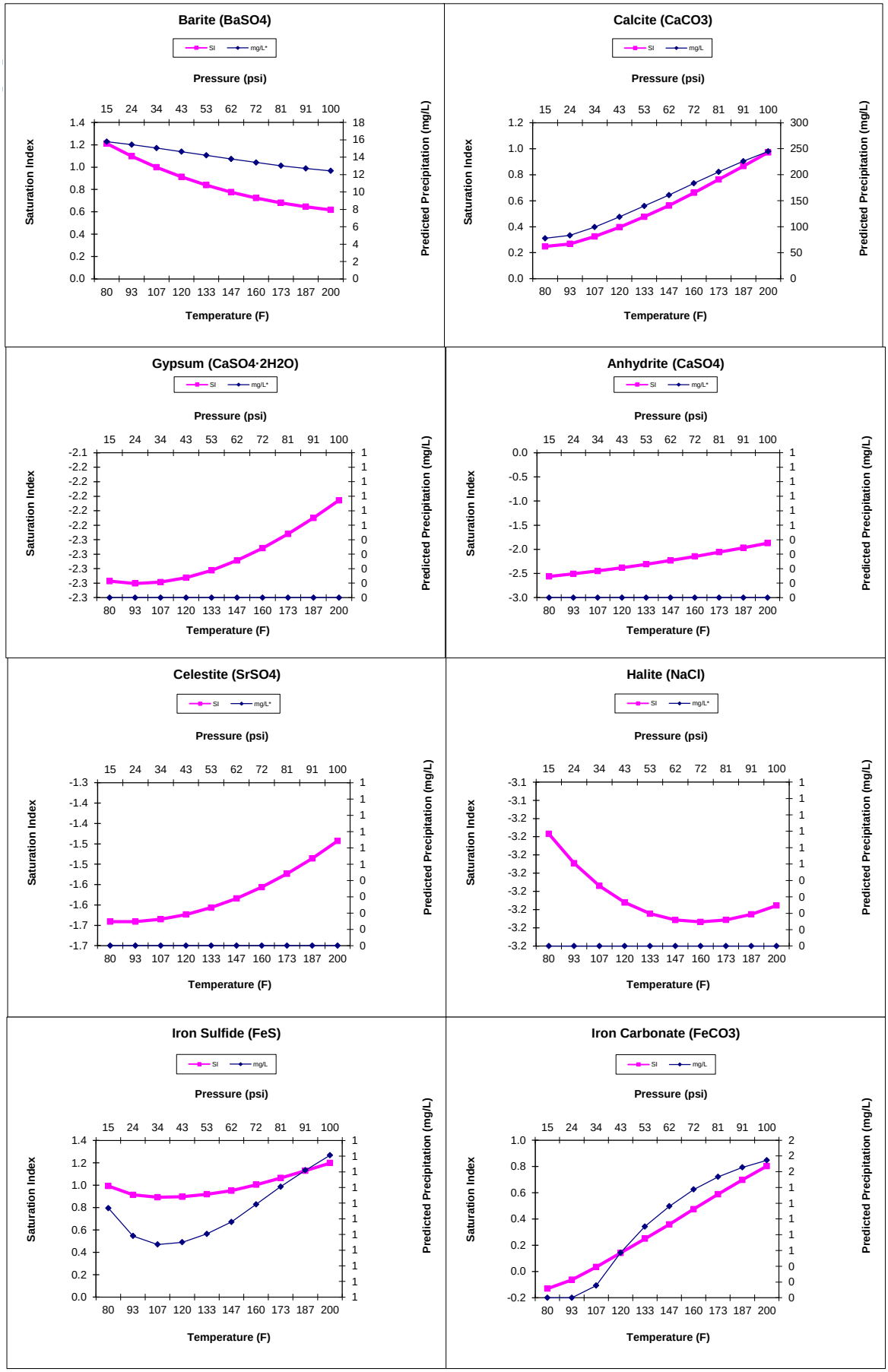
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41211 CAERUS OIL & GAS, Puckett, Puckett 12B-36D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12B-7RD Separator
District:	Four Corners	**Sample ID:**	201201036494
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 12B-7RD Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	250.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	40185
Density/Specific Gravity (g/cm^3):	1.0249
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	23600.0	665.7
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.97	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	15293.0	665.5
Potassium (K^+):	62.5	1.6
Magnesium (Mg^{2+}):	37.1	3.1
Calcium (Ca^{2+}):	380.1	19.0
Strontium (Sr^{2+}):	39.8	0.9
Barium (Ba^{2+}):	84.7	1.2
Iron (Fe^{2+}):	170.3	6.1
Manganese (Mn^{2+}):	2.0	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1210	N/A

ND = Not Determined

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)**
80°F	15 psi	2.16	49.807	-0.53	0.000	-1.85	0.000	-2.07	0.000
96°F	24 psi	2.03	49.613	-0.49	0.000	-1.85	0.000	-2.01	0.000
111°F	34 psi	1.92	49.393	-0.42	0.000	-1.84	0.000	-1.94	0.000
127°F	43 psi	1.82	49.153	-0.34	0.000	-1.84	0.000	-1.86	0.000
142°F	53 psi	1.74	48.903	-0.24	0.000	-1.83	0.000	-1.78	0.000
158°F	62 psi	1.67	48.649	-0.15	0.000	-1.82	0.000	-1.69	0.000
173°F	72 psi	1.61	48.403	-0.04	0.000	-1.80	0.000	-1.59	0.000
189°F	81 psi	1.56	48.172	0.07	6.396	-1.78	0.000	-1.50	0.000
204°F	91 psi	1.52	47.963	0.18	16.139	-1.76	0.000	-1.39	0.000
220°F	100 psi	1.49	47.779	0.30	25.193	-1.74	0.000	-1.29	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)**
80°F	15 psi	-1.14	0.000	-2.28	0.000	1.53	2.066	0.83	55.280
96°F	24 psi	-1.14	0.000	-2.29	0.000	1.47	2.055	0.91	59.379
111°F	34 psi	-1.13	0.000	-2.31	0.000	1.47	2.056	1.03	64.417
127°F	43 psi	-1.12	0.000	-2.32	0.000	1.51	2.061	1.14	69.283
142°F	53 psi	-1.11	0.000	-2.32	0.000	1.55	2.068	1.26	73.700
158°F	62 psi	-1.09	0.000	-2.32	0.000	1.61	2.076	1.37	77.619
173°F	72 psi	-1.07	0.000	-2.32	0.000	1.68	2.085	1.49	81.272
189°F	81 psi	-1.04	0.000	-2.32	0.000	1.76	2.094	1.60	84.583
204°F	91 psi	-1.00	0.000	-2.32	0.000	1.85	2.101	1.71	87.455
220°F	100 psi	-0.96	0.000	-2.31	0.000	1.93	2.107	1.80	89.958

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.

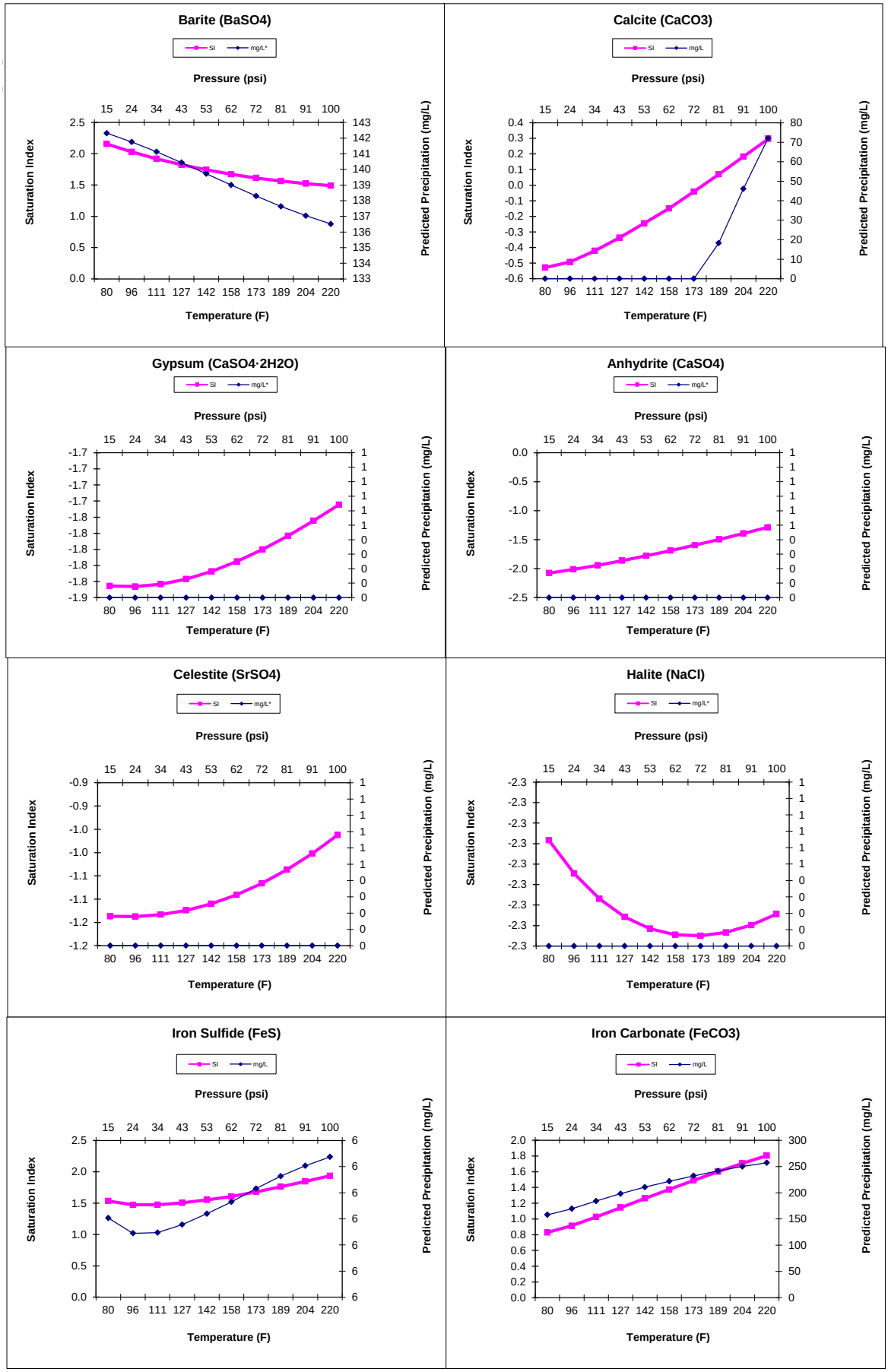
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 12B-7RD Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12C-7D Separator
District:	Four Corners	**Sample ID:**	201201036495
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 12C-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	488.0	8.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	330.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	36647
Density/Specific Gravity (g/cm^3):	1.0226
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	21200.0	598.0
Sulfate (SO_4^{2-}):	450.0	9.4
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	13738.0	597.8
Potassium (K^+):	43.8	1.1
Magnesium (Mg^{2+}):	40.4	3.3
Calcium (Ca^{2+}):	414.0	20.7
Strontium (Sr^{2+}):	40.5	0.9
Barium (Ba^{2+}):	115.9	1.7
Iron (Fe^{2+}):	114.5	4.1
Manganese (Mn^{2+}):	1.5	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1332	N/A

ND = Not Determined

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)**
80°F	15 psi	2.81	68.811	-0.46	0.000	-1.30	0.000	-1.53	0.000
96°F	24 psi	2.68	68.766	-0.43	0.000	-1.30	0.000	-1.47	0.000
111°F	34 psi	2.57	68.716	-0.36	0.000	-1.30	0.000	-1.39	0.000
127°F	43 psi	2.47	68.660	-0.28	0.000	-1.29	0.000	-1.32	0.000
142°F	53 psi	2.39	68.602	-0.18	0.000	-1.28	0.000	-1.23	0.000
158°F	62 psi	2.32	68.544	-0.09	0.000	-1.26	0.000	-1.14	0.000
173°F	72 psi	2.27	68.488	0.03	3.143	-1.25	0.000	-1.04	0.000
189°F	81 psi	2.22	68.435	0.14	16.447	-1.23	0.000	-0.94	0.000
204°F	91 psi	2.18	68.387	0.25	28.795	-1.21	0.000	-0.84	0.000
220°F	100 psi	2.15	68.346	0.37	40.237	-1.19	0.000	-0.73	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)**
80°F	15 psi	-0.62	0.000	-2.37	0.000	1.59	5.353	0.69	47.662
96°F	24 psi	-0.62	0.000	-2.39	0.000	1.53	5.327	0.78	51.593
111°F	34 psi	-0.62	0.000	-2.40	0.000	1.53	5.329	0.89	56.379
127°F	43 psi	-0.61	0.000	-2.41	0.000	1.57	5.344	1.01	60.828
142°F	53 psi	-0.59	0.000	-2.41	0.000	1.62	5.364	1.13	64.668
158°F	62 psi	-0.57	0.000	-2.42	0.000	1.68	5.385	1.24	67.878
173°F	72 psi	-0.54	0.000	-2.42	0.000	1.76	5.410	1.36	70.757
189°F	81 psi	-0.51	0.000	-2.41	0.000	1.85	5.431	1.47	73.078
204°F	91 psi	-0.48	0.000	-2.41	0.000	1.94	5.449	1.58	74.922
220°F	100 psi	-0.43	0.000	-2.41	0.000	2.03	5.463	1.68	76.388

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.

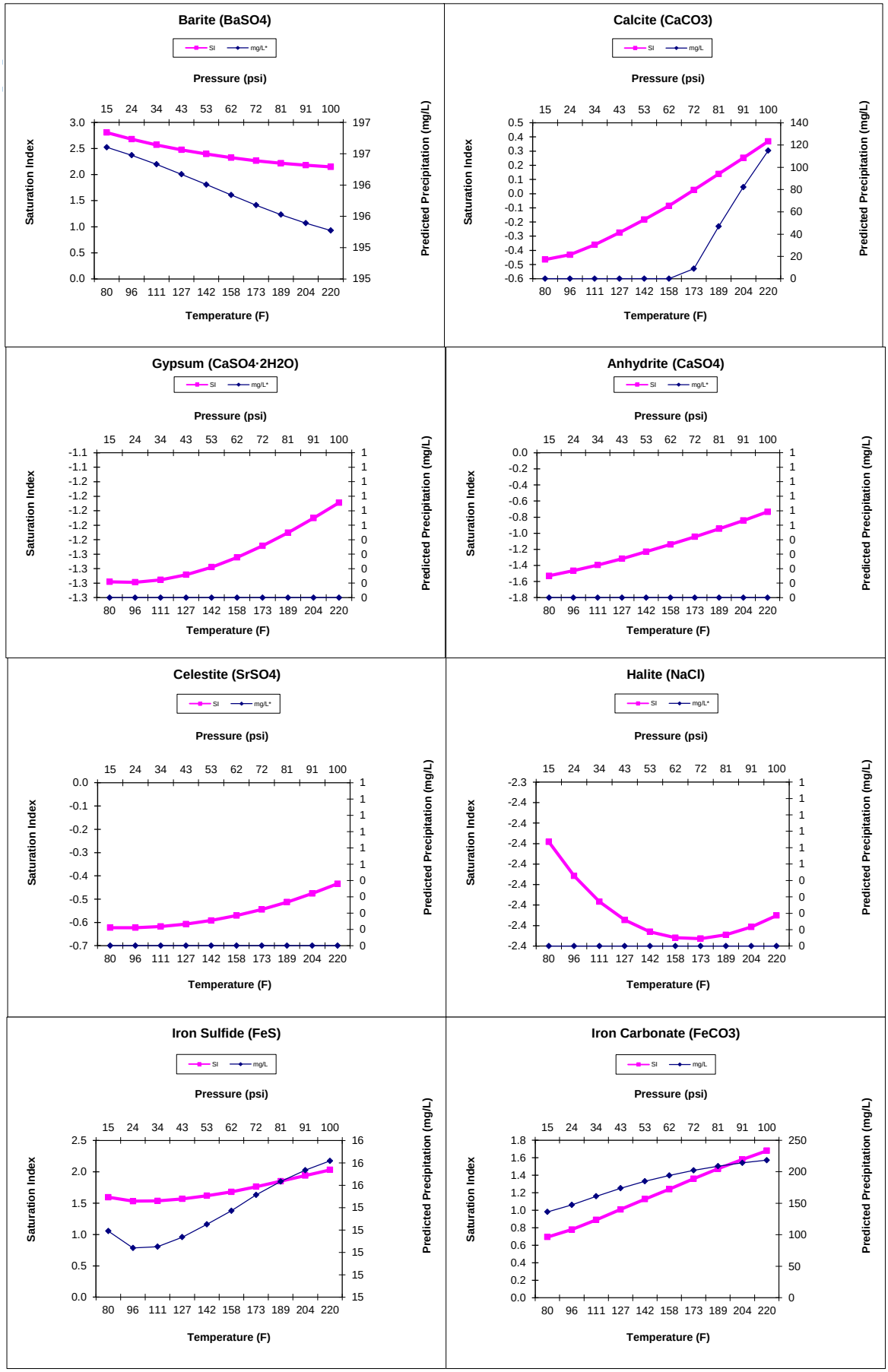
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 12C-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	12D-24D Separator
District:	Four Corners	**Sample ID:**	201201035719
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 12D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	500.0	8.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	155.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21501
Density/Specific Gravity (g/cm³):	1.0122
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12500.0	352.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8100.0	352.5
Potassium (K^+):	48.0	1.2
Magnesium (Mg^{2+}):	20.0	1.6
Calcium (Ca^{2+}):	199.0	9.9
Strontium (Sr^{2+}):	17.0	0.4
Barium (Ba^{2+}):	33.0	0.5
Iron (Fe^{2+}):	33.0	1.2
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	623	N/A

ND = Not Determined

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)**
80°F	15 psi	1.55	18.653	-0.92	0.000	-2.35	0.000	-2.59	0.000
96°F	24 psi	1.42	18.331	-0.89	0.000	-2.36	0.000	-2.53	0.000
111°F	34 psi	1.31	17.976	-0.82	0.000	-2.35	0.000	-2.46	0.000
127°F	43 psi	1.22	17.604	-0.73	0.000	-2.35	0.000	-2.38	0.000
142°F	53 psi	1.14	17.231	-0.63	0.000	-2.33	0.000	-2.29	0.000
158°F	62 psi	1.07	16.875	-0.53	0.000	-2.32	0.000	-2.20	0.000
173°F	72 psi	1.02	16.548	-0.41	0.000	-2.30	0.000	-2.10	0.000
189°F	81 psi	0.97	16.261	-0.29	0.000	-2.27	0.000	-2.00	0.000
204°F	91 psi	0.94	16.021	-0.17	0.000	-2.25	0.000	-1.89	0.000
220°F	100 psi	0.92	15.831	-0.05	0.000	-2.22	0.000	-1.78	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)**
80°F	15 psi	-1.74	0.000	-2.80	0.000	0.63	3.217	0.05	1.947
96°F	24 psi	-1.74	0.000	-2.82	0.000	0.56	3.018	0.13	4.987
111°F	34 psi	-1.73	0.000	-2.83	0.000	0.57	3.049	0.24	8.669
127°F	43 psi	-1.72	0.000	-2.84	0.000	0.61	3.182	0.37	11.929
142°F	53 psi	-1.70	0.000	-2.84	0.000	0.67	3.356	0.49	14.575
158°F	62 psi	-1.67	0.000	-2.85	0.000	0.76	3.565	0.62	16.765
173°F	72 psi	-1.64	0.000	-2.85	0.000	0.86	3.769	0.75	18.483
189°F	81 psi	-1.60	0.000	-2.84	0.000	0.96	3.940	0.87	19.757
204°F	91 psi	-1.56	0.000	-2.84	0.000	1.07	4.082	0.99	20.706
220°F	100 psi	-1.51	0.000	-2.83	0.000	1.18	4.198	1.10	21.417

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.

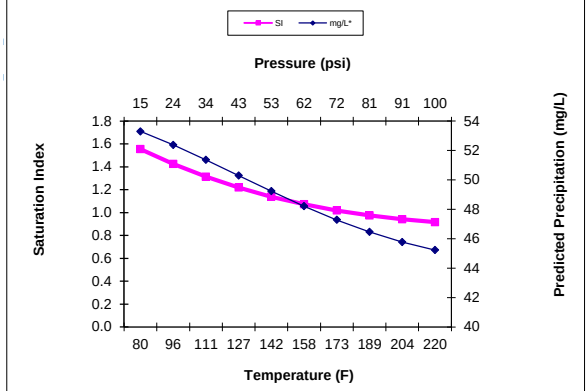
Calculate

ScaleSoftPitzer™ SSP2010

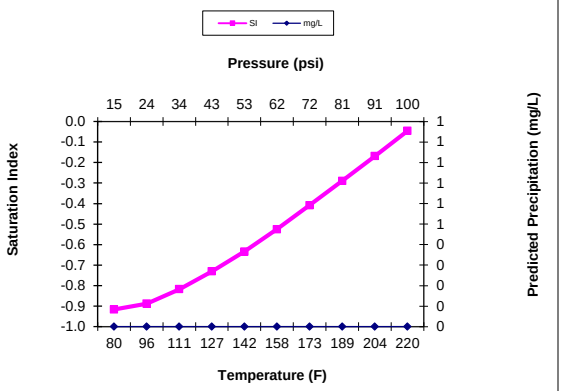
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 12D-24D Separator

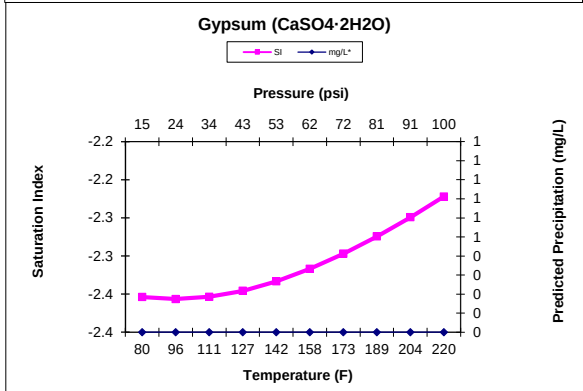
Barite (BaSO4)



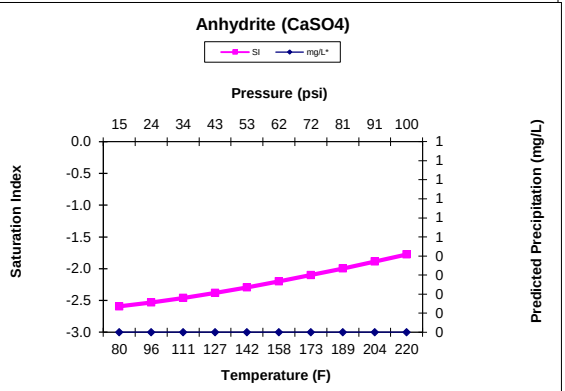
Calcite (CaCO3)



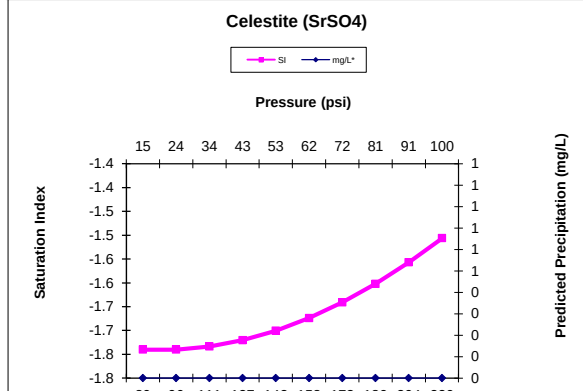
Gypsum (CaSO4·2H2O)



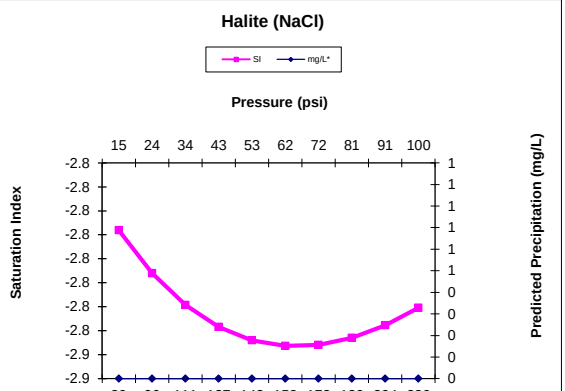
Anhydrite (CaSO4)



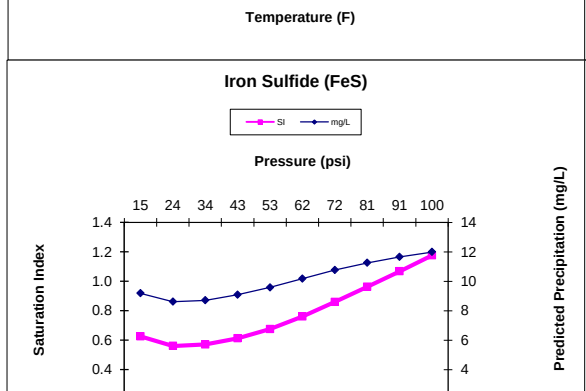
Celestite (SrSO4)



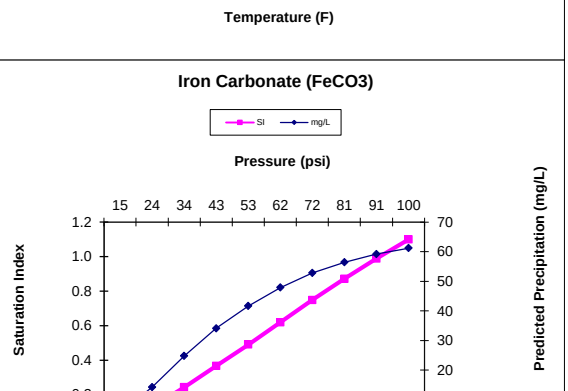
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13-31D Separator
District:	Four Corners	**Sample ID:**	201201037395
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 13-31D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	175.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	43223
Density/Specific Gravity (g/cm^3):	1.0266
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	25700.0	725.0
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	16654.0	724.7
Potassium (K^+):	38.7	1.0
Magnesium (Mg^{2+}):	12.0	1.0
Calcium (Ca^{2+}):	78.2	3.9
Strontium (Sr^{2+}):	11.6	0.3
Barium (Ba^{2+}):	29.4	0.4
Iron (Fe^{2+}):	49.5	1.8
Manganese (Mn^{2+}):	0.9	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	280	N/A

ND = Not Determined

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)**
80°F	15 psi	1.50	16.782	-0.94	0.000	-2.71	0.000	-2.94	0.000
96°F	24 psi	1.38	16.554	-0.90	0.000	-2.71	0.000	-2.88	0.000
111°F	34 psi	1.27	16.293	-0.83	0.000	-2.71	0.000	-2.81	0.000
127°F	43 psi	1.17	16.008	-0.75	0.000	-2.71	0.000	-2.73	0.000
142°F	53 psi	1.09	15.709	-0.66	0.000	-2.70	0.000	-2.65	0.000
158°F	62 psi	1.02	15.407	-0.56	0.000	-2.69	0.000	-2.56	0.000
173°F	72 psi	0.96	15.111	-0.46	0.000	-2.67	0.000	-2.47	0.000
189°F	81 psi	0.91	14.832	-0.34	0.000	-2.66	0.000	-2.37	0.000
204°F	91 psi	0.86	14.578	-0.23	0.000	-2.64	0.000	-2.27	0.000
220°F	100 psi	0.83	14.353	-0.12	0.000	-2.62	0.000	-2.16	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)**
80°F	15 psi	-1.86	0.000	-2.21	0.000	1.37	2.908	0.57	22.818
96°F	24 psi	-1.86	0.000	-2.22	0.000	1.30	2.884	0.66	24.835
111°F	34 psi	-1.85	0.000	-2.23	0.000	1.30	2.883	0.77	27.073
127°F	43 psi	-1.85	0.000	-2.24	0.000	1.33	2.894	0.89	28.976
142°F	53 psi	-1.83	0.000	-2.25	0.000	1.37	2.909	1.00	30.479
158°F	62 psi	-1.82	0.000	-2.25	0.000	1.42	2.927	1.11	31.635
173°F	72 psi	-1.79	0.000	-2.25	0.000	1.49	2.947	1.23	32.576
189°F	81 psi	-1.77	0.000	-2.25	0.000	1.57	2.966	1.34	33.299
204°F	91 psi	-1.73	0.000	-2.25	0.000	1.65	2.983	1.44	33.838
220°F	100 psi	-1.70	0.000	-2.24	0.000	1.73	2.997	1.54	34.245

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.

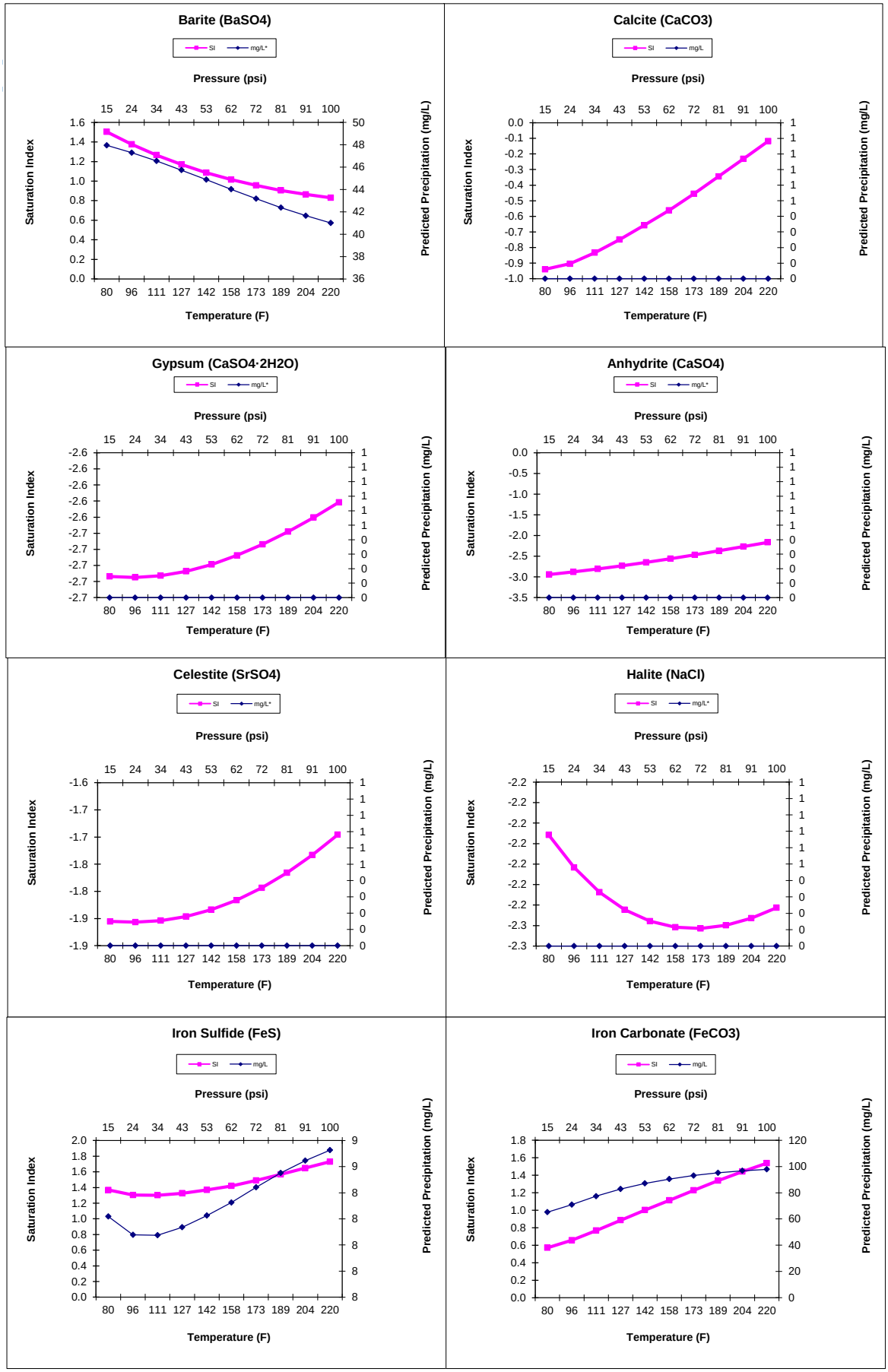
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 13-31D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13D-31D Separator
District:	Four Corners	**Sample ID:**	201201037409
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 13D-31D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	610.0	10.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	530.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	15521
Density/Specific Gravity (g/cm³):	1.0081
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8700.0	245.4
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5638.0	245.3
Potassium (K^+):	40.5	1.0
Magnesium (Mg^{2+}):	25.5	2.1
Calcium (Ca^{2+}):	192.1	9.6
Strontium (Sr^{2+}):	21.9	0.5
Barium (Ba^{2+}):	44.6	0.6
Iron (Fe^{2+}):	47.7	1.7
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	643	N/A

ND = Not Determined

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)**
80°F	15 psi	2.42	26.415	-0.40	0.000	-1.65	0.000	-1.89	0.000
96°F	24 psi	2.29	26.373	-0.37	0.000	-1.65	0.000	-1.83	0.000
111°F	34 psi	2.17	26.325	-0.29	0.000	-1.65	0.000	-1.76	0.000
127°F	43 psi	2.08	26.275	-0.20	0.000	-1.64	0.000	-1.68	0.000
142°F	53 psi	2.00	26.223	-0.10	0.000	-1.63	0.000	-1.59	0.000
158°F	62 psi	1.94	26.173	0.00	0.000	-1.61	0.000	-1.49	0.000
173°F	72 psi	1.89	26.128	0.12	14.010	-1.59	0.000	-1.39	0.000
189°F	81 psi	1.85	26.088	0.24	27.280	-1.56	0.000	-1.28	0.000
204°F	91 psi	1.81	26.055	0.36	39.719	-1.53	0.000	-1.17	0.000
220°F	100 psi	1.79	26.030	0.49	51.357	-1.50	0.000	-1.06	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)**
80°F	15 psi	-0.92	0.000	-3.09	0.000	-8.77	0.000	0.76	26.439
96°F	24 psi	-0.92	0.000	-3.11	0.000	-8.83	0.000	0.85	27.830
111°F	34 psi	-0.91	0.000	-3.12	0.000	-8.82	0.000	0.97	29.355
127°F	43 psi	-0.89	0.000	-3.13	0.000	-8.78	0.000	1.10	30.624
142°F	53 psi	-0.87	0.000	-3.14	0.000	-8.73	0.000	1.22	31.602
158°F	62 psi	-0.84	0.000	-3.14	0.000	-8.66	0.000	1.35	32.335
173°F	72 psi	-0.80	0.000	-3.14	0.000	-8.57	0.000	1.48	32.921
189°F	81 psi	-0.76	0.000	-3.14	0.000	-8.47	0.000	1.61	33.345
204°F	91 psi	-0.71	0.000	-3.13	0.000	-8.37	0.000	1.73	33.653
220°F	100 psi	-0.65	0.000	-3.12	0.000	-8.26	0.000	1.85	33.877

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.

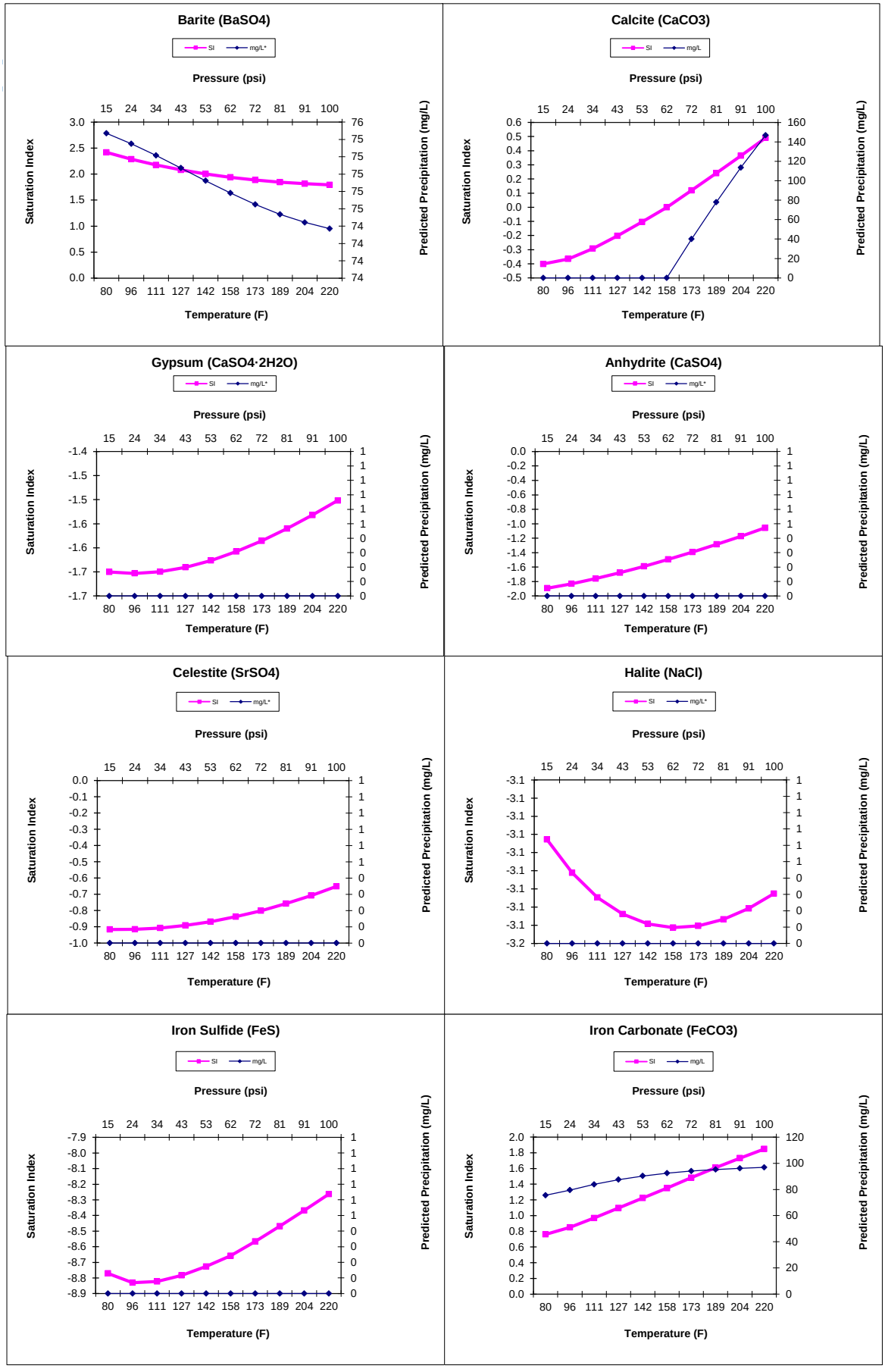
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 13D-31D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14-6D Separator
District:	Four Corners	**Sample ID:**	201201037397
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 14-6D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1952.0	32.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	1000.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	55057
Density/Specific Gravity (g/cm³):	1.0346
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	31800.0	897.0
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	20606.0	896.7
Potassium (K^+):	54.3	1.4
Magnesium (Mg^{2+}):	45.5	3.7
Calcium (Ca^{2+}):	283.4	14.1
Strontium (Sr^{2+}):	38.4	0.9
Barium (Ba^{2+}):	91.1	1.3
Iron (Fe^{2+}):	85.0	3.0
Manganese (Mn^{2+}):	0.9	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1006	N/A

ND = Not Determined

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)**
80°F	15 psi	1.88	52.320	0.09	23.968	-2.23	0.000	-2.46	0.000
96°F	24 psi	1.75	51.737	0.11	29.218	-2.23	0.000	-2.39	0.000
111°F	34 psi	1.64	51.087	0.17	45.691	-2.23	0.000	-2.32	0.000
127°F	43 psi	1.54	50.392	0.25	65.102	-2.23	0.000	-2.24	0.000
142°F	53 psi	1.46	49.675	0.35	85.520	-2.22	0.000	-2.16	0.000
158°F	62 psi	1.39	48.959	0.45	107.327	-2.21	0.000	-2.07	0.000
173°F	72 psi	1.32	48.267	0.56	126.994	-2.20	0.000	-1.98	0.000
189°F	81 psi	1.27	47.615	0.67	144.681	-2.18	0.000	-1.89	0.000
204°F	91 psi	1.23	47.016	0.78	160.516	-2.17	0.000	-1.79	0.000
220°F	100 psi	1.19	46.480	0.89	174.608	-2.15	0.000	-1.69	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)**
80°F	15 psi	-1.44	0.000	-2.03	0.000	-8.65	0.000	1.32	58.156
96°F	24 psi	-1.44	0.000	-2.04	0.000	-8.74	0.000	1.39	58.671
111°F	34 psi	-1.43	0.000	-2.05	0.000	-8.75	0.000	1.50	59.325
127°F	43 psi	-1.43	0.000	-2.06	0.000	-8.73	0.000	1.61	59.875
142°F	53 psi	-1.42	0.000	-2.07	0.000	-8.68	0.000	1.73	60.312
158°F	62 psi	-1.40	0.000	-2.07	0.000	-8.61	0.000	1.85	60.664
173°F	72 psi	-1.38	0.000	-2.07	0.000	-8.53	0.000	1.97	60.914
189°F	81 psi	-1.36	0.000	-2.07	0.000	-8.46	0.000	2.07	61.094
204°F	91 psi	-1.33	0.000	-2.07	0.000	-8.38	0.000	2.17	61.227
220°F	100 psi	-1.30	0.000	-2.06	0.000	-8.30	0.000	2.27	61.326

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.

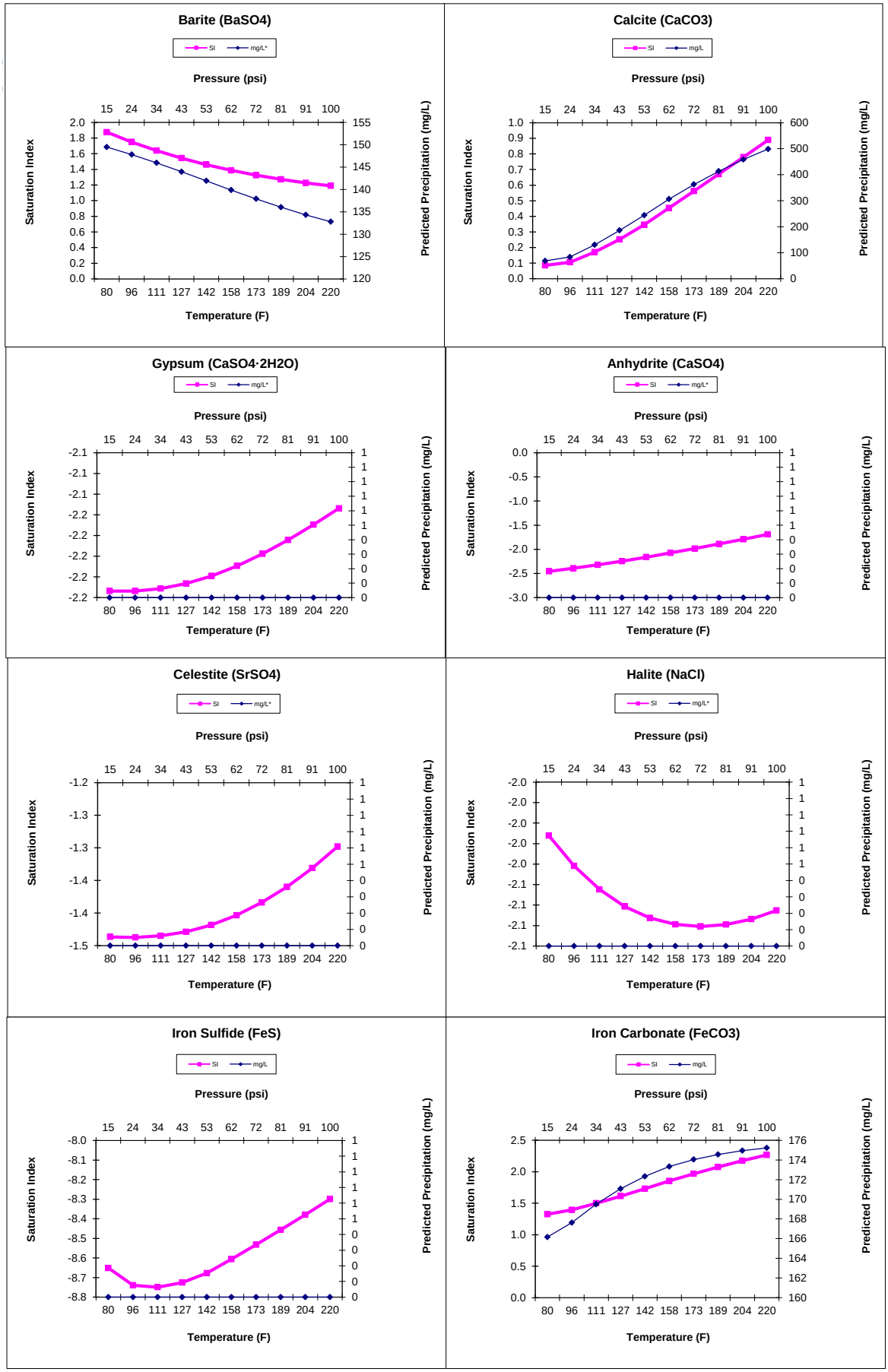
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 14-6D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14C-24D Separator
District:	Four Corners	**Sample ID:**	201201035733
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 14C-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	512.0	8.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	95.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	25586
Density/Specific Gravity (g/cm³):	1.0149
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14800.0	417.5
Sulfate (SO_4^{2-}):	300.0	6.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9590.0	417.3
Potassium (K^+):	70.0	1.8
Magnesium (Mg^{2+}):	29.0	2.4
Calcium (Ca^{2+}):	254.0	12.7
Strontium (Sr^{2+}):	18.0	0.4
Barium (Ba^{2+}):	2.2	0.0
Iron (Fe^{2+}):	10.0	0.4
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	777	N/A

ND = Not Determined

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)**
80°F	15 psi	1.08	1.216	-0.33	0.000	-1.54	0.000	-1.78	0.000
96°F	24 psi	0.95	1.178	-0.29	0.000	-1.54	0.000	-1.71	0.000
111°F	34 psi	0.84	1.135	-0.22	0.000	-1.54	0.000	-1.64	0.000
127°F	43 psi	0.75	1.088	-0.13	0.000	-1.53	0.000	-1.56	0.000
142°F	53 psi	0.67	1.040	-0.03	0.000	-1.52	0.000	-1.48	0.000
158°F	62 psi	0.60	0.992	0.07	7.245	-1.50	0.000	-1.38	0.000
173°F	72 psi	0.54	0.947	0.18	18.835	-1.48	0.000	-1.29	0.000
189°F	81 psi	0.50	0.905	0.29	30.211	-1.46	0.000	-1.18	0.000
204°F	91 psi	0.46	0.870	0.41	40.913	-1.44	0.000	-1.08	0.000
220°F	100 psi	0.44	0.840	0.53	50.959	-1.41	0.000	-0.97	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)**
80°F	15 psi	-1.01	0.000	-2.66	0.000	0.67	1.381	0.01	0.081
96°F	24 psi	-1.01	0.000	-2.68	0.000	0.60	1.305	0.09	1.302
111°F	34 psi	-1.00	0.000	-2.69	0.000	0.61	1.307	0.21	2.616
127°F	43 psi	-0.99	0.000	-2.70	0.000	0.64	1.345	0.33	3.704
142°F	53 psi	-0.97	0.000	-2.71	0.000	0.68	1.401	0.45	4.544
158°F	62 psi	-0.95	0.000	-2.71	0.000	0.74	1.463	0.57	5.176
173°F	72 psi	-0.91	0.000	-2.71	0.000	0.81	1.535	0.70	5.675
189°F	81 psi	-0.88	0.000	-2.71	0.000	0.90	1.605	0.82	6.051
204°F	91 psi	-0.84	0.000	-2.70	0.000	0.99	1.666	0.93	6.326
220°F	100 psi	-0.79	0.000	-2.70	0.000	1.08	1.719	1.04	6.530

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.

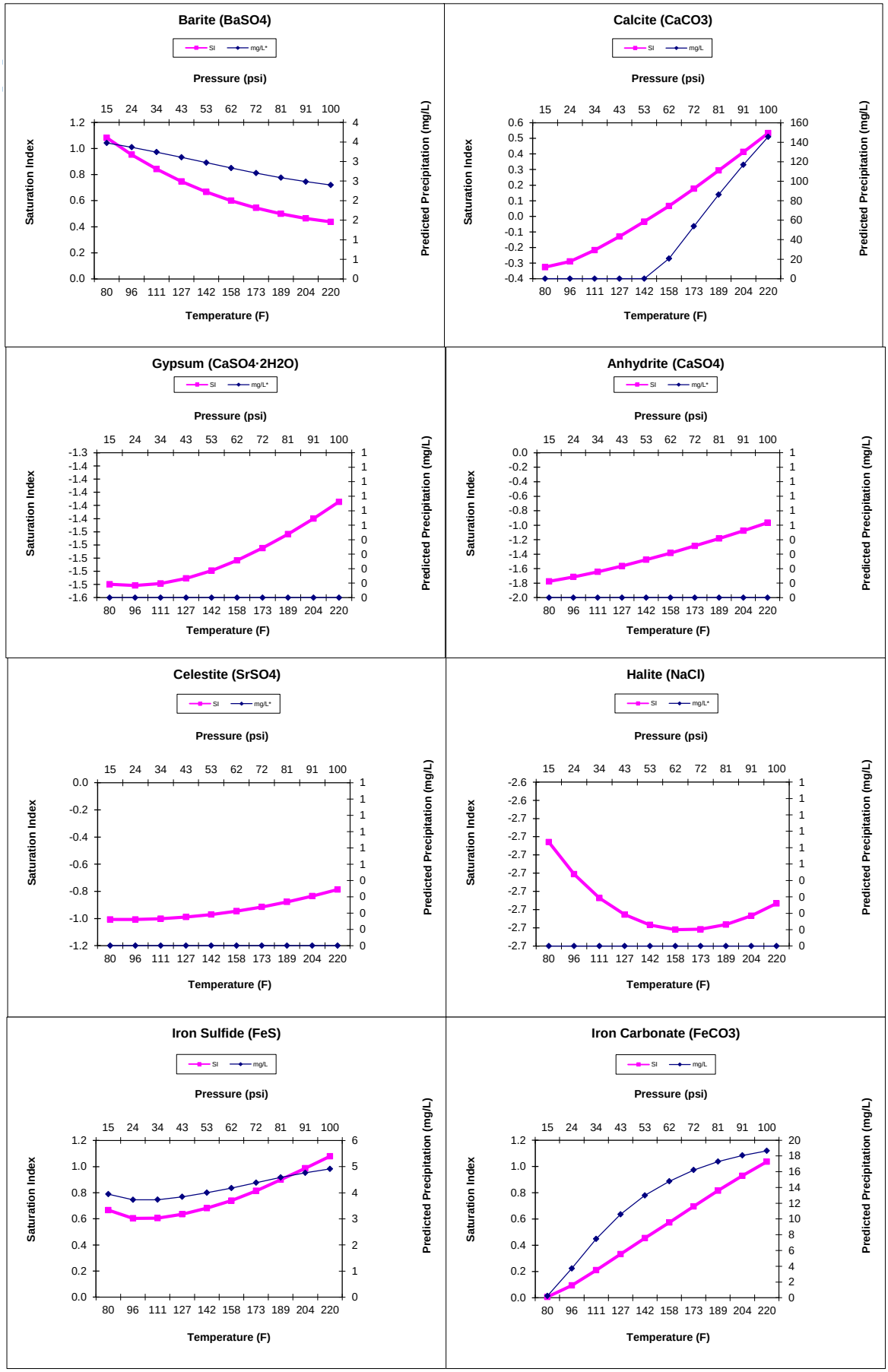
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 14C-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14C-31D Separator
District:	Four Corners	**Sample ID:**	201201037391
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 14C-31D Separator

Field Data

Initial Temperature (°F):	200
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	646.0	10.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	4.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	51390
Density/Specific Gravity (g/cm³):	1.0320
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	30600.0	863.2
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	19829.0	862.9
Potassium (K^+):	39.3	1.0
Magnesium (Mg^{2+}):	23.1	1.9
Calcium (Ca^{2+}):	157.6	7.9
Strontium (Sr^{2+}):	13.3	0.3
Barium (Ba^{2+}):	20.2	0.3
Iron (Fe^{2+}):	11.3	0.4
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	519	N/A

ND = Not Determined

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)**
80°F	15 psi	0.96	10.301	-0.57	0.000	-2.78	0.000	-3.00	0.000
93°F	24 psi	0.85	9.838	-0.55	0.000	-2.78	0.000	-2.94	0.000
107°F	34 psi	0.75	9.327	-0.50	0.000	-2.77	0.000	-2.89	0.000
120°F	43 psi	0.67	8.781	-0.43	0.000	-2.77	0.000	-2.82	0.000
133°F	53 psi	0.59	8.212	-0.36	0.000	-2.77	0.000	-2.75	0.000
147°F	62 psi	0.52	7.636	-0.28	0.000	-2.76	0.000	-2.68	0.000
160°F	72 psi	0.46	7.066	-0.19	0.000	-2.75	0.000	-2.61	0.000
173°F	81 psi	0.41	6.514	-0.10	0.000	-2.74	0.000	-2.53	0.000
187°F	91 psi	0.37	5.992	-0.01	0.000	-2.73	0.000	-2.45	0.000
200°F	100 psi	0.33	5.508	0.09	9.919	-2.71	0.000	-2.36	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)**
80°F	15 psi	-2.16	0.000	-2.06	0.000	1.16	5.012	-0.01	0.000
93°F	24 psi	-2.16	0.000	-2.07	0.000	1.08	4.850	0.05	0.783
107°F	34 psi	-2.16	0.000	-2.08	0.000	1.07	4.817	0.14	2.079
120°F	43 psi	-2.16	0.000	-2.09	0.000	1.08	4.846	0.23	3.245
133°F	53 psi	-2.15	0.000	-2.10	0.000	1.11	4.906	0.33	4.202
147°F	62 psi	-2.14	0.000	-2.10	0.000	1.14	4.986	0.43	4.970
160°F	72 psi	-2.13	0.000	-2.10	0.000	1.20	5.103	0.53	5.636
173°F	81 psi	-2.11	0.000	-2.10	0.000	1.26	5.213	0.63	6.140
187°F	91 psi	-2.09	0.000	-2.10	0.000	1.33	5.317	0.72	6.526
200°F	100 psi	-2.06	0.000	-2.10	0.000	1.39	5.415	0.81	6.824

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.

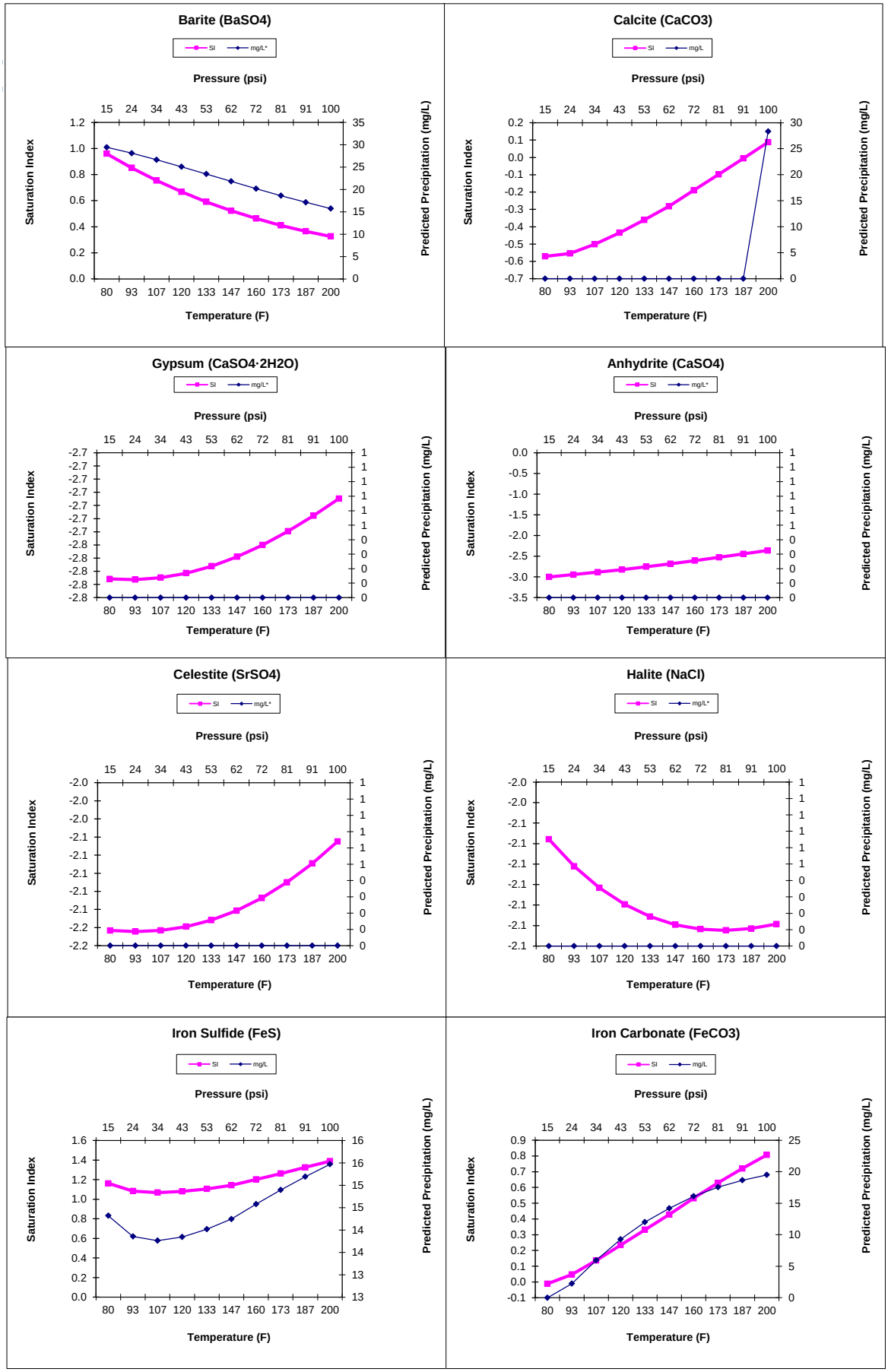
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 14C-31D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14D-24D Separator
District:	Four Corners	**Sample ID:**	201201035734
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 14D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1073.0	17.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	860.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16050
Density/Specific Gravity (g/cm^3):	1.0083
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8800.0	248.2
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.04

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5702.0	248.1
Potassium (K^+):	51.0	1.3
Magnesium (Mg^{2+}):	20.0	1.6
Calcium (Ca^{2+}):	180.0	9.0
Strontium (Sr^{2+}):	13.0	0.3
Barium (Ba^{2+}):	3.0	0.0
Iron (Fe^{2+}):	6.0	0.2
Manganese (Mn^{2+}):	2.0	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	549	N/A

ND = Not Determined

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)**
80°F	15 psi	1.24	1.680	0.42	54.001	-1.67	0.000	-1.91	0.000
96°F	24 psi	1.11	1.643	0.46	58.166	-1.68	0.000	-1.85	0.000
111°F	34 psi	0.99	1.602	0.53	66.120	-1.67	0.000	-1.78	0.000
127°F	43 psi	0.90	1.558	0.62	75.198	-1.66	0.000	-1.70	0.000
142°F	53 psi	0.82	1.513	0.72	84.462	-1.65	0.000	-1.61	0.000
158°F	62 psi	0.76	1.470	0.82	93.491	-1.63	0.000	-1.52	0.000
173°F	72 psi	0.71	1.430	0.93	102.438	-1.61	0.000	-1.41	0.000
189°F	81 psi	0.66	1.395	1.05	111.100	-1.58	0.000	-1.31	0.000
204°F	91 psi	0.63	1.366	1.18	118.889	-1.56	0.000	-1.20	0.000
220°F	100 psi	0.61	1.344	1.30	125.803	-1.53	0.000	-1.08	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)**
80°F	15 psi	-1.15	0.000	-3.08	0.000	1.60	2.638	0.75	3.550
96°F	24 psi	-1.15	0.000	-3.10	0.000	1.53	2.595	0.84	3.702
111°F	34 psi	-1.14	0.000	-3.12	0.000	1.51	2.586	0.96	3.859
127°F	43 psi	-1.13	0.000	-3.13	0.000	1.53	2.596	1.08	3.984
142°F	53 psi	-1.10	0.000	-3.13	0.000	1.56	2.616	1.21	4.078
158°F	62 psi	-1.07	0.000	-3.13	0.000	1.60	2.642	1.33	4.147
173°F	72 psi	-1.04	0.000	-3.13	0.000	1.66	2.676	1.46	4.200
189°F	81 psi	-0.99	0.000	-3.13	0.000	1.74	2.713	1.59	4.240
204°F	91 psi	-0.94	0.000	-3.12	0.000	1.82	2.750	1.71	4.268
220°F	100 psi	-0.89	0.000	-3.11	0.000	1.90	2.785	1.82	4.289

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.

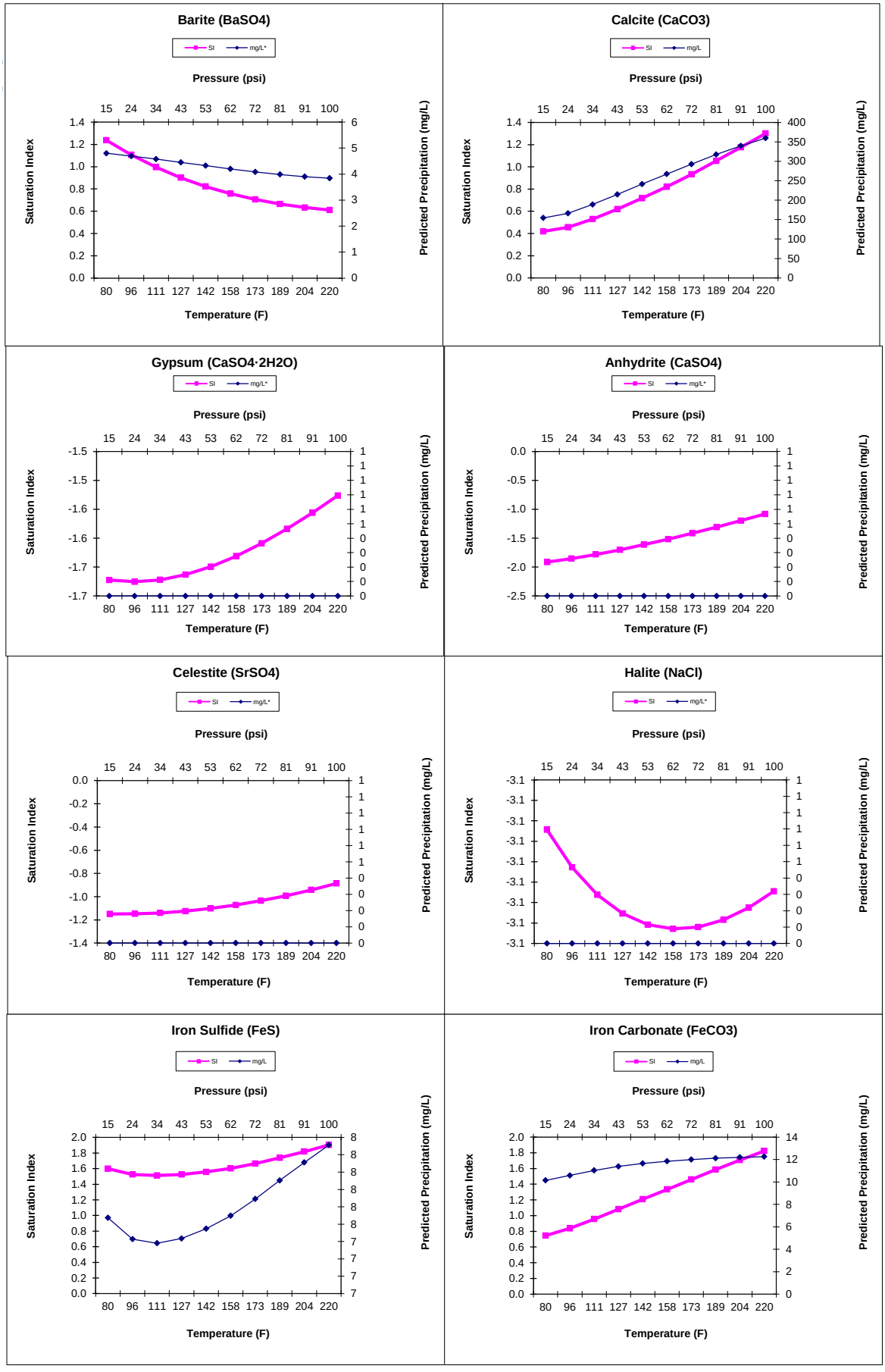
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 14D-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	216-25 Separator
District:	Four Corners	**Sample ID:**	201201036512
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 216-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.6

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	793.0	13.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	125.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	38872
Density/Specific Gravity (g/cm³):	1.0236
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	23000.0	648.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	14904.0	648.6
Potassium (K^+):	42.4	1.1
Magnesium (Mg^{2+}):	11.2	0.9
Calcium (Ca^{2+}):	53.4	2.7
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	8.7	0.1
Iron (Fe^{2+}):	0.5	0.0
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	196	N/A

ND = Not Determined

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)**
80°F	15 psi	0.73	4.119	-0.74	0.000	-3.13	0.000	-3.36	0.000
96°F	24 psi	0.60	3.763	-0.70	0.000	-3.13	0.000	-3.30	0.000
111°F	34 psi	0.49	3.363	-0.63	0.000	-3.13	0.000	-3.23	0.000
127°F	43 psi	0.39	2.932	-0.55	0.000	-3.13	0.000	-3.15	0.000
142°F	53 psi	0.31	2.488	-0.45	0.000	-3.12	0.000	-3.07	0.000
158°F	62 psi	0.24	2.047	-0.36	0.000	-3.11	0.000	-2.98	0.000
173°F	72 psi	0.18	1.625	-0.25	0.000	-3.09	0.000	-2.88	0.000
189°F	81 psi	0.13	1.234	-0.14	0.000	-3.07	0.000	-2.79	0.000
204°F	91 psi	0.09	0.884	-0.02	0.000	-3.06	0.000	-2.68	0.000
220°F	100 psi	0.06	0.583	0.09	6.232	-3.03	0.000	-2.58	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)**
80°F	15 psi	-2.23	0.000	-2.30	0.000	-0.50	0.000	-1.07	0.000
96°F	24 psi	-2.23	0.000	-2.31	0.000	-0.57	0.000	-0.99	0.000
111°F	34 psi	-2.22	0.000	-2.33	0.000	-0.58	0.000	-0.87	0.000
127°F	43 psi	-2.22	0.000	-2.34	0.000	-0.56	0.000	-0.76	0.000
142°F	53 psi	-2.20	0.000	-2.34	0.000	-0.52	0.000	-0.64	0.000
158°F	62 psi	-2.18	0.000	-2.34	0.000	-0.47	0.000	-0.52	0.000
173°F	72 psi	-2.16	0.000	-2.34	0.000	-0.41	0.000	-0.41	0.000
189°F	81 psi	-2.13	0.000	-2.34	0.000	-0.34	0.000	-0.30	0.000
204°F	91 psi	-2.09	0.000	-2.34	0.000	-0.26	0.000	-0.19	0.000
220°F	100 psi	-2.06	0.000	-2.33	0.000	-0.18	0.000	-0.09	0.000

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.

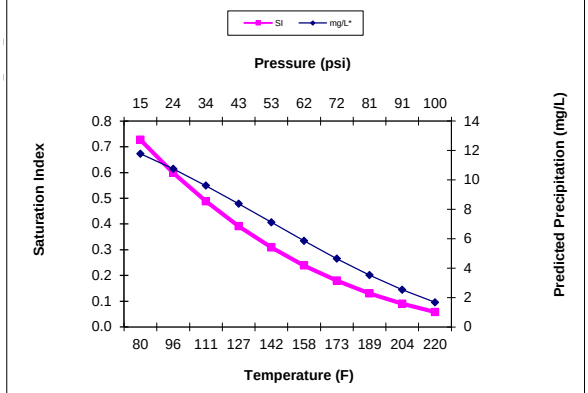
Calculate

ScaleSoftPitzer™ SSP2010

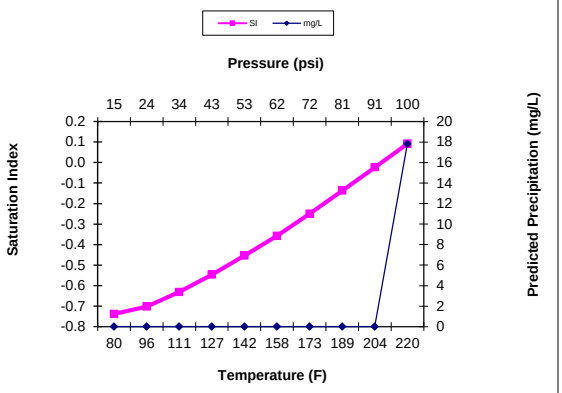
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 216-25 Separator

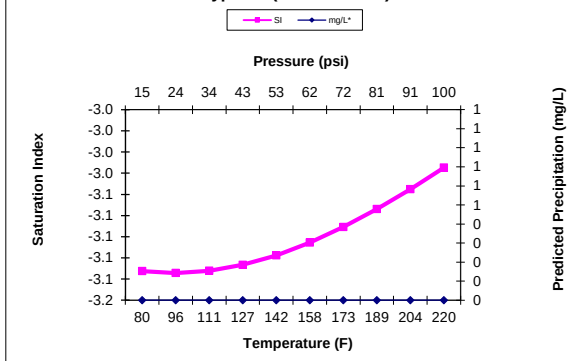
Barite (BaSO4)



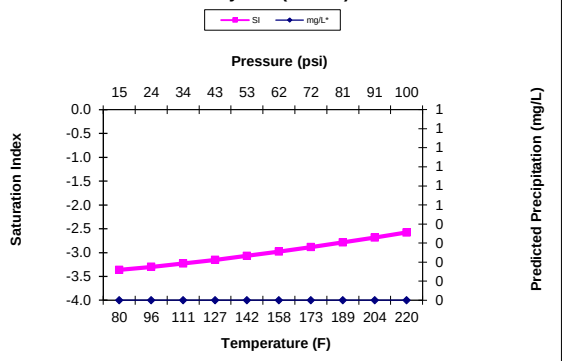
Calcite (CaCO3)



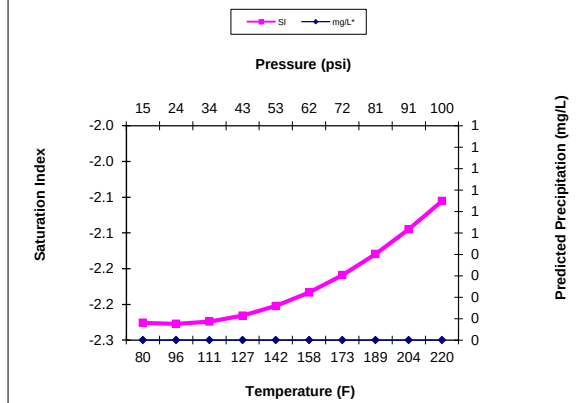
Gypsum (CaSO4·2H2O)



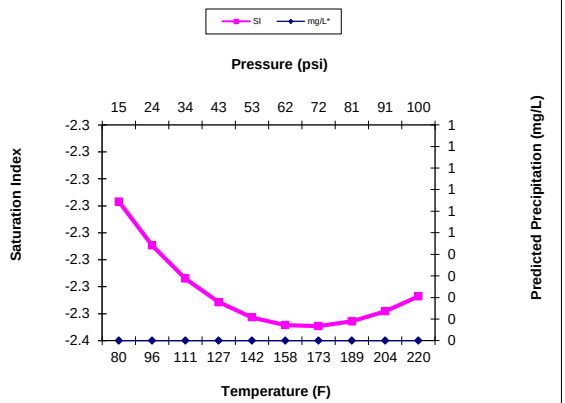
Anhydrite (CaSO4)



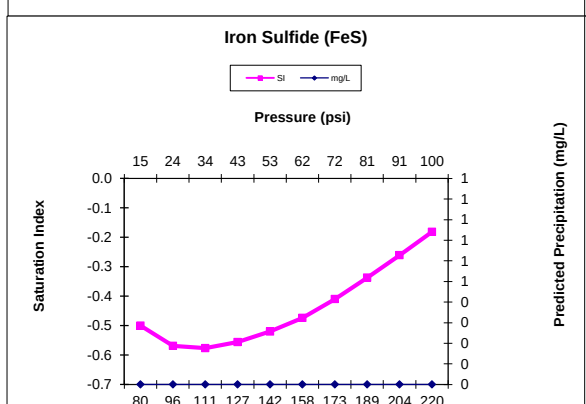
Celestite (SrSO4)



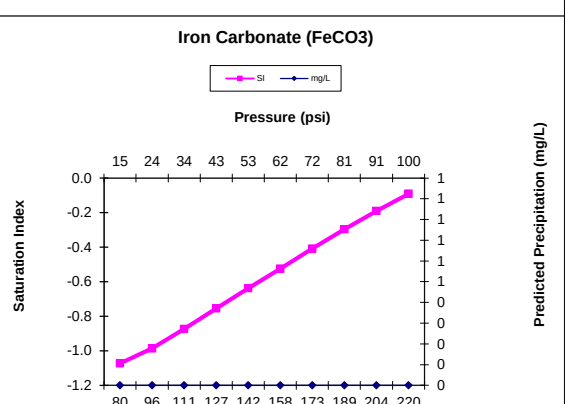
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	218-25 Separator
District:	Four Corners	**Sample ID:**	201201036513
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 218-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	732.0	12.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	475.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	26814
Density/Specific Gravity (g/cm³):	1.0156
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15700.0	442.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	10174.0	442.7
Potassium (K^+):	23.6	0.6
Magnesium (Mg^{2+}):	8.6	0.7
Calcium (Ca^{2+}):	83.2	4.2
Strontium (Sr^{2+}):	10.2	0.2
Barium (Ba^{2+}):	16.9	0.2
Iron (Fe^{2+}):	15.1	0.5
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	267	N/A

ND = Not Determined

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)**
80°F	15 psi	1.18	9.200	-0.25	0.000	-2.80	0.000	-3.04	0.000
96°F	24 psi	1.05	8.914	-0.21	0.000	-2.80	0.000	-2.98	0.000
111°F	34 psi	0.94	8.594	-0.14	0.000	-2.80	0.000	-2.90	0.000
127°F	43 psi	0.84	8.253	-0.05	0.000	-2.79	0.000	-2.83	0.000
142°F	53 psi	0.76	7.907	0.04	3.549	-2.78	0.000	-2.74	0.000
158°F	62 psi	0.69	7.569	0.14	11.358	-2.77	0.000	-2.65	0.000
173°F	72 psi	0.64	7.252	0.25	19.226	-2.75	0.000	-2.55	0.000
189°F	81 psi	0.59	6.968	0.37	26.942	-2.73	0.000	-2.45	0.000
204°F	91 psi	0.55	6.724	0.48	33.994	-2.71	0.000	-2.34	0.000
220°F	100 psi	0.53	6.524	0.60	40.367	-2.68	0.000	-2.23	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)**
80°F	15 psi	-2.03	0.000	-2.61	0.000	-8.53	0.000	0.76	8.836
96°F	24 psi	-2.03	0.000	-2.63	0.000	-8.60	0.000	0.85	9.224
111°F	34 psi	-2.03	0.000	-2.64	0.000	-8.61	0.000	0.96	9.627
127°F	43 psi	-2.02	0.000	-2.65	0.000	-8.60	0.000	1.09	9.951
142°F	53 psi	-2.00	0.000	-2.66	0.000	-8.57	0.000	1.21	10.196
158°F	62 psi	-1.98	0.000	-2.66	0.000	-8.53	0.000	1.33	10.378
173°F	72 psi	-1.95	0.000	-2.66	0.000	-8.47	0.000	1.44	10.518
189°F	81 psi	-1.91	0.000	-2.66	0.000	-8.41	0.000	1.56	10.624
204°F	91 psi	-1.87	0.000	-2.65	0.000	-8.33	0.000	1.68	10.702
220°F	100 psi	-1.82	0.000	-2.65	0.000	-8.25	0.000	1.78	10.759

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.

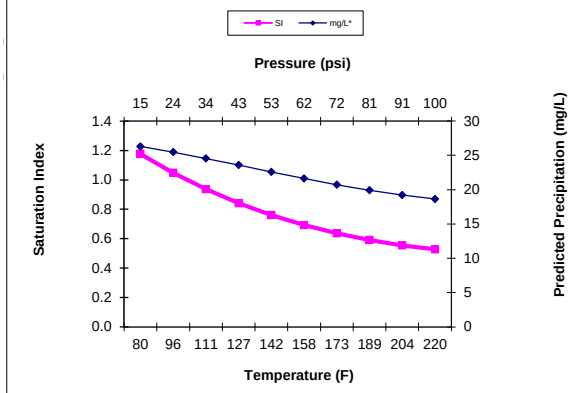
Calculate

ScaleSoftPitzer™ SSP2010

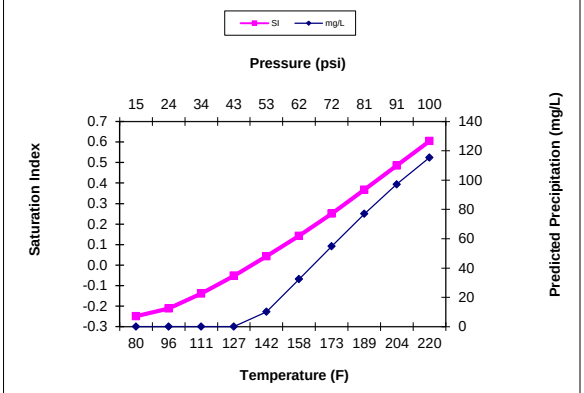
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 218-25 Separator

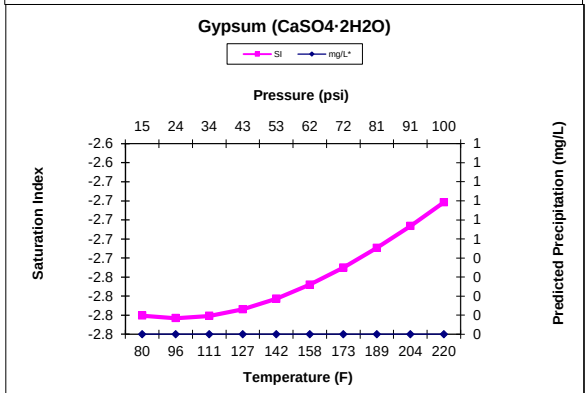
Barite (BaSO4)



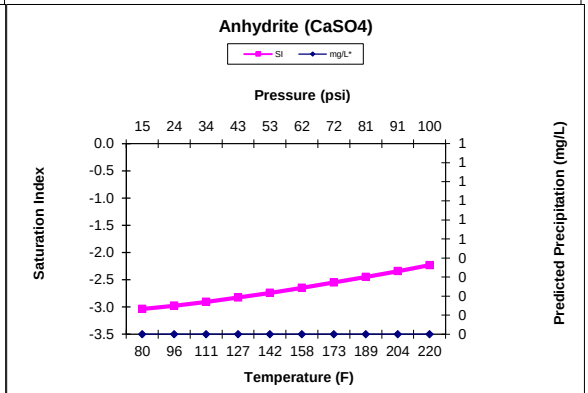
Calcite (CaCO3)



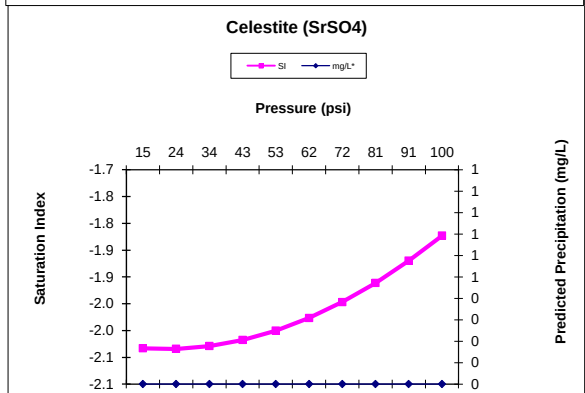
Gypsum (CaSO4·2H2O)



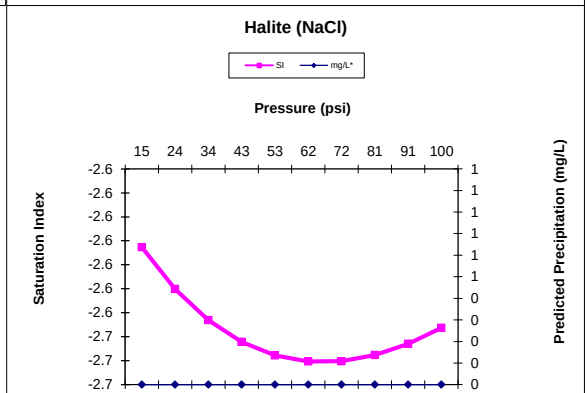
Anhydrite (CaSO4)



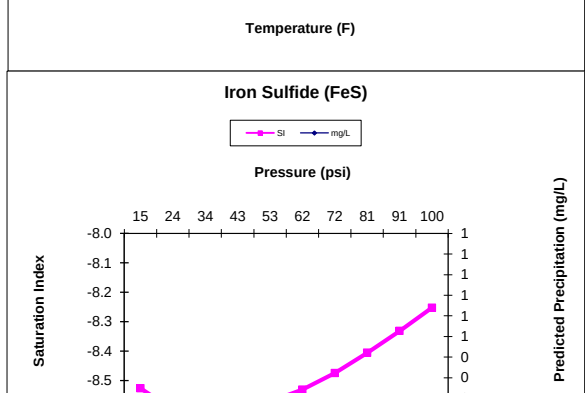
Celestite (SrSO4)



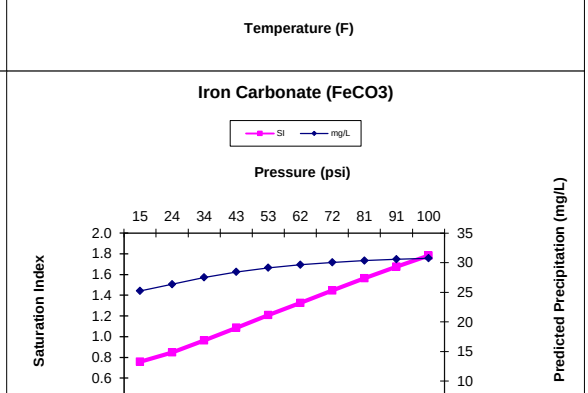
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	21B-24D Separator
District:	Four Corners	**Sample ID:**	201201035726
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 21B-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	610.0	10.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	75.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17708
Density/Specific Gravity (g/cm^3):	1.0094
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10200.0	287.7
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6610.0	287.6
Potassium (K^+):	24.0	0.6
Magnesium (Mg^{2+}):	6.0	0.5
Calcium (Ca^{2+}):	99.0	4.9
Strontium (Sr^{2+}):	7.0	0.2
Barium (Ba^{2+}):	19.0	0.3
Iron (Fe^{2+}):	33.0	1.2
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	294	N/A

ND = Not Determined

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)**
80°F	15 psi	1.70	11.045	-0.11	0.000	-2.27	0.000	-2.51	0.000
96°F	24 psi	1.57	10.955	-0.07	0.000	-2.28	0.000	-2.45	0.000
111°F	34 psi	1.46	10.854	0.00	0.307	-2.27	0.000	-2.38	0.000
127°F	43 psi	1.37	10.747	0.09	7.189	-2.27	0.000	-2.30	0.000
142°F	53 psi	1.29	10.637	0.19	14.374	-2.25	0.000	-2.21	0.000
158°F	62 psi	1.22	10.530	0.29	21.560	-2.23	0.000	-2.12	0.000
173°F	72 psi	1.17	10.431	0.40	28.868	-2.21	0.000	-2.02	0.000
189°F	81 psi	1.13	10.344	0.52	36.209	-2.19	0.000	-1.91	0.000
204°F	91 psi	1.10	10.272	0.64	43.064	-2.16	0.000	-1.80	0.000
220°F	100 psi	1.07	10.216	0.76	49.408	-2.13	0.000	-1.69	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)**
80°F	15 psi	-1.75	0.000	-2.96	0.000	2.46	4.510	1.18	21.744
96°F	24 psi	-1.75	0.000	-2.98	0.000	2.39	4.506	1.27	22.152
111°F	34 psi	-1.74	0.000	-2.99	0.000	2.37	4.505	1.39	22.574
127°F	43 psi	-1.72	0.000	-3.00	0.000	2.38	4.506	1.51	22.915
142°F	53 psi	-1.70	0.000	-3.01	0.000	2.41	4.508	1.64	23.174
158°F	62 psi	-1.67	0.000	-3.01	0.000	2.45	4.510	1.76	23.365
173°F	72 psi	-1.64	0.000	-3.01	0.000	2.51	4.513	1.88	23.511
189°F	81 psi	-1.60	0.000	-3.01	0.000	2.58	4.517	2.00	23.623
204°F	91 psi	-1.55	0.000	-3.00	0.000	2.66	4.519	2.12	23.704
220°F	100 psi	-1.50	0.000	-2.99	0.000	2.74	4.522	2.24	23.763

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.

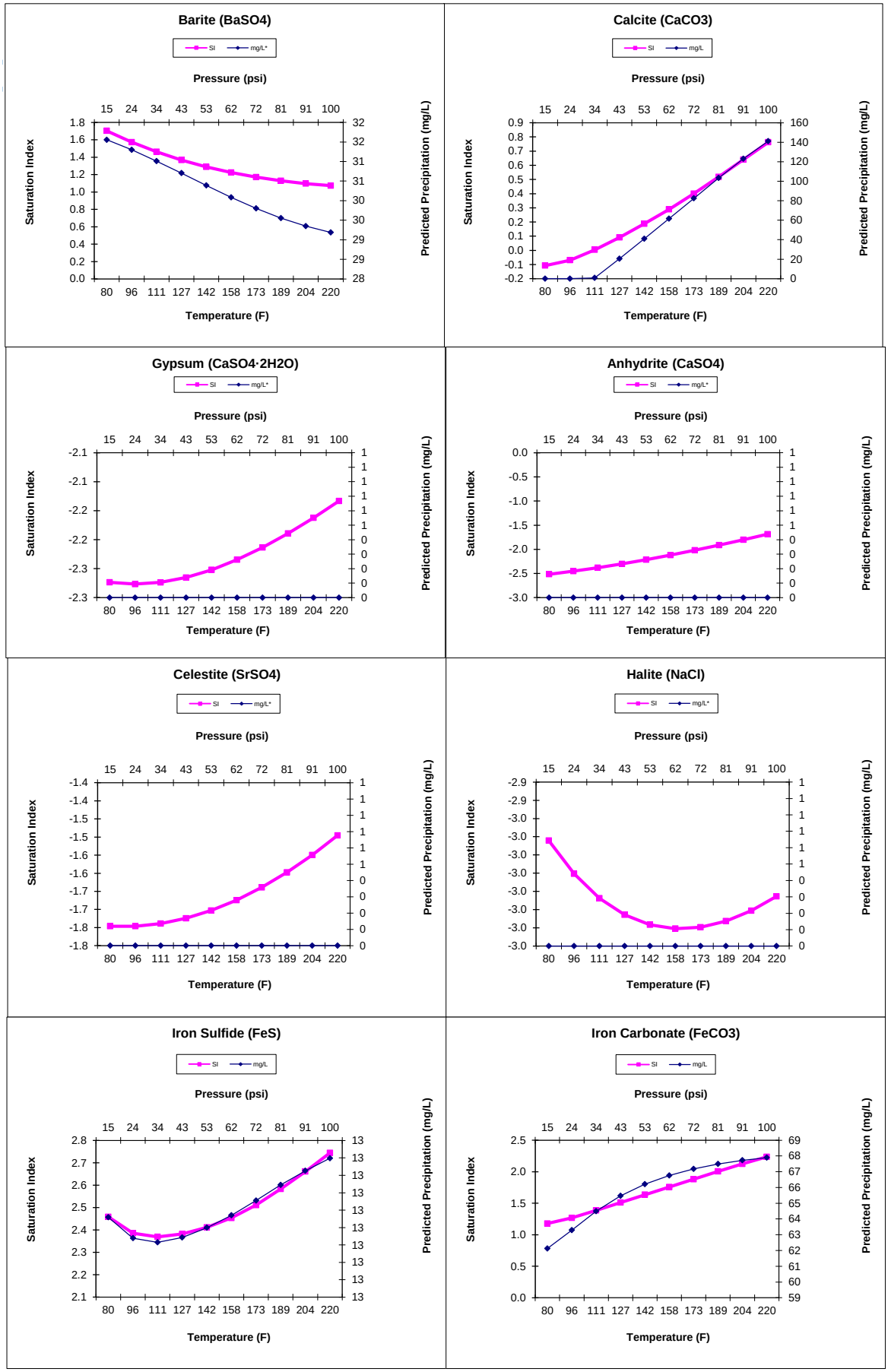
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 21B-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	21C-24D Separator
District:	Four Corners	**Sample ID:**	201201035727
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 21C-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	463.0	7.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	165.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17043
Density/Specific Gravity (g/cm³):	1.0092
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9800.0	276.4
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.97	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6351.0	276.4
Potassium (K^+):	53.0	1.4
Magnesium (Mg^{2+}):	22.0	1.8
Calcium (Ca^{2+}):	229.0	11.4
Strontium (Sr^{2+}):	18.0	0.4
Barium (Ba^{2+}):	15.0	0.2
Iron (Fe^{2+}):	41.0	1.5
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	695	N/A

ND = Not Determined

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)**
80°F	15 psi	1.30	8.372	-0.86	0.000	-2.21	0.000	-2.45	0.000
96°F	24 psi	1.17	8.183	-0.83	0.000	-2.22	0.000	-2.39	0.000
111°F	34 psi	1.06	7.973	-0.76	0.000	-2.21	0.000	-2.32	0.000
127°F	43 psi	0.97	7.752	-0.67	0.000	-2.20	0.000	-2.24	0.000
142°F	53 psi	0.89	7.528	-0.57	0.000	-2.19	0.000	-2.15	0.000
158°F	62 psi	0.83	7.313	-0.46	0.000	-2.17	0.000	-2.06	0.000
173°F	72 psi	0.77	7.116	-0.34	0.000	-2.15	0.000	-1.96	0.000
189°F	81 psi	0.73	6.943	-0.22	0.000	-2.13	0.000	-1.85	0.000
204°F	91 psi	0.70	6.801	-0.10	0.000	-2.10	0.000	-1.74	0.000
220°F	100 psi	0.68	6.692	0.02	2.736	-2.07	0.000	-1.62	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)**
80°F	15 psi	-1.64	0.000	-2.99	0.000	0.61	2.450	0.15	6.468
96°F	24 psi	-1.63	0.000	-3.01	0.000	0.54	2.304	0.23	9.628
111°F	34 psi	-1.63	0.000	-3.03	0.000	0.55	2.332	0.34	13.471
127°F	43 psi	-1.61	0.000	-3.04	0.000	0.60	2.436	0.47	16.905
142°F	53 psi	-1.59	0.000	-3.04	0.000	0.66	2.570	0.60	19.719
158°F	62 psi	-1.56	0.000	-3.04	0.000	0.75	2.726	0.73	22.059
173°F	72 psi	-1.52	0.000	-3.04	0.000	0.85	2.875	0.86	23.910
189°F	81 psi	-1.48	0.000	-3.04	0.000	0.96	2.999	0.99	25.289
204°F	91 psi	-1.43	0.000	-3.03	0.000	1.07	3.099	1.11	26.317
220°F	100 psi	-1.38	0.000	-3.03	0.000	1.18	3.180	1.22	27.089

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.

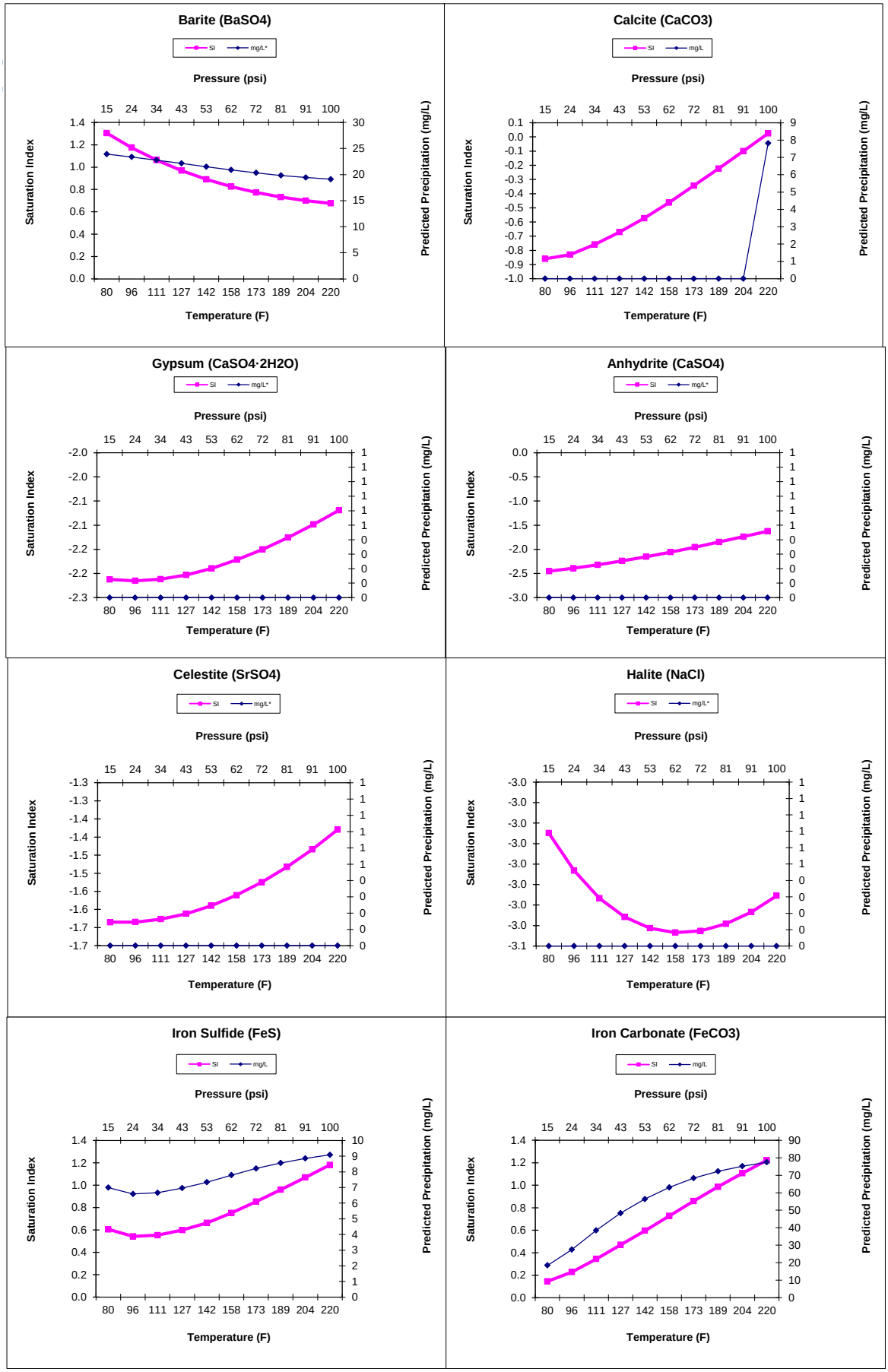
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 21C-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	21C-31D Separator
District:	Four Corners	**Sample ID:**	201201037399
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 21C-31D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	671.0	11.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	675.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	25452
Density/Specific Gravity (g/cm³):	1.0147
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14900.0	420.3
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9655.0	420.1
Potassium (K^+):	11.2	0.3
Magnesium (Mg^{2+}):	9.5	0.8
Calcium (Ca^{2+}):	36.2	1.8
Strontium (Sr^{2+}):	1.6	0.0
Barium (Ba^{2+}):	2.5	0.0
Iron (Fe^{2+}):	64.7	2.3
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	133	N/A

ND = Not Determined

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)**
80°F	15 psi	0.67	1.148	-1.14	0.000	-2.84	0.000	-3.08	0.000
96°F	24 psi	0.54	1.037	-1.10	0.000	-2.85	0.000	-3.02	0.000
111°F	34 psi	0.42	0.911	-1.03	0.000	-2.84	0.000	-2.95	0.000
127°F	43 psi	0.33	0.774	-0.95	0.000	-2.84	0.000	-2.87	0.000
142°F	53 psi	0.25	0.634	-0.85	0.000	-2.82	0.000	-2.78	0.000
158°F	62 psi	0.18	0.495	-0.75	0.000	-2.81	0.000	-2.69	0.000
173°F	72 psi	0.13	0.364	-0.63	0.000	-2.79	0.000	-2.59	0.000
189°F	81 psi	0.08	0.245	-0.52	0.000	-2.77	0.000	-2.49	0.000
204°F	91 psi	0.04	0.142	-0.40	0.000	-2.75	0.000	-2.38	0.000
220°F	100 psi	0.02	0.058	-0.28	0.000	-2.72	0.000	-2.27	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)**
80°F	15 psi	-2.51	0.000	-2.66	0.000	-8.66	0.000	0.86	37.216
96°F	24 psi	-2.51	0.000	-2.67	0.000	-8.73	0.000	0.95	38.814
111°F	34 psi	-2.51	0.000	-2.69	0.000	-8.72	0.000	1.06	40.583
127°F	43 psi	-2.49	0.000	-2.70	0.000	-8.69	0.000	1.19	42.064
142°F	53 psi	-2.48	0.000	-2.70	0.000	-8.64	0.000	1.31	43.214
158°F	62 psi	-2.45	0.000	-2.70	0.000	-8.58	0.000	1.43	44.083
173°F	72 psi	-2.42	0.000	-2.70	0.000	-8.49	0.000	1.55	44.785
189°F	81 psi	-2.38	0.000	-2.70	0.000	-8.40	0.000	1.67	45.302
204°F	91 psi	-2.34	0.000	-2.70	0.000	-8.31	0.000	1.79	45.680
220°F	100 psi	-2.29	0.000	-2.69	0.000	-8.22	0.000	1.90	45.960

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.

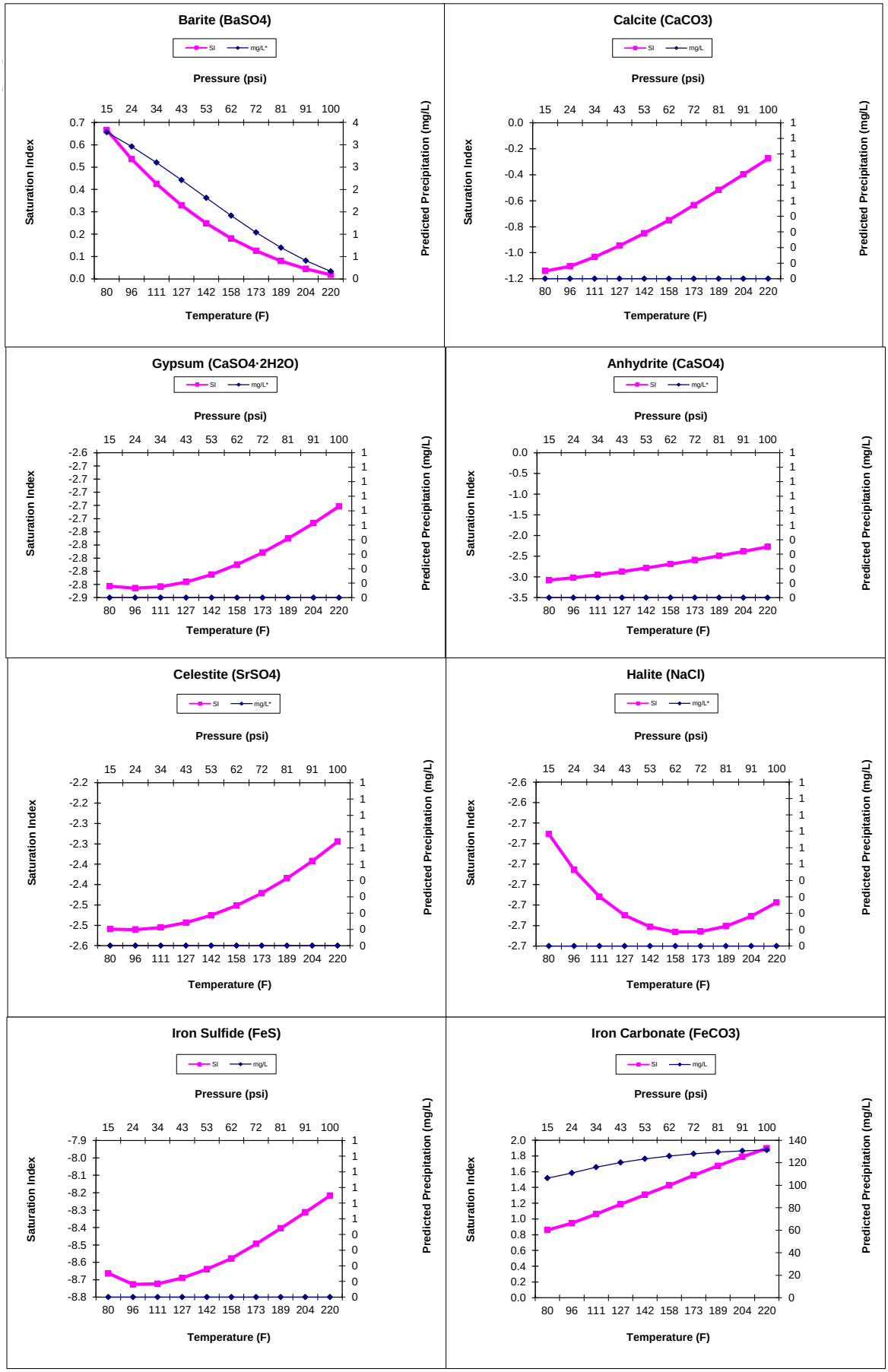
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 21C-31D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	21C-7D Separator
District:	Four Corners	**Sample ID:**	201201036472
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 21C-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	756.0	12.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	265.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	26998
Density/Specific Gravity (g/cm³):	1.0159
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15500.0	437.2
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	10044.0	437.1
Potassium (K^+):	40.4	1.0
Magnesium (Mg^{2+}):	30.7	2.5
Calcium (Ca^{2+}):	262.0	13.1
Strontium (Sr^{2+}):	24.2	0.6
Barium (Ba^{2+}):	47.6	0.7
Iron (Fe^{2+}):	91.9	3.3
Manganese (Mn^{2+}):	1.6	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	844	N/A

ND = Not Determined

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)**
80°F	15 psi	2.21	28.075	0.06	8.572	-1.72	0.000	-1.96	0.000
96°F	24 psi	2.08	28.003	0.10	13.574	-1.72	0.000	-1.89	0.000
111°F	34 psi	1.97	27.921	0.17	23.199	-1.72	0.000	-1.82	0.000
127°F	43 psi	1.87	27.833	0.26	34.293	-1.71	0.000	-1.74	0.000
142°F	53 psi	1.79	27.741	0.35	45.791	-1.70	0.000	-1.66	0.000
158°F	62 psi	1.73	27.650	0.45	57.238	-1.69	0.000	-1.57	0.000
173°F	72 psi	1.67	27.564	0.56	69.077	-1.67	0.000	-1.47	0.000
189°F	81 psi	1.63	27.485	0.68	80.859	-1.65	0.000	-1.37	0.000
204°F	91 psi	1.59	27.416	0.79	91.982	-1.62	0.000	-1.26	0.000
220°F	100 psi	1.56	27.359	0.91	102.465	-1.60	0.000	-1.15	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)**
80°F	15 psi	-1.08	0.000	-2.63	0.000	2.13	2.637	1.36	60.965
96°F	24 psi	-1.08	0.000	-2.64	0.000	2.07	2.634	1.44	61.962
111°F	34 psi	-1.07	0.000	-2.66	0.000	2.06	2.633	1.56	63.032
127°F	43 psi	-1.06	0.000	-2.67	0.000	2.08	2.635	1.68	63.912
142°F	53 psi	-1.04	0.000	-2.67	0.000	2.12	2.637	1.80	64.588
158°F	62 psi	-1.02	0.000	-2.67	0.000	2.17	2.639	1.92	65.094
173°F	72 psi	-0.99	0.000	-2.67	0.000	2.23	2.642	2.04	65.490
189°F	81 psi	-0.95	0.000	-2.67	0.000	2.31	2.645	2.16	65.791
204°F	91 psi	-0.91	0.000	-2.67	0.000	2.39	2.647	2.27	66.010
220°F	100 psi	-0.86	0.000	-2.66	0.000	2.47	2.649	2.38	66.173

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.

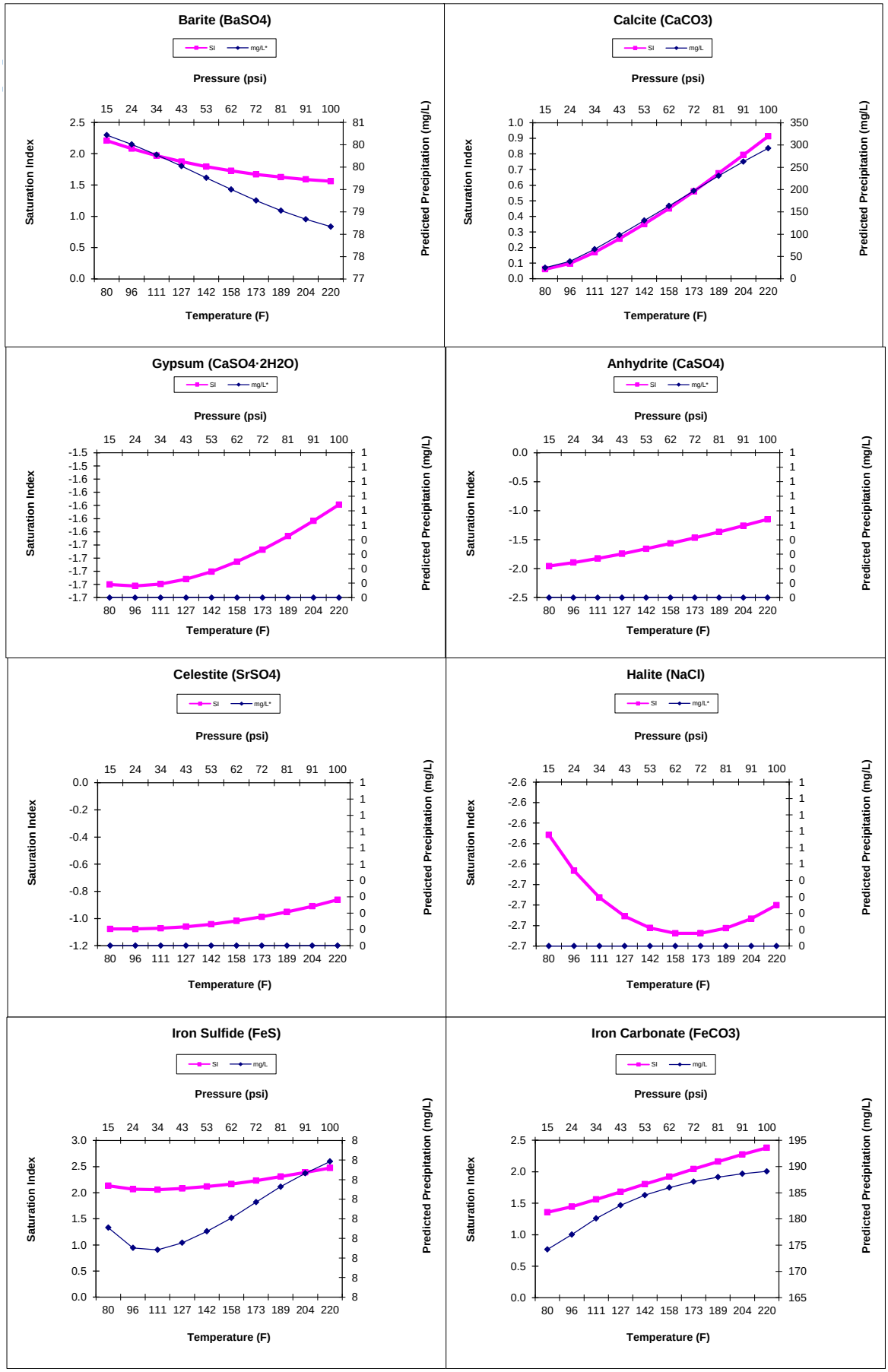
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 21C-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	21D-24D Separator
District:	Four Corners	**Sample ID:**	201201035728
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 21D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	457.0	7.5
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	145.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	15862
Density/Specific Gravity (g/cm^3):	1.0082
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9200.0	259.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5962.0	259.4
Potassium (K^+):	29.0	0.7
Magnesium (Mg^{2+}):	8.0	0.7
Calcium (Ca^{2+}):	106.0	5.3
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	24.0	0.3
Iron (Fe^{2+}):	17.0	0.6
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	326	N/A

ND = Not Determined

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)**
80°F	15 psi	1.55	13.683	-0.19	0.000	-2.51	0.000	-2.75	0.000
96°F	24 psi	1.42	13.480	-0.16	0.000	-2.51	0.000	-2.69	0.000
111°F	34 psi	1.31	13.256	-0.08	0.000	-2.51	0.000	-2.62	0.000
127°F	43 psi	1.21	13.019	0.01	0.415	-2.50	0.000	-2.54	0.000
142°F	53 psi	1.14	12.782	0.10	6.894	-2.49	0.000	-2.45	0.000
158°F	62 psi	1.07	12.556	0.20	13.477	-2.47	0.000	-2.35	0.000
173°F	72 psi	1.02	12.350	0.31	20.273	-2.45	0.000	-2.25	0.000
189°F	81 psi	0.98	12.171	0.43	27.255	-2.42	0.000	-2.14	0.000
204°F	91 psi	0.95	12.026	0.56	33.929	-2.39	0.000	-2.03	0.000
220°F	100 psi	0.92	11.917	0.68	40.276	-2.36	0.000	-1.92	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)**
80°F	15 psi	-1.90	0.000	-3.04	0.000	2.17	4.481	0.77	9.770
96°F	24 psi	-1.90	0.000	-3.06	0.000	2.10	4.469	0.86	10.240
111°F	34 psi	-1.89	0.000	-3.08	0.000	2.08	4.467	0.98	10.727
127°F	43 psi	-1.87	0.000	-3.09	0.000	2.09	4.470	1.10	11.123
142°F	53 psi	-1.85	0.000	-3.09	0.000	2.13	4.476	1.23	11.424
158°F	62 psi	-1.82	0.000	-3.09	0.000	2.17	4.484	1.35	11.648
173°F	72 psi	-1.79	0.000	-3.09	0.000	2.23	4.492	1.47	11.818
189°F	81 psi	-1.74	0.000	-3.09	0.000	2.30	4.501	1.60	11.949
204°F	91 psi	-1.69	0.000	-3.08	0.000	2.38	4.510	1.72	12.044
220°F	100 psi	-1.64	0.000	-3.07	0.000	2.46	4.517	1.83	12.113

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.

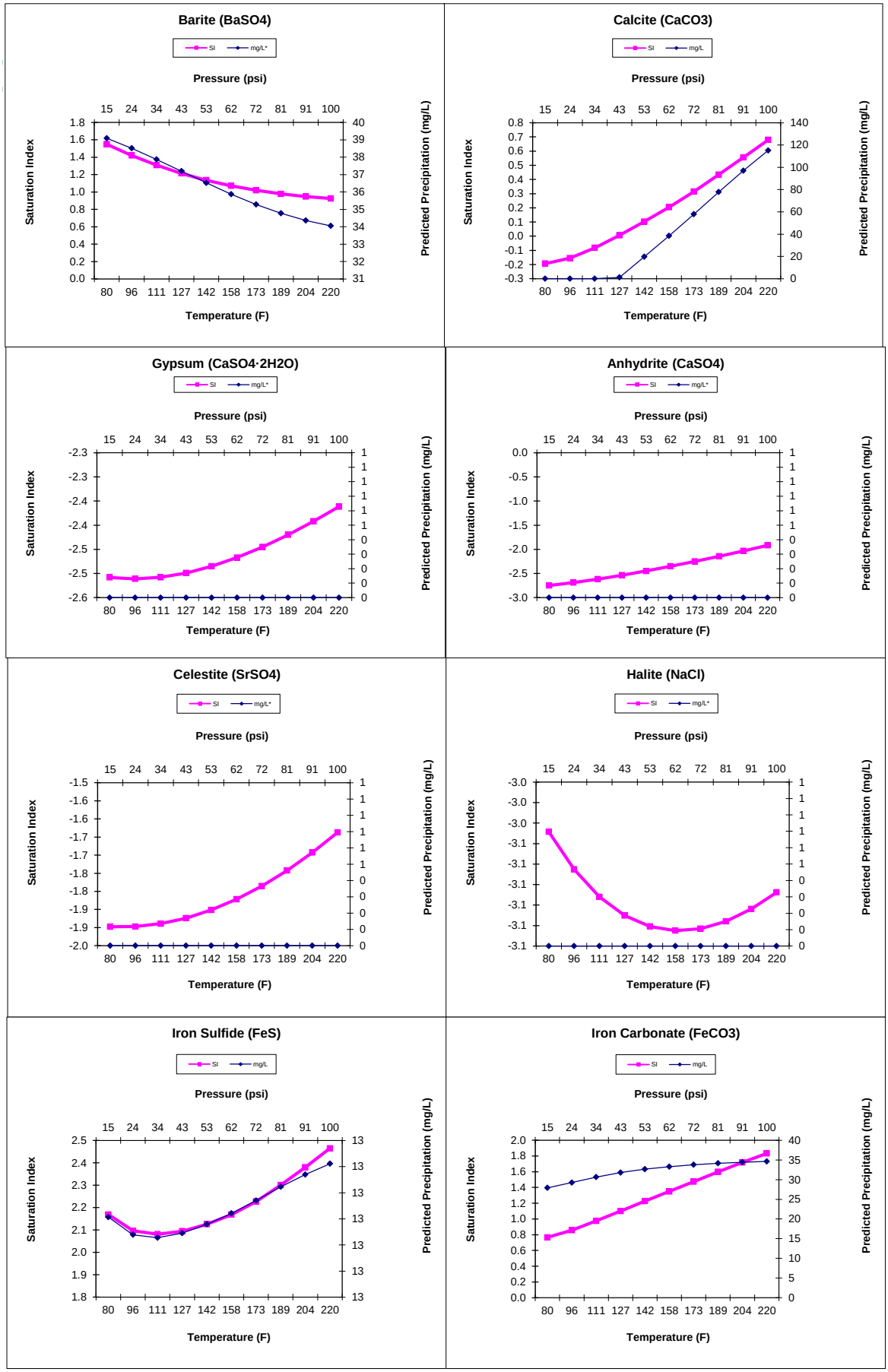
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 21D-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	21D-25D Separator
District:	Four Corners	**Sample ID:**	201201036493
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 21D-25D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17539
Density/Specific Gravity (g/cm³):	1.0093
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10200.0	287.7
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6610.0	287.6
Potassium (K^+):	33.7	0.9
Magnesium (Mg^{2+}):	7.2	0.6
Calcium (Ca^{2+}):	91.7	4.6
Strontium (Sr^{2+}):	8.5	0.2
Barium (Ba^{2+}):	9.2	0.1
Iron (Fe^{2+}):	61.8	2.2
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	275	N/A

ND = Not Determined

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)**
80°F	15 psi	1.57	5.329	-0.66	0.000	-2.14	0.000	-2.38	0.000
96°F	24 psi	1.44	5.275	-0.63	0.000	-2.14	0.000	-2.32	0.000
111°F	34 psi	1.33	5.214	-0.55	0.000	-2.14	0.000	-2.24	0.000
127°F	43 psi	1.23	5.148	-0.46	0.000	-2.13	0.000	-2.16	0.000
142°F	53 psi	1.15	5.082	-0.37	0.000	-2.11	0.000	-2.08	0.000
158°F	62 psi	1.09	5.017	-0.27	0.000	-2.10	0.000	-1.98	0.000
173°F	72 psi	1.03	4.956	-0.15	0.000	-2.08	0.000	-1.88	0.000
189°F	81 psi	0.99	4.903	-0.03	0.000	-2.05	0.000	-1.77	0.000
204°F	91 psi	0.96	4.859	0.09	5.404	-2.02	0.000	-1.66	0.000
220°F	100 psi	0.94	4.825	0.21	12.625	-1.99	0.000	-1.55	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)**
80°F	15 psi	-1.48	0.000	-2.96	0.000	2.10	3.542	0.91	32.944
96°F	24 psi	-1.48	0.000	-2.98	0.000	2.03	3.537	1.00	34.724
111°F	34 psi	-1.48	0.000	-2.99	0.000	2.03	3.537	1.12	36.714
127°F	43 psi	-1.46	0.000	-3.00	0.000	2.06	3.539	1.24	38.453
142°F	53 psi	-1.44	0.000	-3.01	0.000	2.10	3.543	1.37	39.862
158°F	62 psi	-1.41	0.000	-3.01	0.000	2.16	3.547	1.49	40.968
173°F	72 psi	-1.38	0.000	-3.01	0.000	2.23	3.552	1.61	41.851
189°F	81 psi	-1.33	0.000	-3.01	0.000	2.31	3.557	1.74	42.551
204°F	91 psi	-1.29	0.000	-3.00	0.000	2.40	3.561	1.86	43.073
220°F	100 psi	-1.23	0.000	-2.99	0.000	2.49	3.564	1.97	43.464

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.

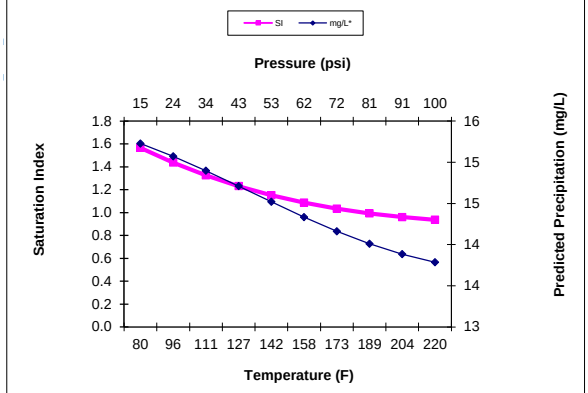
Calculate

ScaleSoftPitzer™ SSP2010

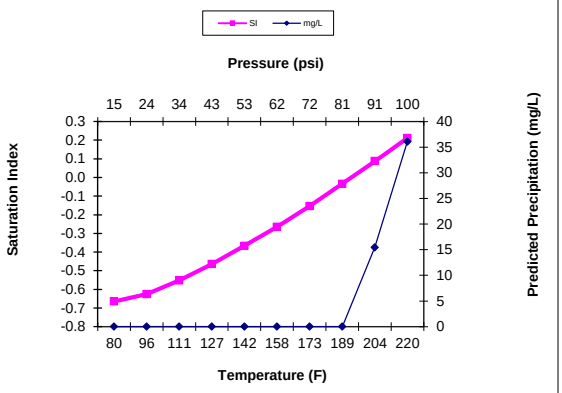
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 21D-25D Separator

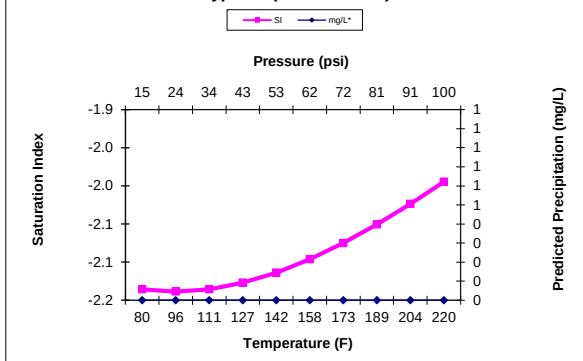
Barite (BaSO4)



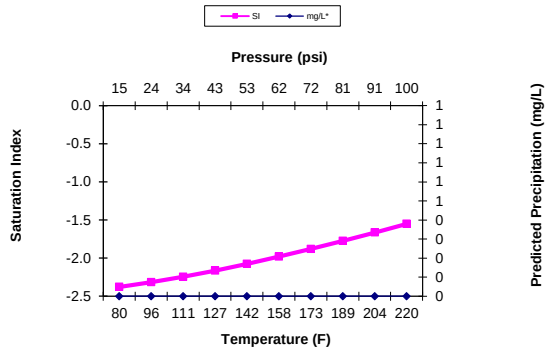
Calcite (CaCO3)



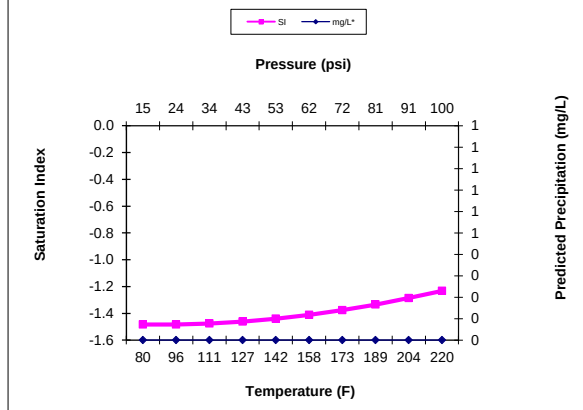
Gypsum (CaSO4·2H2O)



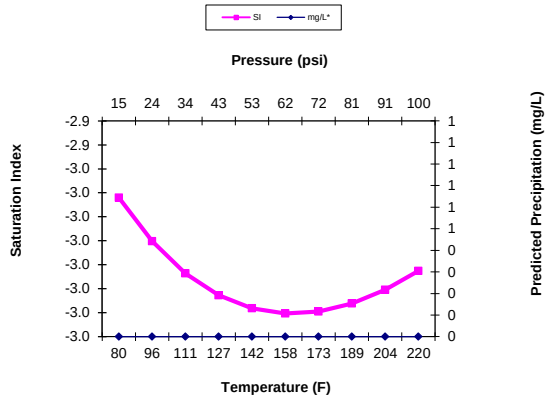
Anhydrite (CaSO4)



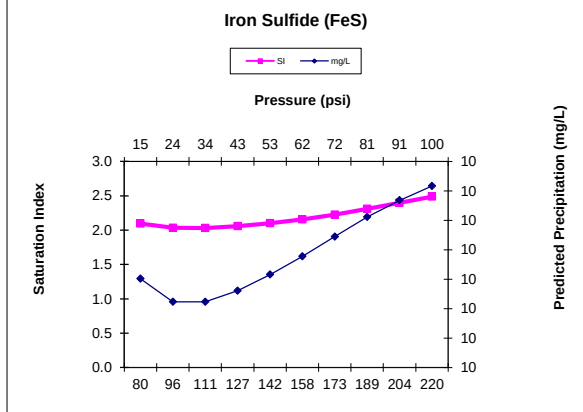
Celestite (SrSO4)



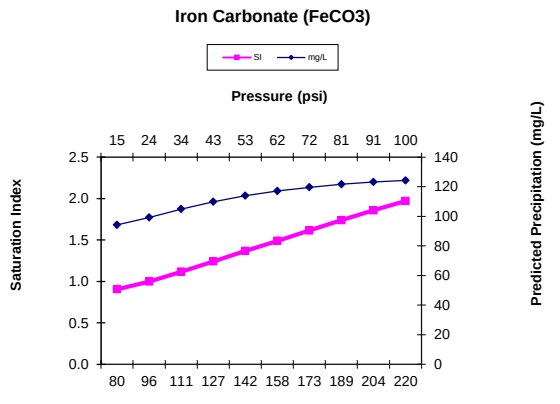
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	22-31D Separator
District:	Four Corners	**Sample ID:**	201201037396
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 22-31D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.1

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	854.0	14.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	750.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	48467
Density/Specific Gravity (g/cm³):	1.0300
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	28700.0	809.6
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	18598.0	809.3
Potassium (K^+):	27.9	0.7
Magnesium (Mg^{2+}):	6.9	0.6
Calcium (Ca^{2+}):	44.3	2.2
Strontium (Sr^{2+}):	6.2	0.1
Barium (Ba^{2+}):	9.2	0.1
Iron (Fe^{2+}):	69.8	2.5
Manganese (Mn^{2+}):	0.8	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	153	N/A

ND = Not Determined

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)**
80°F	15 psi	1.13	5.063	-1.29	0.000	-2.82	0.000	-3.05	0.000
96°F	24 psi	1.00	4.919	-1.26	0.000	-2.82	0.000	-2.98	0.000
111°F	34 psi	0.89	4.754	-1.19	0.000	-2.82	0.000	-2.91	0.000
127°F	43 psi	0.79	4.572	-1.11	0.000	-2.82	0.000	-2.84	0.000
142°F	53 psi	0.71	4.379	-1.02	0.000	-2.81	0.000	-2.75	0.000
158°F	62 psi	0.64	4.181	-0.92	0.000	-2.80	0.000	-2.67	0.000
173°F	72 psi	0.58	3.985	-0.81	0.000	-2.78	0.000	-2.57	0.000
189°F	81 psi	0.52	3.797	-0.70	0.000	-2.77	0.000	-2.48	0.000
204°F	91 psi	0.48	3.622	-0.58	0.000	-2.75	0.000	-2.38	0.000
220°F	100 psi	0.44	3.465	-0.47	0.000	-2.74	0.000	-2.28	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)**
80°F	15 psi	-2.00	0.000	-2.11	0.000	-9.15	0.000	0.63	34.802
96°F	24 psi	-2.00	0.000	-2.13	0.000	-9.22	0.000	0.70	37.085
111°F	34 psi	-1.99	0.000	-2.14	0.000	-9.22	0.000	0.81	39.828
127°F	43 psi	-1.99	0.000	-2.15	0.000	-9.19	0.000	0.93	42.179
142°F	53 psi	-1.98	0.000	-2.15	0.000	-9.14	0.000	1.04	44.029
158°F	62 psi	-1.96	0.000	-2.16	0.000	-9.07	0.000	1.16	45.547
173°F	72 psi	-1.94	0.000	-2.16	0.000	-8.98	0.000	1.28	46.709
189°F	81 psi	-1.91	0.000	-2.16	0.000	-8.90	0.000	1.39	47.561
204°F	91 psi	-1.88	0.000	-2.15	0.000	-8.81	0.000	1.49	48.195
220°F	100 psi	-1.85	0.000	-2.15	0.000	-8.72	0.000	1.58	48.671

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.

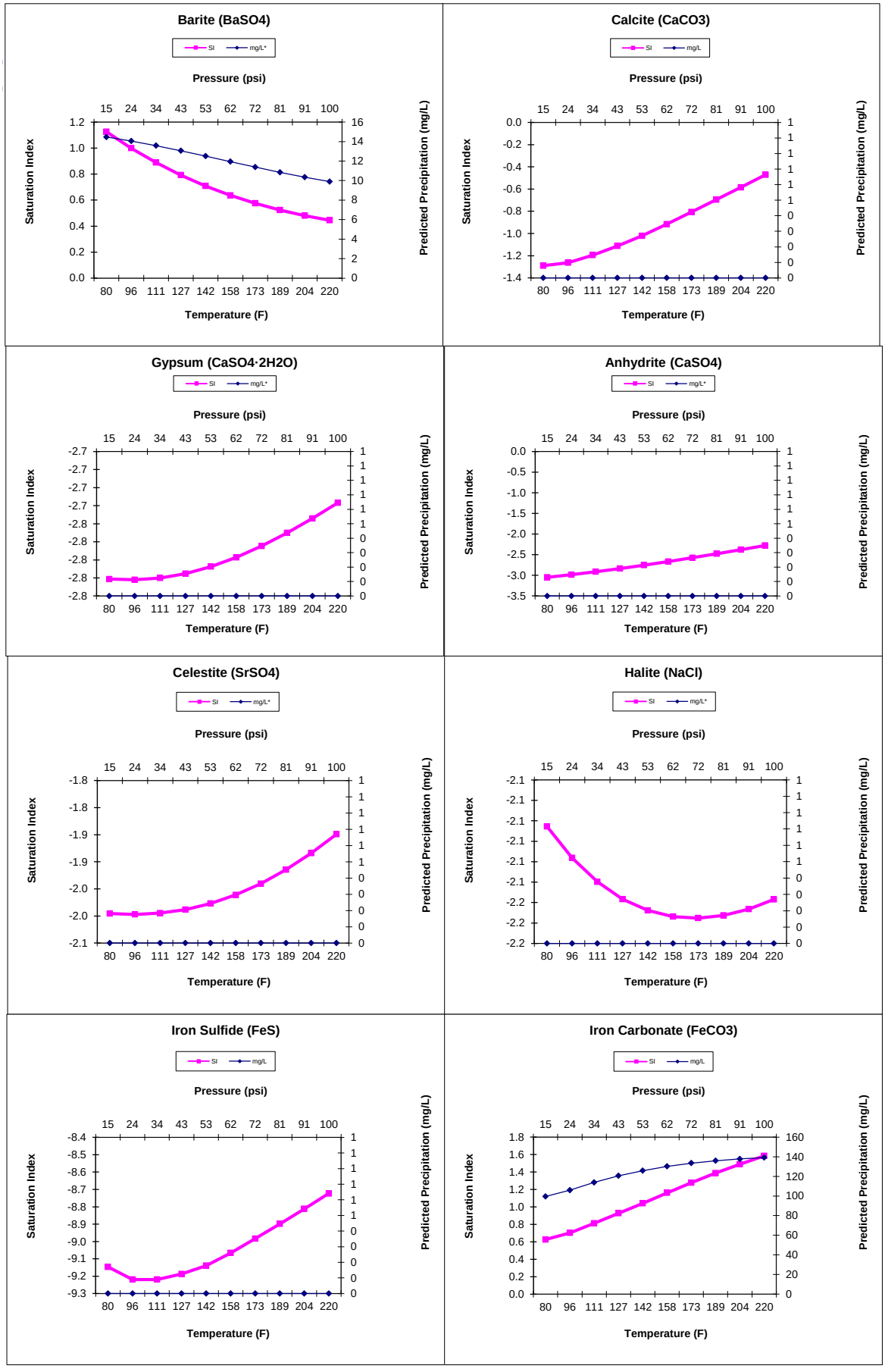
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 22-31D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	22A-24D Separator
District:	Four Corners	**Sample ID:**	201201035720
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 22A-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	561.0	9.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21411
Density/Specific Gravity (g/cm³):	1.0121
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12400.0	349.8
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8035.0	349.7
Potassium (K^+):	45.0	1.2
Magnesium (Mg^{2+}):	20.0	1.6
Calcium (Ca^{2+}):	185.0	9.2
Strontium (Sr^{2+}):	16.0	0.4
Barium (Ba^{2+}):	18.0	0.3
Iron (Fe^{2+}):	30.0	1.1
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	576	N/A

ND = Not Determined

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)**
80°F	15 psi	1.59	10.396	-0.90	0.000	-2.08	0.000	-2.32	0.000
96°F	24 psi	1.46	10.289	-0.87	0.000	-2.08	0.000	-2.26	0.000
111°F	34 psi	1.35	10.167	-0.80	0.000	-2.08	0.000	-2.19	0.000
127°F	43 psi	1.26	10.037	-0.71	0.000	-2.07	0.000	-2.11	0.000
142°F	53 psi	1.18	9.904	-0.62	0.000	-2.06	0.000	-2.02	0.000
158°F	62 psi	1.11	9.773	-0.50	0.000	-2.04	0.000	-1.93	0.000
173°F	72 psi	1.06	9.651	-0.39	0.000	-2.02	0.000	-1.83	0.000
189°F	81 psi	1.01	9.541	-0.27	0.000	-2.00	0.000	-1.72	0.000
204°F	91 psi	0.98	9.449	-0.15	0.000	-1.98	0.000	-1.61	0.000
220°F	100 psi	0.96	9.375	-0.02	0.000	-1.95	0.000	-1.50	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)**
80°F	15 psi	-1.46	0.000	-2.80	0.000	0.29	1.028	0.06	2.411
96°F	24 psi	-1.46	0.000	-2.82	0.000	0.22	0.835	0.14	5.156
111°F	34 psi	-1.46	0.000	-2.84	0.000	0.23	0.861	0.26	8.497
127°F	43 psi	-1.44	0.000	-2.85	0.000	0.27	0.985	0.38	11.422
142°F	53 psi	-1.42	0.000	-2.85	0.000	0.34	1.146	0.50	13.767
158°F	62 psi	-1.40	0.000	-2.85	0.000	0.43	1.348	0.64	15.717
173°F	72 psi	-1.36	0.000	-2.85	0.000	0.53	1.535	0.76	17.196
189°F	81 psi	-1.33	0.000	-2.85	0.000	0.63	1.692	0.89	18.281
204°F	91 psi	-1.28	0.000	-2.84	0.000	0.73	1.821	1.01	19.083
220°F	100 psi	-1.23	0.000	-2.84	0.000	0.84	1.926	1.12	19.680

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.

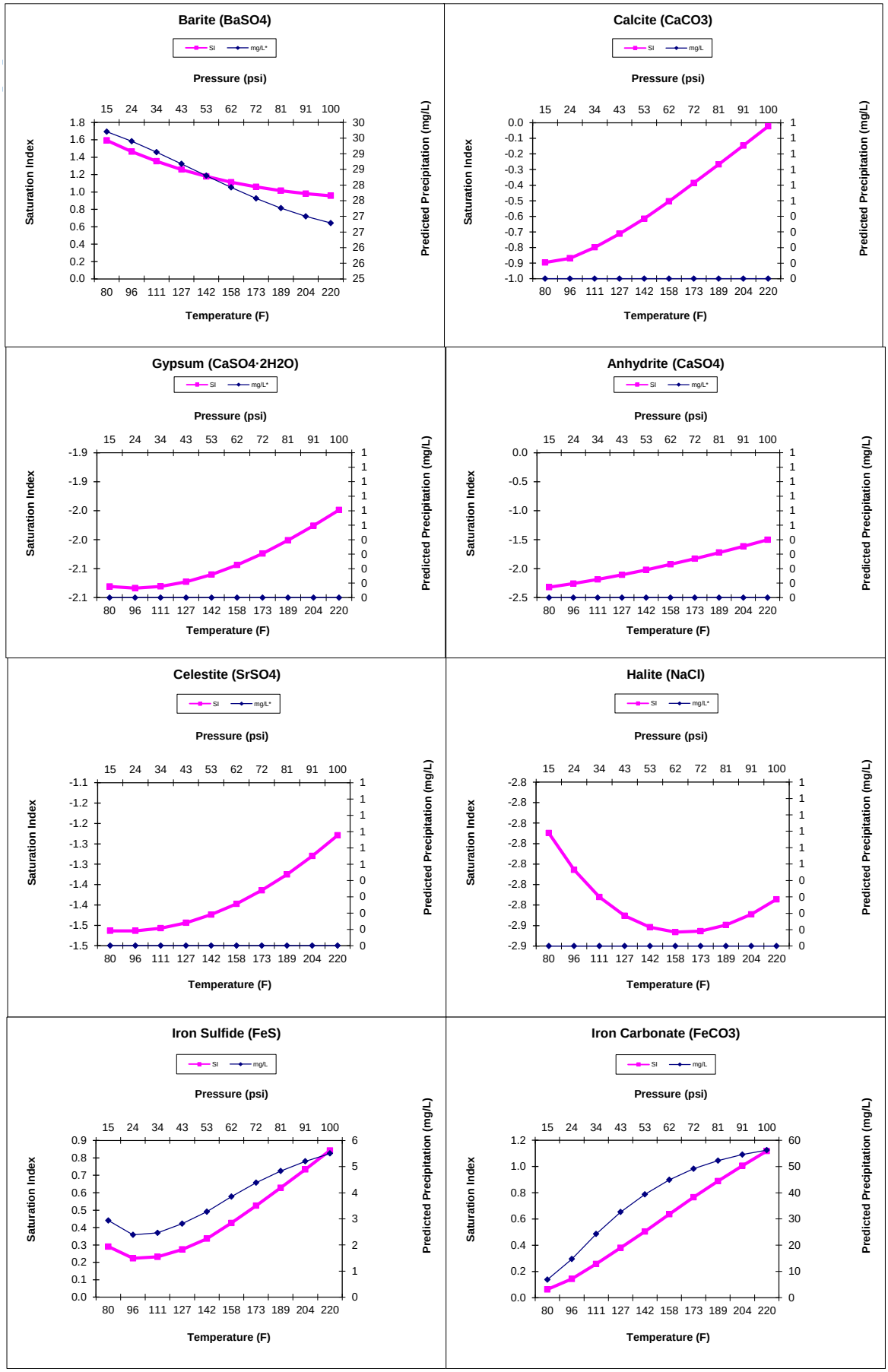
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 22A-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	22A-7D Separator
District:	Four Corners	**Sample ID:**	201201036501
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 22A-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	610.0	10.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	450.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	39711
Density/Specific Gravity (g/cm³):	1.0244
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	23400.0	660.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	15163.0	659.8
Potassium (K^+):	46.6	1.2
Magnesium (Mg^{2+}):	37.4	3.1
Calcium (Ca^{2+}):	293.4	14.6
Strontium (Sr^{2+}):	36.8	0.8
Barium (Ba^{2+}):	69.1	1.0
Iron (Fe^{2+}):	3.0	0.1
Manganese (Mn^{2+}):	2.1	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	980	N/A

ND = Not Determined

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)**
80°F	15 psi	1.60	35.183	-0.32	0.000	-2.42	0.000	-2.65	0.000
96°F	24 psi	1.48	34.150	-0.29	0.000	-2.42	0.000	-2.58	0.000
111°F	34 psi	1.37	33.117	-0.22	0.000	-2.42	0.000	-2.51	0.000
127°F	43 psi	1.27	32.111	-0.13	0.000	-2.41	0.000	-2.43	0.000
142°F	53 psi	1.19	31.154	-0.04	0.000	-2.40	0.000	-2.35	0.000
158°F	62 psi	1.12	30.263	0.06	7.499	-2.39	0.000	-2.26	0.000
173°F	72 psi	1.06	29.455	0.16	21.073	-2.37	0.000	-2.17	0.000
189°F	81 psi	1.01	28.738	0.28	34.197	-2.36	0.000	-2.07	0.000
204°F	91 psi	0.97	28.118	0.39	46.533	-2.34	0.000	-1.97	0.000
220°F	100 psi	0.94	27.595	0.51	58.120	-2.32	0.000	-1.86	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)**
80°F	15 psi	-1.63	0.000	-2.28	0.000	0.15	0.326	-0.59	0.000
96°F	24 psi	-1.63	0.000	-2.30	0.000	0.08	0.190	-0.51	0.000
111°F	34 psi	-1.63	0.000	-2.31	0.000	0.08	0.187	-0.40	0.000
127°F	43 psi	-1.62	0.000	-2.32	0.000	0.11	0.246	-0.28	0.000
142°F	53 psi	-1.61	0.000	-2.33	0.000	0.15	0.335	-0.16	0.000
158°F	62 psi	-1.59	0.000	-2.33	0.000	0.20	0.439	-0.05	0.000
173°F	72 psi	-1.56	0.000	-2.33	0.000	0.28	0.570	0.07	0.305
189°F	81 psi	-1.53	0.000	-2.33	0.000	0.36	0.700	0.18	0.723
204°F	91 psi	-1.50	0.000	-2.33	0.000	0.44	0.820	0.28	1.031
220°F	100 psi	-1.46	0.000	-2.32	0.000	0.52	0.930	0.38	1.261

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.

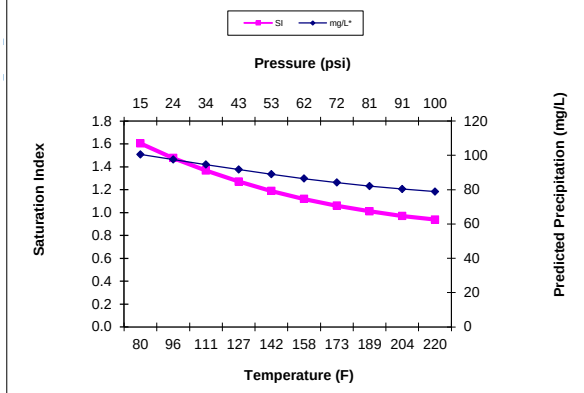
Calculate

ScaleSoftPitzer™ SSP2010

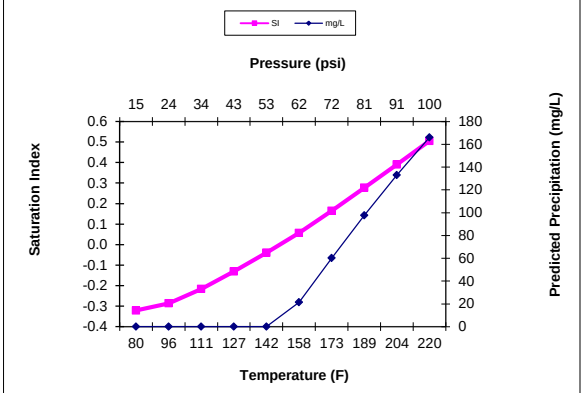
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 22A-7D Separator

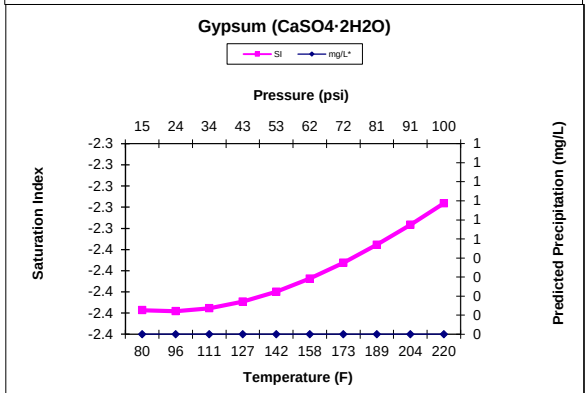
Barite (BaSO4)



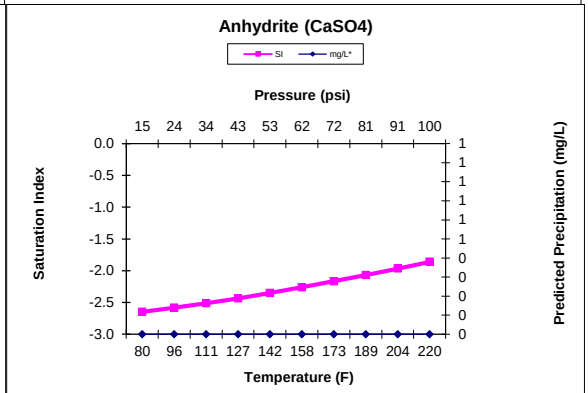
Calcite (CaCO3)



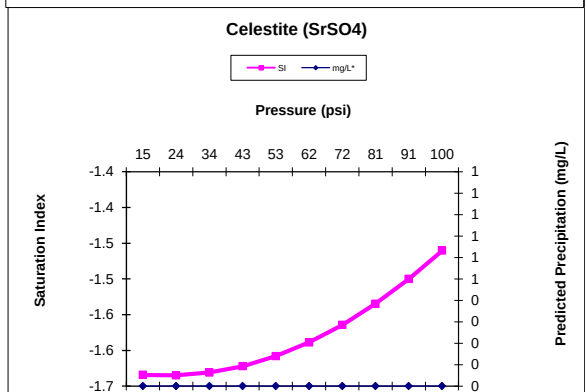
Gypsum (CaSO4·2H2O)



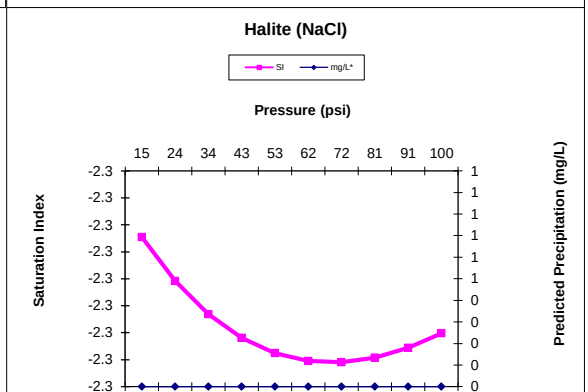
Anhydrite (CaSO4)



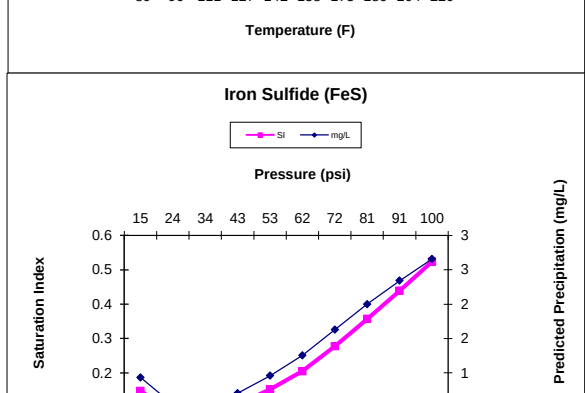
Celestite (SrSO4)



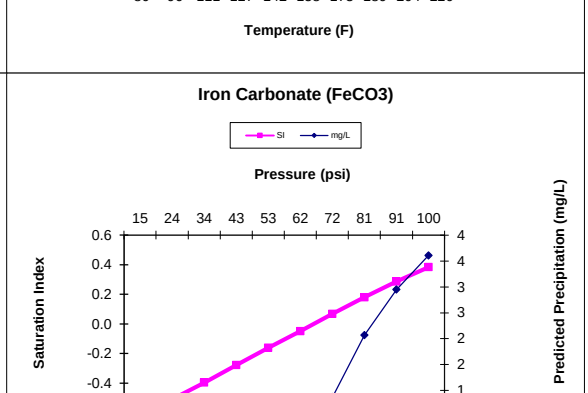
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	22C-17D Separator
District:	Four Corners	**Sample ID:**	201201036471
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/14/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 22C-17D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1586.0	26.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	230.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	30528
Density/Specific Gravity (g/cm^3):	1.0180
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	17400.0	490.8
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.04	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	11275.0	490.6
Potassium (K^+):	27.9	0.7
Magnesium (Mg^{2+}):	10.7	0.9
Calcium (Ca^{2+}):	72.4	3.6
Strontium (Sr^{2+}):	7.0	0.2
Barium (Ba^{2+}):	13.3	0.2
Iron (Fe^{2+}):	34.7	1.2
Manganese (Mn^{2+}):	0.8	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	243	N/A

ND = Not Determined

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)**
80°F	15 psi	1.32	7.463	0.03	3.064	-2.59	0.000	-2.83	0.000
96°F	24 psi	1.19	7.319	0.07	6.558	-2.59	0.000	-2.77	0.000
111°F	34 psi	1.07	7.156	0.14	13.097	-2.59	0.000	-2.70	0.000
127°F	43 psi	0.98	6.979	0.22	20.177	-2.59	0.000	-2.62	0.000
142°F	53 psi	0.90	6.795	0.32	26.961	-2.58	0.000	-2.53	0.000
158°F	62 psi	0.83	6.611	0.42	33.126	-2.56	0.000	-2.44	0.000
173°F	72 psi	0.77	6.436	0.53	38.940	-2.55	0.000	-2.34	0.000
189°F	81 psi	0.72	6.276	0.64	43.975	-2.53	0.000	-2.24	0.000
204°F	91 psi	0.69	6.134	0.76	48.116	-2.50	0.000	-2.14	0.000
220°F	100 psi	0.66	6.016	0.87	51.481	-2.48	0.000	-2.03	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)**
80°F	15 psi	-1.95	0.000	-2.53	0.000	2.07	2.337	1.51	24.328
96°F	24 psi	-1.95	0.000	-2.55	0.000	1.99	2.332	1.59	24.490
111°F	34 psi	-1.94	0.000	-2.56	0.000	1.98	2.331	1.71	24.660
127°F	43 psi	-1.93	0.000	-2.57	0.000	1.99	2.332	1.83	24.797
142°F	53 psi	-1.92	0.000	-2.58	0.000	2.01	2.334	1.95	24.900
158°F	62 psi	-1.89	0.000	-2.58	0.000	2.05	2.336	2.07	24.977
173°F	72 psi	-1.87	0.000	-2.58	0.000	2.11	2.339	2.19	25.037
189°F	81 psi	-1.83	0.000	-2.58	0.000	2.18	2.342	2.30	25.081
204°F	91 psi	-1.79	0.000	-2.57	0.000	2.25	2.345	2.41	25.114
220°F	100 psi	-1.75	0.000	-2.57	0.000	2.32	2.347	2.52	25.138

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.

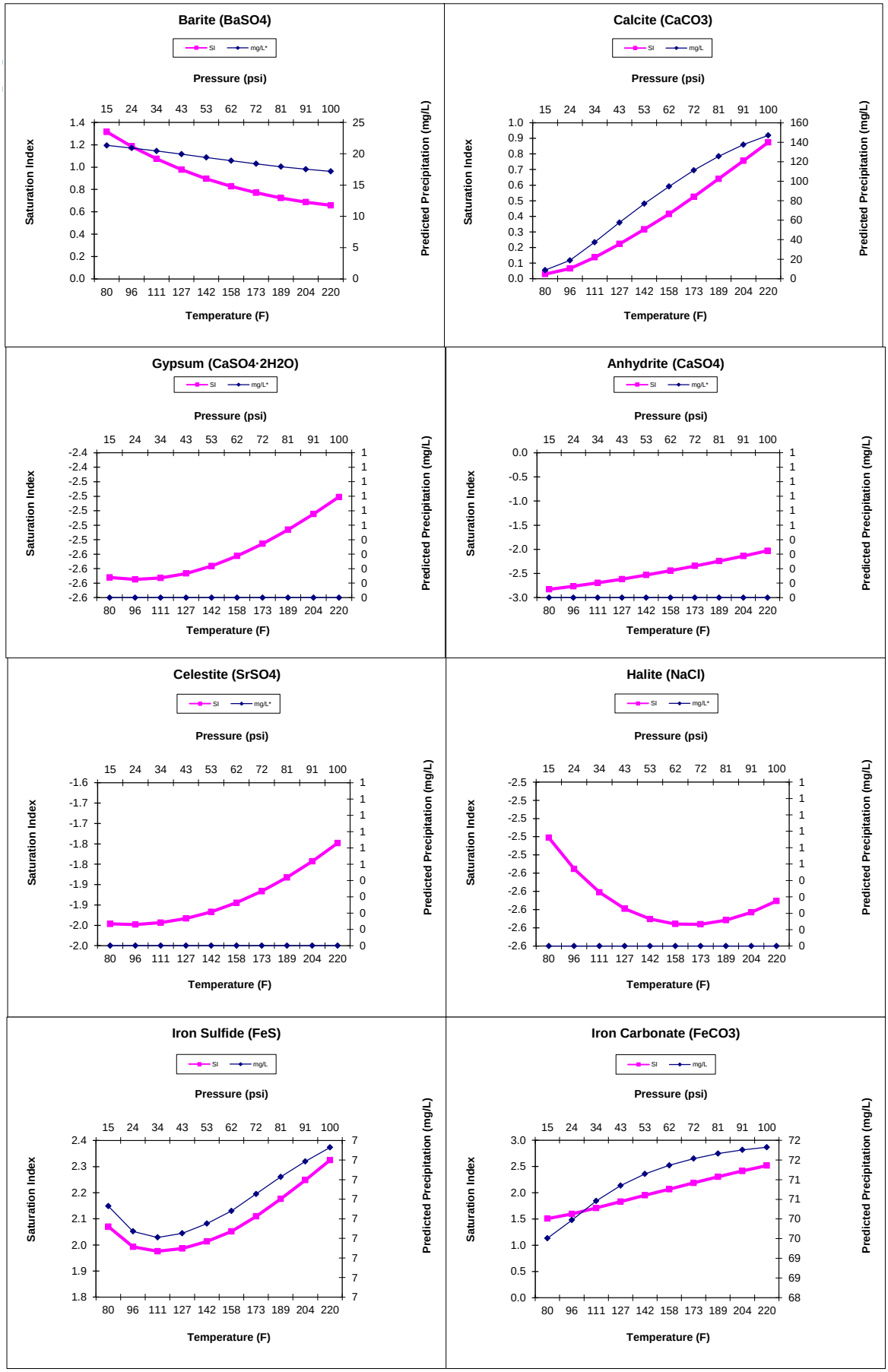
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 22C-17D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	22C-31D Separator
District:	Four Corners	**Sample ID:**	201201037400
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 22C-31D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.1

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	610.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	28256
Density/Specific Gravity (g/cm³):	1.0168
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	16500.0	465.4
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	10692.0	465.3
Potassium (K^+):	40.2	1.0
Magnesium (Mg^{2+}):	27.4	2.3
Calcium (Ca^{2+}):	208.6	10.4
Strontium (Sr^{2+}):	24.5	0.6
Barium (Ba^{2+}):	58.3	0.8
Iron (Fe^{2+}):	55.0	2.0
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	705	N/A

ND = Not Determined

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)**
80°F	15 psi	1.98	34.054	-0.78	0.000	-2.14	0.000	-2.37	0.000
96°F	24 psi	1.85	33.849	-0.75	0.000	-2.14	0.000	-2.31	0.000
111°F	34 psi	1.74	33.618	-0.68	0.000	-2.13	0.000	-2.24	0.000
127°F	43 psi	1.65	33.370	-0.60	0.000	-2.13	0.000	-2.16	0.000
142°F	53 psi	1.57	33.115	-0.50	0.000	-2.12	0.000	-2.07	0.000
158°F	62 psi	1.50	32.864	-0.40	0.000	-2.10	0.000	-1.98	0.000
173°F	72 psi	1.44	32.626	-0.28	0.000	-2.08	0.000	-1.88	0.000
189°F	81 psi	1.40	32.409	-0.17	0.000	-2.06	0.000	-1.78	0.000
204°F	91 psi	1.36	32.221	-0.05	0.000	-2.04	0.000	-1.68	0.000
220°F	100 psi	1.33	32.065	0.07	8.479	-2.02	0.000	-1.57	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)**
80°F	15 psi	-1.38	0.000	-2.57	0.000	-9.28	0.000	0.37	18.569
96°F	24 psi	-1.38	0.000	-2.59	0.000	-9.34	0.000	0.45	21.554
111°F	34 psi	-1.38	0.000	-2.60	0.000	-9.34	0.000	0.57	25.101
127°F	43 psi	-1.37	0.000	-2.61	0.000	-9.30	0.000	0.69	28.222
142°F	53 psi	-1.35	0.000	-2.62	0.000	-9.24	0.000	0.81	30.751
158°F	62 psi	-1.33	0.000	-2.62	0.000	-9.17	0.000	0.93	32.790
173°F	72 psi	-1.30	0.000	-2.62	0.000	-9.07	0.000	1.06	34.450
189°F	81 psi	-1.26	0.000	-2.62	0.000	-8.98	0.000	1.18	35.685
204°F	91 psi	-1.22	0.000	-2.61	0.000	-8.88	0.000	1.29	36.608
220°F	100 psi	-1.18	0.000	-2.61	0.000	-8.78	0.000	1.40	37.303

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.

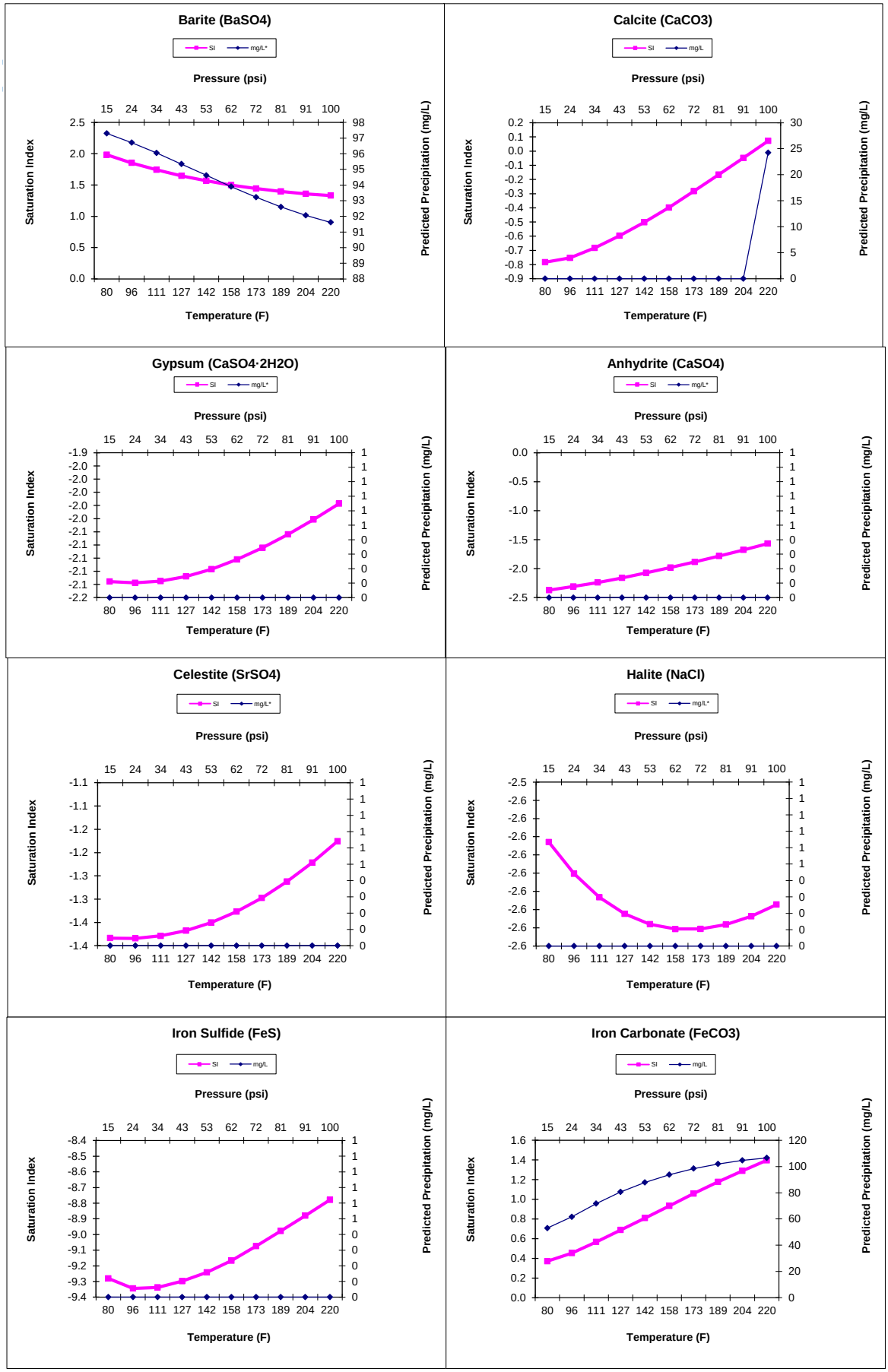
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 22C-31D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	22D-24D Separator
District:	Four Corners	**Sample ID:**	201201035721
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 22D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	683.0	11.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	175.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	30319
Density/Specific Gravity (g/cm³):	1.0181
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	17800.0	502.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	11534.0	501.9
Potassium (K^+):	42.0	1.1
Magnesium (Mg^{2+}):	17.0	1.4
Calcium (Ca^{2+}):	157.0	7.8
Strontium (Sr^{2+}):	14.0	0.3
Barium (Ba^{2+}):	17.0	0.2
Iron (Fe^{2+}):	5.0	0.2
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	491	N/A

ND = Not Determined

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)**
80°F	15 psi	1.12	9.140	-0.92	0.000	-2.58	0.000	-2.81	0.000
96°F	24 psi	0.99	8.816	-0.89	0.000	-2.58	0.000	-2.75	0.000
111°F	34 psi	0.88	8.456	-0.82	0.000	-2.58	0.000	-2.68	0.000
127°F	43 psi	0.79	8.071	-0.74	0.000	-2.57	0.000	-2.60	0.000
142°F	53 psi	0.71	7.679	-0.65	0.000	-2.56	0.000	-2.51	0.000
158°F	62 psi	0.64	7.295	-0.53	0.000	-2.55	0.000	-2.42	0.000
173°F	72 psi	0.58	6.934	-0.42	0.000	-2.53	0.000	-2.33	0.000
189°F	81 psi	0.53	6.606	-0.30	0.000	-2.51	0.000	-2.23	0.000
204°F	91 psi	0.50	6.321	-0.19	0.000	-2.49	0.000	-2.12	0.000
220°F	100 psi	0.47	6.084	-0.07	0.000	-2.46	0.000	-2.01	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)**
80°F	15 psi	-1.95	0.000	-2.51	0.000	-0.19	0.000	-0.68	0.000
96°F	24 psi	-1.95	0.000	-2.53	0.000	-0.26	0.000	-0.60	0.000
111°F	34 psi	-1.94	0.000	-2.54	0.000	-0.26	0.000	-0.49	0.000
127°F	43 psi	-1.93	0.000	-2.55	0.000	-0.22	0.000	-0.37	0.000
142°F	53 psi	-1.92	0.000	-2.55	0.000	-0.16	0.000	-0.25	0.000
158°F	62 psi	-1.89	0.000	-2.56	0.000	-0.07	0.000	-0.12	0.000
173°F	72 psi	-1.86	0.000	-2.56	0.000	0.02	0.086	0.01	0.041
189°F	81 psi	-1.83	0.000	-2.56	0.000	0.12	0.434	0.12	0.871
204°F	91 psi	-1.79	0.000	-2.55	0.000	0.22	0.751	0.23	1.482
220°F	100 psi	-1.75	0.000	-2.54	0.000	0.32	1.038	0.34	1.938

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.

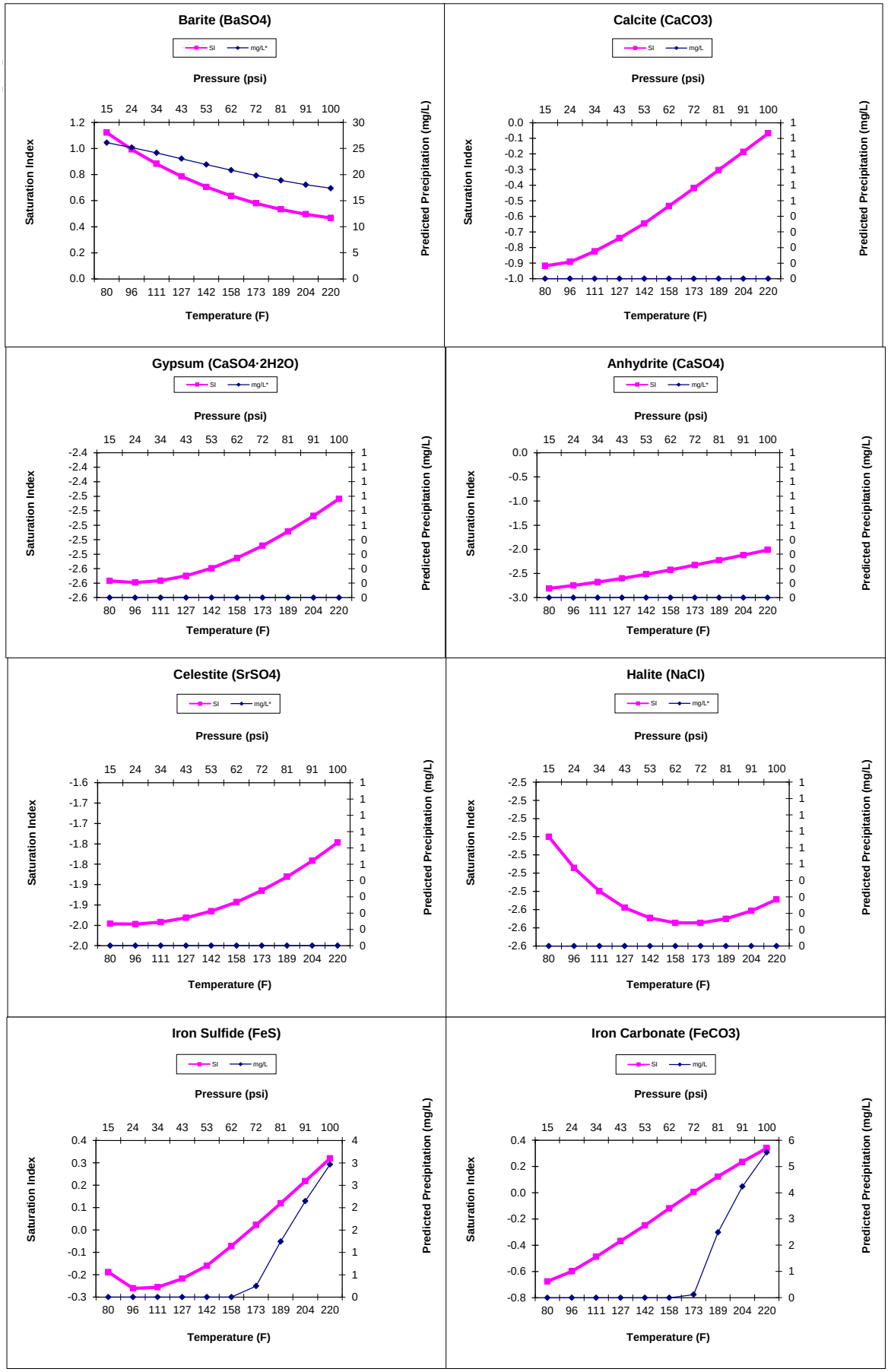
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 22D-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	22D-31D Separator
District:	Four Corners	**Sample ID:**	201201037406
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 22D-31D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	310.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	14659
Density/Specific Gravity (g/cm³):	1.0074
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8400.0	237.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	5443.0	236.9
Potassium (K^+):	29.7	0.8
Magnesium (Mg^{2+}):	14.4	1.2
Calcium (Ca^{2+}):	102.5	5.1
Strontium (Sr^{2+}):	12.4	0.3
Barium (Ba^{2+}):	27.2	0.4
Iron (Fe^{2+}):	30.1	1.1
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	349	N/A

ND = Not Determined

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)**
80°F	15 psi	1.63	15.565	-0.81	0.000	-2.49	0.000	-2.73	0.000
96°F	24 psi	1.50	15.363	-0.78	0.000	-2.50	0.000	-2.67	0.000
111°F	34 psi	1.39	15.140	-0.70	0.000	-2.49	0.000	-2.60	0.000
127°F	43 psi	1.30	14.906	-0.61	0.000	-2.48	0.000	-2.52	0.000
142°F	53 psi	1.22	14.673	-0.51	0.000	-2.47	0.000	-2.43	0.000
158°F	62 psi	1.16	14.450	-0.41	0.000	-2.45	0.000	-2.34	0.000
173°F	72 psi	1.11	14.249	-0.29	0.000	-2.43	0.000	-2.23	0.000
189°F	81 psi	1.07	14.077	-0.17	0.000	-2.40	0.000	-2.13	0.000
204°F	91 psi	1.03	13.938	-0.04	0.000	-2.37	0.000	-2.01	0.000
220°F	100 psi	1.01	13.835	0.08	7.331	-2.34	0.000	-1.90	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)**
80°F	15 psi	-1.73	0.000	-3.12	0.000	1.26	4.872	0.42	12.238
96°F	24 psi	-1.73	0.000	-3.14	0.000	1.20	4.810	0.51	13.835
111°F	34 psi	-1.72	0.000	-3.15	0.000	1.21	4.822	0.63	15.607
127°F	43 psi	-1.71	0.000	-3.16	0.000	1.25	4.866	0.76	17.091
142°F	53 psi	-1.69	0.000	-3.16	0.000	1.31	4.923	0.88	18.243
158°F	62 psi	-1.65	0.000	-3.17	0.000	1.39	4.983	1.01	19.112
173°F	72 psi	-1.62	0.000	-3.16	0.000	1.48	5.050	1.14	19.812
189°F	81 psi	-1.57	0.000	-3.16	0.000	1.58	5.106	1.27	20.316
204°F	91 psi	-1.52	0.000	-3.16	0.000	1.69	5.152	1.39	20.682
220°F	100 psi	-1.46	0.000	-3.15	0.000	1.80	5.189	1.51	20.950

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.

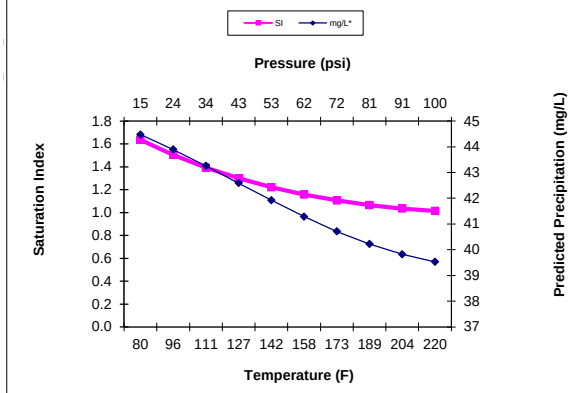
Calculate

ScaleSoftPitzer™ SSP2010

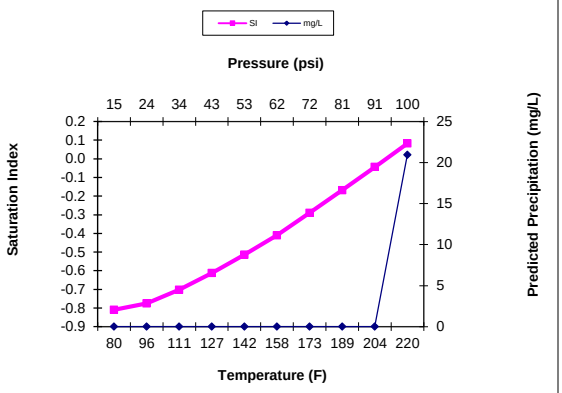
Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 22D-31D Separator

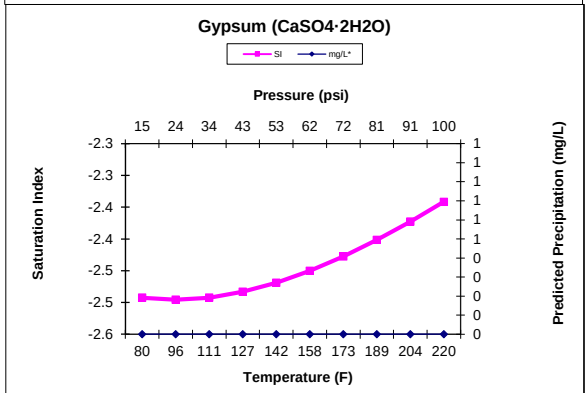
Barite (BaSO4)



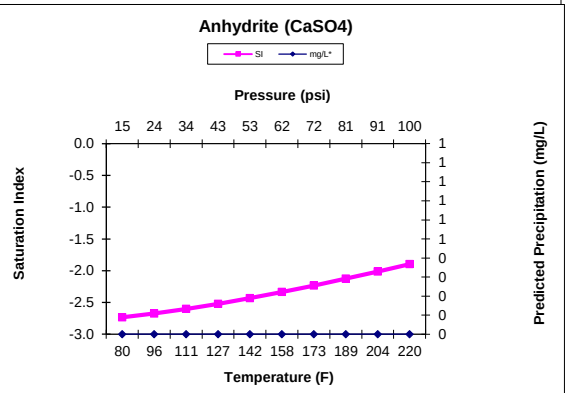
Calcite (CaCO3)



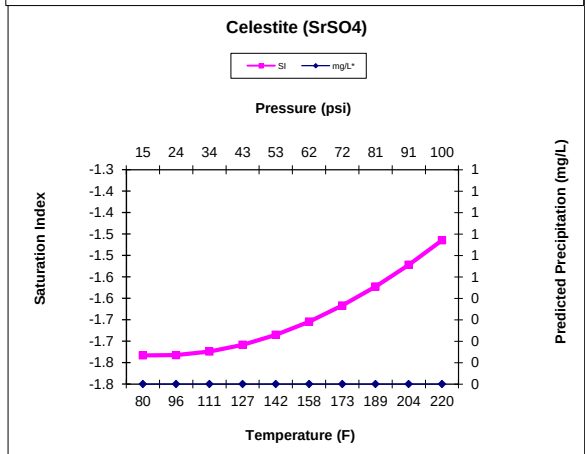
Gypsum (CaSO4·2H2O)



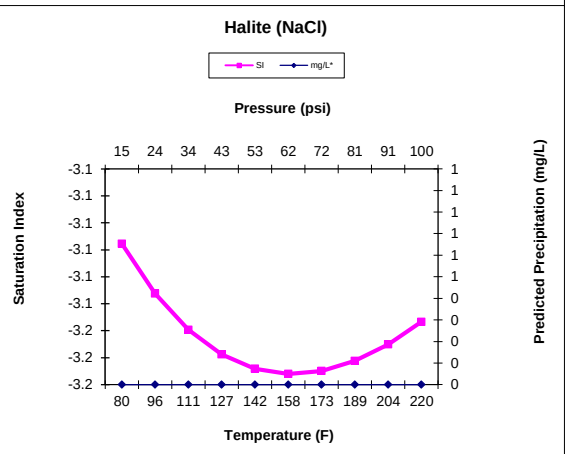
Anhydrite (CaSO4)



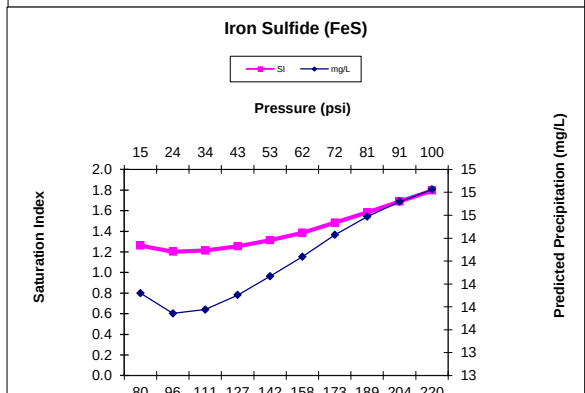
Celestite (SrSO4)



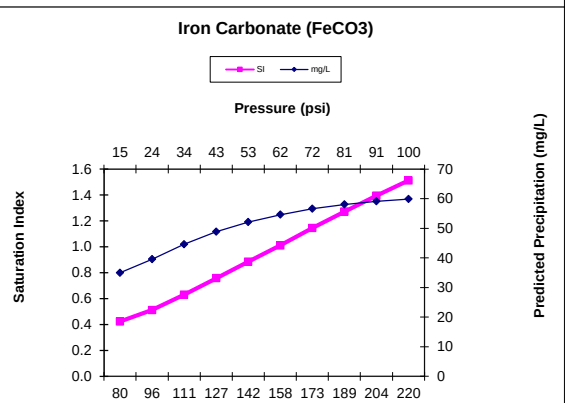
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	236-25 Separator
District:	Four Corners	**Sample ID:**	201201036514
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 236-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	610.0	10.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	125.0
aqueous H_2S (ppm):	5.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23799
Density/Specific Gravity (g/cm³):	1.0135
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14000.0	394.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9072.0	394.8
Potassium (K^+):	16.0	0.4
Magnesium (Mg^{2+}):	3.3	0.3
Calcium (Ca^{2+}):	37.7	1.9
Strontium (Sr^{2+}):	2.5	0.1
Barium (Ba^{2+}):	3.8	0.1
Iron (Fe^{2+}):	3.6	0.1
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	114	N/A

ND = Not Determined

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)**
80°F	15 psi	0.59	1.661	-0.57	0.000	-3.10	0.000	-3.34	0.000
96°F	24 psi	0.46	1.451	-0.53	0.000	-3.10	0.000	-3.27	0.000
111°F	34 psi	0.35	1.217	-0.46	0.000	-3.10	0.000	-3.20	0.000
127°F	43 psi	0.25	0.966	-0.37	0.000	-3.09	0.000	-3.12	0.000
142°F	53 psi	0.17	0.710	-0.28	0.000	-3.08	0.000	-3.04	0.000
158°F	62 psi	0.10	0.460	-0.18	0.000	-3.06	0.000	-2.95	0.000
173°F	72 psi	0.05	0.226	-0.08	0.000	-3.04	0.000	-2.85	0.000
189°F	81 psi	0.00	0.017	0.04	1.907	-3.02	0.000	-2.74	0.000
204°F	91 psi	-0.03	0.000	0.16	7.029	-3.00	0.000	-2.64	0.000
220°F	100 psi	-0.06	0.000	0.28	11.606	-2.97	0.000	-2.52	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)**
80°F	15 psi	-2.59	0.000	-2.71	0.000	1.74	1.955	0.16	0.809
96°F	24 psi	-2.59	0.000	-2.72	0.000	1.66	1.945	0.25	1.141
111°F	34 psi	-2.58	0.000	-2.74	0.000	1.64	1.942	0.37	1.484
127°F	43 psi	-2.57	0.000	-2.75	0.000	1.65	1.943	0.49	1.763
142°F	53 psi	-2.55	0.000	-2.75	0.000	1.67	1.947	0.61	1.974
158°F	62 psi	-2.53	0.000	-2.75	0.000	1.71	1.952	0.73	2.131
173°F	72 psi	-2.50	0.000	-2.75	0.000	1.76	1.958	0.84	2.252
189°F	81 psi	-2.46	0.000	-2.75	0.000	1.82	1.965	0.96	2.345
204°F	91 psi	-2.42	0.000	-2.74	0.000	1.90	1.971	1.08	2.413
220°F	100 psi	-2.37	0.000	-2.74	0.000	1.97	1.977	1.18	2.463

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.

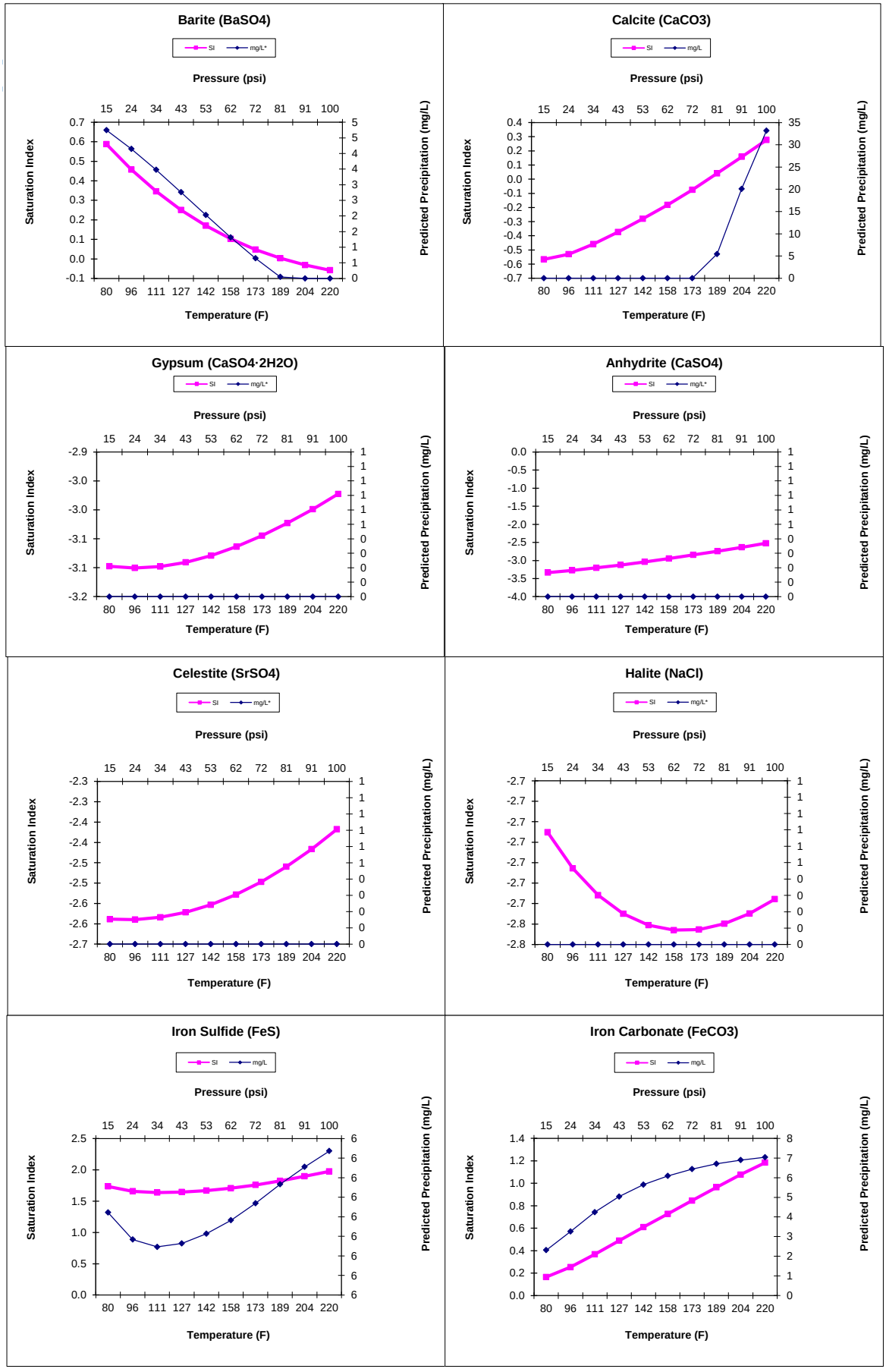
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 236-25 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	238-25 Separator
District:	Four Corners	**Sample ID:**	201201036515
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 238-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24836
Density/Specific Gravity (g/cm³):	1.0143
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14700.0	414.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	9526.0	414.5
Potassium (K^+):	15.6	0.4
Magnesium (Mg^{2+}):	7.4	0.6
Calcium (Ca^{2+}):	82.8	4.1
Strontium (Sr^{2+}):	8.4	0.2
Barium (Ba^{2+}):	17.7	0.3
Iron (Fe^{2+}):	1.1	0.0
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	260	N/A

ND = Not Determined

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)**
80°F	15 psi	1.23	9.750	-1.18	0.000	-2.78	0.000	-3.02	0.000
96°F	24 psi	1.10	9.480	-1.15	0.000	-2.78	0.000	-2.96	0.000
111°F	34 psi	0.99	9.179	-1.08	0.000	-2.78	0.000	-2.88	0.000
127°F	43 psi	0.90	8.859	-0.99	0.000	-2.77	0.000	-2.81	0.000
142°F	53 psi	0.82	8.534	-0.90	0.000	-2.76	0.000	-2.72	0.000
158°F	62 psi	0.75	8.217	-0.80	0.000	-2.75	0.000	-2.63	0.000
173°F	72 psi	0.69	7.922	-0.68	0.000	-2.73	0.000	-2.53	0.000
189°F	81 psi	0.65	7.659	-0.57	0.000	-2.71	0.000	-2.43	0.000
204°F	91 psi	0.61	7.434	-0.45	0.000	-2.68	0.000	-2.32	0.000
220°F	100 psi	0.59	7.252	-0.33	0.000	-2.66	0.000	-2.21	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)**
80°F	15 psi	-2.09	0.000	-2.67	0.000	-0.33	0.000	-1.34	0.000
96°F	24 psi	-2.09	0.000	-2.68	0.000	-0.39	0.000	-1.26	0.000
111°F	34 psi	-2.09	0.000	-2.70	0.000	-0.39	0.000	-1.14	0.000
127°F	43 psi	-2.07	0.000	-2.71	0.000	-0.35	0.000	-1.02	0.000
142°F	53 psi	-2.06	0.000	-2.71	0.000	-0.29	0.000	-0.90	0.000
158°F	62 psi	-2.03	0.000	-2.71	0.000	-0.22	0.000	-0.78	0.000
173°F	72 psi	-2.00	0.000	-2.71	0.000	-0.13	0.000	-0.65	0.000
189°F	81 psi	-1.96	0.000	-2.71	0.000	-0.04	0.000	-0.53	0.000
204°F	91 psi	-1.92	0.000	-2.71	0.000	0.06	0.068	-0.42	0.000
220°F	100 psi	-1.87	0.000	-2.70	0.000	0.16	0.169	-0.31	0.000

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.

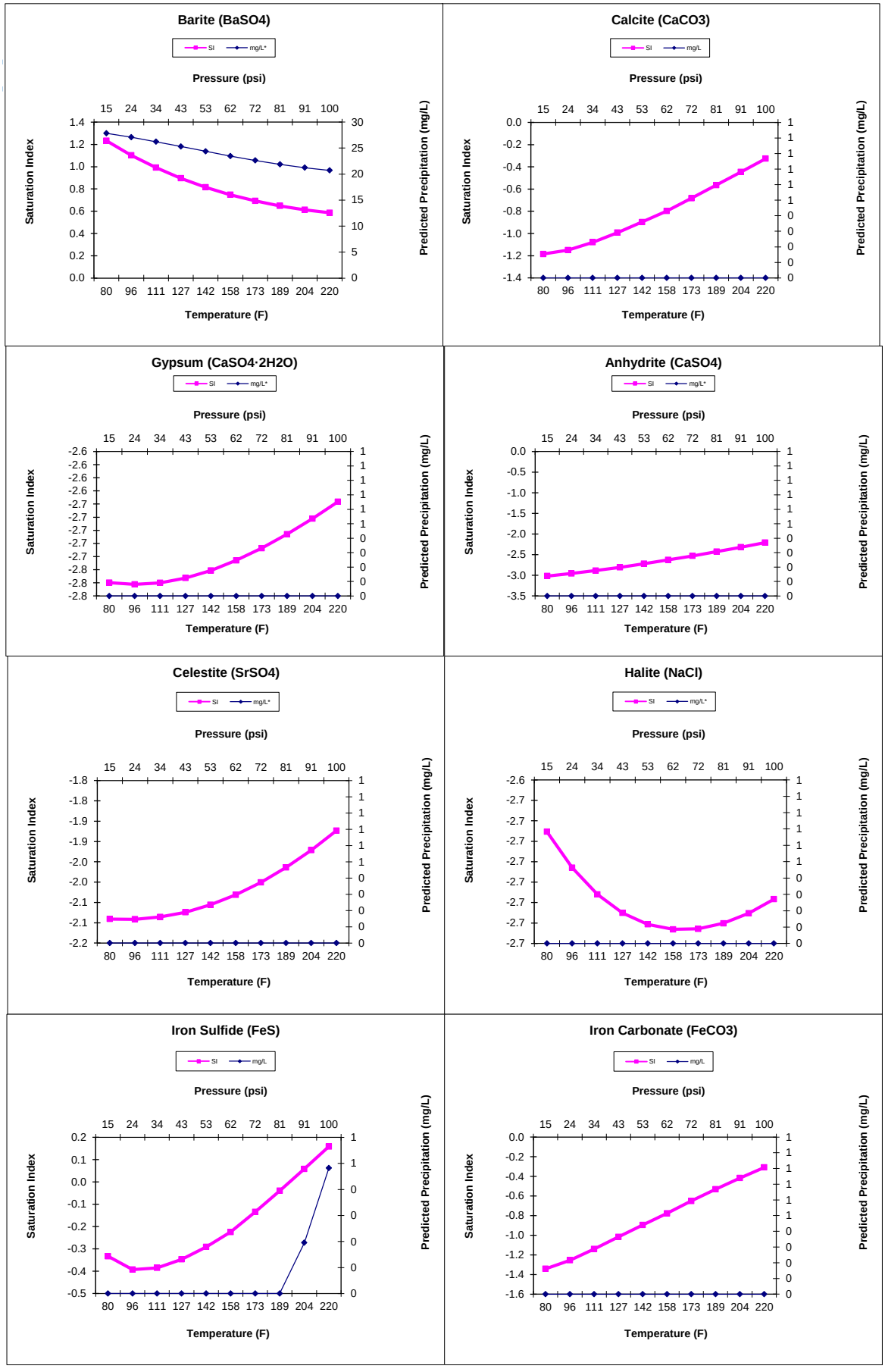
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 238-25 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23A-24D Separator
District:	Four Corners	**Sample ID:**	201201035729
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 23A-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	793.0	13.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	510.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	14396
Density/Specific Gravity (g/cm³):	1.0071
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8100.0	228.5
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.04

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5248.0	228.4
Potassium (K^+):	23.0	0.6
Magnesium (Mg^{2+}):	7.0	0.6
Calcium (Ca^{2+}):	81.0	4.0
Strontium (Sr^{2+}):	7.0	0.2
Barium (Ba^{2+}):	26.0	0.4
Iron (Fe^{2+}):	11.0	0.4
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	258	N/A

ND = Not Determined

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)**
80°F	15 psi	1.93	15.243	-0.04	0.000	-2.28	0.000	-2.52	0.000
96°F	24 psi	1.80	15.165	-0.01	0.000	-2.28	0.000	-2.46	0.000
111°F	34 psi	1.69	15.078	0.07	5.745	-2.28	0.000	-2.39	0.000
127°F	43 psi	1.59	14.985	0.16	12.762	-2.27	0.000	-2.31	0.000
142°F	53 psi	1.51	14.891	0.26	19.884	-2.25	0.000	-2.22	0.000
158°F	62 psi	1.45	14.801	0.36	26.774	-2.23	0.000	-2.12	0.000
173°F	72 psi	1.40	14.718	0.48	33.543	-2.21	0.000	-2.02	0.000
189°F	81 psi	1.36	14.647	0.60	39.986	-2.19	0.000	-1.91	0.000
204°F	91 psi	1.33	14.588	0.72	45.676	-2.16	0.000	-1.80	0.000
220°F	100 psi	1.31	14.545	0.85	50.619	-2.13	0.000	-1.68	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)**
80°F	15 psi	-1.67	0.000	-3.15	0.000	-8.45	0.000	0.87	6.836
96°F	24 psi	-1.67	0.000	-3.17	0.000	-8.52	0.000	0.97	7.055
111°F	34 psi	-1.66	0.000	-3.18	0.000	-8.53	0.000	1.09	7.280
127°F	43 psi	-1.64	0.000	-3.19	0.000	-8.51	0.000	1.22	7.459
142°F	53 psi	-1.62	0.000	-3.19	0.000	-8.48	0.000	1.34	7.593
158°F	62 psi	-1.59	0.000	-3.20	0.000	-8.43	0.000	1.47	7.692
173°F	72 psi	-1.55	0.000	-3.19	0.000	-8.37	0.000	1.60	7.767
189°F	81 psi	-1.51	0.000	-3.19	0.000	-8.30	0.000	1.73	7.823
204°F	91 psi	-1.46	0.000	-3.18	0.000	-8.21	0.000	1.85	7.863
220°F	100 psi	-1.40	0.000	-3.18	0.000	-8.13	0.000	1.97	7.893

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.

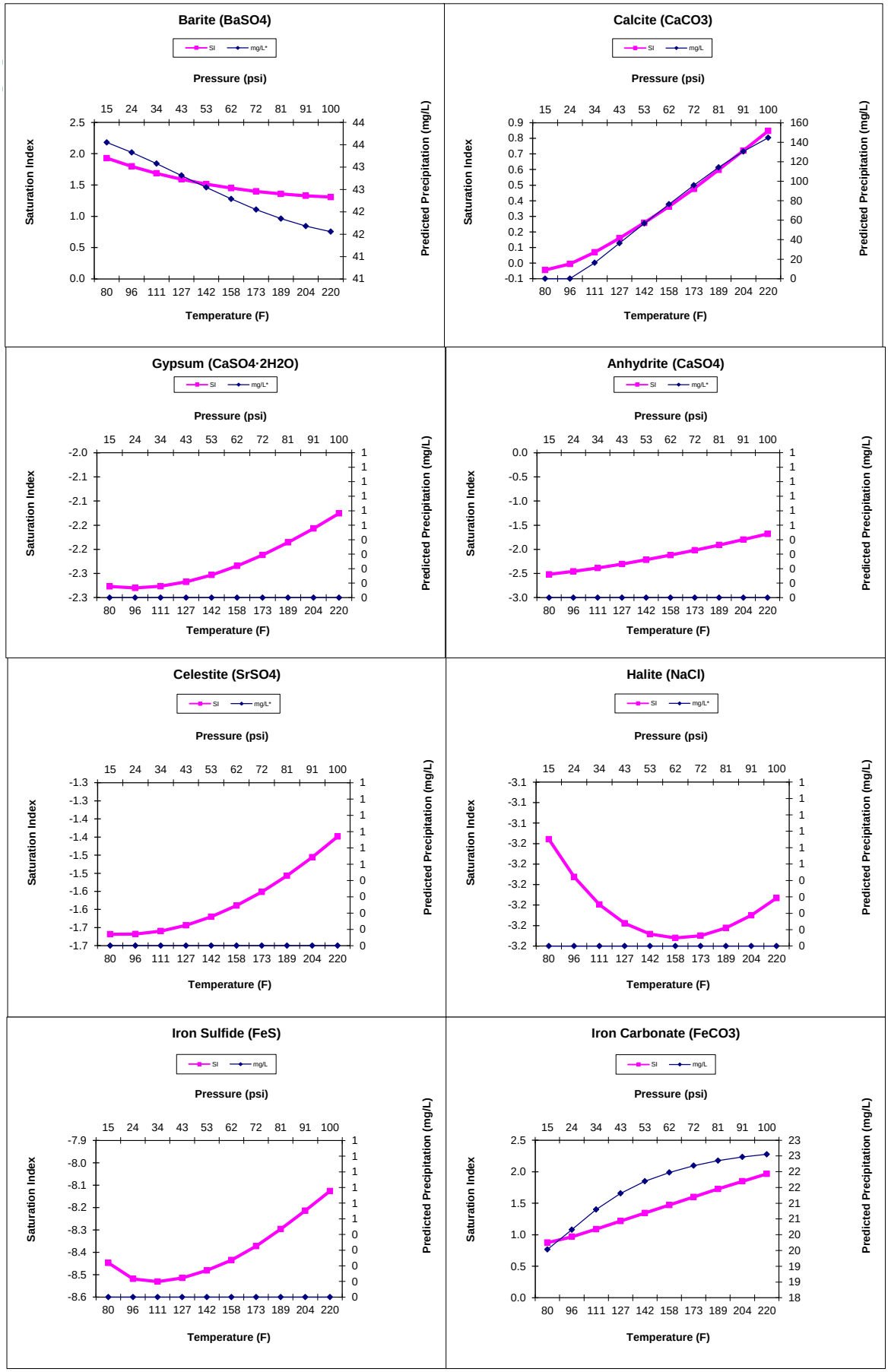
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 23A-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23B-24D Separator
District:	Four Corners	**Sample ID:**	201201035730
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 23B-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	275.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20594
Density/Specific Gravity (g/cm³):	1.0114
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12000.0	338.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7776.0	338.4
Potassium (K^+):	35.0	0.9
Magnesium (Mg^{2+}):	13.0	1.1
Calcium (Ca^{2+}):	115.0	5.7
Strontium (Sr^{2+}):	11.0	0.3
Barium (Ba^{2+}):	26.0	0.4
Iron (Fe^{2+}):	19.0	0.7
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	373	N/A

ND = Not Determined

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)**
80°F	15 psi	1.48	14.675	-0.11	0.000	-2.57	0.000	-2.81	0.000
96°F	24 psi	1.35	14.409	-0.07	0.000	-2.57	0.000	-2.75	0.000
111°F	34 psi	1.23	14.114	0.00	0.343	-2.57	0.000	-2.67	0.000
127°F	43 psi	1.14	13.803	0.09	7.139	-2.56	0.000	-2.60	0.000
142°F	53 psi	1.06	13.490	0.19	14.282	-2.55	0.000	-2.51	0.000
158°F	62 psi	0.99	13.189	0.29	21.487	-2.53	0.000	-2.41	0.000
173°F	72 psi	0.94	12.912	0.40	28.878	-2.51	0.000	-2.31	0.000
189°F	81 psi	0.90	12.669	0.52	36.430	-2.49	0.000	-2.21	0.000
204°F	91 psi	0.86	12.466	0.64	43.599	-2.46	0.000	-2.10	0.000
220°F	100 psi	0.84	12.306	0.76	50.365	-2.43	0.000	-1.99	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)**
80°F	15 psi	-1.91	0.000	-2.83	0.000	-8.28	0.000	0.86	11.479
96°F	24 psi	-1.91	0.000	-2.85	0.000	-8.35	0.000	0.95	11.906
111°F	34 psi	-1.90	0.000	-2.86	0.000	-8.37	0.000	1.07	12.346
127°F	43 psi	-1.89	0.000	-2.87	0.000	-8.36	0.000	1.19	12.701
142°F	53 psi	-1.87	0.000	-2.88	0.000	-8.33	0.000	1.32	12.970
158°F	62 psi	-1.84	0.000	-2.88	0.000	-8.29	0.000	1.44	13.169
173°F	72 psi	-1.81	0.000	-2.88	0.000	-8.23	0.000	1.56	13.321
189°F	81 psi	-1.77	0.000	-2.88	0.000	-8.16	0.000	1.68	13.437
204°F	91 psi	-1.72	0.000	-2.87	0.000	-8.09	0.000	1.80	13.522
220°F	100 psi	-1.67	0.000	-2.86	0.000	-8.01	0.000	1.91	13.583

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.

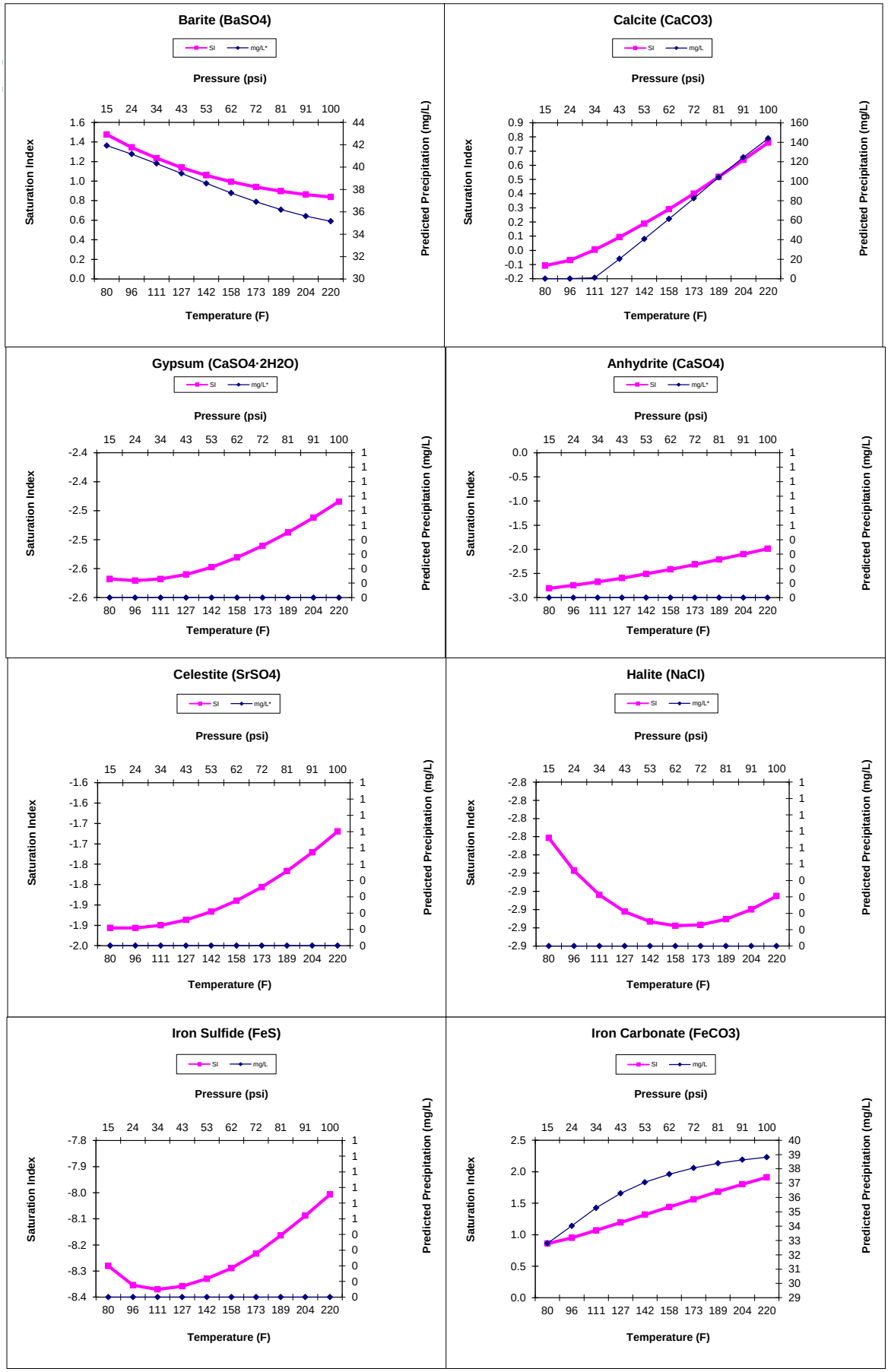
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 23B-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	241-1 Separator
District:	Four Corners	**Sample ID:**	201201036506
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 241-1 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.6

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	451.0	7.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	110.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	25369
Density/Specific Gravity (g/cm^3):	1.0146
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	14900.0	420.3
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	9655.0	420.1
Potassium (K^+):	25.2	0.6
Magnesium (Mg^{2+}):	12.7	1.0
Calcium (Ca^{2+}):	107.0	5.3
Strontium (Sr^{2+}):	13.5	0.3
Barium (Ba^{2+}):	4.1	0.1
Iron (Fe^{2+}):	0.4	0.0
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	338	N/A

ND = Not Determined

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)
80°F	15 psi	1.18	2.271	-0.65	0.000	-2.08	0.000	-2.31	0.000
96°F	24 psi	1.05	2.215	-0.62	0.000	-2.08	0.000	-2.25	0.000
111°F	34 psi	0.94	2.152	-0.54	0.000	-2.08	0.000	-2.18	0.000
127°F	43 psi	0.85	2.083	-0.46	0.000	-2.07	0.000	-2.10	0.000
142°F	53 psi	0.77	2.012	-0.36	0.000	-2.06	0.000	-2.02	0.000
158°F	62 psi	0.70	1.942	-0.26	0.000	-2.04	0.000	-1.92	0.000
173°F	72 psi	0.64	1.876	-0.15	0.000	-2.02	0.000	-1.83	0.000
189°F	81 psi	0.60	1.815	-0.04	0.000	-2.00	0.000	-1.72	0.000
204°F	91 psi	0.56	1.763	0.08	6.199	-1.98	0.000	-1.62	0.000
220°F	100 psi	0.54	1.720	0.20	14.810	-1.95	0.000	-1.51	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)
80°F	15 psi	-1.29	0.000	-2.66	0.000	-0.31	0.000	-1.40	0.000
96°F	24 psi	-1.29	0.000	-2.67	0.000	-0.38	0.000	-1.31	0.000
111°F	34 psi	-1.29	0.000	-2.69	0.000	-0.38	0.000	-1.19	0.000
127°F	43 psi	-1.28	0.000	-2.70	0.000	-0.35	0.000	-1.07	0.000
142°F	53 psi	-1.26	0.000	-2.70	0.000	-0.31	0.000	-0.95	0.000
158°F	62 psi	-1.23	0.000	-2.70	0.000	-0.26	0.000	-0.83	0.000
173°F	72 psi	-1.20	0.000	-2.70	0.000	-0.19	0.000	-0.71	0.000
189°F	81 psi	-1.17	0.000	-2.70	0.000	-0.11	0.000	-0.59	0.000
204°F	91 psi	-1.12	0.000	-2.70	0.000	-0.02	0.000	-0.47	0.000
220°F	100 psi	-1.08	0.000	-2.69	0.000	0.07	0.026	-0.37	0.000

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.

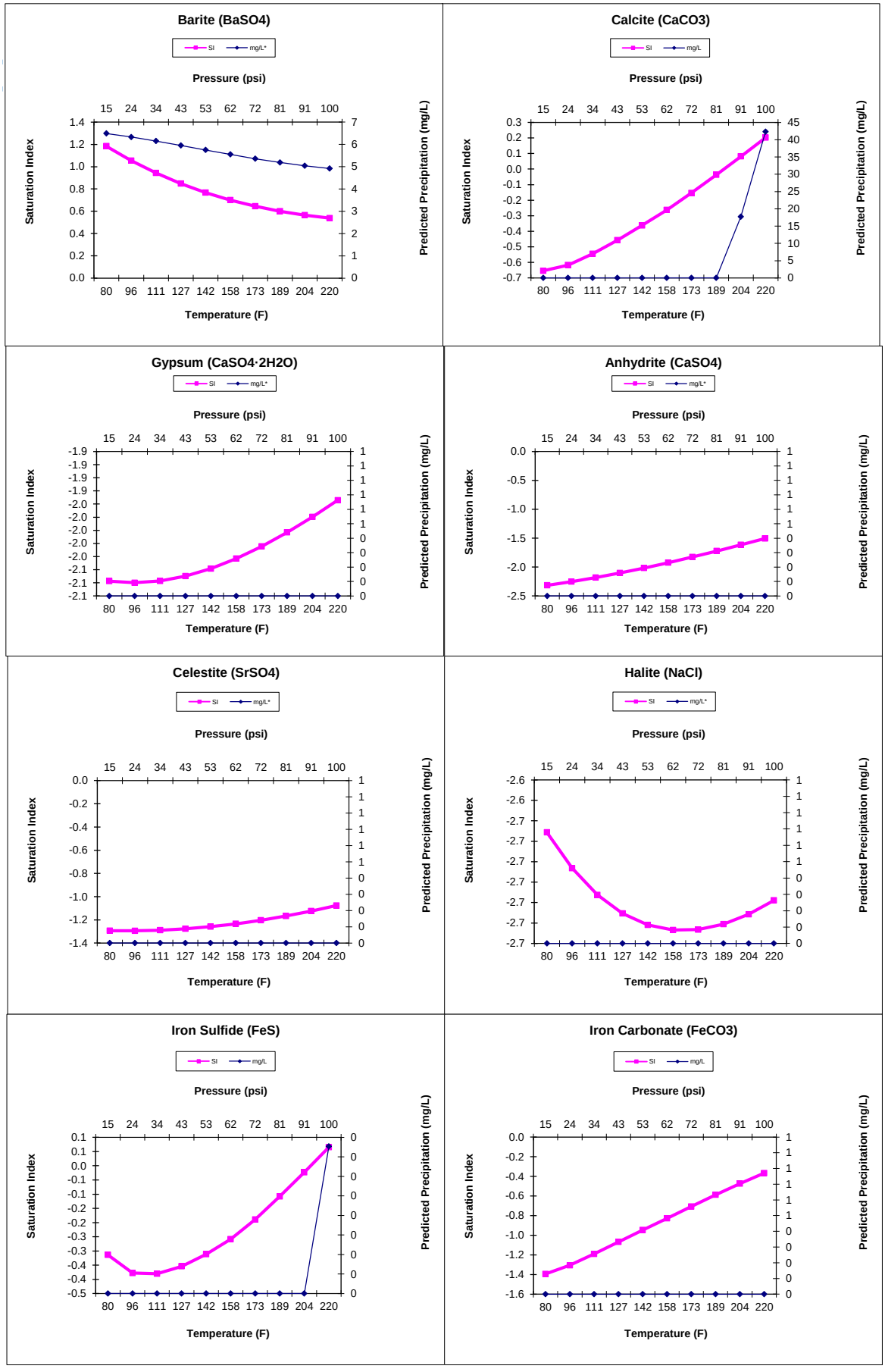
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 241-1 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	241-36 Separator
District:	Four Corners	**Sample ID:**	201201036521
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 241-36 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	671.0	11.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	275.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24952
Density/Specific Gravity (g/cm³):	1.0143
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14600.0	411.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	9461.0	411.7
Potassium (K^+):	31.9	0.8
Magnesium (Mg^{2+}):	15.5	1.3
Calcium (Ca^{2+}):	100.0	5.0
Strontium (Sr^{2+}):	12.1	0.3
Barium (Ba^{2+}):	9.0	0.1
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	0.9	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	334	N/A

ND = Not Determined

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)**
80°F	15 psi	0.93	4.625	-0.40	0.000	-2.70	0.000	-2.93	0.000
96°F	24 psi	0.80	4.387	-0.37	0.000	-2.70	0.000	-2.87	0.000
111°F	34 psi	0.69	4.122	-0.29	0.000	-2.70	0.000	-2.80	0.000
127°F	43 psi	0.60	3.838	-0.21	0.000	-2.69	0.000	-2.72	0.000
142°F	53 psi	0.51	3.549	-0.11	0.000	-2.68	0.000	-2.64	0.000
158°F	62 psi	0.45	3.267	-0.01	0.000	-2.66	0.000	-2.54	0.000
173°F	72 psi	0.39	3.003	0.10	8.912	-2.64	0.000	-2.44	0.000
189°F	81 psi	0.35	2.766	0.22	18.683	-2.62	0.000	-2.34	0.000
204°F	91 psi	0.31	2.564	0.34	27.770	-2.60	0.000	-2.23	0.000
220°F	100 psi	0.29	2.400	0.46	36.165	-2.57	0.000	-2.12	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)**
80°F	15 psi	-1.93	0.000	-2.67	0.000	0.18	0.158	-0.66	0.000
96°F	24 psi	-1.93	0.000	-2.69	0.000	0.11	0.104	-0.57	0.000
111°F	34 psi	-1.93	0.000	-2.70	0.000	0.10	0.099	-0.45	0.000
127°F	43 psi	-1.92	0.000	-2.71	0.000	0.13	0.118	-0.33	0.000
142°F	53 psi	-1.90	0.000	-2.72	0.000	0.17	0.150	-0.21	0.000
158°F	62 psi	-1.87	0.000	-2.72	0.000	0.22	0.187	-0.09	0.000
173°F	72 psi	-1.84	0.000	-2.72	0.000	0.28	0.233	0.03	0.051
189°F	81 psi	-1.81	0.000	-2.72	0.000	0.36	0.279	0.15	0.211
204°F	91 psi	-1.76	0.000	-2.71	0.000	0.44	0.321	0.27	0.328
220°F	100 psi	-1.72	0.000	-2.70	0.000	0.53	0.358	0.37	0.414

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.

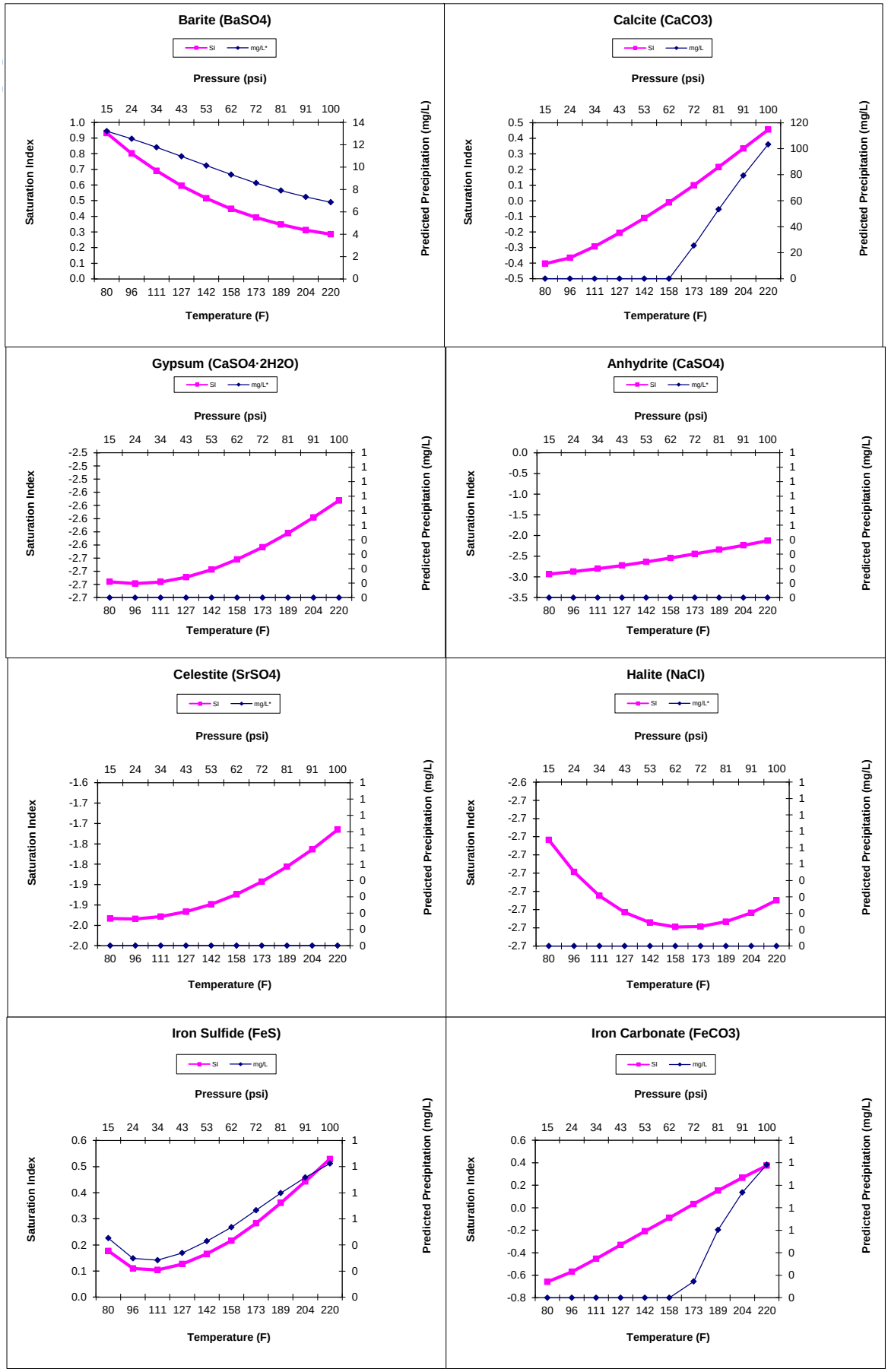
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 241-36 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	242-36 Separator
District:	Four Corners	**Sample ID:**	201201036522
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 242-36 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	170.0	2.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	200.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19022
Density/Specific Gravity (g/cm³):	1.0103
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11400.0	321.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	7387.0	321.5
Potassium (K^+):	-1.4	0.0
Magnesium (Mg^{2+}):	1.4	0.1
Calcium (Ca^{2+}):	12.2	0.6
Strontium (Sr^{2+}):	0.0	0.0
Barium (Ba^{2+}):	1.8	0.0
Iron (Fe^{2+}):	0.1	0.0
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	38	N/A

ND = Not Determined

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)**
80°F	15 psi	0.35	0.565	-2.29	0.000	-3.51	0.000	-3.75	0.000
96°F	24 psi	0.21	0.400	-2.25	0.000	-3.52	0.000	-3.69	0.000
111°F	34 psi	0.10	0.216	-2.18	0.000	-3.51	0.000	-3.62	0.000
127°F	43 psi	0.01	0.021	-2.09	0.000	-3.51	0.000	-3.54	0.000
142°F	53 psi	-0.07	0.000	-1.99	0.000	-3.49	0.000	-3.45	0.000
158°F	62 psi	-0.14	0.000	-1.89	0.000	-3.48	0.000	-3.36	0.000
173°F	72 psi	-0.19	0.000	-1.78	0.000	-3.46	0.000	-3.26	0.000
189°F	81 psi	-0.23	0.000	-1.66	0.000	-3.43	0.000	-3.15	0.000
204°F	91 psi	-0.26	0.000	-1.54	0.000	-3.41	0.000	-3.04	0.000
220°F	100 psi	-0.29	0.000	-1.42	0.000	-3.38	0.000	-2.93	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)**
80°F	15 psi	-4.43	0.000	-2.87	0.000	-1.35	0.000	-2.51	0.000
96°F	24 psi	-4.43	0.000	-2.89	0.000	-1.40	0.000	-2.41	0.000
111°F	34 psi	-4.43	0.000	-2.90	0.000	-1.39	0.000	-2.30	0.000
127°F	43 psi	-4.41	0.000	-2.91	0.000	-1.35	0.000	-2.17	0.000
142°F	53 psi	-4.39	0.000	-2.92	0.000	-1.30	0.000	-2.05	0.000
158°F	62 psi	-4.36	0.000	-2.92	0.000	-1.23	0.000	-1.93	0.000
173°F	72 psi	-4.33	0.000	-2.92	0.000	-1.15	0.000	-1.80	0.000
189°F	81 psi	-4.29	0.000	-2.91	0.000	-1.05	0.000	-1.68	0.000
204°F	91 psi	-4.24	0.000	-2.91	0.000	-0.95	0.000	-1.56	0.000
220°F	100 psi	-4.19	0.000	-2.90	0.000	-0.85	0.000	-1.45	0.000

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.

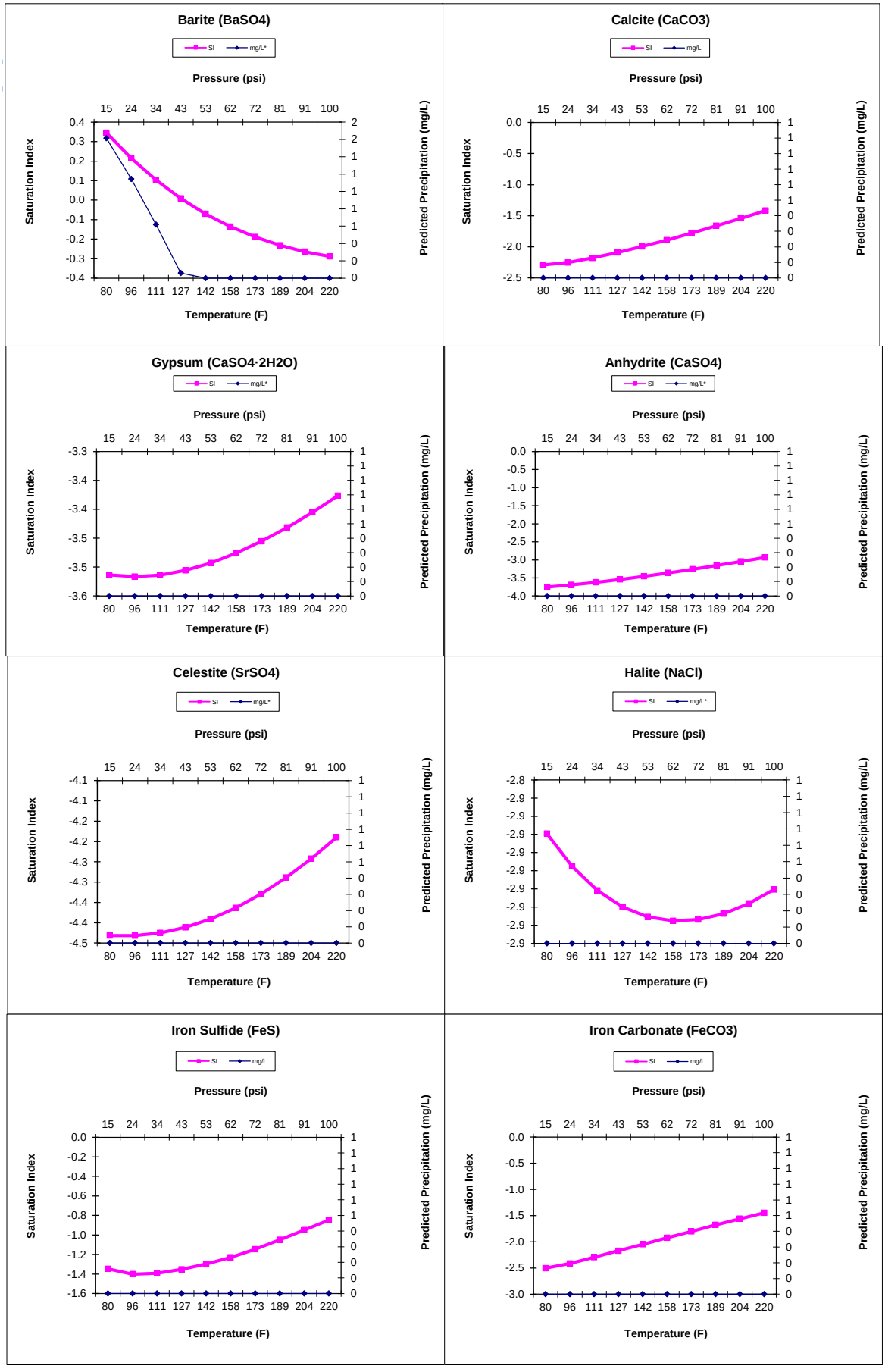
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 242-36 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	246-1 Separator
District:	Four Corners	**Sample ID:**	201201036507
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 246-1 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.1

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	219.0	3.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20543
Density/Specific Gravity (g/cm^3):	1.0113
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12300.0	347.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	7970.0	346.8
Potassium (K^+):	-2.2	-0.1
Magnesium (Mg^{2+}):	0.7	0.1
Calcium (Ca^{2+}):	5.0	0.2
Strontium (Sr^{2+}):	-0.5	0.0
Barium (Ba^{2+}):	0.5	0.0
Iron (Fe^{2+}):	0.1	0.0
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	15	N/A

ND = Not Determined

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)**
80°F	15 psi	-0.24	0.000	-2.78	0.000	-3.93	0.000	-4.17	0.000
96°F	24 psi	-0.37	0.000	-2.74	0.000	-3.93	0.000	-4.11	0.000
111°F	34 psi	-0.48	0.000	-2.67	0.000	-3.93	0.000	-4.04	0.000
127°F	43 psi	-0.58	0.000	-2.58	0.000	-3.92	0.000	-3.96	0.000
142°F	53 psi	-0.66	0.000	-2.49	0.000	-3.91	0.000	-3.87	0.000
158°F	62 psi	-0.72	0.000	-2.38	0.000	-3.89	0.000	-3.78	0.000
173°F	72 psi	-0.78	0.000	-2.27	0.000	-3.87	0.000	-3.68	0.000
189°F	81 psi	-0.82	0.000	-2.15	0.000	-3.85	0.000	-3.57	0.000
204°F	91 psi	-0.85	0.000	-2.03	0.000	-3.83	0.000	-3.46	0.000
220°F	100 psi	-0.88	0.000	-1.91	0.000	-3.80	0.000	-3.35	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)**
80°F	15 psi		0.000	-2.81	0.000	-1.72	0.000	-2.85	0.000
96°F	24 psi		0.000	-2.83	0.000	-1.78	0.000	-2.76	0.000
111°F	34 psi		0.000	-2.84	0.000	-1.77	0.000	-2.64	0.000
127°F	43 psi		0.000	-2.85	0.000	-1.72	0.000	-2.52	0.000
142°F	53 psi		0.000	-2.85	0.000	-1.66	0.000	-2.39	0.000
158°F	62 psi		0.000	-2.86	0.000	-1.59	0.000	-2.27	0.000
173°F	72 psi		0.000	-2.86	0.000	-1.50	0.000	-2.15	0.000
189°F	81 psi		0.000	-2.85	0.000	-1.40	0.000	-2.02	0.000
204°F	91 psi		0.000	-2.85	0.000	-1.30	0.000	-1.91	0.000
220°F	100 psi		0.000	-2.84	0.000	-1.19	0.000	-1.79	0.000

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.

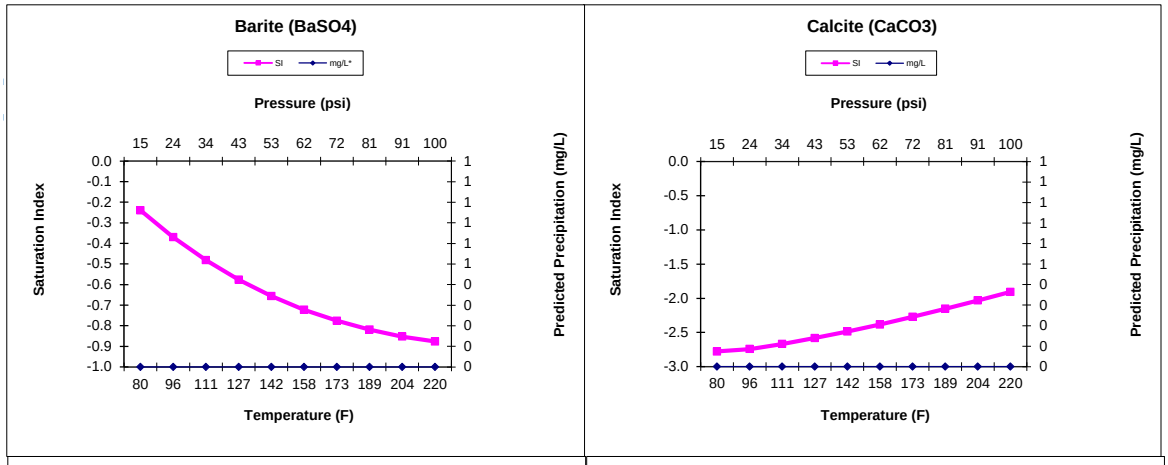
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

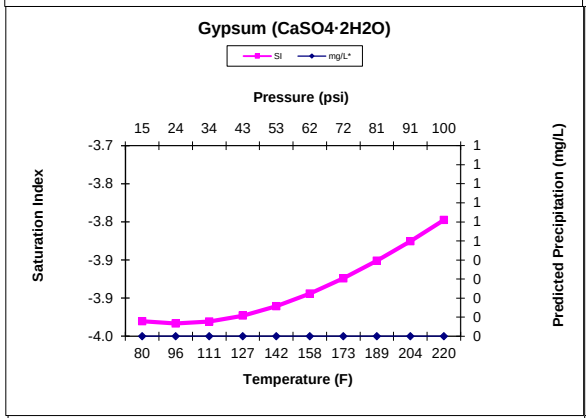
Calculate

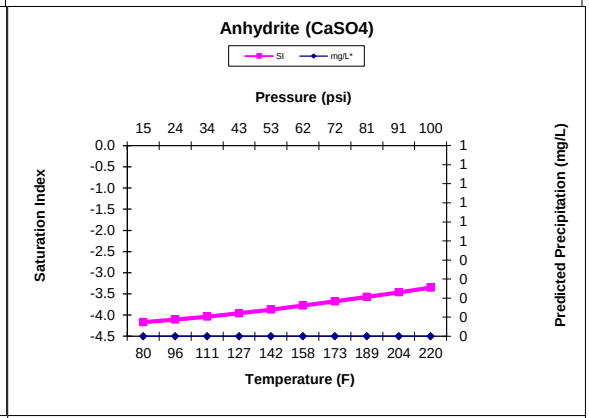
ScaleSoftPitzer™ SSP2010

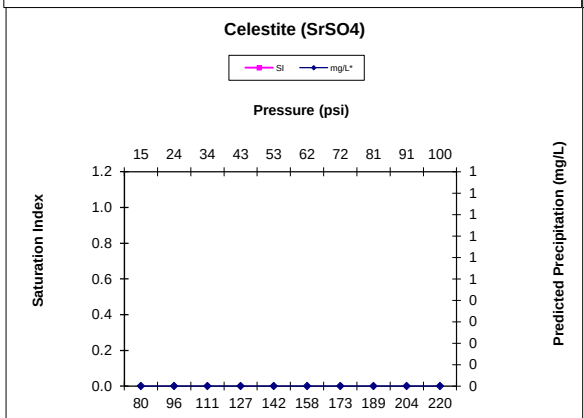
Comments: _____

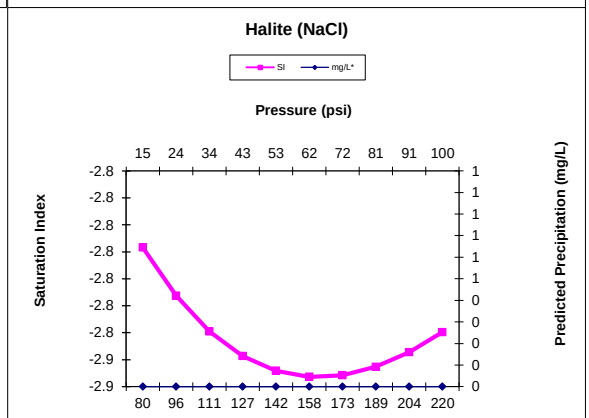
Sample ID: 41212 CAERUS OIL & GAS, Puckett, 246-1 Separator

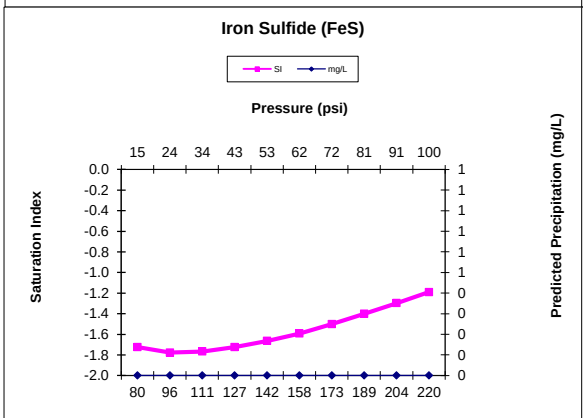


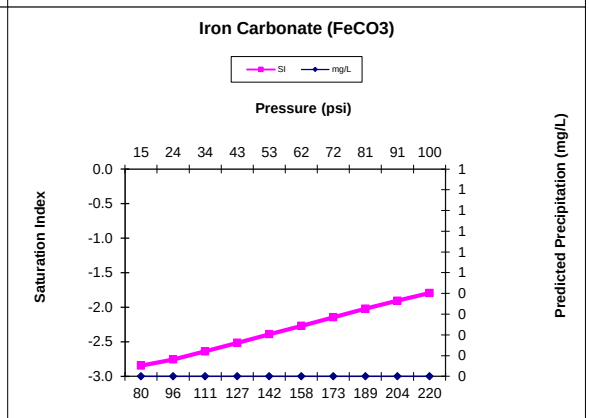












Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	241-36 Separator
District:	Four Corners	**Sample ID:**	201201036521
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 241-36 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	671.0	11.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	275.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24952
Density/Specific Gravity (g/cm³):	1.0143
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14600.0	411.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	9461.0	411.7
Potassium (K^+):	31.9	0.8
Magnesium (Mg^{2+}):	15.5	1.3
Calcium (Ca^{2+}):	100.0	5.0
Strontium (Sr^{2+}):	12.1	0.3
Barium (Ba^{2+}):	9.0	0.1
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	0.9	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	334	N/A

ND = Not Determined

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)**
80°F	15 psi	0.93	4.625	-0.40	0.000	-2.70	0.000	-2.93	0.000
96°F	24 psi	0.80	4.387	-0.37	0.000	-2.70	0.000	-2.87	0.000
111°F	34 psi	0.69	4.122	-0.29	0.000	-2.70	0.000	-2.80	0.000
127°F	43 psi	0.60	3.838	-0.21	0.000	-2.69	0.000	-2.72	0.000
142°F	53 psi	0.51	3.549	-0.11	0.000	-2.68	0.000	-2.64	0.000
158°F	62 psi	0.45	3.267	-0.01	0.000	-2.66	0.000	-2.54	0.000
173°F	72 psi	0.39	3.003	0.10	8.912	-2.64	0.000	-2.44	0.000
189°F	81 psi	0.35	2.766	0.22	18.683	-2.62	0.000	-2.34	0.000
204°F	91 psi	0.31	2.564	0.34	27.770	-2.60	0.000	-2.23	0.000
220°F	100 psi	0.29	2.400	0.46	36.165	-2.57	0.000	-2.12	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)**
80°F	15 psi	-1.93	0.000	-2.67	0.000	0.18	0.158	-0.66	0.000
96°F	24 psi	-1.93	0.000	-2.69	0.000	0.11	0.104	-0.57	0.000
111°F	34 psi	-1.93	0.000	-2.70	0.000	0.10	0.099	-0.45	0.000
127°F	43 psi	-1.92	0.000	-2.71	0.000	0.13	0.118	-0.33	0.000
142°F	53 psi	-1.90	0.000	-2.72	0.000	0.17	0.150	-0.21	0.000
158°F	62 psi	-1.87	0.000	-2.72	0.000	0.22	0.187	-0.09	0.000
173°F	72 psi	-1.84	0.000	-2.72	0.000	0.28	0.233	0.03	0.051
189°F	81 psi	-1.81	0.000	-2.72	0.000	0.36	0.279	0.15	0.211
204°F	91 psi	-1.76	0.000	-2.71	0.000	0.44	0.321	0.27	0.328
220°F	100 psi	-1.72	0.000	-2.70	0.000	0.53	0.358	0.37	0.414

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.

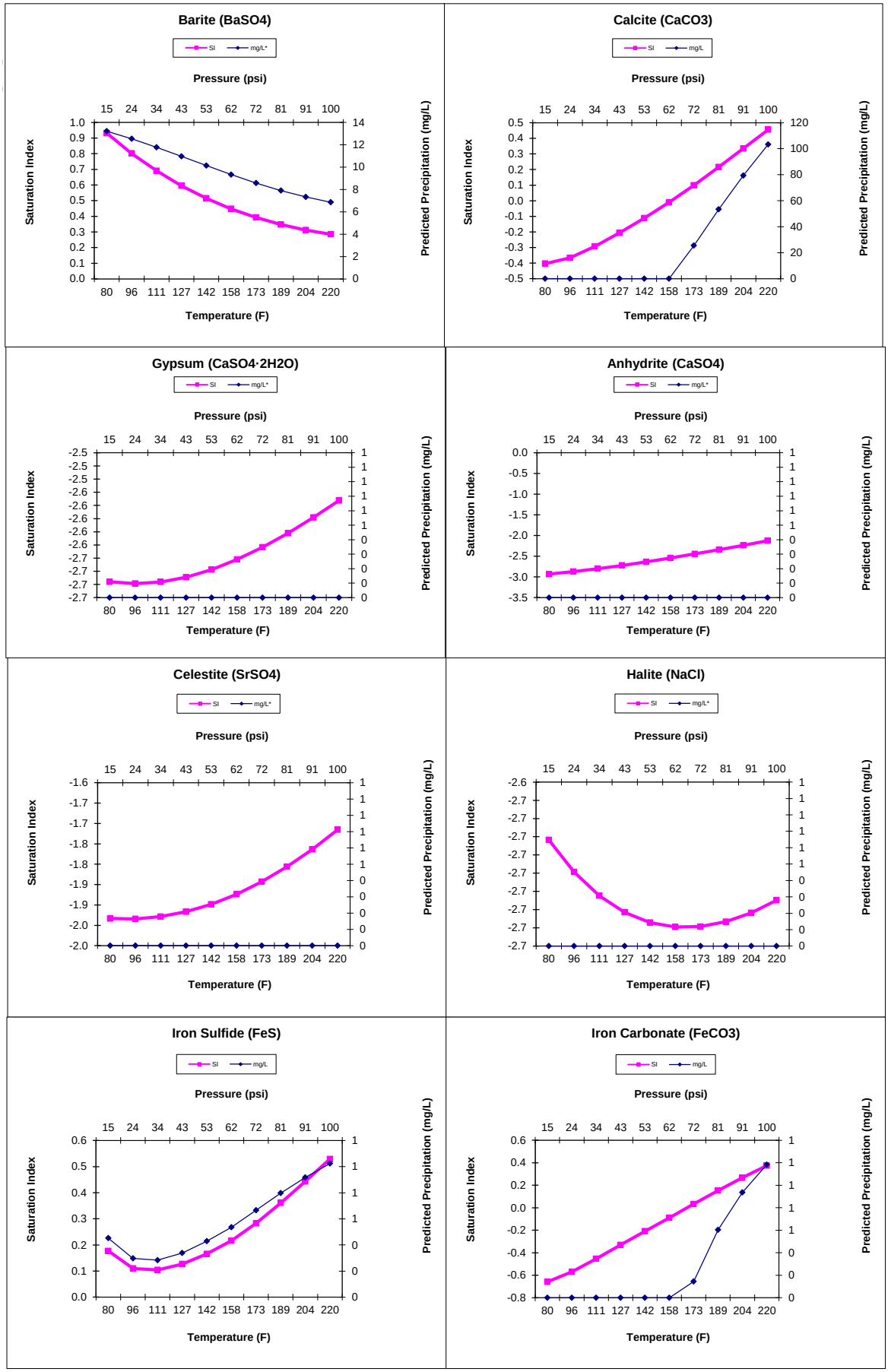
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 241-36 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	247-25 Separator
District:	Four Corners	**Sample ID:**	201201036516
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 247-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	28968
Density/Specific Gravity (g/cm^3):	1.0171
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	17200.0	485.2
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	11146.0	485.0
Potassium (K^+):	25.9	0.7
Magnesium (Mg^{2+}):	11.9	1.0
Calcium (Ca^{2+}):	119.2	5.9
Strontium (Sr^{2+}):	11.9	0.3
Barium (Ba^{2+}):	18.2	0.3
Iron (Fe^{2+}):	18.6	0.7
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	374	N/A

ND = Not Determined

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)**
80°F	15 psi	1.17	9.862	-1.01	0.000	-2.68	0.000	-2.92	0.000
96°F	24 psi	1.04	9.547	-0.97	0.000	-2.69	0.000	-2.86	0.000
111°F	34 psi	0.93	9.196	-0.90	0.000	-2.68	0.000	-2.79	0.000
127°F	43 psi	0.84	8.822	-0.81	0.000	-2.68	0.000	-2.71	0.000
142°F	53 psi	0.76	8.441	-0.72	0.000	-2.67	0.000	-2.62	0.000
158°F	62 psi	0.69	8.069	-0.62	0.000	-2.65	0.000	-2.53	0.000
173°F	72 psi	0.63	7.719	-0.51	0.000	-2.63	0.000	-2.43	0.000
189°F	81 psi	0.58	7.403	-0.39	0.000	-2.61	0.000	-2.33	0.000
204°F	91 psi	0.55	7.130	-0.28	0.000	-2.59	0.000	-2.23	0.000
220°F	100 psi	0.52	6.904	-0.16	0.000	-2.57	0.000	-2.12	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)**
80°F	15 psi	-2.00	0.000	-2.54	0.000	0.59	1.467	-0.10	0.000
96°F	24 psi	-2.00	0.000	-2.55	0.000	0.53	1.380	-0.01	0.000
111°F	34 psi	-1.99	0.000	-2.57	0.000	0.54	1.389	0.11	2.473
127°F	43 psi	-1.98	0.000	-2.58	0.000	0.57	1.442	0.23	4.795
142°F	53 psi	-1.97	0.000	-2.58	0.000	0.62	1.513	0.35	6.672
158°F	62 psi	-1.94	0.000	-2.59	0.000	0.69	1.590	0.47	8.142
173°F	72 psi	-1.91	0.000	-2.58	0.000	0.77	1.677	0.59	9.349
189°F	81 psi	-1.88	0.000	-2.58	0.000	0.86	1.758	0.71	10.283
204°F	91 psi	-1.84	0.000	-2.58	0.000	0.95	1.827	0.82	10.984
220°F	100 psi	-1.79	0.000	-2.57	0.000	1.04	1.885	0.92	11.512

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.

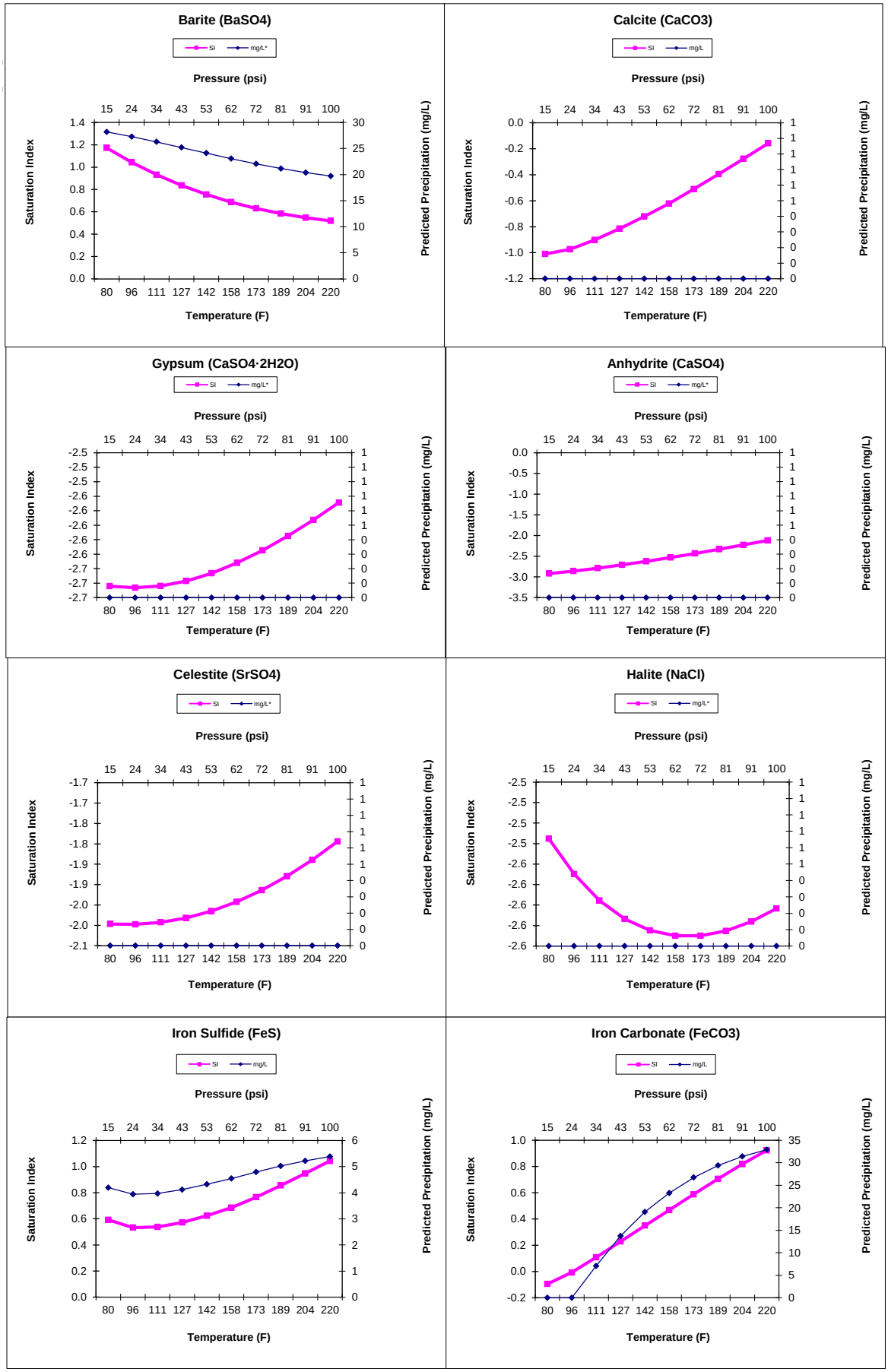
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 247-25 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24A-24D Separator
District:	Four Corners	**Sample ID:**	201201036498
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 24A-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	32971
Density/Specific Gravity (g/cm³):	1.0198
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	19500.0	550.1
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	12636.0	549.9
Potassium (K^+):	42.0	1.1
Magnesium (Mg^{2+}):	20.5	1.7
Calcium (Ca^{2+}):	169.7	8.5
Strontium (Sr^{2+}):	16.4	0.4
Barium (Ba^{2+}):	6.5	0.1
Iron (Fe^{2+}):	2.3	0.1
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	532	N/A

ND = Not Determined

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)**
80°F	15 psi	1.14	3.592	-0.80	0.000	-2.10	0.000	-2.34	0.000
96°F	24 psi	1.02	3.494	-0.77	0.000	-2.11	0.000	-2.28	0.000
111°F	34 psi	0.90	3.382	-0.69	0.000	-2.10	0.000	-2.20	0.000
127°F	43 psi	0.81	3.261	-0.61	0.000	-2.10	0.000	-2.13	0.000
142°F	53 psi	0.73	3.134	-0.52	0.000	-2.09	0.000	-2.04	0.000
158°F	62 psi	0.66	3.007	-0.42	0.000	-2.07	0.000	-1.95	0.000
173°F	72 psi	0.60	2.885	-0.31	0.000	-2.06	0.000	-1.85	0.000
189°F	81 psi	0.55	2.771	-0.19	0.000	-2.04	0.000	-1.75	0.000
204°F	91 psi	0.52	2.670	-0.08	0.000	-2.02	0.000	-1.65	0.000
220°F	100 psi	0.49	2.584	0.04	3.770	-2.00	0.000	-1.54	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)**
80°F	15 psi	-1.43	0.000	-2.44	0.000	-0.31	0.000	-0.95	0.000
96°F	24 psi	-1.43	0.000	-2.45	0.000	-0.37	0.000	-0.86	0.000
111°F	34 psi	-1.43	0.000	-2.46	0.000	-0.37	0.000	-0.75	0.000
127°F	43 psi	-1.42	0.000	-2.47	0.000	-0.34	0.000	-0.63	0.000
142°F	53 psi	-1.40	0.000	-2.48	0.000	-0.29	0.000	-0.51	0.000
158°F	62 psi	-1.38	0.000	-2.48	0.000	-0.23	0.000	-0.39	0.000
173°F	72 psi	-1.36	0.000	-2.48	0.000	-0.15	0.000	-0.27	0.000
189°F	81 psi	-1.32	0.000	-2.48	0.000	-0.06	0.000	-0.16	0.000
204°F	91 psi	-1.29	0.000	-2.48	0.000	0.03	0.052	-0.05	0.000
220°F	100 psi	-1.24	0.000	-2.47	0.000	0.12	0.205	0.06	0.201

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.

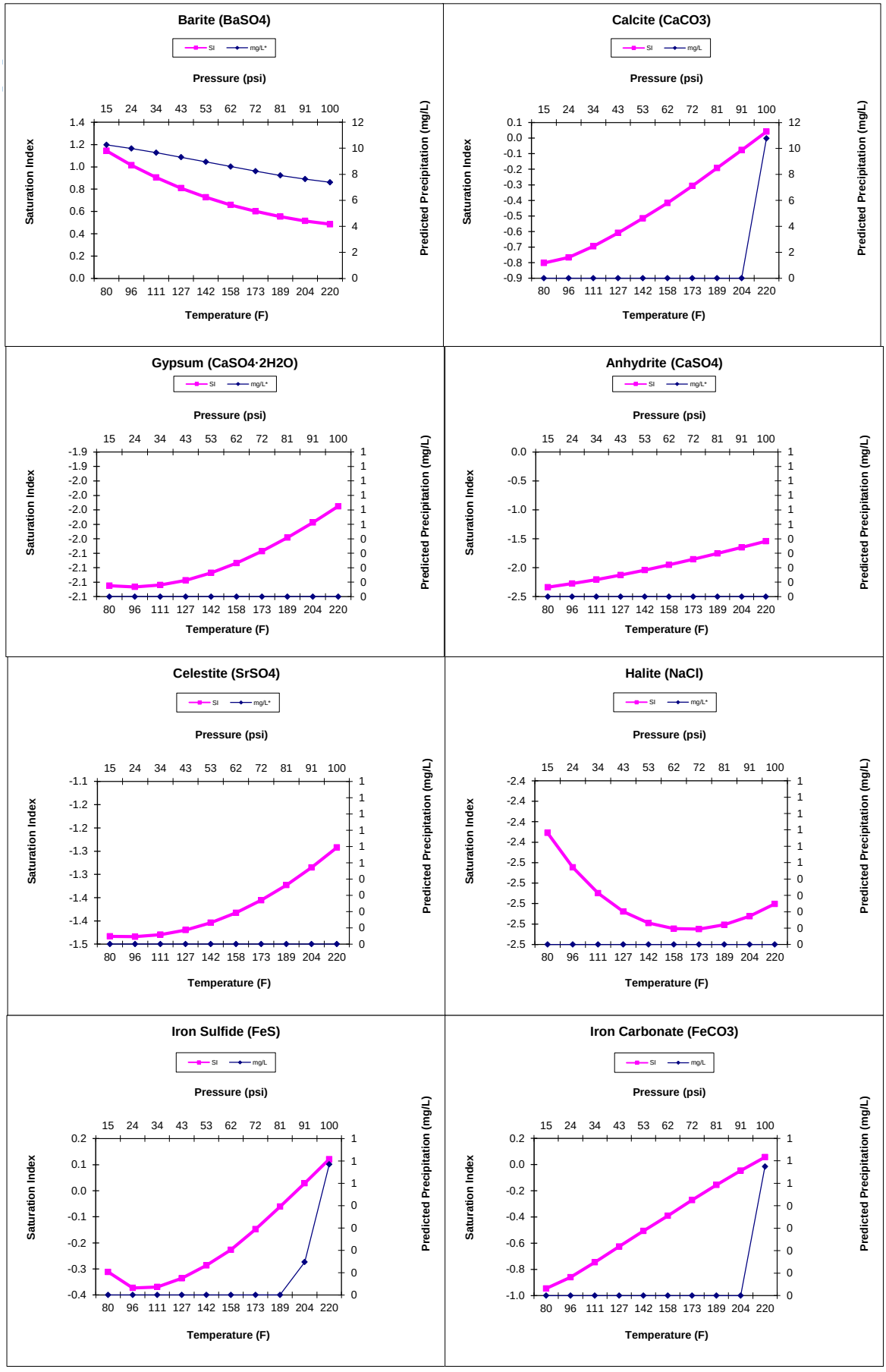
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 24A-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24B-24D Separator
District:	Four Corners	**Sample ID:**	201201036499
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 24B-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	610.0	10.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	275.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	44771
Density/Specific Gravity (g/cm³):	1.0276
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	26600.0	750.4
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	17237.0	750.1
Potassium (K^+):	43.2	1.1
Magnesium (Mg^{2+}):	17.4	1.4
Calcium (Ca^{2+}):	137.8	6.9
Strontium (Sr^{2+}):	14.8	0.3
Barium (Ba^{2+}):	7.7	0.1
Iron (Fe^{2+}):	3.3	0.1
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	439	N/A

ND = Not Determined

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)**
80°F	15 psi	0.91	3.982	-0.65	0.000	-2.48	0.000	-2.71	0.000
96°F	24 psi	0.78	3.782	-0.62	0.000	-2.48	0.000	-2.64	0.000
111°F	34 psi	0.67	3.553	-0.55	0.000	-2.48	0.000	-2.57	0.000
127°F	43 psi	0.57	3.303	-0.46	0.000	-2.47	0.000	-2.50	0.000
142°F	53 psi	0.49	3.038	-0.37	0.000	-2.47	0.000	-2.41	0.000
158°F	62 psi	0.42	2.770	-0.27	0.000	-2.45	0.000	-2.33	0.000
173°F	72 psi	0.36	2.507	-0.17	0.000	-2.44	0.000	-2.23	0.000
189°F	81 psi	0.31	2.257	-0.06	0.000	-2.43	0.000	-2.14	0.000
204°F	91 psi	0.26	2.028	0.05	5.710	-2.41	0.000	-2.03	0.000
220°F	100 psi	0.23	1.824	0.17	16.947	-2.39	0.000	-1.93	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)**
80°F	15 psi	-1.77	0.000	-2.18	0.000	0.19	0.433	-0.57	0.000
96°F	24 psi	-1.77	0.000	-2.19	0.000	0.12	0.294	-0.48	0.000
111°F	34 psi	-1.76	0.000	-2.20	0.000	0.12	0.289	-0.37	0.000
127°F	43 psi	-1.76	0.000	-2.21	0.000	0.15	0.344	-0.25	0.000
142°F	53 psi	-1.74	0.000	-2.22	0.000	0.19	0.430	-0.14	0.000
158°F	62 psi	-1.73	0.000	-2.22	0.000	0.24	0.530	-0.03	0.000
173°F	72 psi	-1.70	0.000	-2.22	0.000	0.31	0.658	0.09	0.415
189°F	81 psi	-1.68	0.000	-2.22	0.000	0.38	0.787	0.20	0.843
204°F	91 psi	-1.64	0.000	-2.22	0.000	0.46	0.906	0.30	1.159
220°F	100 psi	-1.61	0.000	-2.21	0.000	0.55	1.018	0.40	1.395

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.

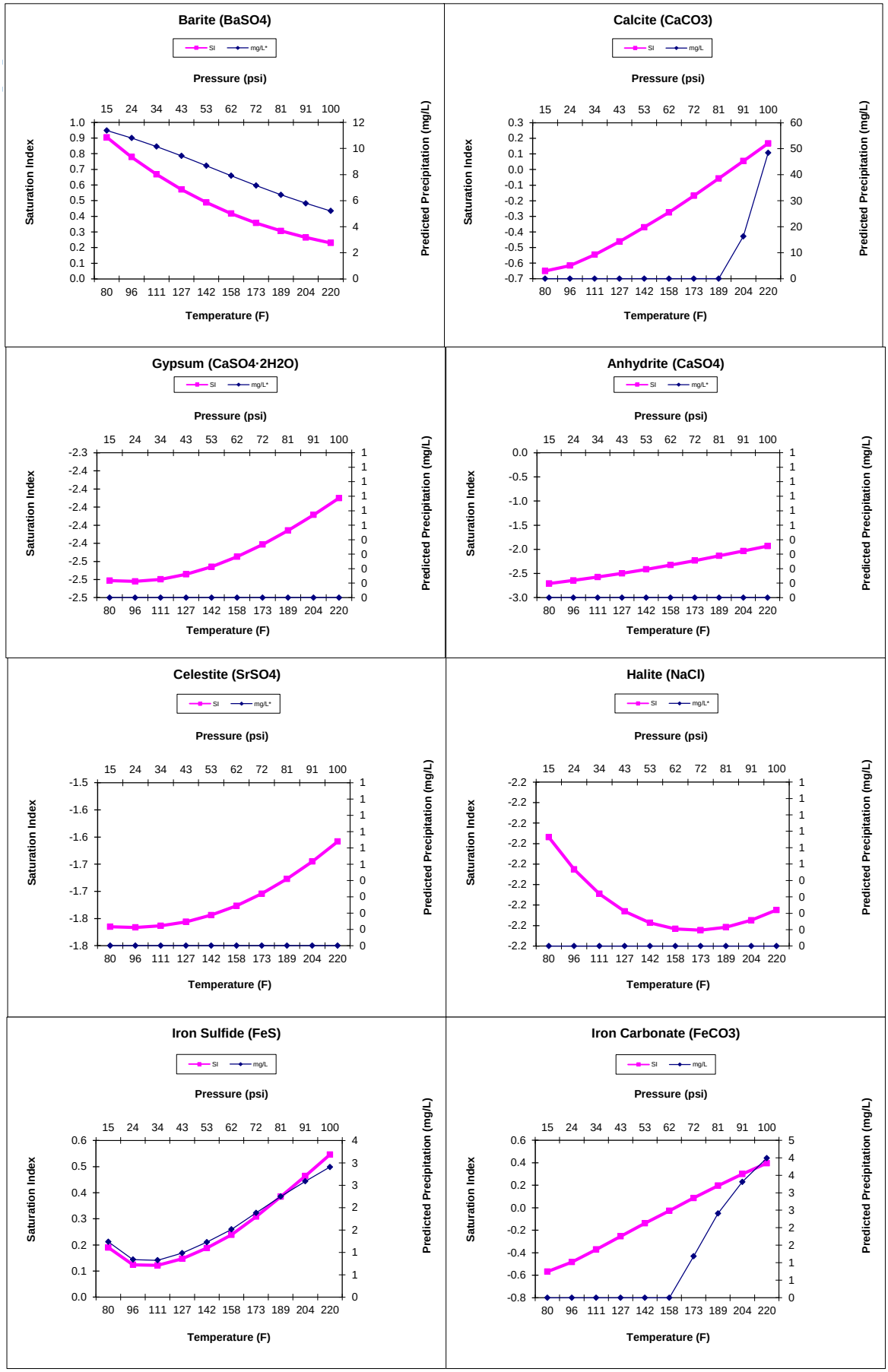
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 24B-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24C-24D Separator
District:	Four Corners	**Sample ID:**	201201035735
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 24C-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	573.0	9.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22882
Density/Specific Gravity (g/cm^3):	1.0130
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13300.0	375.2
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	8618.0	375.0
Potassium (K^+):	48.0	1.2
Magnesium (Mg^{2+}):	18.0	1.5
Calcium (Ca^{2+}):	138.0	6.9
Strontium (Sr^{2+}):	14.0	0.3
Barium (Ba^{2+}):	10.0	0.1
Iron (Fe^{2+}):	13.0	0.5
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	442	N/A

ND = Not Determined

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)**
80°F	15 psi	1.49	5.747	-0.03	0.000	-2.05	0.000	-2.29	0.000
96°F	24 psi	1.36	5.676	0.01	1.042	-2.06	0.000	-2.23	0.000
111°F	34 psi	1.25	5.597	0.09	7.158	-2.05	0.000	-2.16	0.000
127°F	43 psi	1.15	5.512	0.17	14.282	-2.05	0.000	-2.08	0.000
142°F	53 psi	1.07	5.424	0.27	21.774	-2.03	0.000	-1.99	0.000
158°F	62 psi	1.01	5.337	0.37	29.340	-2.02	0.000	-1.90	0.000
173°F	72 psi	0.95	5.256	0.48	37.108	-2.00	0.000	-1.80	0.000
189°F	81 psi	0.91	5.183	0.59	45.083	-1.98	0.000	-1.70	0.000
204°F	91 psi	0.87	5.120	0.71	52.682	-1.95	0.000	-1.59	0.000
220°F	100 psi	0.85	5.070	0.83	59.892	-1.92	0.000	-1.48	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)**
80°F	15 psi	-1.37	0.000	-2.75	0.000	1.54	1.443	0.69	7.288
96°F	24 psi	-1.37	0.000	-2.77	0.000	1.47	1.433	0.78	7.682
111°F	34 psi	-1.36	0.000	-2.78	0.000	1.45	1.431	0.90	8.088
127°F	43 psi	-1.35	0.000	-2.79	0.000	1.46	1.432	1.02	8.417
142°F	53 psi	-1.33	0.000	-2.79	0.000	1.49	1.436	1.15	8.666
158°F	62 psi	-1.30	0.000	-2.80	0.000	1.53	1.442	1.27	8.850
173°F	72 psi	-1.27	0.000	-2.80	0.000	1.58	1.448	1.39	8.991
189°F	81 psi	-1.23	0.000	-2.79	0.000	1.65	1.456	1.51	9.099
204°F	91 psi	-1.19	0.000	-2.79	0.000	1.72	1.463	1.62	9.178
220°F	100 psi	-1.14	0.000	-2.78	0.000	1.80	1.469	1.73	9.236

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.

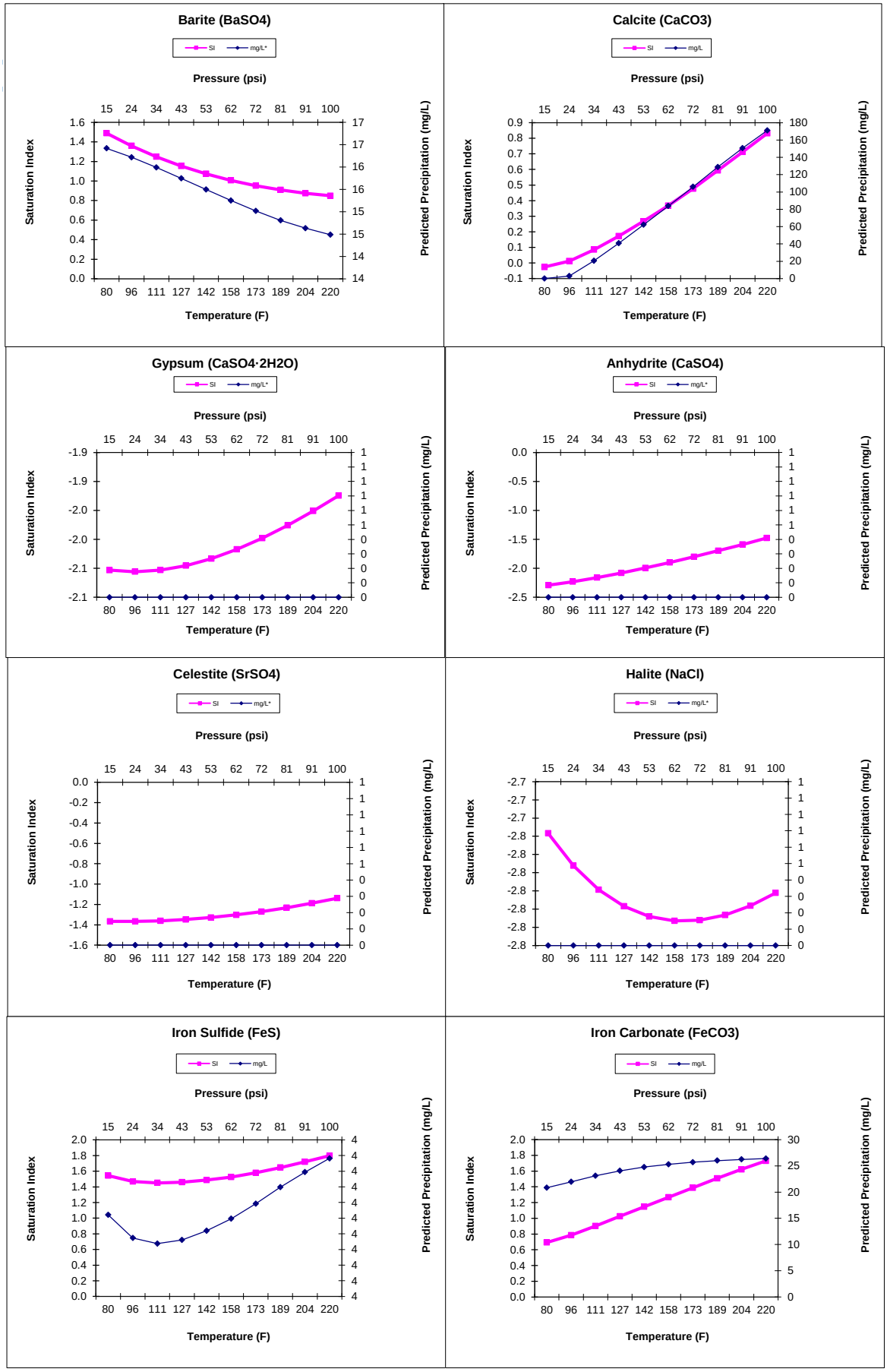
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 24C-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24C-31D Separator
District:	Four Corners	**Sample ID:**	201201037408
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 24C-31D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.6

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	915.0	15.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	220.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16304
Density/Specific Gravity (g/cm³):	1.0085
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9200.0	259.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5962.0	259.4
Potassium (K^+):	32.9	0.8
Magnesium (Mg^{2+}):	12.3	1.0
Calcium (Ca^{2+}):	86.1	4.3
Strontium (Sr^{2+}):	10.6	0.2
Barium (Ba^{2+}):	23.7	0.3
Iron (Fe^{2+}):	11.0	0.4
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	295	N/A

ND = Not Determined

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)**
80°F	15 psi	1.54	13.480	-0.37	0.000	-2.59	0.000	-2.84	0.000
96°F	24 psi	1.41	13.275	-0.33	0.000	-2.60	0.000	-2.77	0.000
111°F	34 psi	1.29	13.047	-0.26	0.000	-2.59	0.000	-2.70	0.000
127°F	43 psi	1.20	12.807	-0.17	0.000	-2.59	0.000	-2.62	0.000
142°F	53 psi	1.12	12.567	-0.07	0.000	-2.57	0.000	-2.53	0.000
158°F	62 psi	1.06	12.337	0.03	2.861	-2.55	0.000	-2.44	0.000
173°F	72 psi	1.00	12.128	0.15	13.995	-2.53	0.000	-2.34	0.000
189°F	81 psi	0.96	11.947	0.27	24.132	-2.51	0.000	-2.23	0.000
204°F	91 psi	0.93	11.800	0.39	33.147	-2.48	0.000	-2.12	0.000
220°F	100 psi	0.91	11.689	0.52	41.056	-2.45	0.000	-2.00	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)**
80°F	15 psi	-1.83	0.000	-3.05	0.000	1.26	3.297	0.53	5.521
96°F	24 psi	-1.83	0.000	-3.06	0.000	1.20	3.235	0.62	5.973
111°F	34 psi	-1.82	0.000	-3.08	0.000	1.20	3.237	0.74	6.452
127°F	43 psi	-1.81	0.000	-3.09	0.000	1.23	3.269	0.86	6.840
142°F	53 psi	-1.79	0.000	-3.09	0.000	1.28	3.316	0.99	7.132
158°F	62 psi	-1.76	0.000	-3.09	0.000	1.34	3.367	1.11	7.348
173°F	72 psi	-1.72	0.000	-3.09	0.000	1.42	3.430	1.24	7.517
189°F	81 psi	-1.68	0.000	-3.09	0.000	1.51	3.487	1.37	7.640
204°F	91 psi	-1.63	0.000	-3.08	0.000	1.61	3.538	1.49	7.728
220°F	100 psi	-1.57	0.000	-3.08	0.000	1.70	3.581	1.61	7.792

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.

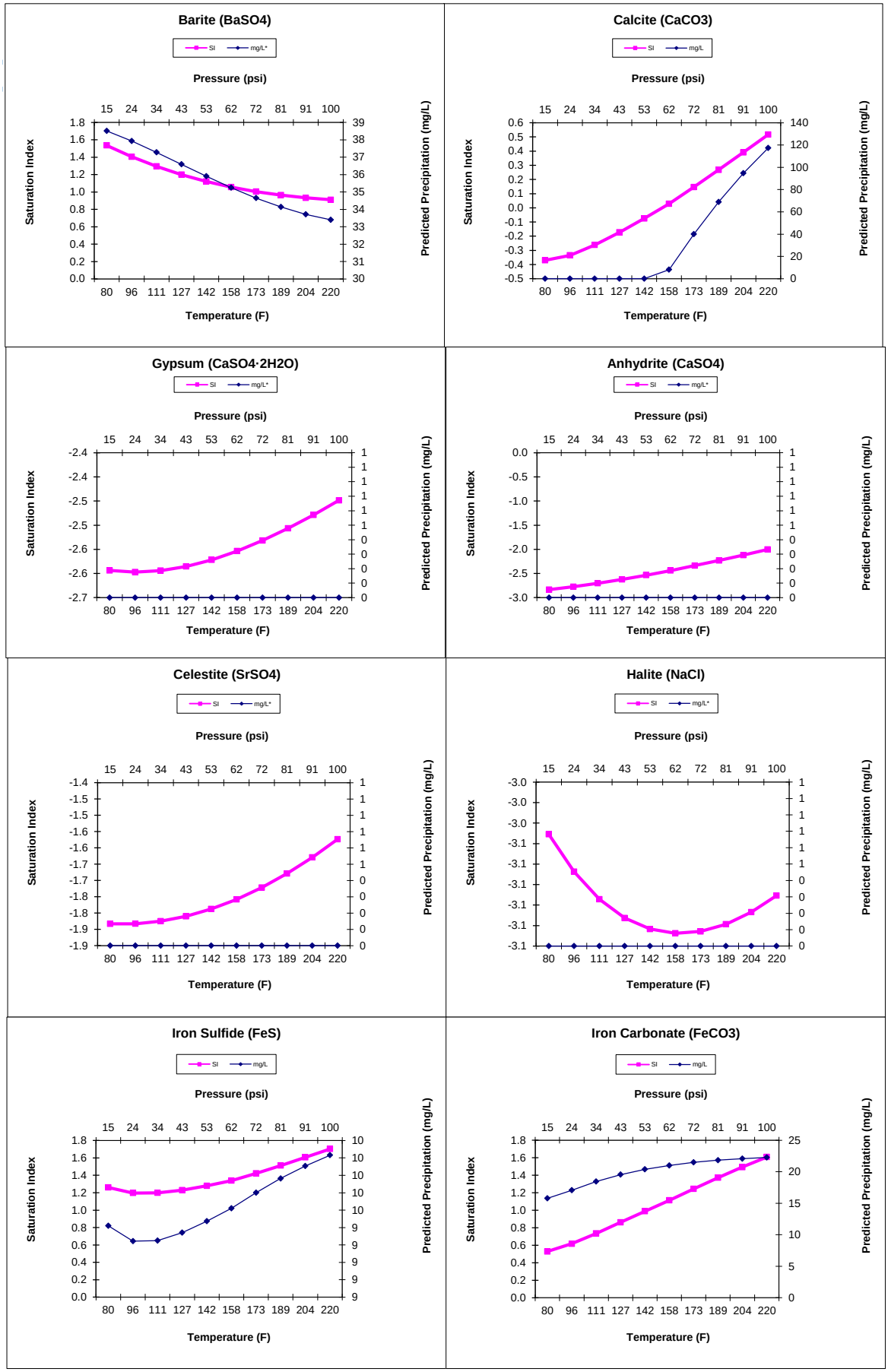
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 24C-31D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24D-24D Separator
District:	Four Corners	**Sample ID:**	201201035736
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 24D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	634.0	10.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	95.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	18621
Density/Specific Gravity (g/cm³):	1.0101
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10700.0	301.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6934.0	301.7
Potassium (K^+):	50.0	1.3
Magnesium (Mg^{2+}):	23.0	1.9
Calcium (Ca^{2+}):	177.0	8.8
Strontium (Sr^{2+}):	20.0	0.5
Barium (Ba^{2+}):	27.0	0.4
Iron (Fe^{2+}):	6.0	0.2
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	580	N/A

ND = Not Determined

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)**
80°F	15 psi	1.53	15.318	0.15	14.764	-2.35	0.000	-2.59	0.000
96°F	24 psi	1.40	15.068	0.19	18.332	-2.35	0.000	-2.53	0.000
111°F	34 psi	1.29	14.791	0.26	25.065	-2.35	0.000	-2.45	0.000
127°F	43 psi	1.19	14.500	0.35	32.901	-2.34	0.000	-2.37	0.000
142°F	53 psi	1.11	14.208	0.45	41.121	-2.32	0.000	-2.29	0.000
158°F	62 psi	1.05	13.928	0.55	49.399	-2.31	0.000	-2.19	0.000
173°F	72 psi	1.00	13.671	0.66	57.871	-2.29	0.000	-2.09	0.000
189°F	81 psi	0.95	13.448	0.78	66.537	-2.26	0.000	-1.98	0.000
204°F	91 psi	0.92	13.264	0.90	74.779	-2.24	0.000	-1.87	0.000
220°F	100 psi	0.90	13.121	1.02	82.589	-2.21	0.000	-1.76	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)**
80°F	15 psi	-1.62	0.000	-2.92	0.000	1.54	2.588	0.44	2.722
96°F	24 psi	-1.62	0.000	-2.94	0.000	1.46	2.542	0.53	3.026
111°F	34 psi	-1.61	0.000	-2.96	0.000	1.45	2.532	0.65	3.339
127°F	43 psi	-1.59	0.000	-2.96	0.000	1.46	2.541	0.78	3.590
142°F	53 psi	-1.57	0.000	-2.97	0.000	1.49	2.562	0.90	3.780
158°F	62 psi	-1.54	0.000	-2.97	0.000	1.53	2.589	1.02	3.920
173°F	72 psi	-1.51	0.000	-2.97	0.000	1.59	2.624	1.15	4.027
189°F	81 psi	-1.47	0.000	-2.97	0.000	1.66	2.664	1.27	4.108
204°F	91 psi	-1.42	0.000	-2.96	0.000	1.74	2.703	1.39	4.167
220°F	100 psi	-1.37	0.000	-2.96	0.000	1.82	2.740	1.50	4.210

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.

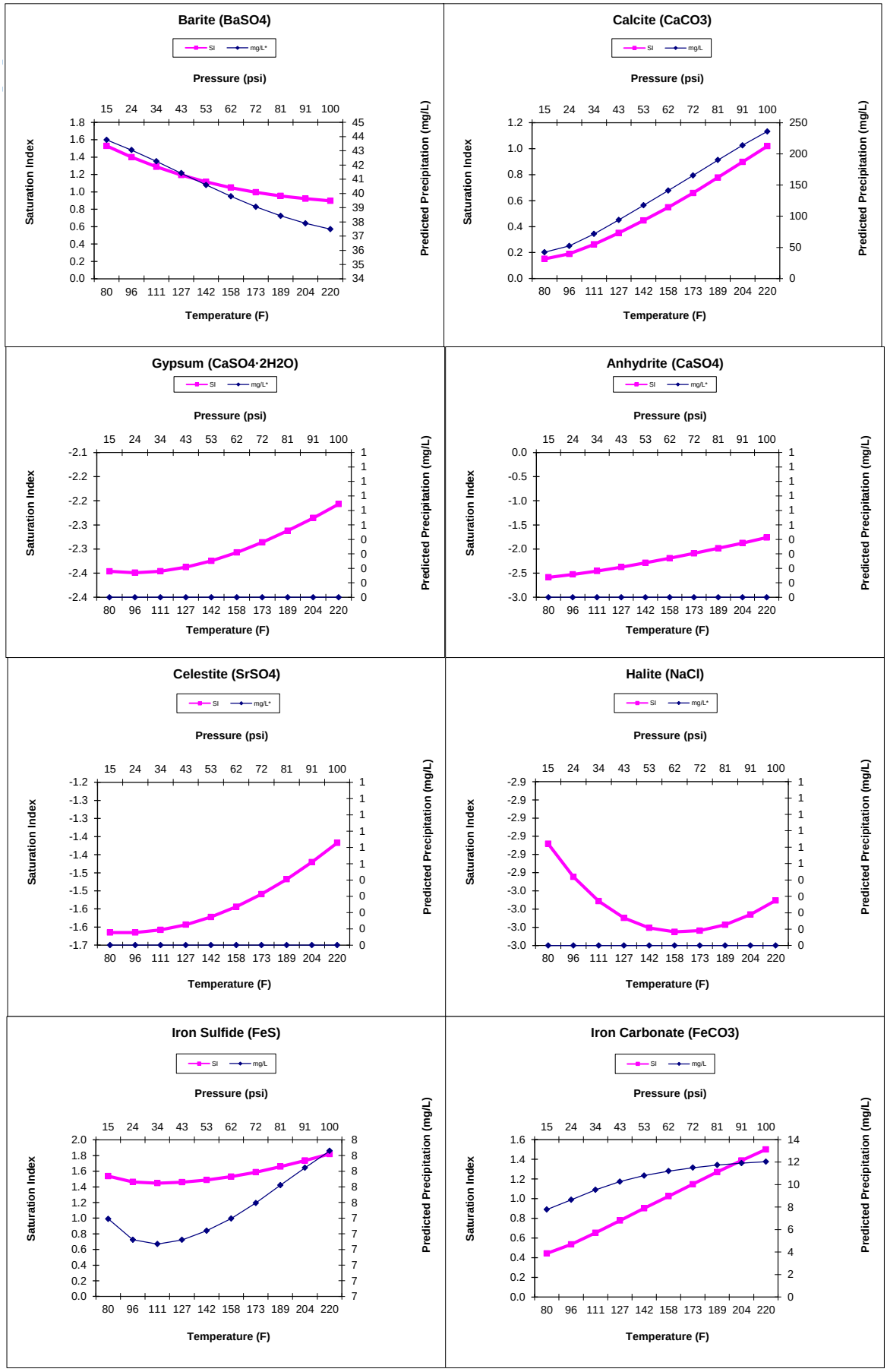
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 24D-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	251-1 Separator
District:	Four Corners	**Sample ID:**	201201036508
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 251-1 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.6

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	110.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	26357
Density/Specific Gravity (g/cm³):	1.0153
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15600.0	440.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	10109.0	439.9
Potassium (K^+):	31.2	0.8
Magnesium (Mg^{2+}):	20.7	1.7
Calcium (Ca^{2+}):	151.4	7.6
Strontium (Sr^{2+}):	22.6	0.5
Barium (Ba^{2+}):	5.2	0.1
Iron (Fe^{2+}):	0.9	0.0
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	493	N/A

ND = Not Determined

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)**
80°F	15 psi	0.66	2.361	-0.60	0.000	-2.55	0.000	-2.78	0.000
96°F	24 psi	0.53	2.123	-0.56	0.000	-2.55	0.000	-2.72	0.000
111°F	34 psi	0.42	1.856	-0.49	0.000	-2.55	0.000	-2.65	0.000
127°F	43 psi	0.33	1.571	-0.40	0.000	-2.54	0.000	-2.57	0.000
142°F	53 psi	0.25	1.279	-0.31	0.000	-2.53	0.000	-2.49	0.000
158°F	62 psi	0.18	0.994	-0.21	0.000	-2.51	0.000	-2.39	0.000
173°F	72 psi	0.12	0.725	-0.10	0.000	-2.49	0.000	-2.30	0.000
189°F	81 psi	0.08	0.484	0.01	0.939	-2.47	0.000	-2.19	0.000
204°F	91 psi	0.04	0.276	0.13	9.384	-2.45	0.000	-2.09	0.000
220°F	100 psi	0.02	0.105	0.25	17.420	-2.43	0.000	-1.98	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)**
80°F	15 psi	-1.69	0.000	-2.62	0.000	0.08	0.073	-1.10	0.000
96°F	24 psi	-1.69	0.000	-2.64	0.000	0.01	0.014	-1.01	0.000
111°F	34 psi	-1.68	0.000	-2.65	0.000	0.01	0.012	-0.89	0.000
127°F	43 psi	-1.67	0.000	-2.66	0.000	0.04	0.036	-0.77	0.000
142°F	53 psi	-1.65	0.000	-2.66	0.000	0.08	0.074	-0.65	0.000
158°F	62 psi	-1.63	0.000	-2.67	0.000	0.13	0.117	-0.53	0.000
173°F	72 psi	-1.60	0.000	-2.67	0.000	0.20	0.168	-0.41	0.000
189°F	81 psi	-1.56	0.000	-2.66	0.000	0.28	0.220	-0.29	0.000
204°F	91 psi	-1.52	0.000	-2.66	0.000	0.36	0.266	-0.18	0.000
220°F	100 psi	-1.47	0.000	-2.65	0.000	0.45	0.306	-0.08	0.000

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.

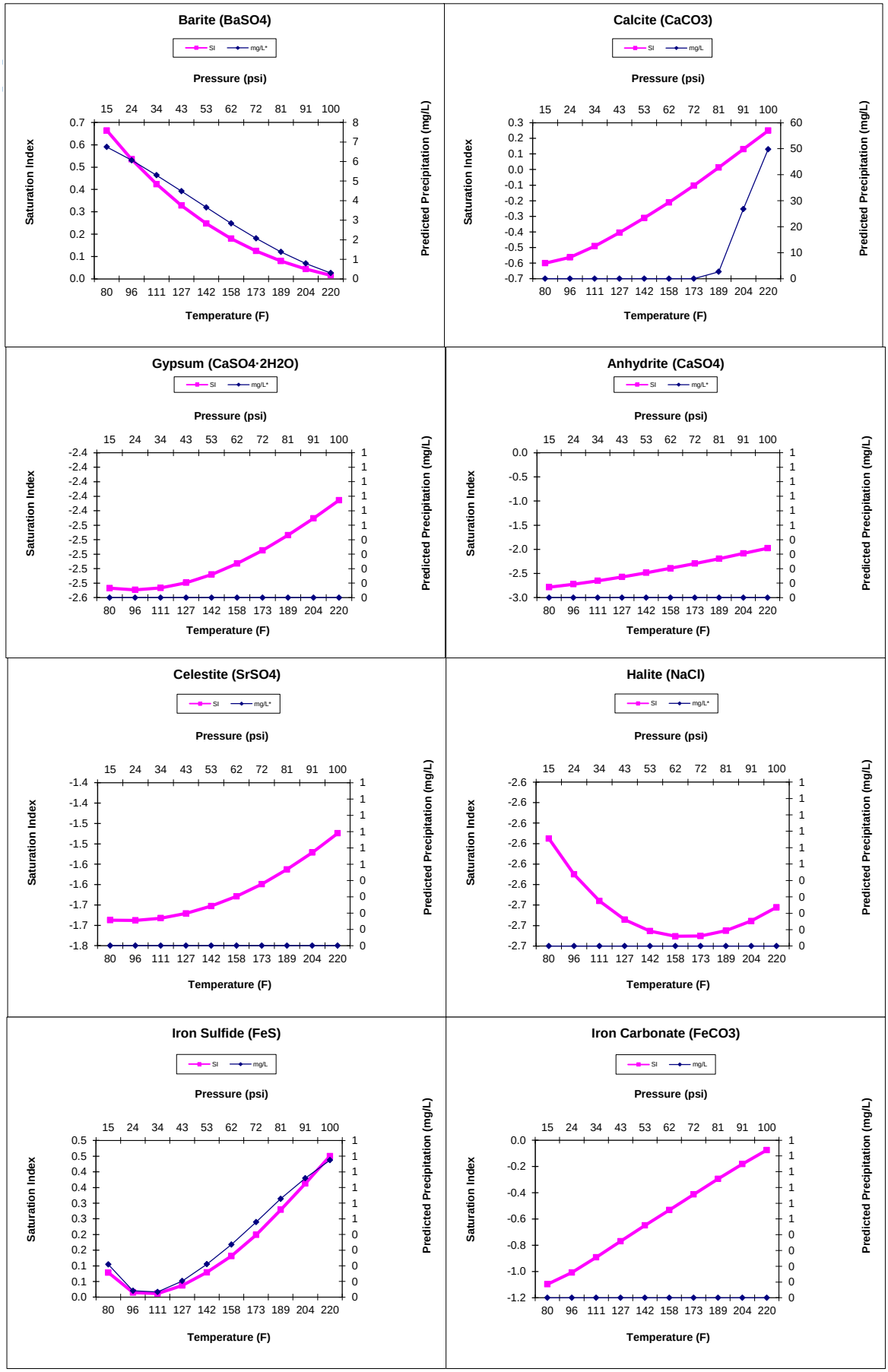
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 251-1 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	251-25 Separator
District:	Four Corners	**Sample ID:**	201201036484
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 251-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	658.0	10.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	600.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	28107
Density/Specific Gravity (g/cm³):	1.0165
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	16300.0	459.8
Sulfate (SO_4^{2-}):	450.0	9.4
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.03	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	10564.0	459.7
Potassium (K^+):	19.4	0.5
Magnesium (Mg^{2+}):	7.8	0.6
Calcium (Ca^{2+}):	75.3	3.8
Strontium (Sr^{2+}):	6.0	0.1
Barium (Ba^{2+}):	9.9	0.1
Iron (Fe^{2+}):	15.9	0.6
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	235	N/A

ND = Not Determined

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)**
80°F	15 psi	1.87	5.815	-0.95	0.000	-1.91	0.000	-2.15	0.000
96°F	24 psi	1.75	5.787	-0.91	0.000	-1.91	0.000	-2.09	0.000
111°F	34 psi	1.63	5.756	-0.84	0.000	-1.91	0.000	-2.02	0.000
127°F	43 psi	1.54	5.722	-0.75	0.000	-1.91	0.000	-1.94	0.000
142°F	53 psi	1.46	5.686	-0.66	0.000	-1.89	0.000	-1.85	0.000
158°F	62 psi	1.39	5.651	-0.56	0.000	-1.88	0.000	-1.76	0.000
173°F	72 psi	1.33	5.617	-0.44	0.000	-1.86	0.000	-1.66	0.000
189°F	81 psi	1.29	5.587	-0.33	0.000	-1.84	0.000	-1.56	0.000
204°F	91 psi	1.25	5.560	-0.21	0.000	-1.82	0.000	-1.45	0.000
220°F	100 psi	1.22	5.538	-0.09	0.000	-1.79	0.000	-1.34	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)**
80°F	15 psi	-1.33	0.000	-2.58	0.000	-9.45	0.000	0.12	2.542
96°F	24 psi	-1.33	0.000	-2.60	0.000	-9.51	0.000	0.20	4.029
111°F	34 psi	-1.33	0.000	-2.61	0.000	-9.51	0.000	0.32	5.677
127°F	43 psi	-1.32	0.000	-2.62	0.000	-9.48	0.000	0.44	7.049
142°F	53 psi	-1.30	0.000	-2.63	0.000	-9.42	0.000	0.56	8.110
158°F	62 psi	-1.28	0.000	-2.63	0.000	-9.36	0.000	0.68	8.911
173°F	72 psi	-1.25	0.000	-2.63	0.000	-9.27	0.000	0.81	9.563
189°F	81 psi	-1.21	0.000	-2.63	0.000	-9.18	0.000	0.92	10.034
204°F	91 psi	-1.17	0.000	-2.62	0.000	-9.09	0.000	1.04	10.379
220°F	100 psi	-1.12	0.000	-2.62	0.000	-8.99	0.000	1.14	10.634

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.

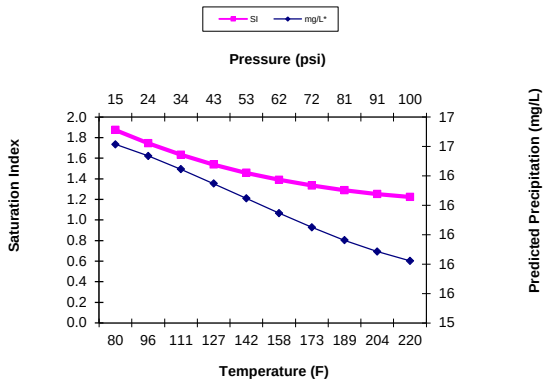
Calculate

ScaleSoftPitzer™ SSP2010

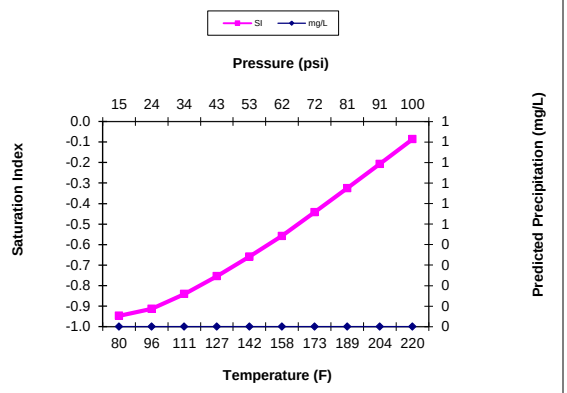
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 251-25 Separator

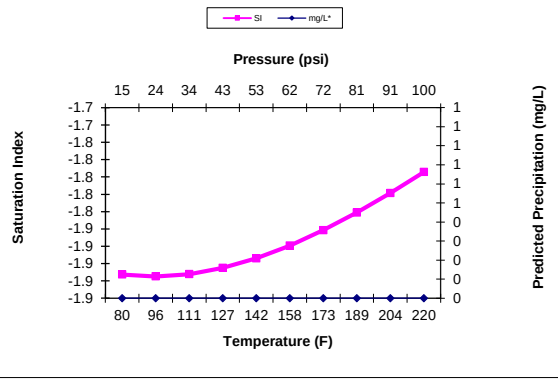
Barite (BaSO4)



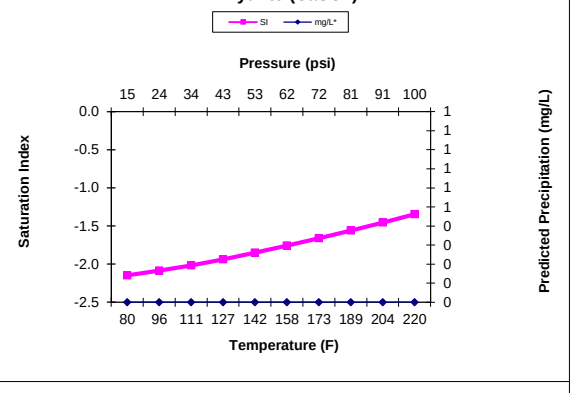
Calcite (CaCO3)



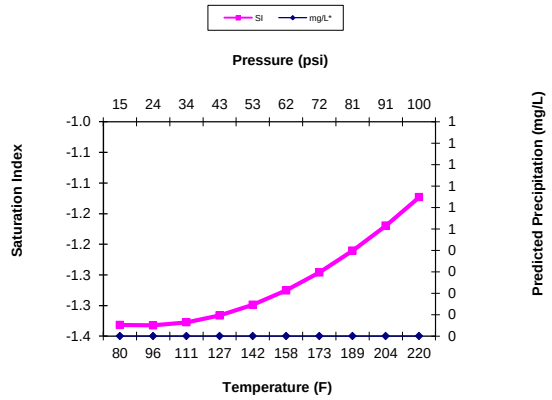
Gypsum (CaSO4·2H2O)



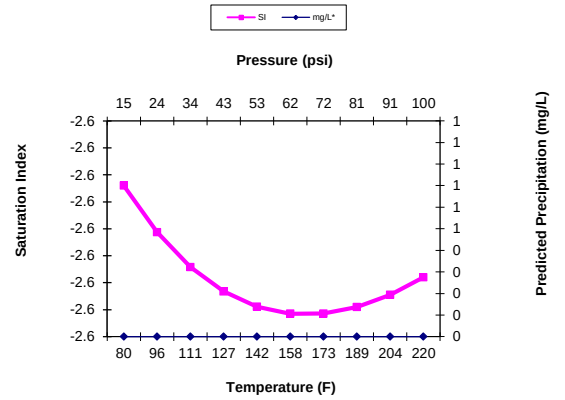
Anhydrite (CaSO4)



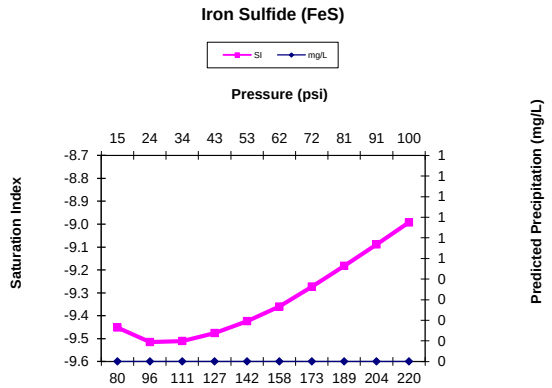
Celestite (SrSO4)



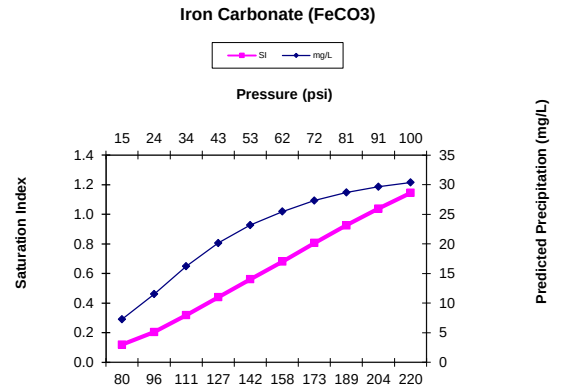
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	255-1 Separator
District:	Four Corners	**Sample ID:**	201201036509
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 255-1 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	18711
Density/Specific Gravity (g/cm³):	1.0101
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10900.0	307.5
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	7063.0	307.4
Potassium (K^+):	25.9	0.7
Magnesium (Mg^{2+}):	11.2	0.9
Calcium (Ca^{2+}):	100.3	5.0
Strontium (Sr^{2+}):	10.8	0.2
Barium (Ba^{2+}):	17.8	0.3
Iron (Fe^{2+}):	15.8	0.6
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	322	N/A

ND = Not Determined

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)**
80°F	15 psi	1.95	10.468	-1.04	0.000	-1.99	0.000	-2.24	0.000
96°F	24 psi	1.82	10.424	-1.00	0.000	-2.00	0.000	-2.17	0.000
111°F	34 psi	1.71	10.374	-0.93	0.000	-1.99	0.000	-2.10	0.000
127°F	43 psi	1.62	10.320	-0.84	0.000	-1.99	0.000	-2.02	0.000
142°F	53 psi	1.54	10.266	-0.74	0.000	-1.97	0.000	-1.93	0.000
158°F	62 psi	1.47	10.213	-0.64	0.000	-1.96	0.000	-1.84	0.000
173°F	72 psi	1.42	10.163	-0.53	0.000	-1.94	0.000	-1.74	0.000
189°F	81 psi	1.38	10.119	-0.41	0.000	-1.91	0.000	-1.63	0.000
204°F	91 psi	1.34	10.083	-0.28	0.000	-1.88	0.000	-1.52	0.000
220°F	100 psi	1.32	10.054	-0.16	0.000	-1.86	0.000	-1.41	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)**
80°F	15 psi	-1.28	0.000	-2.91	0.000	0.94	4.044	-0.10	0.000
96°F	24 psi	-1.28	0.000	-2.93	0.000	0.88	3.912	-0.01	0.000
111°F	34 psi	-1.27	0.000	-2.94	0.000	0.89	3.935	0.11	2.130
127°F	43 psi	-1.26	0.000	-2.95	0.000	0.93	4.030	0.23	4.187
142°F	53 psi	-1.24	0.000	-2.95	0.000	0.99	4.156	0.36	5.833
158°F	62 psi	-1.21	0.000	-2.96	0.000	1.06	4.293	0.48	7.108
173°F	72 psi	-1.18	0.000	-2.96	0.000	1.14	4.451	0.61	8.145
189°F	81 psi	-1.13	0.000	-2.95	0.000	1.24	4.599	0.73	8.931
204°F	91 psi	-1.09	0.000	-2.95	0.000	1.34	4.729	0.85	9.512
220°F	100 psi	-1.03	0.000	-2.94	0.000	1.44	4.841	0.96	9.946

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.

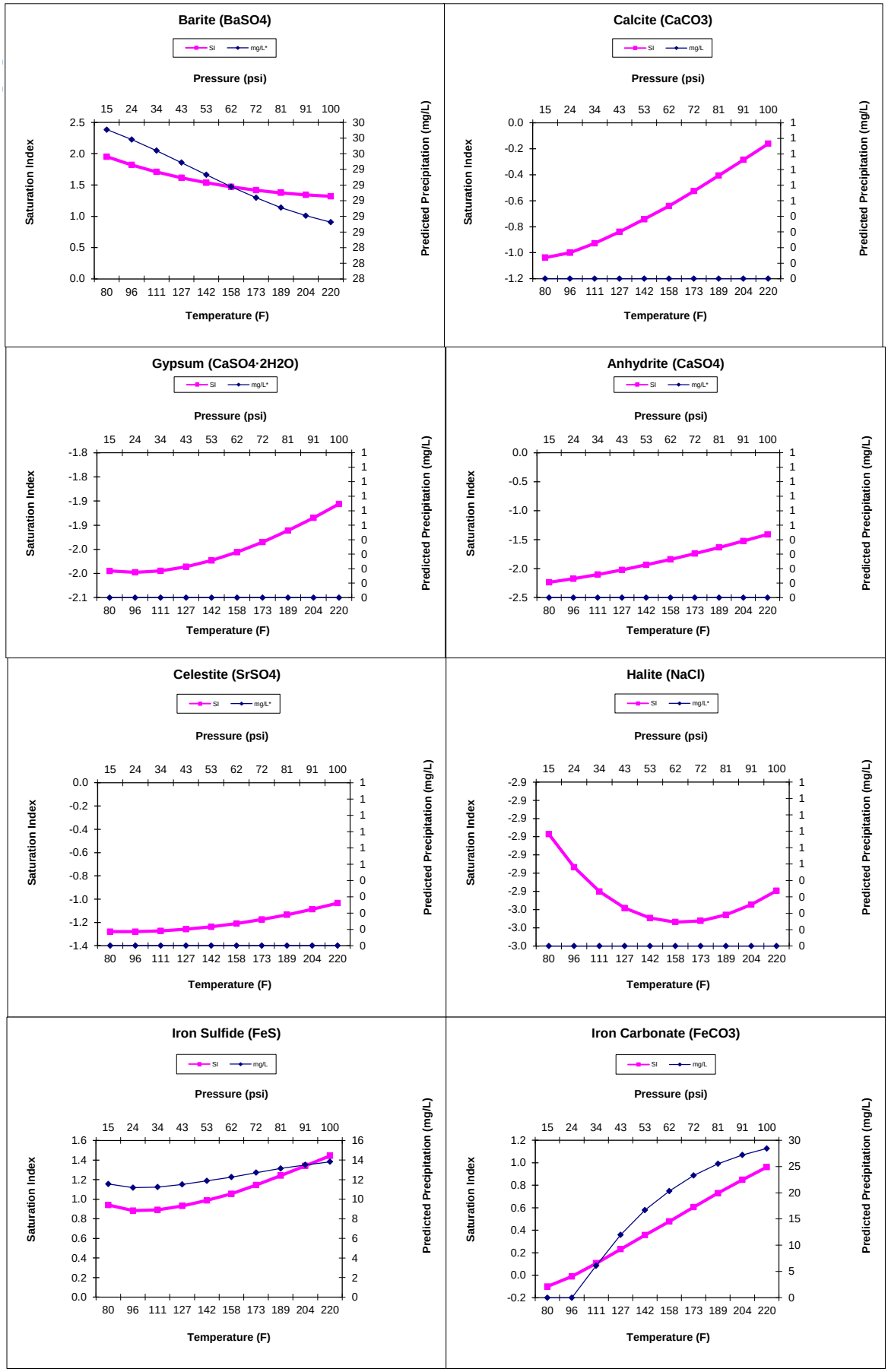
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 255-1 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	261-36 Separator
District:	Four Corners	**Sample ID:**	201201036523
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 261-36 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	500.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23154
Density/Specific Gravity (g/cm³):	1.0131
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13600.0	383.6
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8813.0	383.5
Potassium (K^+):	10.1	0.3
Magnesium (Mg^{2+}):	2.9	0.2
Calcium (Ca^{2+}):	35.9	1.8
Strontium (Sr^{2+}):	3.6	0.1
Barium (Ba^{2+}):	8.9	0.1
Iron (Fe^{2+}):	52.0	1.9
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	112	N/A

ND = Not Determined

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)**
80°F	15 psi	1.56	5.115	-1.53	0.000	-2.51	0.000	-2.75	0.000
96°F	24 psi	1.43	5.063	-1.50	0.000	-2.52	0.000	-2.69	0.000
111°F	34 psi	1.32	5.005	-1.43	0.000	-2.51	0.000	-2.62	0.000
127°F	43 psi	1.22	4.941	-1.34	0.000	-2.51	0.000	-2.54	0.000
142°F	53 psi	1.14	4.876	-1.24	0.000	-2.50	0.000	-2.45	0.000
158°F	62 psi	1.08	4.811	-1.14	0.000	-2.48	0.000	-2.36	0.000
173°F	72 psi	1.02	4.750	-1.03	0.000	-2.46	0.000	-2.26	0.000
189°F	81 psi	0.98	4.696	-0.91	0.000	-2.44	0.000	-2.16	0.000
204°F	91 psi	0.94	4.649	-0.79	0.000	-2.41	0.000	-2.05	0.000
220°F	100 psi	0.92	4.611	-0.66	0.000	-2.39	0.000	-1.94	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)**
80°F	15 psi	-1.83	0.000	-2.73	0.000	-9.12	0.000	0.36	16.369
96°F	24 psi	-1.84	0.000	-2.75	0.000	-9.18	0.000	0.45	19.324
111°F	34 psi	-1.83	0.000	-2.76	0.000	-9.17	0.000	0.56	22.769
127°F	43 psi	-1.82	0.000	-2.77	0.000	-9.13	0.000	0.69	25.835
142°F	53 psi	-1.80	0.000	-2.77	0.000	-9.07	0.000	0.81	28.357
158°F	62 psi	-1.77	0.000	-2.78	0.000	-9.01	0.000	0.93	30.362
173°F	72 psi	-1.74	0.000	-2.78	0.000	-8.91	0.000	1.06	32.059
189°F	81 psi	-1.70	0.000	-2.77	0.000	-8.82	0.000	1.18	33.350
204°F	91 psi	-1.66	0.000	-2.77	0.000	-8.72	0.000	1.30	34.322
220°F	100 psi	-1.61	0.000	-2.76	0.000	-8.61	0.000	1.41	35.059

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.

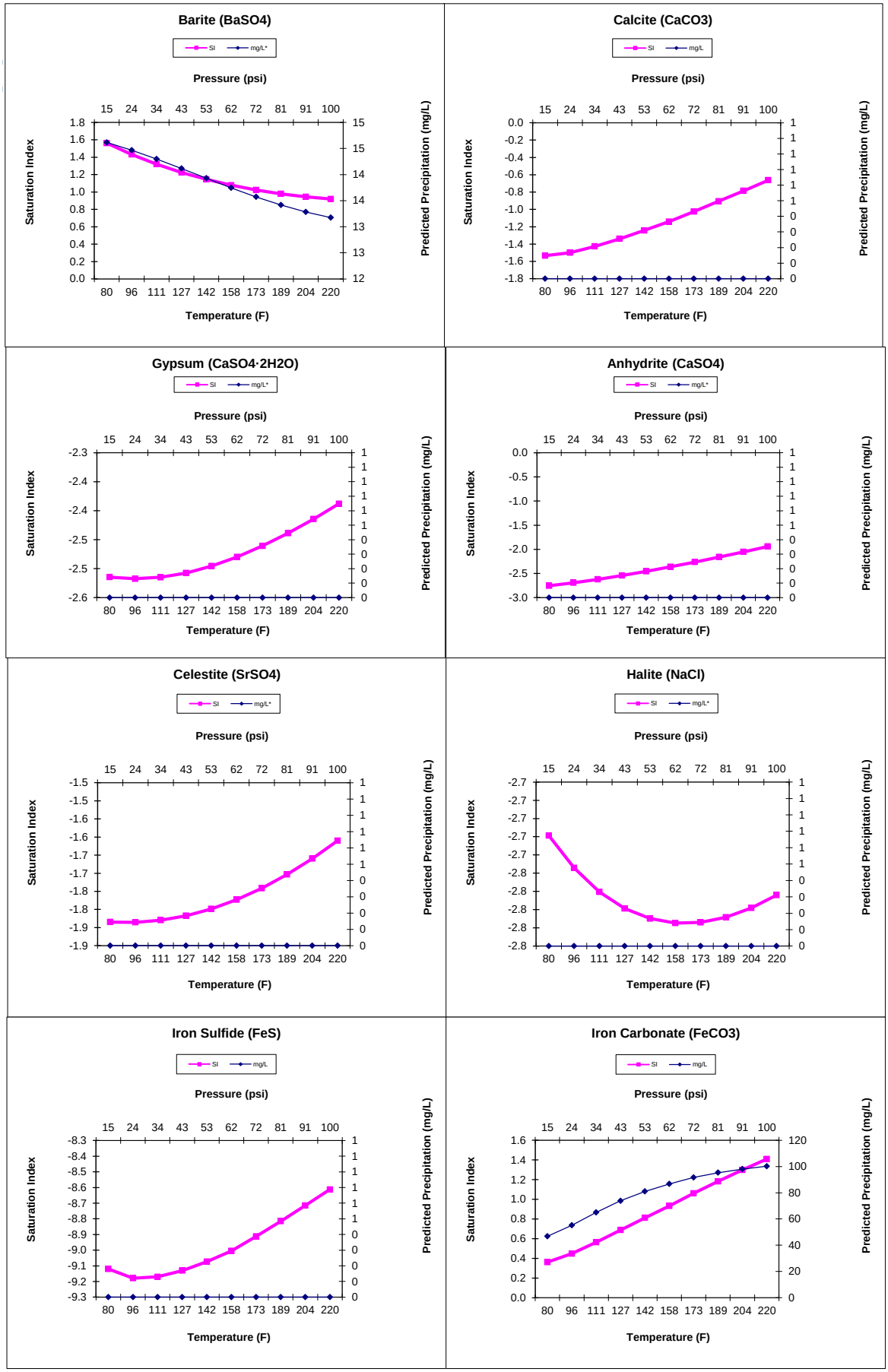
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 261-36 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	262-1 Separator
District:	Four Corners	**Sample ID:**	201201036510
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 262-1 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	90.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24523
Density/Specific Gravity (g/cm³):	1.0140
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14400.0	406.2
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	9331.0	406.0
Potassium (K^+):	23.7	0.6
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	75.4	3.8
Strontium (Sr^{2+}):	10.7	0.2
Barium (Ba^{2+}):	23.9	0.3
Iron (Fe^{2+}):	0.7	0.0
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	255	N/A

ND = Not Determined

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)**
80°F	15 psi	1.67	13.822	-0.41	0.000	-2.51	0.000	-2.75	0.000
96°F	24 psi	1.54	13.696	-0.38	0.000	-2.52	0.000	-2.69	0.000
111°F	34 psi	1.43	13.553	-0.30	0.000	-2.51	0.000	-2.62	0.000
127°F	43 psi	1.33	13.400	-0.22	0.000	-2.51	0.000	-2.54	0.000
142°F	53 psi	1.25	13.242	-0.12	0.000	-2.49	0.000	-2.45	0.000
158°F	62 psi	1.18	13.087	-0.02	0.000	-2.48	0.000	-2.36	0.000
173°F	72 psi	1.13	12.940	0.09	5.759	-2.46	0.000	-2.26	0.000
189°F	81 psi	1.08	12.808	0.20	13.115	-2.44	0.000	-2.16	0.000
204°F	91 psi	1.05	12.694	0.32	20.014	-2.41	0.000	-2.05	0.000
220°F	100 psi	1.02	12.601	0.44	26.431	-2.39	0.000	-1.94	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)**
80°F	15 psi	-1.68	0.000	-2.68	0.000	0.31	0.179	-0.71	0.000
96°F	24 psi	-1.68	0.000	-2.70	0.000	0.24	0.146	-0.62	0.000
111°F	34 psi	-1.67	0.000	-2.71	0.000	0.22	0.139	-0.50	0.000
127°F	43 psi	-1.66	0.000	-2.72	0.000	0.24	0.146	-0.38	0.000
142°F	53 psi	-1.64	0.000	-2.73	0.000	0.27	0.160	-0.25	0.000
158°F	62 psi	-1.62	0.000	-2.73	0.000	0.31	0.179	-0.14	0.000
173°F	72 psi	-1.59	0.000	-2.73	0.000	0.36	0.202	-0.02	0.000
189°F	81 psi	-1.55	0.000	-2.73	0.000	0.43	0.228	0.10	0.106
204°F	91 psi	-1.51	0.000	-2.72	0.000	0.51	0.252	0.22	0.198
220°F	100 psi	-1.46	0.000	-2.72	0.000	0.59	0.273	0.32	0.266

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.

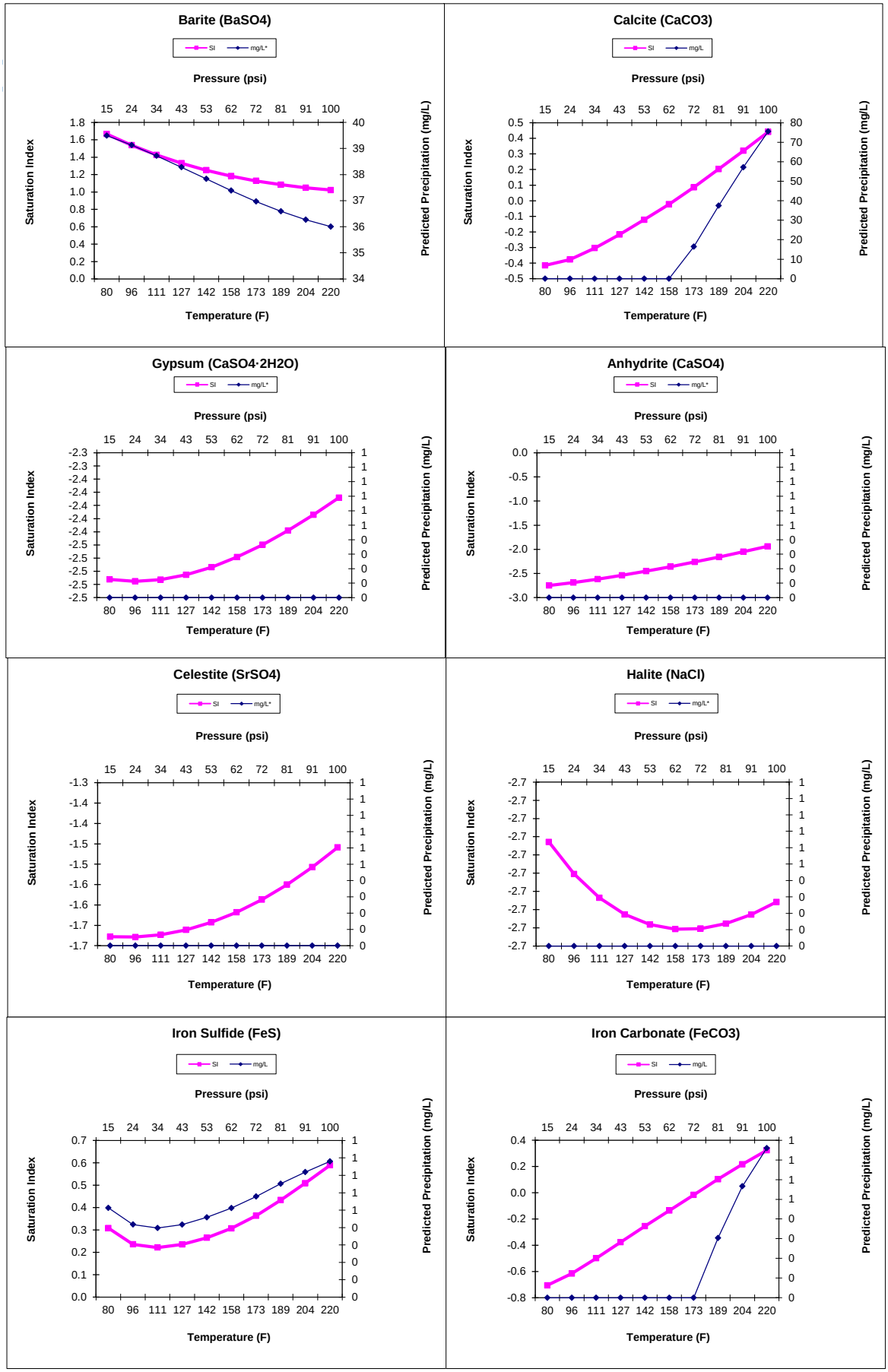
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 262-1 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	262-25 Separator
District:	Four Corners	**Sample ID:**	201201036517
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 262-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	790.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22311
Density/Specific Gravity (g/cm³):	1.0126
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12900.0	363.9
Sulfate (SO_4^{2-}):	300.0	6.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8359.0	363.8
Potassium (K^+):	42.1	1.1
Magnesium (Mg^{2+}):	5.5	0.5
Calcium (Ca^{2+}):	68.4	3.4
Strontium (Sr^{2+}):	6.6	0.1
Barium (Ba^{2+}):	9.8	0.1
Iron (Fe^{2+}):	69.6	2.5
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	208	N/A

ND = Not Determined

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)**
80°F	15 psi	1.79	5.745	-1.14	0.000	-2.05	0.000	-2.29	0.000
96°F	24 psi	1.66	5.712	-1.11	0.000	-2.05	0.000	-2.22	0.000
111°F	34 psi	1.55	5.674	-1.03	0.000	-2.05	0.000	-2.15	0.000
127°F	43 psi	1.46	5.633	-0.95	0.000	-2.04	0.000	-2.07	0.000
142°F	53 psi	1.38	5.591	-0.85	0.000	-2.03	0.000	-1.99	0.000
158°F	62 psi	1.31	5.549	-0.75	0.000	-2.01	0.000	-1.89	0.000
173°F	72 psi	1.26	5.510	-0.63	0.000	-1.99	0.000	-1.79	0.000
189°F	81 psi	1.21	5.475	-0.51	0.000	-1.97	0.000	-1.69	0.000
204°F	91 psi	1.18	5.446	-0.39	0.000	-1.94	0.000	-1.58	0.000
220°F	100 psi	1.15	5.422	-0.27	0.000	-1.92	0.000	-1.47	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)**
80°F	15 psi	-1.39	0.000	-2.77	0.000	-8.98	0.000	0.61	31.978
96°F	24 psi	-1.39	0.000	-2.79	0.000	-9.04	0.000	0.70	34.674
111°F	34 psi	-1.38	0.000	-2.80	0.000	-9.04	0.000	0.82	37.821
127°F	43 psi	-1.37	0.000	-2.81	0.000	-9.00	0.000	0.94	40.573
142°F	53 psi	-1.35	0.000	-2.82	0.000	-8.94	0.000	1.06	42.791
158°F	62 psi	-1.32	0.000	-2.82	0.000	-8.87	0.000	1.19	44.537
173°F	72 psi	-1.29	0.000	-2.82	0.000	-8.77	0.000	1.31	45.982
189°F	81 psi	-1.25	0.000	-2.82	0.000	-8.68	0.000	1.44	47.049
204°F	91 psi	-1.21	0.000	-2.81	0.000	-8.57	0.000	1.55	47.842
220°F	100 psi	-1.16	0.000	-2.81	0.000	-8.47	0.000	1.67	48.436

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.

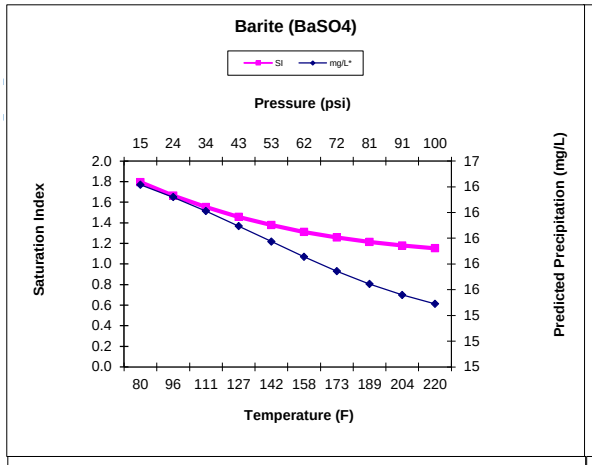
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

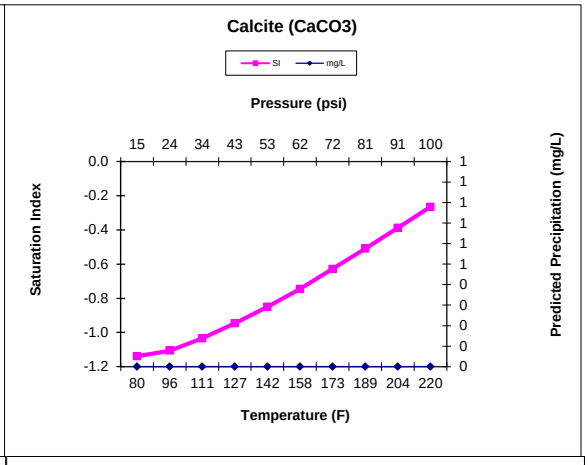
Calculate

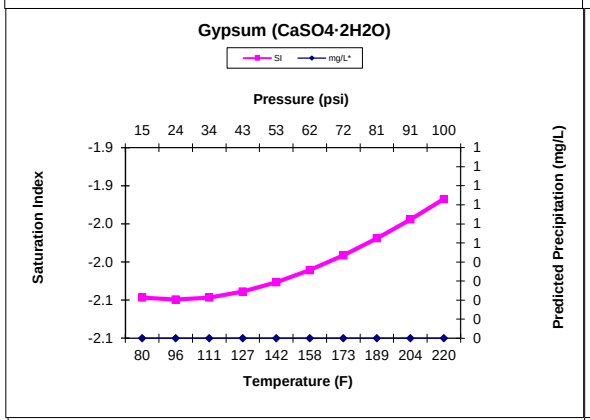
ScaleSoftPitzer™ SSP2010

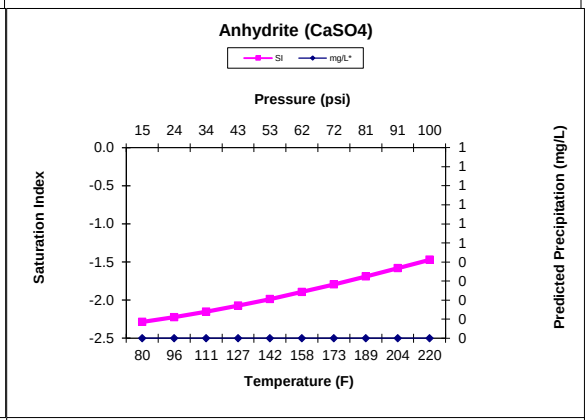
Comments: _____

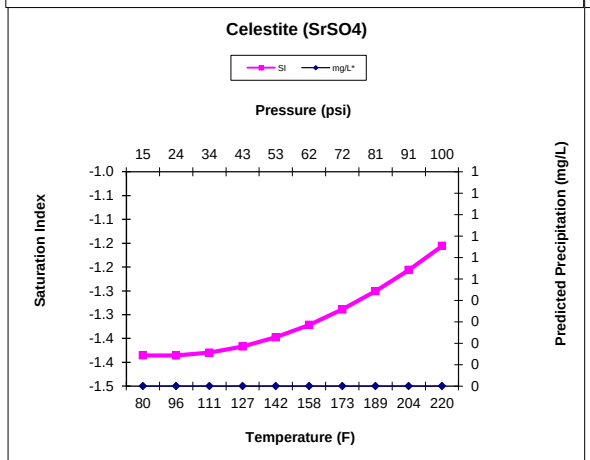
Sample ID: 41212 CAERUS OIL & GAS, Puckett, 262-25 Separator

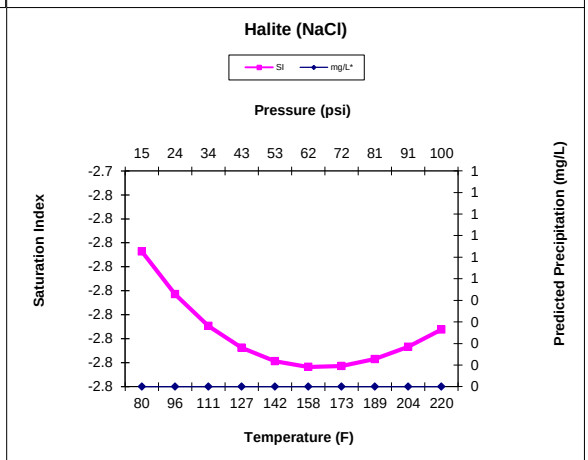


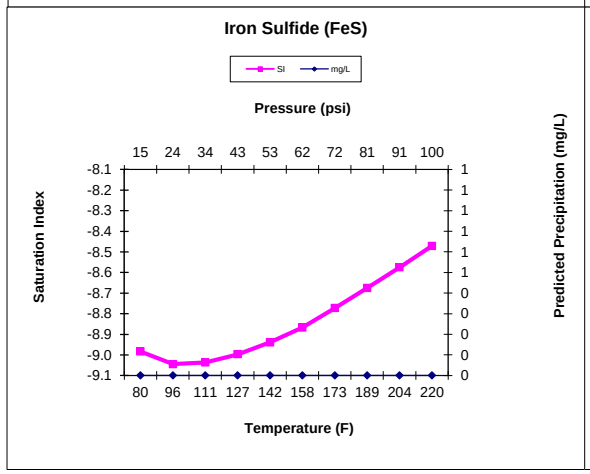


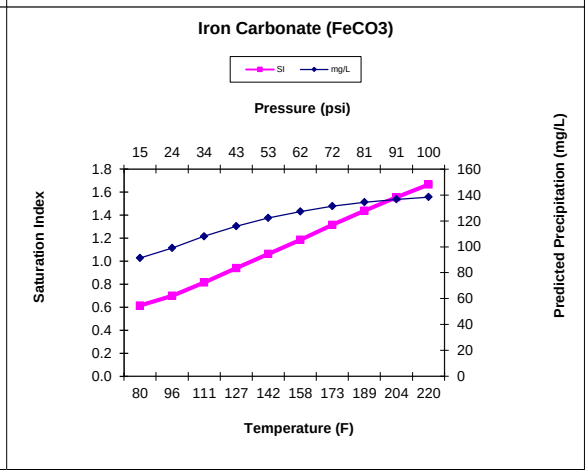












Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	31B-24D Separator
District:	Four Corners	**Sample ID:**	201201035710
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 31B-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	585.0	9.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	145.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20843
Density/Specific Gravity (g/cm³):	1.0115
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11500.0	324.4
Sulfate (SO_4^{2-}):	1150.0	23.9
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.08	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7452.0	324.3
Potassium (K^+):	26.0	0.7
Magnesium (Mg^{2+}):	11.0	0.9
Calcium (Ca^{2+}):	83.0	4.1
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	20.0	0.3
Iron (Fe^{2+}):	6.0	0.2
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	278	N/A

ND = Not Determined

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)**
80°F	15 psi	2.70	11.873	-0.24	0.000	-1.36	0.000	-1.60	0.000
96°F	24 psi	2.57	11.864	-0.20	0.000	-1.37	0.000	-1.54	0.000
111°F	34 psi	2.46	11.855	-0.12	0.000	-1.36	0.000	-1.47	0.000
127°F	43 psi	2.37	11.845	-0.03	0.000	-1.35	0.000	-1.39	0.000
142°F	53 psi	2.29	11.834	0.06	4.501	-1.34	0.000	-1.30	0.000
158°F	62 psi	2.22	11.824	0.17	11.370	-1.32	0.000	-1.21	0.000
173°F	72 psi	2.17	11.815	0.27	18.341	-1.30	0.000	-1.11	0.000
189°F	81 psi	2.12	11.806	0.39	25.336	-1.28	0.000	-1.00	0.000
204°F	91 psi	2.09	11.799	0.51	31.848	-1.25	0.000	-0.89	0.000
220°F	100 psi	2.07	11.793	0.63	37.854	-1.23	0.000	-0.78	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)**
80°F	15 psi	-0.65	0.000	-2.87	0.000	1.21	1.335	0.37	2.437
96°F	24 psi	-0.65	0.000	-2.89	0.000	1.13	1.308	0.46	2.790
111°F	34 psi	-0.65	0.000	-2.90	0.000	1.12	1.301	0.58	3.154
127°F	43 psi	-0.63	0.000	-2.91	0.000	1.13	1.306	0.70	3.449
142°F	53 psi	-0.61	0.000	-2.92	0.000	1.15	1.317	0.83	3.672
158°F	62 psi	-0.58	0.000	-2.92	0.000	1.19	1.332	0.95	3.837
173°F	72 psi	-0.55	0.000	-2.92	0.000	1.25	1.350	1.07	3.962
189°F	81 psi	-0.51	0.000	-2.92	0.000	1.32	1.371	1.19	4.059
204°F	91 psi	-0.46	0.000	-2.91	0.000	1.39	1.390	1.31	4.128
220°F	100 psi	-0.41	0.000	-2.91	0.000	1.47	1.407	1.42	4.180

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.

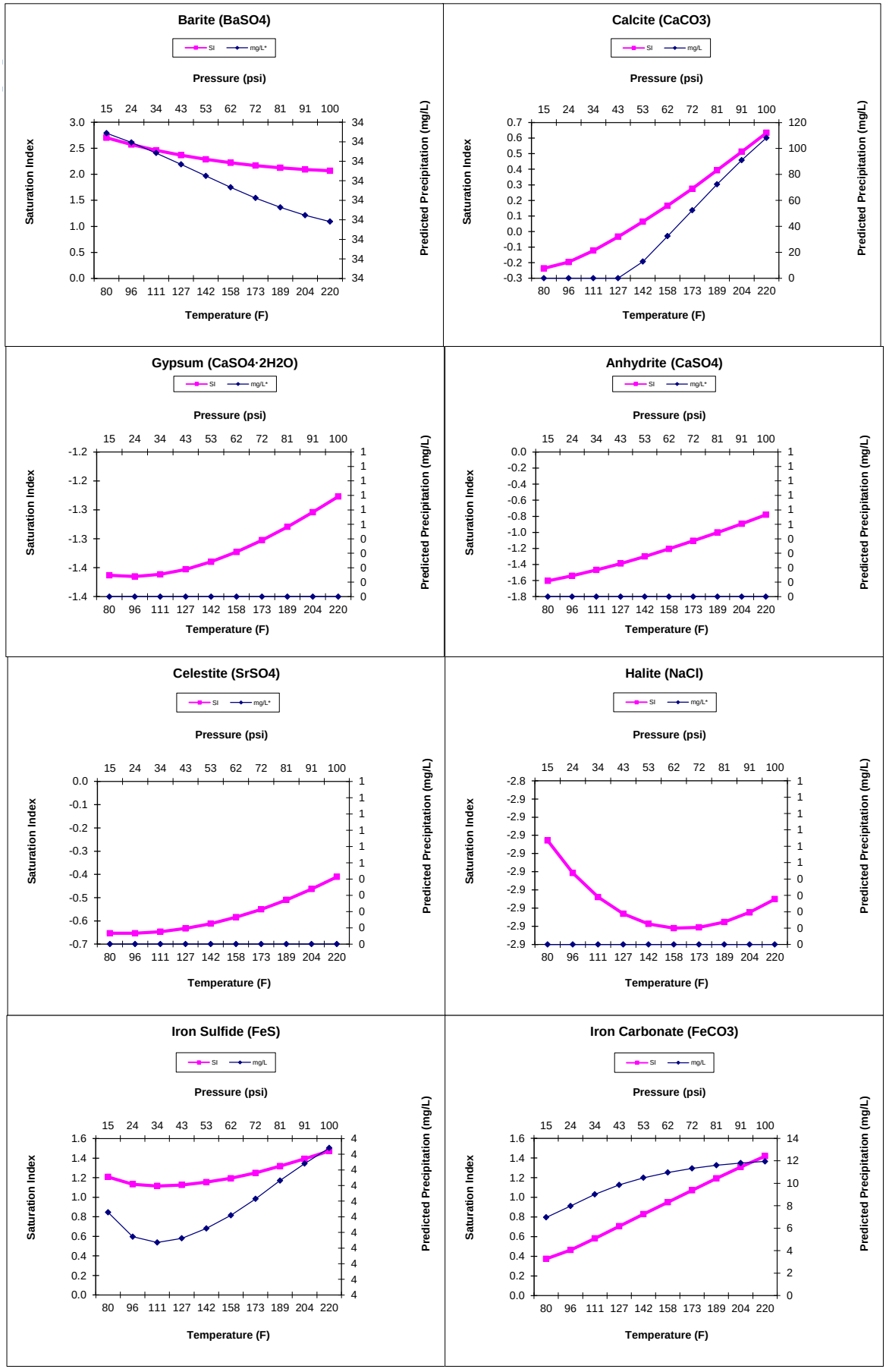
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 31B-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	31D-24D Separator
District:	Four Corners	**Sample ID:**	201201035711
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 31D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	756.0	12.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	435.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23552
Density/Specific Gravity (g/cm³):	1.0136
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13600.0	383.6
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	8813.0	383.5
Potassium (K^+):	38.0	1.0
Magnesium (Mg^{2+}):	15.0	1.2
Calcium (Ca^{2+}):	171.0	8.5
Strontium (Sr^{2+}):	13.0	0.3
Barium (Ba^{2+}):	27.0	0.4
Iron (Fe^{2+}):	19.0	0.7
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	524	N/A

ND = Not Determined

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)**
80°F	15 psi	1.73	15.695	-0.81	0.000	-2.14	0.000	-2.38	0.000
96°F	24 psi	1.60	15.569	-0.79	0.000	-2.15	0.000	-2.32	0.000
111°F	34 psi	1.49	15.427	-0.72	0.000	-2.14	0.000	-2.25	0.000
127°F	43 psi	1.40	15.274	-0.63	0.000	-2.14	0.000	-2.17	0.000
142°F	53 psi	1.32	15.117	-0.53	0.000	-2.12	0.000	-2.08	0.000
158°F	62 psi	1.25	14.962	-0.42	0.000	-2.11	0.000	-1.99	0.000
173°F	72 psi	1.19	14.816	-0.30	0.000	-2.09	0.000	-1.89	0.000
189°F	81 psi	1.15	14.686	-0.18	0.000	-2.07	0.000	-1.79	0.000
204°F	91 psi	1.12	14.573	-0.06	0.000	-2.04	0.000	-1.68	0.000
220°F	100 psi	1.09	14.483	0.06	8.398	-2.02	0.000	-1.57	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)**
80°F	15 psi	-1.59	0.000	-2.73	0.000	-9.89	0.000	0.00	0.000
96°F	24 psi	-1.59	0.000	-2.75	0.000	-9.97	0.000	0.07	1.896
111°F	34 psi	-1.58	0.000	-2.76	0.000	-9.96	0.000	0.18	4.403
127°F	43 psi	-1.57	0.000	-2.77	0.000	-9.92	0.000	0.30	6.565
142°F	53 psi	-1.55	0.000	-2.78	0.000	-9.86	0.000	0.43	8.306
158°F	62 psi	-1.52	0.000	-2.78	0.000	-9.76	0.000	0.57	9.721
173°F	72 psi	-1.49	0.000	-2.78	0.000	-9.66	0.000	0.69	10.736
189°F	81 psi	-1.45	0.000	-2.78	0.000	-9.56	0.000	0.82	11.470
204°F	91 psi	-1.41	0.000	-2.77	0.000	-9.46	0.000	0.93	12.007
220°F	100 psi	-1.36	0.000	-2.76	0.000	-9.35	0.000	1.04	12.404

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.

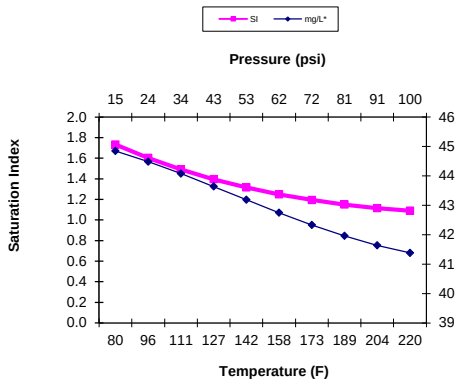
Calculate

ScaleSoftPitzer™ SSP2010

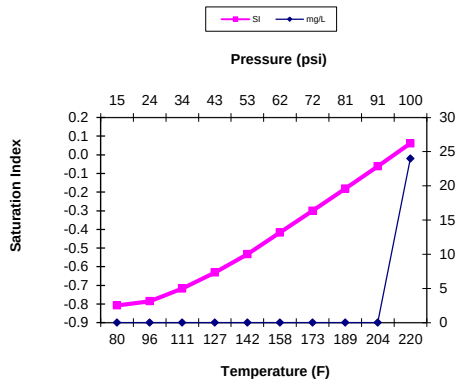
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 31D-24D Separator

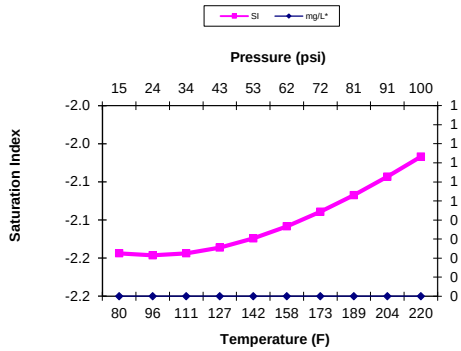
Barite (BaSO4)



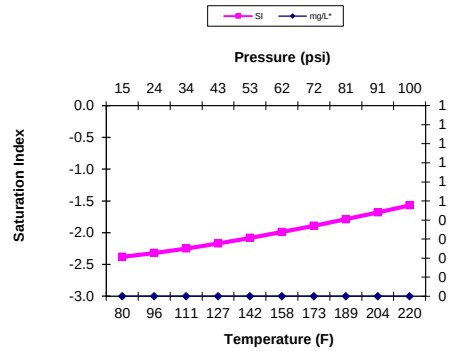
Calcite (CaCO3)



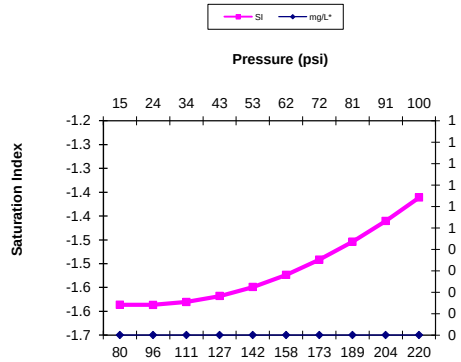
Gypsum (CaSO4·2H2O)



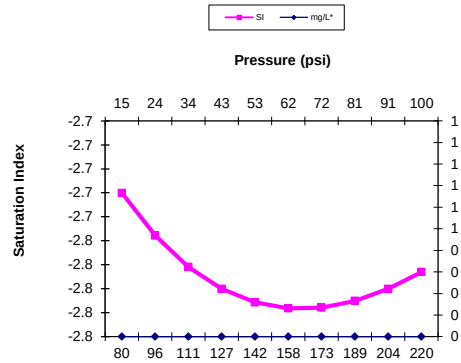
Anhydrite (CaSO4)



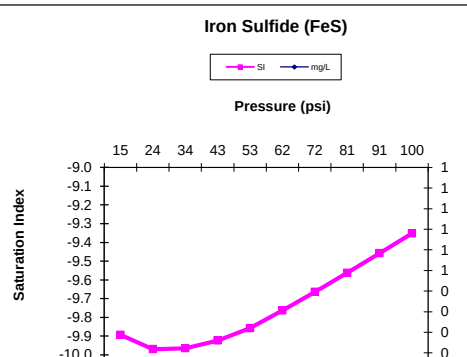
Celestite (SrSO4)



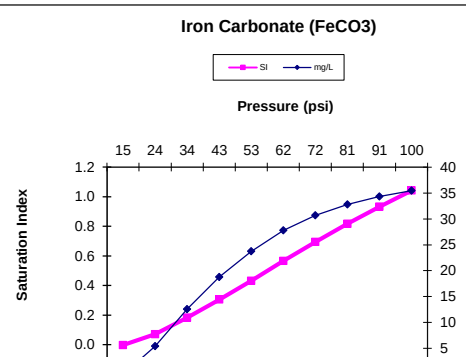
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32A-24D Separator
District:	Four Corners	**Sample ID:**	201201035737
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 32A-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	561.0	9.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	260.0
aqueous H_2S (ppm):	5.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20861
Density/Specific Gravity (g/cm³):	1.0115
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11500.0	324.4
Sulfate (SO_4^{2-}):	1150.0	23.9
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.08	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7452.0	324.3
Potassium (K^+):	27.0	0.7
Magnesium (Mg^{2+}):	7.0	0.6
Calcium (Ca^{2+}):	94.0	4.7
Strontium (Sr^{2+}):	10.0	0.2
Barium (Ba^{2+}):	24.0	0.3
Iron (Fe^{2+}):	36.0	1.3
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	293	N/A

ND = Not Determined

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)**
80°F	15 psi	2.78	14.252	-0.20	0.000	-1.31	0.000	-1.55	0.000
96°F	24 psi	2.65	14.243	-0.17	0.000	-1.31	0.000	-1.49	0.000
111°F	34 psi	2.54	14.234	-0.09	0.000	-1.31	0.000	-1.42	0.000
127°F	43 psi	2.44	14.224	-0.01	0.000	-1.30	0.000	-1.34	0.000
142°F	53 psi	2.36	14.213	0.09	6.451	-1.29	0.000	-1.25	0.000
158°F	62 psi	2.30	14.203	0.19	13.386	-1.27	0.000	-1.15	0.000
173°F	72 psi	2.24	14.193	0.30	20.478	-1.25	0.000	-1.06	0.000
189°F	81 psi	2.20	14.185	0.41	27.673	-1.23	0.000	-0.95	0.000
204°F	91 psi	2.17	14.178	0.53	34.450	-1.20	0.000	-0.84	0.000
220°F	100 psi	2.14	14.172	0.65	40.785	-1.18	0.000	-0.73	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)**
80°F	15 psi	-0.61	0.000	-2.87	0.000	2.72	8.196	1.13	23.263
96°F	24 psi	-0.61	0.000	-2.89	0.000	2.64	8.190	1.22	23.775
111°F	34 psi	-0.60	0.000	-2.90	0.000	2.62	8.188	1.33	24.311
127°F	43 psi	-0.59	0.000	-2.91	0.000	2.63	8.190	1.45	24.749
142°F	53 psi	-0.57	0.000	-2.92	0.000	2.66	8.192	1.58	25.083
158°F	62 psi	-0.54	0.000	-2.92	0.000	2.70	8.196	1.69	25.334
173°F	72 psi	-0.51	0.000	-2.92	0.000	2.75	8.200	1.81	25.526
189°F	81 psi	-0.47	0.000	-2.92	0.000	2.82	8.204	1.93	25.674
204°F	91 psi	-0.42	0.000	-2.91	0.000	2.89	8.209	2.05	25.782
220°F	100 psi	-0.37	0.000	-2.91	0.000	2.97	8.212	2.16	25.862

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.

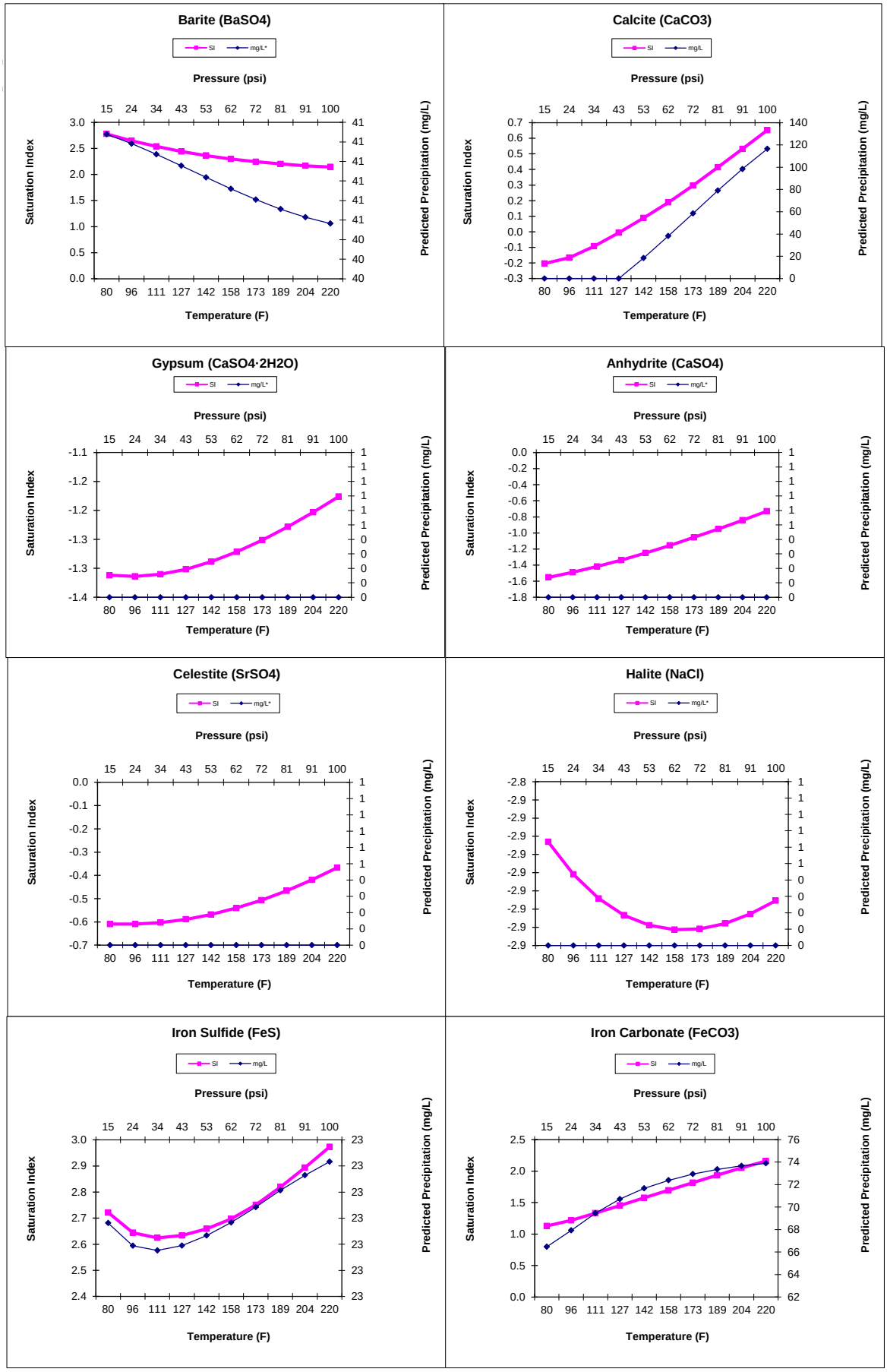
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 32A-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32A-7D Separator
District:	Four Corners	**Sample ID:**	201201036473
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 32A-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	488.0	8.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	350.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	31461
Density/Specific Gravity (g/cm^3):	1.0190
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	18400.0	519.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	11923.0	518.8
Potassium (K^+):	43.7	1.1
Magnesium (Mg^{2+}):	30.6	2.5
Calcium (Ca^{2+}):	283.0	14.1
Strontium (Sr^{2+}):	39.8	0.9
Barium (Ba^{2+}):	154.7	2.3
Iron (Fe^{2+}):	48.1	1.7
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	991	N/A

ND = Not Determined

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)**
80°F	15 psi	2.06	41.832	-0.32	0.000	-2.35	0.000	-2.58	0.000
96°F	24 psi	1.93	41.601	-0.28	0.000	-2.35	0.000	-2.52	0.000
111°F	34 psi	1.82	41.340	-0.21	0.000	-2.35	0.000	-2.45	0.000
127°F	43 psi	1.72	41.059	-0.12	0.000	-2.34	0.000	-2.37	0.000
142°F	53 psi	1.64	40.770	-0.03	0.000	-2.33	0.000	-2.29	0.000
158°F	62 psi	1.57	40.483	0.07	7.149	-2.32	0.000	-2.19	0.000
173°F	72 psi	1.51	40.210	0.17	18.210	-2.30	0.000	-2.10	0.000
189°F	81 psi	1.47	39.960	0.29	29.126	-2.28	0.000	-2.00	0.000
204°F	91 psi	1.43	39.740	0.41	39.395	-2.26	0.000	-1.89	0.000
220°F	100 psi	1.40	39.554	0.52	49.033	-2.24	0.000	-1.78	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)**
80°F	15 psi	-1.52	0.000	-2.48	0.000	1.51	2.830	0.64	23.375
96°F	24 psi	-1.52	0.000	-2.50	0.000	1.45	2.814	0.72	25.191
111°F	34 psi	-1.51	0.000	-2.51	0.000	1.45	2.814	0.84	27.196
127°F	43 psi	-1.50	0.000	-2.52	0.000	1.47	2.821	0.96	28.901
142°F	53 psi	-1.49	0.000	-2.53	0.000	1.52	2.833	1.08	30.249
158°F	62 psi	-1.46	0.000	-2.53	0.000	1.57	2.845	1.19	31.285
173°F	72 psi	-1.44	0.000	-2.53	0.000	1.64	2.859	1.31	32.116
189°F	81 psi	-1.40	0.000	-2.53	0.000	1.72	2.873	1.43	32.758
204°F	91 psi	-1.36	0.000	-2.52	0.000	1.81	2.885	1.54	33.235
220°F	100 psi	-1.32	0.000	-2.52	0.000	1.89	2.895	1.64	33.592

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.

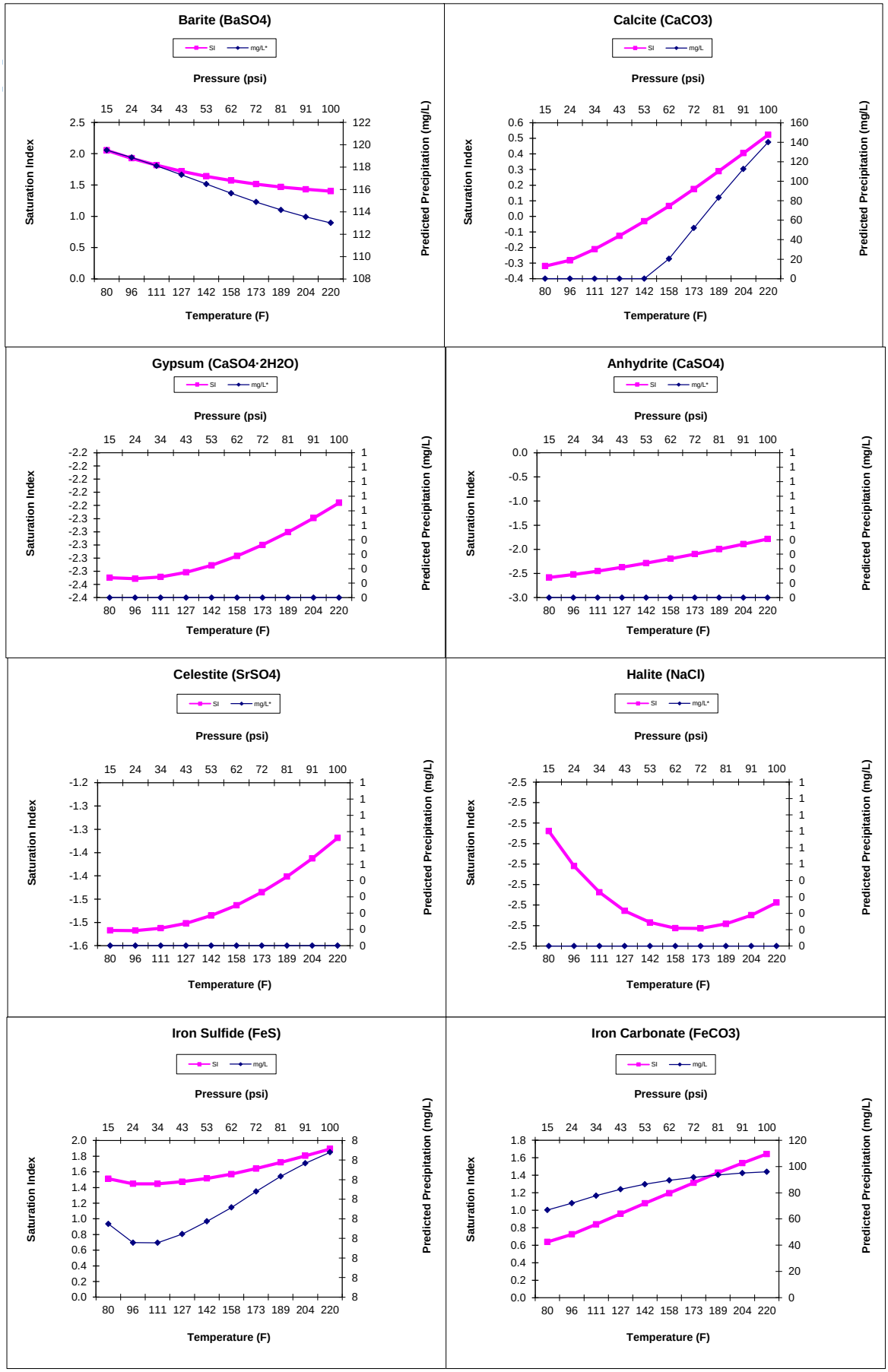
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 32A-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32B-24D Separator
District:	Four Corners	**Sample ID:**	201201035738
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 32B-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	585.0	9.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20881
Density/Specific Gravity (g/cm^3):	1.0116
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12100.0	341.3
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	7841.0	341.2
Potassium (K^+):	35.0	0.9
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	94.0	4.7
Strontium (Sr^{2+}):	10.0	0.2
Barium (Ba^{2+}):	24.0	0.3
Iron (Fe^{2+}):	33.0	1.2
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	301	N/A

ND = Not Determined

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)**
80°F	15 psi	1.91	14.079	-0.17	0.000	-2.18	0.000	-2.42	0.000
96°F	24 psi	1.78	14.010	-0.13	0.000	-2.19	0.000	-2.36	0.000
111°F	34 psi	1.67	13.933	-0.06	0.000	-2.18	0.000	-2.29	0.000
127°F	43 psi	1.57	13.850	0.03	2.035	-2.17	0.000	-2.21	0.000
142°F	53 psi	1.50	13.764	0.12	9.016	-2.16	0.000	-2.12	0.000
158°F	62 psi	1.43	13.680	0.22	16.020	-2.15	0.000	-2.03	0.000
173°F	72 psi	1.37	13.602	0.33	23.166	-2.13	0.000	-1.93	0.000
189°F	81 psi	1.33	13.532	0.45	30.388	-2.10	0.000	-1.82	0.000
204°F	91 psi	1.30	13.473	0.57	37.164	-2.08	0.000	-1.72	0.000
220°F	100 psi	1.27	13.426	0.69	43.470	-2.05	0.000	-1.60	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)**
80°F	15 psi	-1.48	0.000	-2.82	0.000	2.36	3.735	1.13	21.433
96°F	24 psi	-1.48	0.000	-2.84	0.000	2.28	3.731	1.22	21.892
111°F	34 psi	-1.47	0.000	-2.86	0.000	2.27	3.730	1.33	22.369
127°F	43 psi	-1.46	0.000	-2.87	0.000	2.28	3.731	1.46	22.756
142°F	53 psi	-1.44	0.000	-2.87	0.000	2.30	3.733	1.58	23.050
158°F	62 psi	-1.41	0.000	-2.87	0.000	2.34	3.735	1.70	23.268
173°F	72 psi	-1.38	0.000	-2.87	0.000	2.40	3.738	1.82	23.435
189°F	81 psi	-1.34	0.000	-2.87	0.000	2.47	3.741	1.94	23.563
204°F	91 psi	-1.29	0.000	-2.86	0.000	2.54	3.744	2.06	23.656
220°F	100 psi	-1.24	0.000	-2.86	0.000	2.62	3.746	2.17	23.725

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.

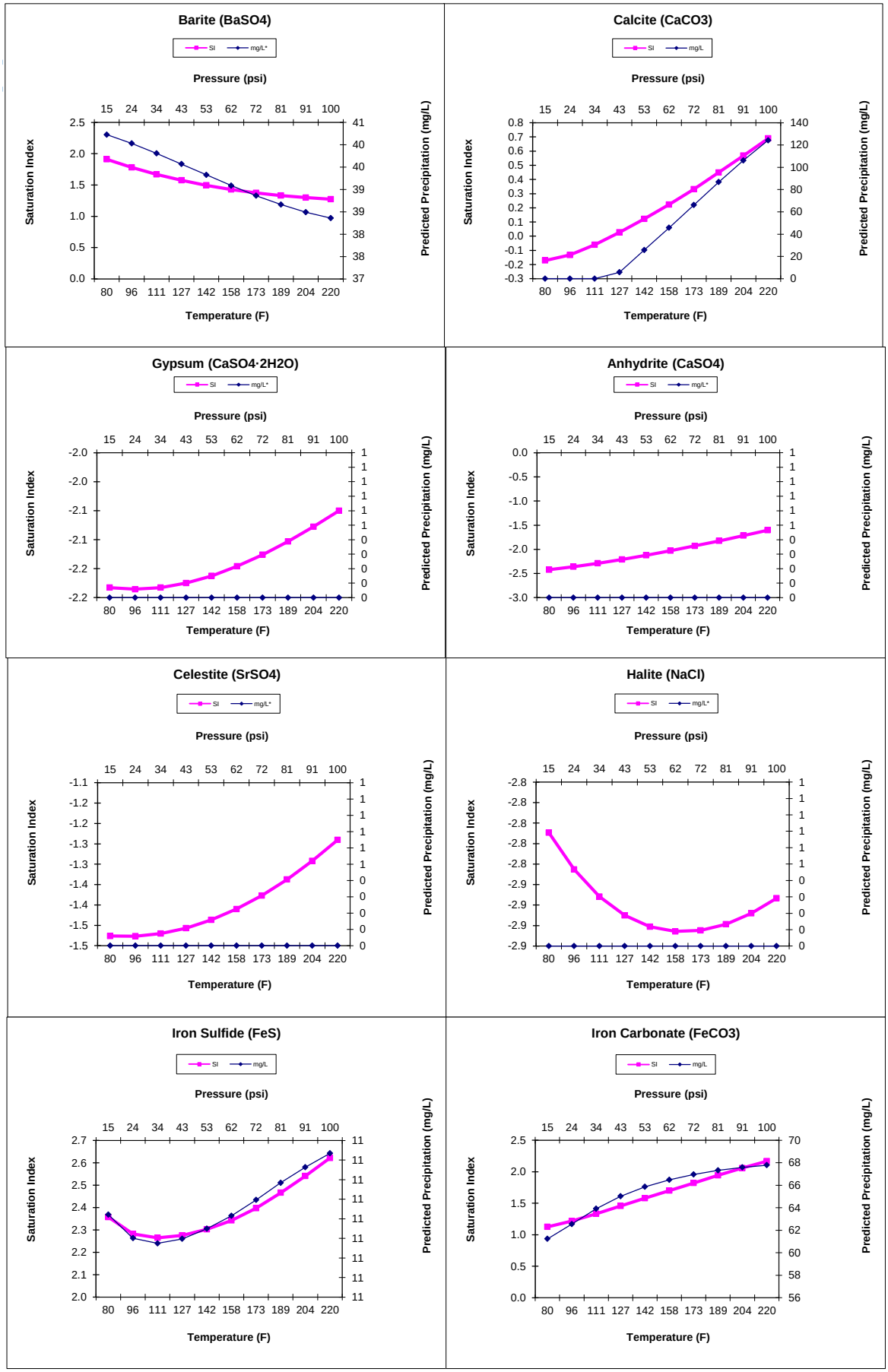
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 32B-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32B2-7D Separator
District:	Four Corners	**Sample ID:**	201201036474
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 32B2-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.9

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	610.0	10.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	450.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	37194
Density/Specific Gravity (g/cm³):	1.0227
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	21800.0	615.0
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	14126.0	614.7
Potassium (K^+):	31.0	0.8
Magnesium (Mg^{2+}):	30.7	2.5
Calcium (Ca^{2+}):	229.9	11.5
Strontium (Sr^{2+}):	29.9	0.7
Barium (Ba^{2+}):	103.2	1.5
Iron (Fe^{2+}):	32.7	1.2
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	810	N/A

ND = Not Determined

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)**
80°F	15 psi	2.41	61.015	0.08	8.008	-1.90	0.000	-2.13	0.000
96°F	24 psi	2.28	60.889	0.12	11.874	-1.90	0.000	-2.06	0.000
111°F	34 psi	2.17	60.744	0.19	19.052	-1.89	0.000	-1.99	0.000
127°F	43 psi	2.08	60.587	0.27	27.346	-1.89	0.000	-1.91	0.000
142°F	53 psi	1.99	60.423	0.36	36.009	-1.88	0.000	-1.83	0.000
158°F	62 psi	1.92	60.257	0.46	44.714	-1.87	0.000	-1.74	0.000
173°F	72 psi	1.87	60.096	0.57	53.631	-1.85	0.000	-1.64	0.000
189°F	81 psi	1.82	59.946	0.68	62.820	-1.83	0.000	-1.55	0.000
204°F	91 psi	1.78	59.811	0.79	71.583	-1.81	0.000	-1.44	0.000
220°F	100 psi	1.75	59.694	0.90	79.926	-1.79	0.000	-1.34	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)**
80°F	15 psi	-1.10	0.000	-2.34	0.000	-8.23	0.000	0.95	20.169
96°F	24 psi	-1.10	0.000	-2.36	0.000	-8.31	0.000	1.04	20.799
111°F	34 psi	-1.10	0.000	-2.37	0.000	-8.33	0.000	1.16	21.458
127°F	43 psi	-1.09	0.000	-2.38	0.000	-8.32	0.000	1.27	21.993
142°F	53 psi	-1.07	0.000	-2.39	0.000	-8.30	0.000	1.39	22.402
158°F	62 psi	-1.05	0.000	-2.39	0.000	-8.26	0.000	1.50	22.708
173°F	72 psi	-1.03	0.000	-2.39	0.000	-8.21	0.000	1.62	22.943
189°F	81 psi	-0.99	0.000	-2.39	0.000	-8.15	0.000	1.73	23.127
204°F	91 psi	-0.96	0.000	-2.39	0.000	-8.09	0.000	1.84	23.261
220°F	100 psi	-0.92	0.000	-2.38	0.000	-8.02	0.000	1.93	23.361

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.

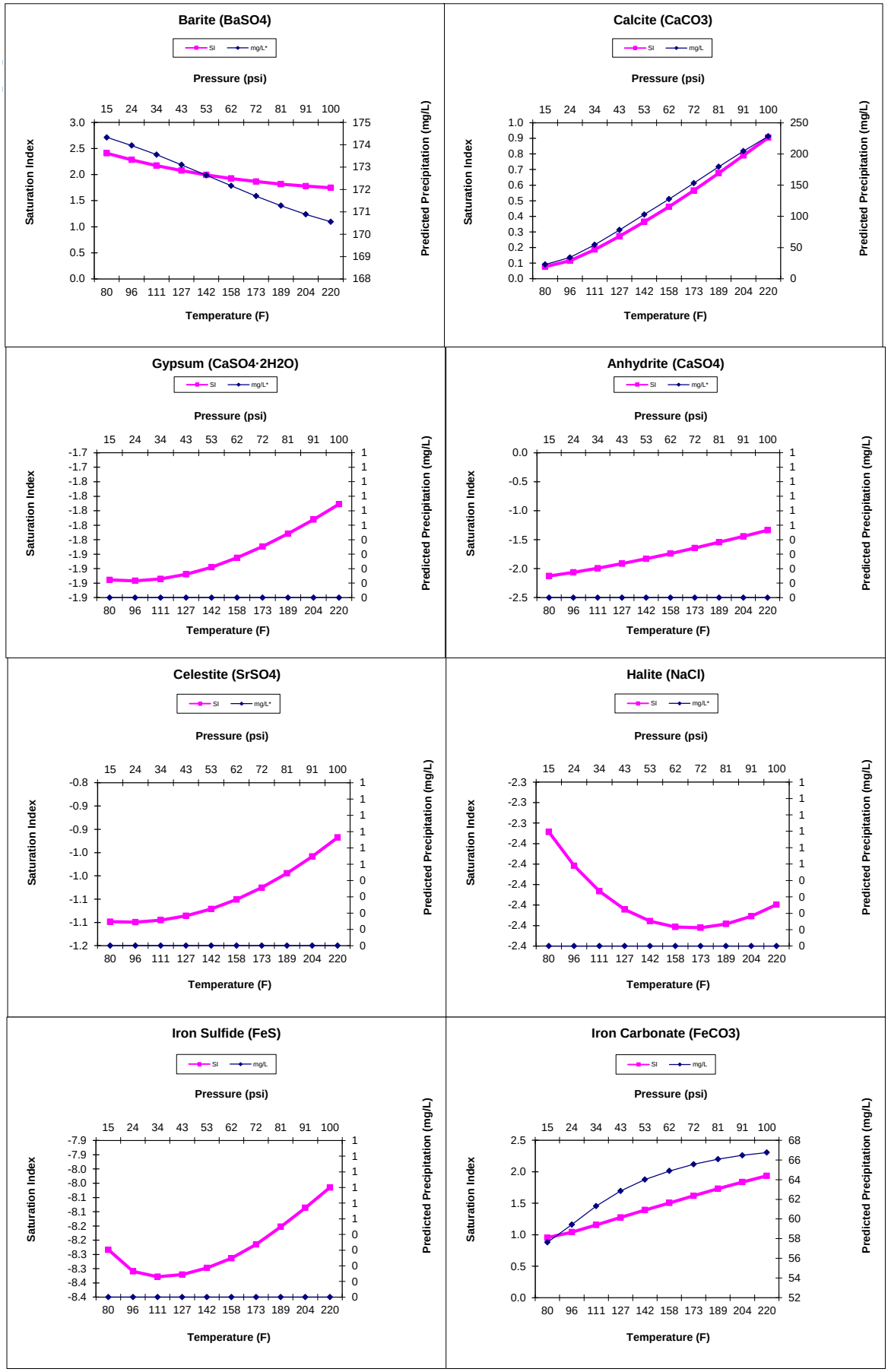
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 32B2-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32C-24D Separator
District:	Four Corners	**Sample ID:**	201201035739
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 32C-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	488.0	8.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	175.0
aqueous H_2S (ppm):	5.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19135
Density/Specific Gravity (g/cm^3):	1.0104
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11000.0	310.3
Sulfate (SO_4^{2-}):	350.0	7.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.03	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7128.0	310.2
Potassium (K^+):	28.0	0.7
Magnesium (Mg^{2+}):	8.0	0.7
Calcium (Ca^{2+}):	83.0	4.1
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	19.0	0.3
Iron (Fe^{2+}):	22.0	0.8
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	265	N/A

ND = Not Determined

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)**
80°F	15 psi	2.21	11.230	-0.30	0.000	-1.84	0.000	-2.08	0.000
96°F	24 psi	2.08	11.204	-0.26	0.000	-1.84	0.000	-2.02	0.000
111°F	34 psi	1.97	11.176	-0.19	0.000	-1.84	0.000	-1.95	0.000
127°F	43 psi	1.88	11.145	-0.11	0.000	-1.83	0.000	-1.87	0.000
142°F	53 psi	1.80	11.114	-0.01	0.000	-1.82	0.000	-1.78	0.000
158°F	62 psi	1.73	11.083	0.09	5.700	-1.80	0.000	-1.69	0.000
173°F	72 psi	1.68	11.055	0.20	12.287	-1.78	0.000	-1.58	0.000
189°F	81 psi	1.63	11.030	0.31	19.016	-1.76	0.000	-1.48	0.000
204°F	91 psi	1.60	11.009	0.43	25.402	-1.73	0.000	-1.37	0.000
220°F	100 psi	1.58	10.992	0.56	31.418	-1.70	0.000	-1.26	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)**
80°F	15 psi	-1.12	0.000	-2.90	0.000	2.48	7.448	0.87	13.205
96°F	24 psi	-1.12	0.000	-2.92	0.000	2.40	7.433	0.96	13.701
111°F	34 psi	-1.12	0.000	-2.93	0.000	2.39	7.431	1.08	14.218
127°F	43 psi	-1.10	0.000	-2.94	0.000	2.40	7.434	1.20	14.640
142°F	53 psi	-1.08	0.000	-2.95	0.000	2.42	7.441	1.32	14.962
158°F	62 psi	-1.06	0.000	-2.95	0.000	2.46	7.449	1.44	15.203
173°F	72 psi	-1.02	0.000	-2.95	0.000	2.52	7.460	1.56	15.388
189°F	81 psi	-0.98	0.000	-2.95	0.000	2.59	7.470	1.68	15.530
204°F	91 psi	-0.93	0.000	-2.94	0.000	2.66	7.480	1.80	15.634
220°F	100 psi	-0.88	0.000	-2.93	0.000	2.74	7.489	1.91	15.711

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.

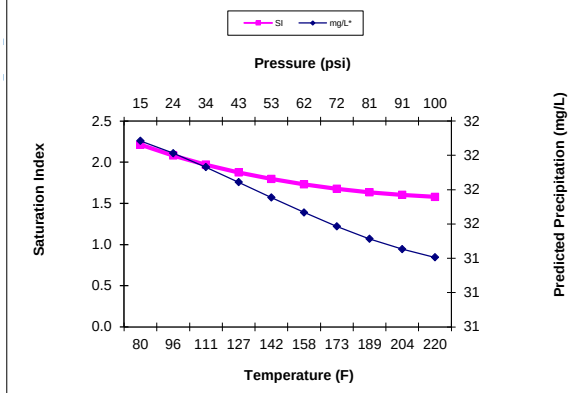
Calculate

ScaleSoftPitzer™ SSP2010

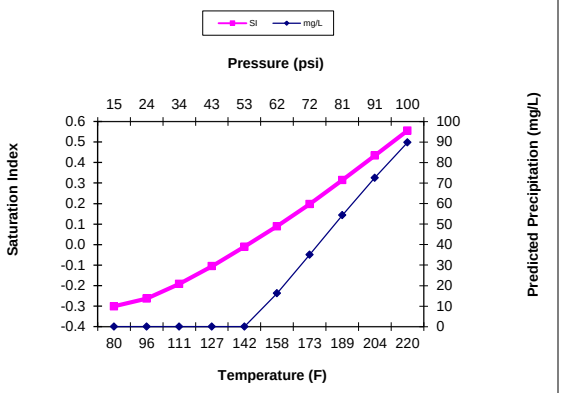
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 32C-24D Separator

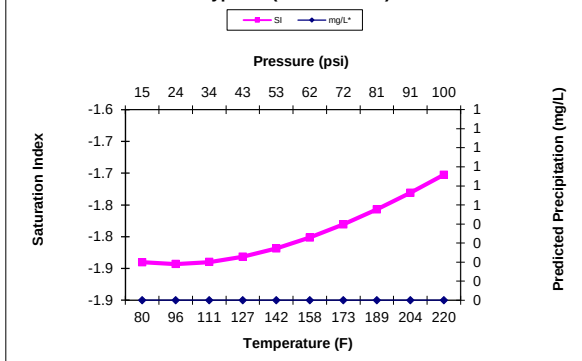
Barite (BaSO4)



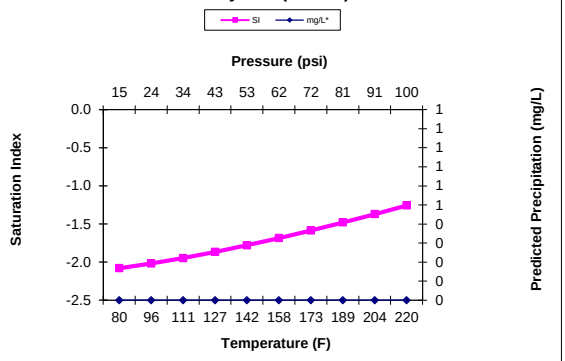
Calcite (CaCO3)



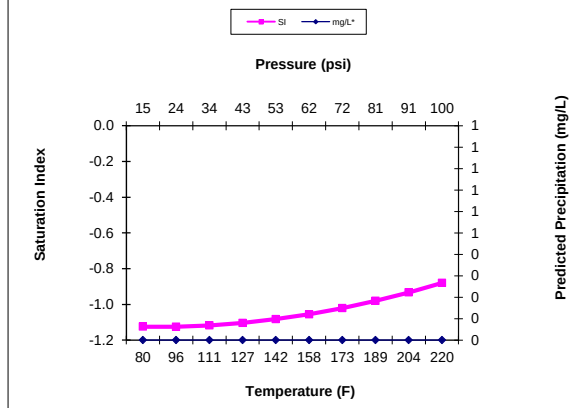
Gypsum (CaSO4·2H2O)



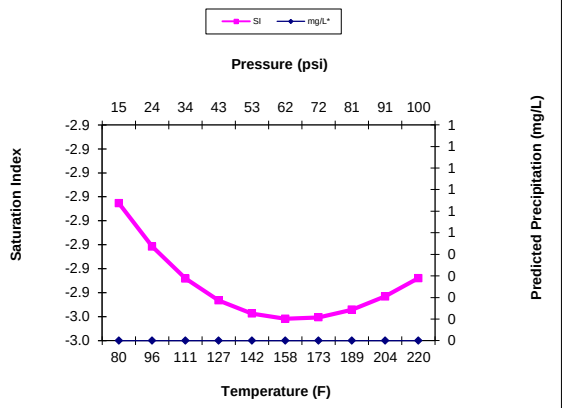
Anhydrite (CaSO4)



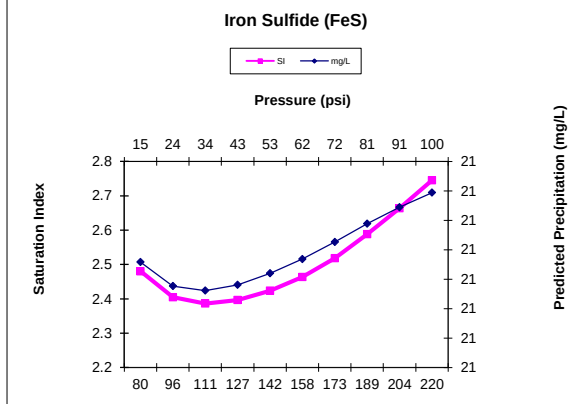
Celestite (SrSO4)



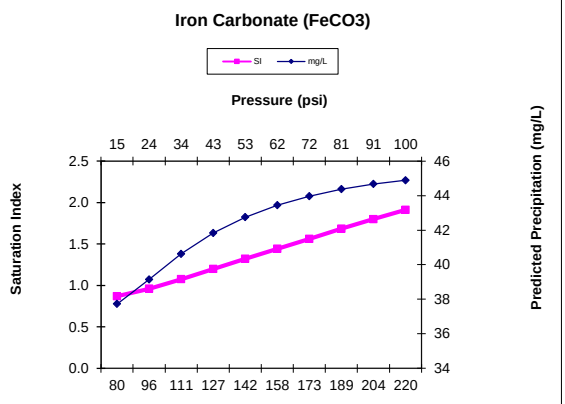
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	32D-24D Separator
District:	Four Corners	**Sample ID:**	201201035740
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 32D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	597.0	9.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	185.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17684
Density/Specific Gravity (g/cm^3):	1.0094
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10000.0	282.1
Sulfate (SO_4^{2-}):	400.0	8.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.03	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6480.0	282.0
Potassium (K^+):	29.0	0.7
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	102.0	5.1
Strontium (Sr^{2+}):	10.0	0.2
Barium (Ba^{2+}):	24.0	0.3
Iron (Fe^{2+}):	33.0	1.2
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	321	N/A

ND = Not Determined

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)**
80°F	15 psi	2.40	14.217	-0.11	0.000	-1.66	0.000	-1.90	0.000
96°F	24 psi	2.27	14.196	-0.07	0.000	-1.67	0.000	-1.84	0.000
111°F	34 psi	2.16	14.173	0.00	0.277	-1.66	0.000	-1.77	0.000
127°F	43 psi	2.06	14.148	0.09	7.175	-1.65	0.000	-1.69	0.000
142°F	53 psi	1.99	14.122	0.19	14.382	-1.64	0.000	-1.60	0.000
158°F	62 psi	1.92	14.097	0.29	21.600	-1.62	0.000	-1.51	0.000
173°F	72 psi	1.87	14.074	0.40	28.951	-1.60	0.000	-1.41	0.000
189°F	81 psi	1.83	14.054	0.52	36.356	-1.58	0.000	-1.30	0.000
204°F	91 psi	1.79	14.037	0.64	43.292	-1.55	0.000	-1.19	0.000
220°F	100 psi	1.77	14.024	0.76	49.736	-1.52	0.000	-1.08	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)**
80°F	15 psi	-1.00	0.000	-2.98	0.000	2.45	4.503	1.16	21.649
96°F	24 psi	-1.00	0.000	-3.00	0.000	2.38	4.499	1.25	22.073
111°F	34 psi	-0.99	0.000	-3.01	0.000	2.36	4.498	1.37	22.513
127°F	43 psi	-0.97	0.000	-3.02	0.000	2.37	4.499	1.49	22.868
142°F	53 psi	-0.95	0.000	-3.03	0.000	2.40	4.501	1.62	23.138
158°F	62 psi	-0.92	0.000	-3.03	0.000	2.45	4.504	1.74	23.338
173°F	72 psi	-0.89	0.000	-3.03	0.000	2.50	4.507	1.86	23.491
189°F	81 psi	-0.85	0.000	-3.02	0.000	2.58	4.510	1.99	23.608
204°F	91 psi	-0.80	0.000	-3.02	0.000	2.65	4.513	2.11	23.692
220°F	100 psi	-0.74	0.000	-3.01	0.000	2.74	4.515	2.22	23.754

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.

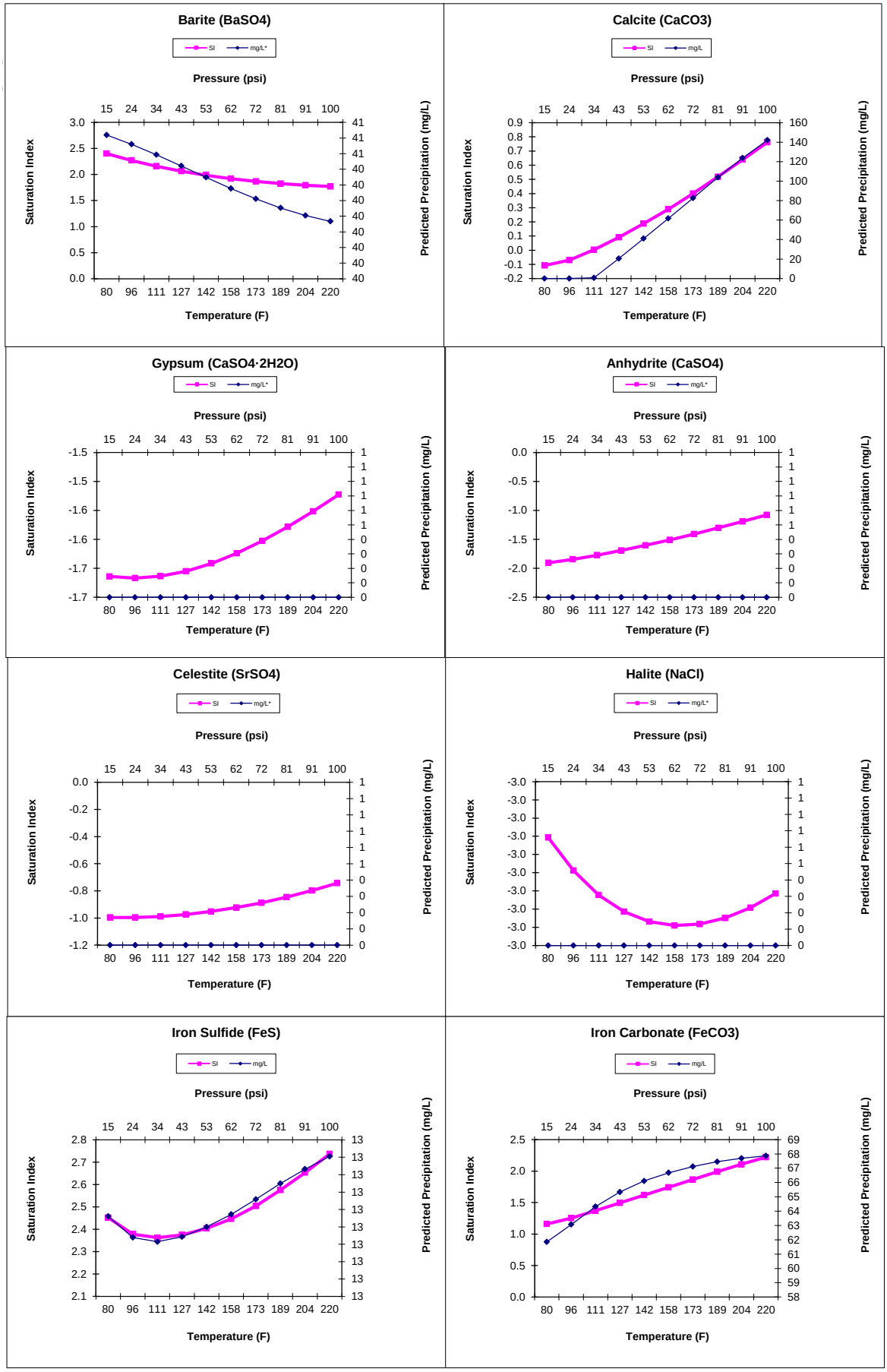
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 32D-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	33C-24D Separator
District:	Four Corners	**Sample ID:**	201201035731
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 33C-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1952.0	32.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	195.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17257
Density/Specific Gravity (g/cm^3):	1.0090
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9200.0	259.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.11

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5962.0	259.4
Potassium (K^+):	20.0	0.5
Magnesium (Mg^{2+}):	3.0	0.2
Calcium (Ca^{2+}):	38.0	1.9
Strontium (Sr^{2+}):	7.0	0.2
Barium (Ba^{2+}):	18.0	0.3
Iron (Fe^{2+}):	7.0	0.3
Manganese (Mn^{2+}):	0.1	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	128	N/A

ND = Not Determined

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)**
80°F	15 psi	1.40	10.151	0.02	1.455	-2.94	0.000	-3.18	0.000
96°F	24 psi	1.27	9.959	0.06	3.640	-2.94	0.000	-3.12	0.000
111°F	34 psi	1.16	9.745	0.13	7.679	-2.94	0.000	-3.05	0.000
127°F	43 psi	1.06	9.519	0.22	11.918	-2.93	0.000	-2.97	0.000
142°F	53 psi	0.99	9.291	0.32	15.829	-2.92	0.000	-2.88	0.000
158°F	62 psi	0.92	9.072	0.42	19.238	-2.90	0.000	-2.78	0.000
173°F	72 psi	0.87	8.872	0.54	22.329	-2.88	0.000	-2.68	0.000
189°F	81 psi	0.83	8.698	0.66	24.857	-2.85	0.000	-2.58	0.000
204°F	91 psi	0.79	8.556	0.78	26.847	-2.82	0.000	-2.46	0.000
220°F	100 psi	0.77	8.448	0.91	28.401	-2.79	0.000	-2.35	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)**
80°F	15 psi	-2.03	0.000	-3.05	0.000	1.63	2.147	1.16	4.724
96°F	24 psi	-2.03	0.000	-3.07	0.000	1.56	2.125	1.25	4.791
111°F	34 psi	-2.02	0.000	-3.08	0.000	1.54	2.121	1.37	4.861
127°F	43 psi	-2.01	0.000	-3.09	0.000	1.56	2.125	1.50	4.917
142°F	53 psi	-1.98	0.000	-3.09	0.000	1.59	2.135	1.62	4.959
158°F	62 psi	-1.95	0.000	-3.10	0.000	1.63	2.147	1.75	4.990
173°F	72 psi	-1.92	0.000	-3.10	0.000	1.70	2.163	1.88	5.014
189°F	81 psi	-1.88	0.000	-3.09	0.000	1.77	2.178	2.00	5.031
204°F	91 psi	-1.83	0.000	-3.09	0.000	1.85	2.193	2.12	5.044
220°F	100 psi	-1.77	0.000	-3.08	0.000	1.94	2.206	2.24	5.053

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.

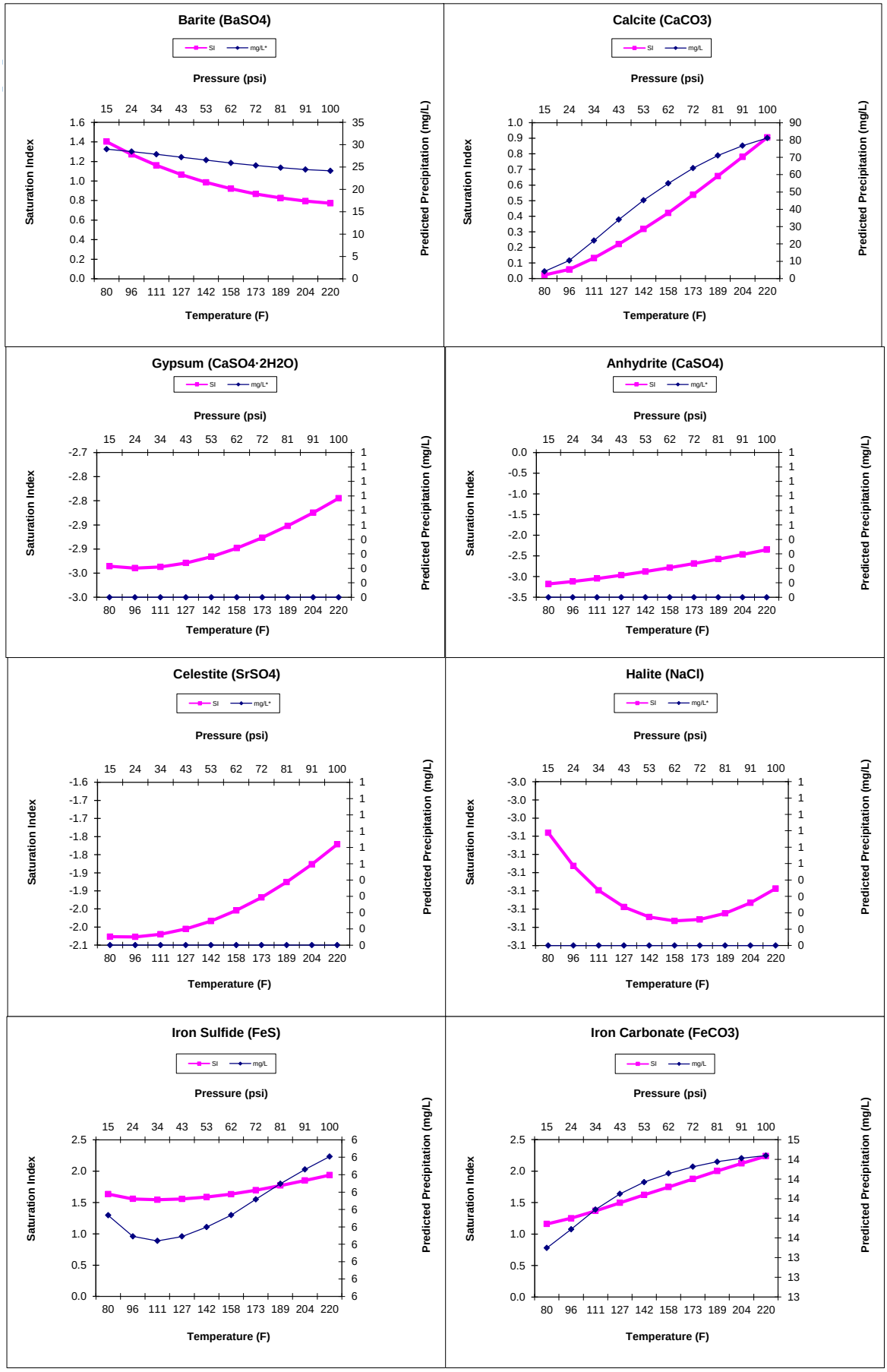
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 33C-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	33C-7D Separator
District:	Four Corners	**Sample ID:**	201201036483
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 33C-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	457.0	7.5
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	365.0
aqueous H_2S (ppm):	4.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	36549
Density/Specific Gravity (g/cm^3):	1.0224
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	21500.0	606.5
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	13932.0	606.3
Potassium (K^+):	41.8	1.1
Magnesium (Mg^{2+}):	39.0	3.2
Calcium (Ca^{2+}):	312.5	15.6
Strontium (Sr^{2+}):	35.7	0.8
Barium (Ba^{2+}):	130.3	1.9
Iron (Fe^{2+}):	49.6	1.8
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1077	N/A

ND = Not Determined

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)**
80°F	15 psi	1.91	41.405	-0.12	0.000	-2.36	0.000	-2.60	0.000
96°F	24 psi	1.79	41.041	-0.08	0.000	-2.37	0.000	-2.53	0.000
111°F	34 psi	1.68	40.633	-0.01	0.000	-2.36	0.000	-2.46	0.000
127°F	43 psi	1.58	40.197	0.07	6.800	-2.36	0.000	-2.38	0.000
142°F	53 psi	1.50	39.750	0.16	15.220	-2.35	0.000	-2.30	0.000
158°F	62 psi	1.43	39.308	0.26	23.632	-2.33	0.000	-2.21	0.000
173°F	72 psi	1.37	38.888	0.36	32.253	-2.32	0.000	-2.11	0.000
189°F	81 psi	1.32	38.502	0.47	40.995	-2.30	0.000	-2.01	0.000
204°F	91 psi	1.28	38.160	0.58	49.253	-2.28	0.000	-1.91	0.000
220°F	100 psi	1.25	37.867	0.70	57.031	-2.26	0.000	-1.80	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)**
80°F	15 psi	-1.62	0.000	-2.36	0.000	2.25	6.971	0.80	26.627
96°F	24 psi	-1.62	0.000	-2.37	0.000	2.18	6.960	0.88	28.097
111°F	34 psi	-1.62	0.000	-2.38	0.000	2.17	6.959	0.99	29.702
127°F	43 psi	-1.61	0.000	-2.39	0.000	2.18	6.962	1.11	31.063
142°F	53 psi	-1.59	0.000	-2.40	0.000	2.21	6.968	1.23	32.139
158°F	62 psi	-1.57	0.000	-2.40	0.000	2.26	6.975	1.34	32.966
173°F	72 psi	-1.55	0.000	-2.40	0.000	2.31	6.983	1.45	33.622
189°F	81 psi	-1.51	0.000	-2.40	0.000	2.38	6.991	1.56	34.142
204°F	91 psi	-1.48	0.000	-2.40	0.000	2.45	6.998	1.67	34.530
220°F	100 psi	-1.44	0.000	-2.39	0.000	2.53	7.005	1.77	34.822

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.

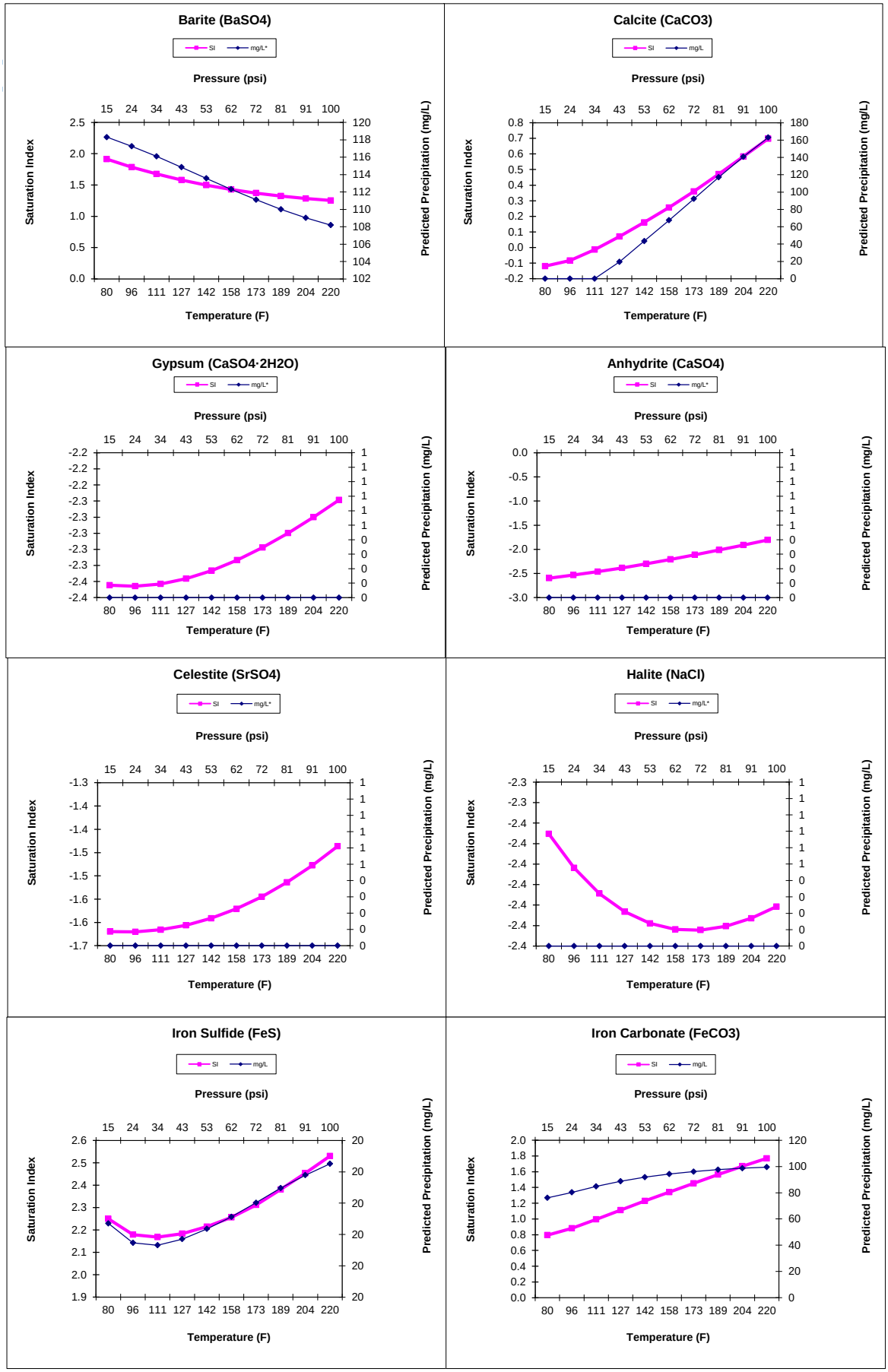
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 33C-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	33D-24D Separator
District:	Four Corners	**Sample ID:**	201201035732
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 33D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	780.0	12.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	3.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	18469
Density/Specific Gravity (g/cm^3):	1.0099
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10600.0	299.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6869.0	298.9
Potassium (K^+):	38.0	1.0
Magnesium (Mg^{2+}):	4.0	0.3
Calcium (Ca^{2+}):	52.0	2.6
Strontium (Sr^{2+}):	12.0	0.3
Barium (Ba^{2+}):	38.0	0.6
Iron (Fe^{2+}):	26.0	0.9
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	188	N/A

ND = Not Determined

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)**
80°F	15 psi	1.69	21.666	-0.28	0.000	-2.86	0.000	-3.10	0.000
96°F	24 psi	1.56	21.355	-0.24	0.000	-2.86	0.000	-3.04	0.000
111°F	34 psi	1.45	21.015	-0.17	0.000	-2.86	0.000	-2.97	0.000
127°F	43 psi	1.35	20.660	-0.08	0.000	-2.85	0.000	-2.89	0.000
142°F	53 psi	1.28	20.308	0.01	0.876	-2.84	0.000	-2.80	0.000
158°F	62 psi	1.21	19.974	0.11	7.063	-2.82	0.000	-2.71	0.000
173°F	72 psi	1.16	19.670	0.23	13.118	-2.80	0.000	-2.61	0.000
189°F	81 psi	1.11	19.408	0.34	18.841	-2.78	0.000	-2.50	0.000
204°F	91 psi	1.08	19.193	0.47	23.855	-2.75	0.000	-2.39	0.000
220°F	100 psi	1.06	19.028	0.59	28.174	-2.72	0.000	-2.28	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)**
80°F	15 psi	-1.82	0.000	-2.93	0.000	2.44	5.249	1.19	17.386
96°F	24 psi	-1.82	0.000	-2.95	0.000	2.36	5.242	1.28	17.663
111°F	34 psi	-1.82	0.000	-2.96	0.000	2.35	5.241	1.40	17.949
127°F	43 psi	-1.80	0.000	-2.97	0.000	2.36	5.243	1.52	18.179
142°F	53 psi	-1.78	0.000	-2.98	0.000	2.39	5.245	1.65	18.353
158°F	62 psi	-1.75	0.000	-2.98	0.000	2.43	5.249	1.77	18.481
173°F	72 psi	-1.72	0.000	-2.98	0.000	2.49	5.253	1.89	18.579
189°F	81 psi	-1.68	0.000	-2.98	0.000	2.56	5.258	2.02	18.653
204°F	91 psi	-1.63	0.000	-2.97	0.000	2.64	5.262	2.14	18.707
220°F	100 psi	-1.58	0.000	-2.96	0.000	2.72	5.265	2.25	18.746

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.

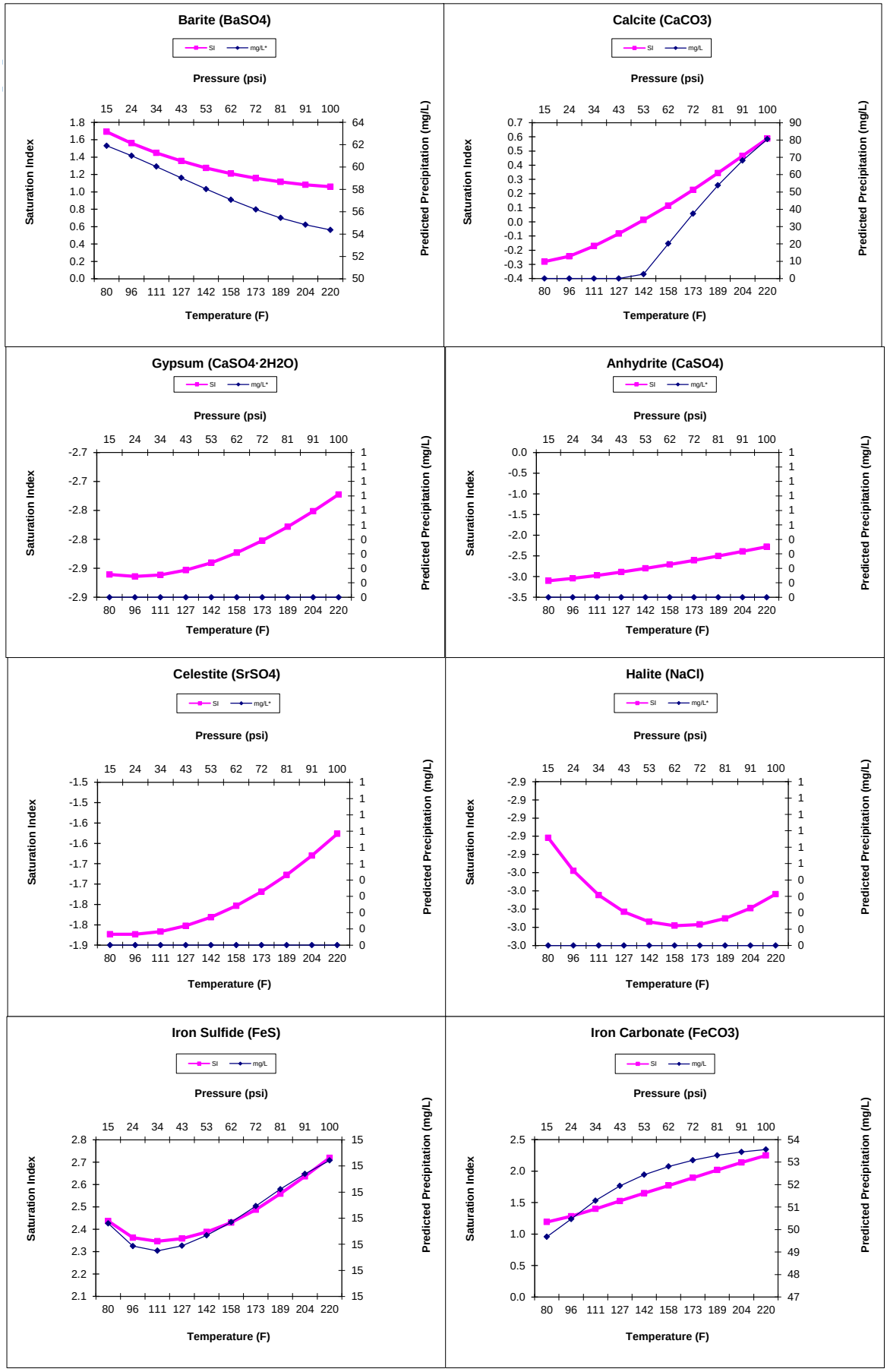
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 33D-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	34A-30D Separator
District:	Four Corners	**Sample ID:**	201201037401
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 34A-30D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	250.0
aqueous H_2S (ppm):	4.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	9777
Density/Specific Gravity (g/cm^3):	1.0041
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	5400.0	152.3
Sulfate (SO_4^{2-}):	250.0	5.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	3499.0	152.3
Potassium (K^+):	27.8	0.7
Magnesium (Mg^{2+}):	19.1	1.6
Calcium (Ca^{2+}):	150.9	7.5
Strontium (Sr^{2+}):	15.1	0.3
Barium (Ba^{2+}):	19.4	0.3
Iron (Fe^{2+}):	29.3	1.1
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	487	N/A

ND = Not Determined

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)**
80°F	15 psi	2.33	11.494	-0.87	0.000	-1.50	0.000	-1.75	0.000
96°F	24 psi	2.20	11.474	-0.83	0.000	-1.50	0.000	-1.68	0.000
111°F	34 psi	2.09	11.452	-0.76	0.000	-1.50	0.000	-1.61	0.000
127°F	43 psi	2.00	11.428	-0.67	0.000	-1.49	0.000	-1.53	0.000
142°F	53 psi	1.92	11.405	-0.57	0.000	-1.47	0.000	-1.44	0.000
158°F	62 psi	1.86	11.382	-0.46	0.000	-1.45	0.000	-1.34	0.000
173°F	72 psi	1.81	11.362	-0.34	0.000	-1.43	0.000	-1.23	0.000
189°F	81 psi	1.77	11.345	-0.22	0.000	-1.40	0.000	-1.12	0.000
204°F	91 psi	1.74	11.331	-0.09	0.000	-1.37	0.000	-1.01	0.000
220°F	100 psi	1.73	11.322	0.04	3.044	-1.33	0.000	-0.89	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)**
80°F	15 psi	-0.82	0.000	-3.48	0.000	1.29	7.715	0.18	5.767
96°F	24 psi	-0.82	0.000	-3.49	0.000	1.24	7.596	0.27	8.120
111°F	34 psi	-0.81	0.000	-3.51	0.000	1.25	7.633	0.39	10.806
127°F	43 psi	-0.79	0.000	-3.52	0.000	1.30	7.738	0.52	13.151
142°F	53 psi	-0.76	0.000	-3.52	0.000	1.36	7.869	0.65	15.039
158°F	62 psi	-0.73	0.000	-3.52	0.000	1.44	8.006	0.78	16.507
173°F	72 psi	-0.69	0.000	-3.52	0.000	1.54	8.158	0.92	17.716
189°F	81 psi	-0.64	0.000	-3.52	0.000	1.65	8.286	1.05	18.607
204°F	91 psi	-0.58	0.000	-3.51	0.000	1.76	8.392	1.18	19.263
220°F	100 psi	-0.52	0.000	-3.50	0.000	1.88	8.478	1.30	19.748

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.

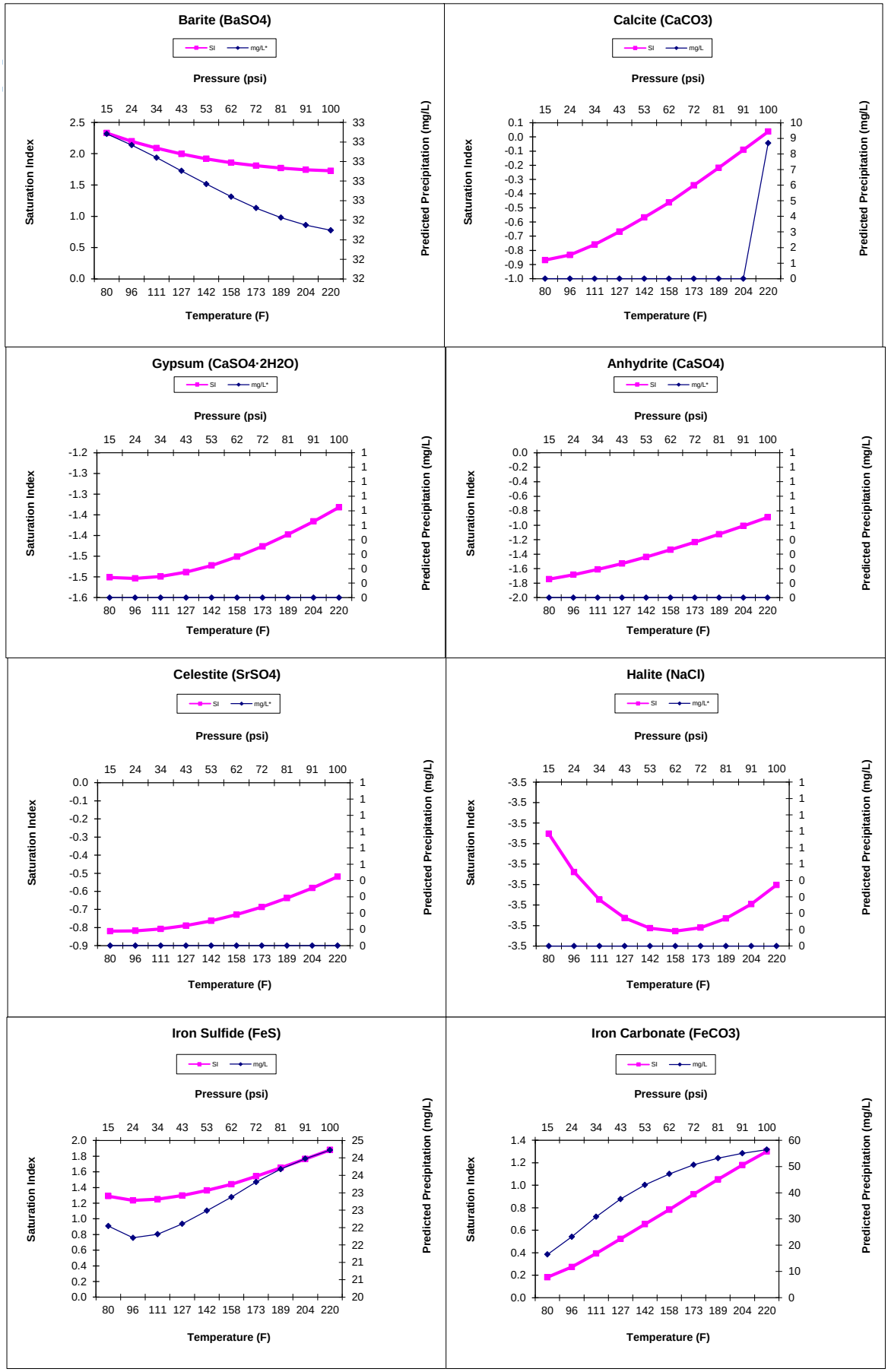
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 34A-30D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	34A-7D Separator
District:	Four Corners	**Sample ID:**	201201036478
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 34A-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	585.0	9.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	350.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	71151
Density/Specific Gravity (g/cm³):	1.0448
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	41800.0	1179.1
Sulfate (SO_4^{2-}):	1100.0	22.9
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	27086.0	1178.7
Potassium (K^+):	37.6	1.0
Magnesium (Mg^{2+}):	24.9	2.0
Calcium (Ca^{2+}):	270.3	13.5
Strontium (Sr^{2+}):	24.7	0.6
Barium (Ba^{2+}):	90.1	1.3
Iron (Fe^{2+}):	130.8	4.7
Manganese (Mn^{2+}):	1.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	872	N/A

ND = Not Determined

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)**
80°F	15 psi	2.80	53.507	-0.27	0.000	-1.33	0.000	-1.54	0.000
96°F	24 psi	2.68	53.477	-0.23	0.000	-1.32	0.000	-1.47	0.000
111°F	34 psi	2.57	53.443	-0.16	0.000	-1.32	0.000	-1.40	0.000
127°F	43 psi	2.47	53.405	-0.08	0.000	-1.32	0.000	-1.33	0.000
142°F	53 psi	2.39	53.364	0.01	1.129	-1.31	0.000	-1.24	0.000
158°F	62 psi	2.31	53.321	0.10	11.815	-1.30	0.000	-1.16	0.000
173°F	72 psi	2.25	53.277	0.20	22.862	-1.29	0.000	-1.07	0.000
189°F	81 psi	2.19	53.233	0.30	33.897	-1.28	0.000	-0.98	0.000
204°F	91 psi	2.15	53.190	0.41	44.304	-1.27	0.000	-0.88	0.000
220°F	100 psi	2.10	53.150	0.51	54.127	-1.26	0.000	-0.79	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)**
80°F	15 psi	-0.68	0.000	-1.79	0.000	1.97	2.834	1.10	72.387
96°F	24 psi	-0.68	0.000	-1.80	0.000	1.89	2.827	1.18	75.290
111°F	34 psi	-0.67	0.000	-1.81	0.000	1.88	2.826	1.29	78.630
127°F	43 psi	-0.67	0.000	-1.82	0.000	1.89	2.828	1.40	81.593
142°F	53 psi	-0.66	0.000	-1.83	0.000	1.92	2.830	1.51	84.038
158°F	62 psi	-0.65	0.000	-1.83	0.000	1.96	2.833	1.61	85.997
173°F	72 psi	-0.63	0.000	-1.83	0.000	2.01	2.837	1.71	87.627
189°F	81 psi	-0.61	0.000	-1.83	0.000	2.07	2.841	1.81	88.973
204°F	91 psi	-0.59	0.000	-1.83	0.000	2.13	2.845	1.91	90.014
220°F	100 psi	-0.56	0.000	-1.82	0.000	2.19	2.848	1.99	90.823

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.

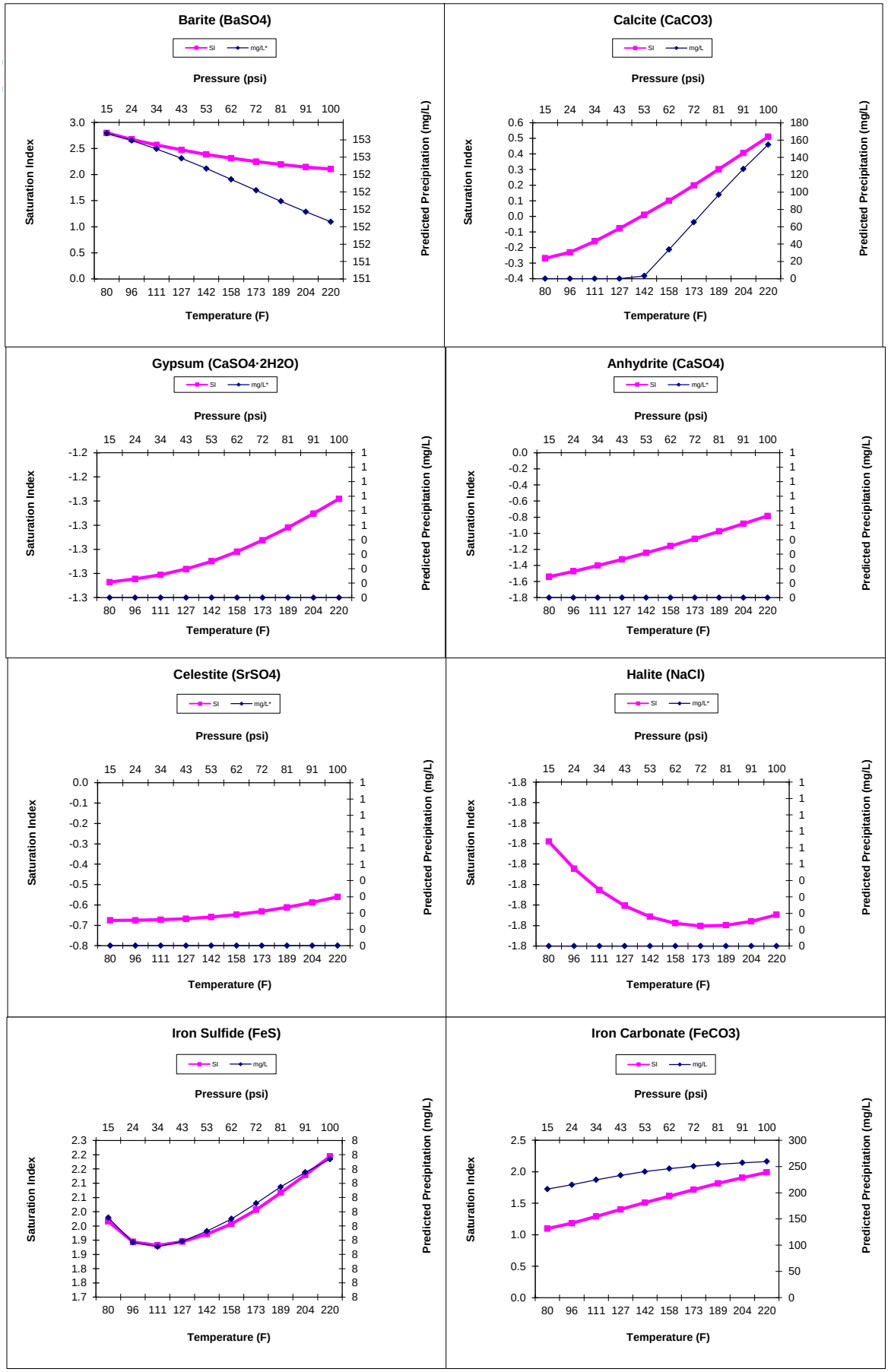
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 34A-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	34B-30D Separator
District:	Four Corners	**Sample ID:**	201201037402
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 34B-30D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	120.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	9269
Density/Specific Gravity (g/cm³):	1.0038
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	5100.0	143.9
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.96

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	3305.0	143.8
Potassium (K^+):	37.2	1.0
Magnesium (Mg^{2+}):	22.4	1.8
Calcium (Ca^{2+}):	209.8	10.5
Strontium (Sr^{2+}):	19.4	0.4
Barium (Ba^{2+}):	27.7	0.4
Iron (Fe^{2+}):	30.7	1.1
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	659	N/A

ND = Not Determined

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)**
80°F	15 psi	2.28	16.383	-0.42	0.000	-1.57	0.000	-1.81	0.000
96°F	24 psi	2.15	16.348	-0.38	0.000	-1.57	0.000	-1.75	0.000
111°F	34 psi	2.04	16.309	-0.30	0.000	-1.57	0.000	-1.68	0.000
127°F	43 psi	1.94	16.268	-0.21	0.000	-1.55	0.000	-1.60	0.000
142°F	53 psi	1.87	16.227	-0.11	0.000	-1.54	0.000	-1.50	0.000
158°F	62 psi	1.81	16.188	-0.01	0.000	-1.52	0.000	-1.41	0.000
173°F	72 psi	1.76	16.153	0.11	9.108	-1.49	0.000	-1.30	0.000
189°F	81 psi	1.72	16.123	0.24	18.522	-1.46	0.000	-1.19	0.000
204°F	91 psi	1.69	16.100	0.36	27.330	-1.43	0.000	-1.08	0.000
220°F	100 psi	1.67	16.084	0.49	35.538	-1.40	0.000	-0.96	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)**
80°F	15 psi	-0.92	0.000	-3.52	0.000	1.53	3.800	0.51	13.369
96°F	24 psi	-0.92	0.000	-3.54	0.000	1.48	3.778	0.61	14.865
111°F	34 psi	-0.91	0.000	-3.55	0.000	1.49	3.783	0.73	16.494
127°F	43 psi	-0.89	0.000	-3.56	0.000	1.53	3.800	0.86	17.869
142°F	53 psi	-0.86	0.000	-3.57	0.000	1.59	3.821	0.99	18.947
158°F	62 psi	-0.83	0.000	-3.57	0.000	1.66	3.843	1.12	19.764
173°F	72 psi	-0.79	0.000	-3.57	0.000	1.75	3.866	1.25	20.405
189°F	81 psi	-0.74	0.000	-3.56	0.000	1.85	3.887	1.38	20.887
204°F	91 psi	-0.68	0.000	-3.56	0.000	1.95	3.905	1.51	21.237
220°F	100 psi	-0.62	0.000	-3.55	0.000	2.06	3.919	1.64	21.492

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.

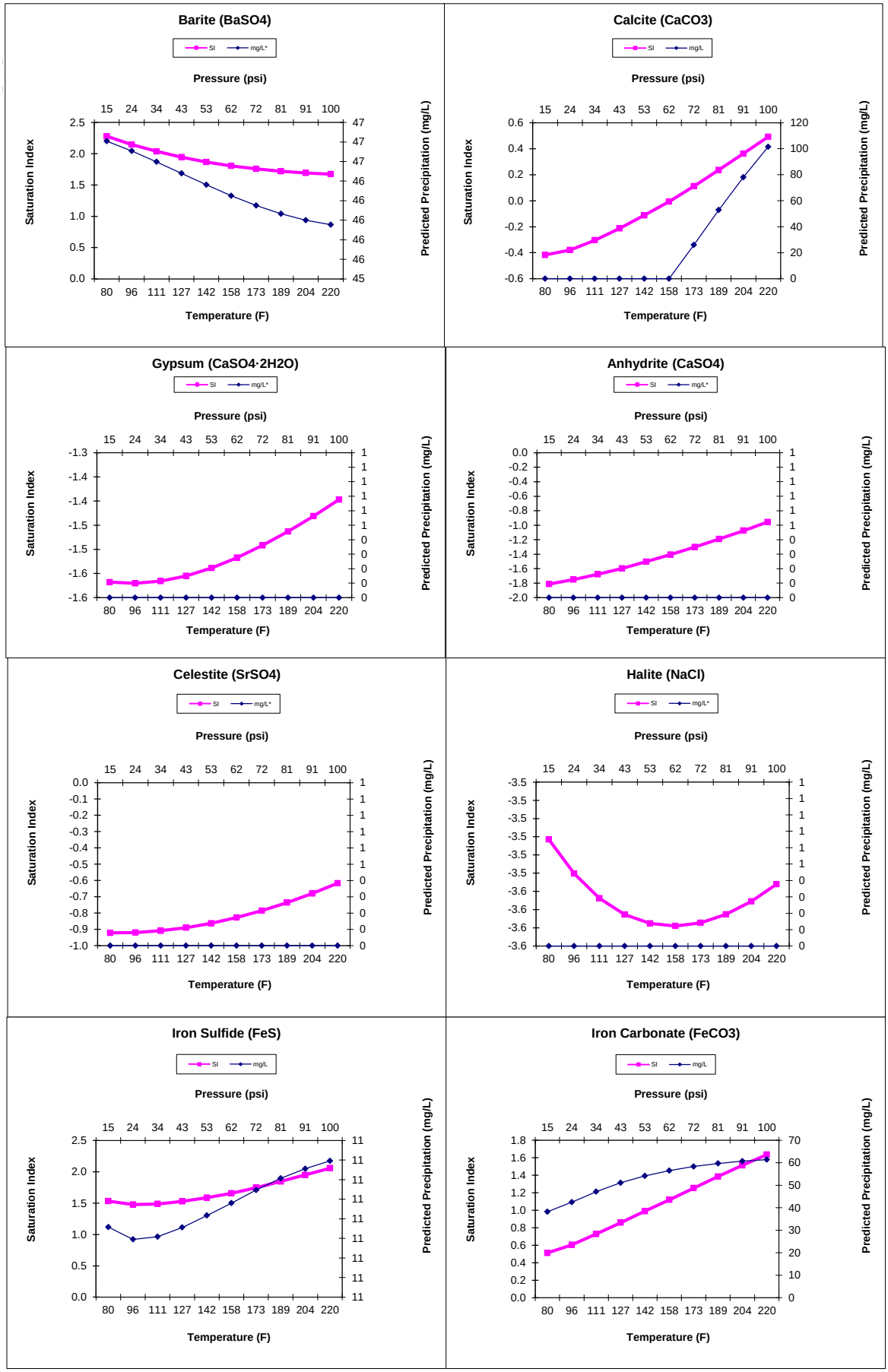
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 34B-30D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	Puckett 34C-7D Separator
District:	Four Corners	**Sample ID:**	201201036479
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, Puckett 34C-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1098.0	18.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	90.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	31889
Density/Specific Gravity (g/cm³):	1.0190
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	18400.0	519.0
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	11923.0	518.8
Potassium (K^+):	34.3	0.9
Magnesium (Mg^{2+}):	17.7	1.5
Calcium (Ca^{2+}):	157.4	7.9
Strontium (Sr^{2+}):	13.8	0.3
Barium (Ba^{2+}):	9.9	0.1
Iron (Fe^{2+}):	34.9	1.3
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	489	N/A

ND = Not Determined

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)**
80°F	15 psi	1.46	5.686	0.29	35.960	-1.99	0.000	-2.22	0.000
96°F	24 psi	1.34	5.614	0.33	40.100	-1.99	0.000	-2.16	0.000
111°F	34 psi	1.22	5.532	0.40	47.874	-1.99	0.000	-2.09	0.000
127°F	43 psi	1.13	5.442	0.49	56.687	-1.98	0.000	-2.01	0.000
142°F	53 psi	1.05	5.349	0.58	65.646	-1.97	0.000	-1.93	0.000
158°F	62 psi	0.98	5.256	0.68	74.354	-1.96	0.000	-1.83	0.000
173°F	72 psi	0.92	5.167	0.78	82.967	-1.94	0.000	-1.74	0.000
189°F	81 psi	0.87	5.084	0.90	91.359	-1.92	0.000	-1.64	0.000
204°F	91 psi	0.84	5.011	1.01	98.907	-1.90	0.000	-1.53	0.000
220°F	100 psi	0.81	4.948	1.13	105.619	-1.88	0.000	-1.42	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)**
80°F	15 psi	-1.37	0.000	-2.48	0.000	1.98	1.463	1.40	24.106
96°F	24 psi	-1.37	0.000	-2.50	0.000	1.90	1.460	1.49	24.333
111°F	34 psi	-1.37	0.000	-2.51	0.000	1.88	1.459	1.60	24.569
127°F	43 psi	-1.36	0.000	-2.52	0.000	1.89	1.459	1.72	24.758
142°F	53 psi	-1.34	0.000	-2.53	0.000	1.91	1.460	1.84	24.901
158°F	62 psi	-1.32	0.000	-2.53	0.000	1.94	1.461	1.96	25.007
173°F	72 psi	-1.29	0.000	-2.53	0.000	1.99	1.463	2.07	25.089
189°F	81 psi	-1.26	0.000	-2.53	0.000	2.05	1.466	2.19	25.151
204°F	91 psi	-1.22	0.000	-2.53	0.000	2.12	1.468	2.29	25.197
220°F	100 psi	-1.18	0.000	-2.52	0.000	2.19	1.470	2.40	25.230

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.

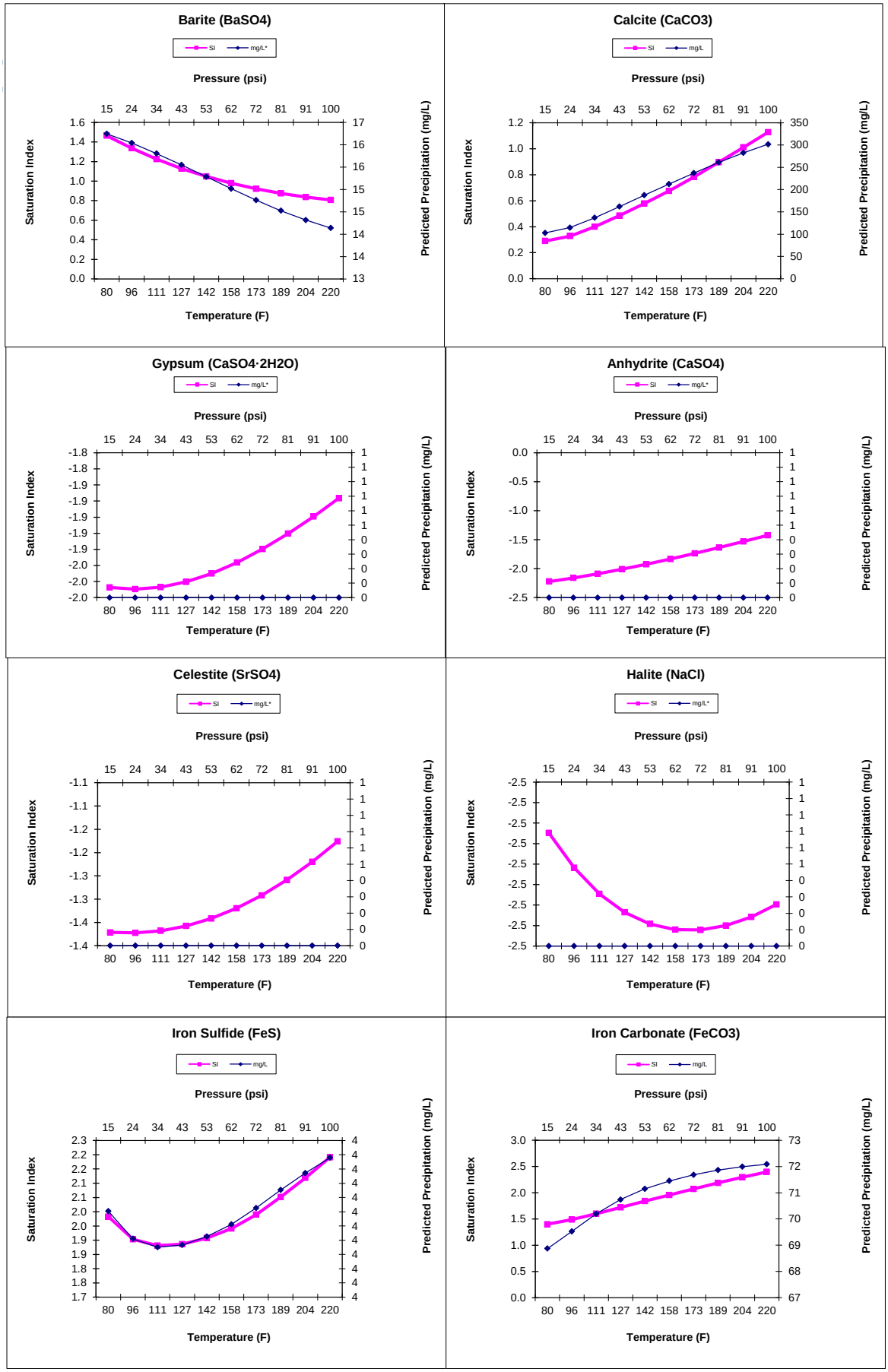
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, Puckett 34C-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	34D-30D Separator
District:	Four Corners	**Sample ID:**	201201037403
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 34D-30D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	300.0
aqueous H_2S (ppm):	4.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	12368
Density/Specific Gravity (g/cm^3):	1.0059
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	6900.0	194.6
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	4471.0	194.6
Potassium (K^+):	37.2	1.0
Magnesium (Mg^{2+}):	22.4	1.8
Calcium (Ca^{2+}):	209.8	10.5
Strontium (Sr^{2+}):	19.4	0.4
Barium (Ba^{2+}):	27.7	0.4
Iron (Fe^{2+}):	30.7	1.1
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	659	N/A

ND = Not Determined

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)**
80°F	15 psi	2.00	16.278	-0.38	0.000	-1.83	0.000	-2.08	0.000
96°F	24 psi	1.87	16.207	-0.34	0.000	-1.84	0.000	-2.02	0.000
111°F	34 psi	1.76	16.127	-0.27	0.000	-1.83	0.000	-1.94	0.000
127°F	43 psi	1.66	16.043	-0.18	0.000	-1.82	0.000	-1.86	0.000
142°F	53 psi	1.59	15.957	-0.08	0.000	-1.81	0.000	-1.77	0.000
158°F	62 psi	1.52	15.876	0.02	2.661	-1.79	0.000	-1.67	0.000
173°F	72 psi	1.47	15.801	0.14	15.902	-1.76	0.000	-1.57	0.000
189°F	81 psi	1.43	15.738	0.26	28.465	-1.74	0.000	-1.46	0.000
204°F	91 psi	1.40	15.687	0.39	40.241	-1.71	0.000	-1.35	0.000
220°F	100 psi	1.38	15.649	0.52	51.255	-1.67	0.000	-1.23	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)**
80°F	15 psi	-1.19	0.000	-3.28	0.000	1.66	7.841	0.56	14.857
96°F	24 psi	-1.19	0.000	-3.30	0.000	1.60	7.789	0.65	16.140
111°F	34 psi	-1.18	0.000	-3.31	0.000	1.61	7.799	0.77	17.535
127°F	43 psi	-1.16	0.000	-3.32	0.000	1.65	7.837	0.90	18.693
142°F	53 psi	-1.14	0.000	-3.32	0.000	1.71	7.886	1.02	19.584
158°F	62 psi	-1.10	0.000	-3.33	0.000	1.78	7.937	1.15	20.250
173°F	72 psi	-1.07	0.000	-3.33	0.000	1.87	7.993	1.29	20.779
189°F	81 psi	-1.02	0.000	-3.32	0.000	1.97	8.042	1.41	21.163
204°F	91 psi	-0.97	0.000	-3.31	0.000	2.07	8.082	1.54	21.441
220°F	100 psi	-0.91	0.000	-3.31	0.000	2.18	8.115	1.66	21.643

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.

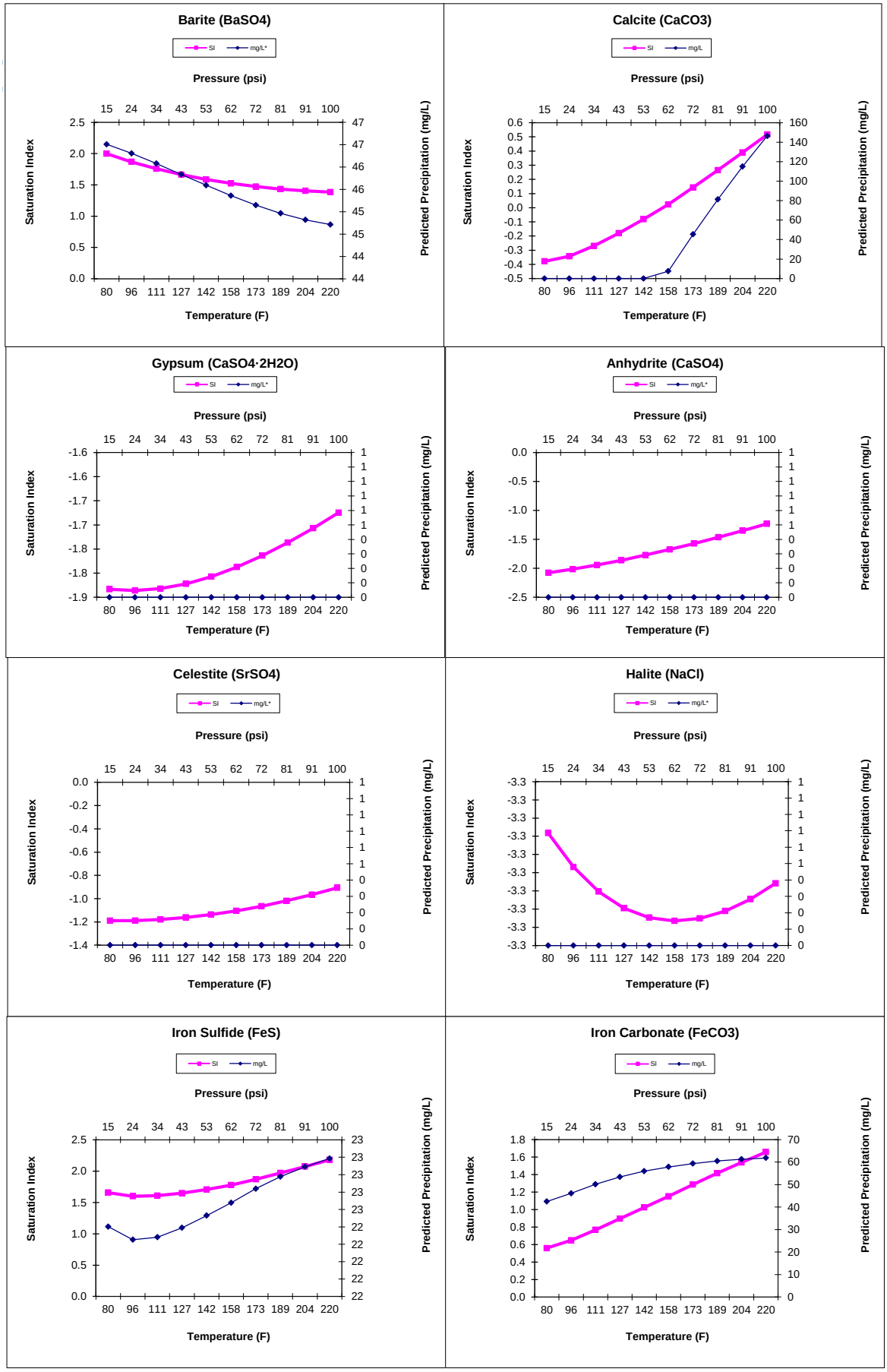
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 34D-30D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	34D-7D Separator
District:	Four Corners	**Sample ID:**	201201036480
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 34D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	1200.0	19.7
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	28064
Density/Specific Gravity (g/cm³):	1.0164
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	16000.0	451.3
Sulfate (SO_4^{2-}):	250.0	5.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	10368.0	451.2
Potassium (K^+):	33.1	0.8
Magnesium (Mg^{2+}):	16.7	1.4
Calcium (Ca^{2+}):	157.3	7.8
Strontium (Sr^{2+}):	11.6	0.3
Barium (Ba^{2+}):	4.9	0.1
Iron (Fe^{2+}):	21.8	0.8
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	479	N/A

ND = Not Determined

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)**
80°F	15 psi	1.31	2.765	0.54	60.864	-1.84	0.000	-2.08	0.000
96°F	24 psi	1.18	2.715	0.58	64.378	-1.84	0.000	-2.01	0.000
111°F	34 psi	1.07	2.658	0.65	70.916	-1.84	0.000	-1.94	0.000
127°F	43 psi	0.97	2.597	0.74	78.271	-1.83	0.000	-1.86	0.000
142°F	53 psi	0.89	2.533	0.83	85.669	-1.82	0.000	-1.78	0.000
158°F	62 psi	0.83	2.469	0.93	92.760	-1.81	0.000	-1.69	0.000
173°F	72 psi	0.77	2.409	1.03	99.581	-1.79	0.000	-1.59	0.000
189°F	81 psi	0.72	2.354	1.15	106.145	-1.77	0.000	-1.49	0.000
204°F	91 psi	0.69	2.305	1.26	111.895	-1.75	0.000	-1.38	0.000
220°F	100 psi	0.66	2.265	1.38	116.857	-1.72	0.000	-1.27	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)**
80°F	15 psi	-1.30	0.000	-2.60	0.000	2.06	1.313	1.46	15.188
96°F	24 psi	-1.30	0.000	-2.62	0.000	1.97	1.310	1.55	15.306
111°F	34 psi	-1.30	0.000	-2.63	0.000	1.94	1.309	1.66	15.426
127°F	43 psi	-1.29	0.000	-2.64	0.000	1.94	1.308	1.78	15.522
142°F	53 psi	-1.27	0.000	-2.64	0.000	1.95	1.309	1.90	15.594
158°F	62 psi	-1.25	0.000	-2.65	0.000	1.98	1.310	2.02	15.648
173°F	72 psi	-1.22	0.000	-2.65	0.000	2.02	1.312	2.14	15.689
189°F	81 psi	-1.18	0.000	-2.65	0.000	2.08	1.313	2.25	15.720
204°F	91 psi	-1.14	0.000	-2.64	0.000	2.14	1.315	2.36	15.743
220°F	100 psi	-1.09	0.000	-2.63	0.000	2.21	1.317	2.46	15.760

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.

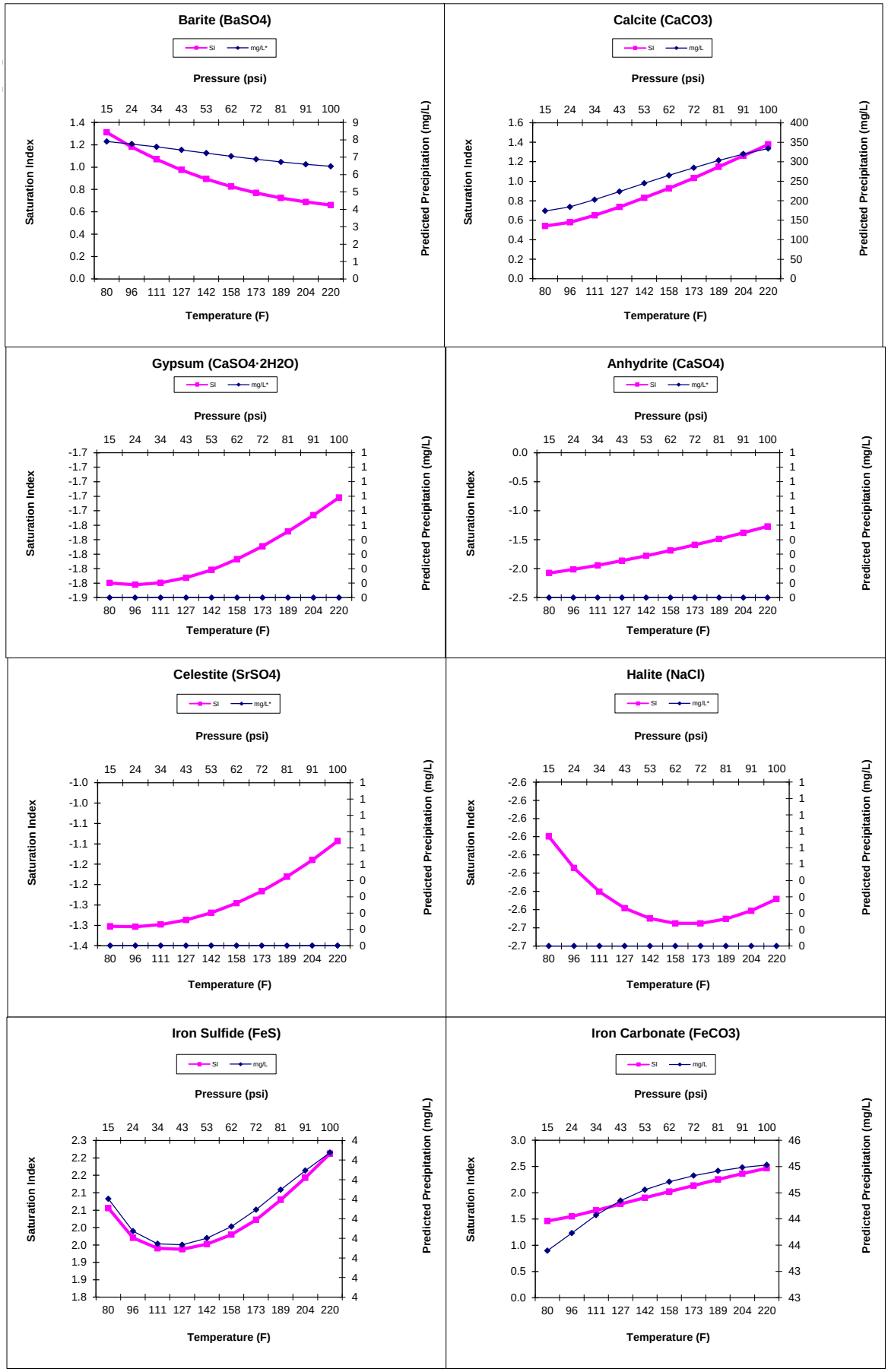
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 34D-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41-36 Separator
District:	Four Corners	**Sample ID:**	201201036520
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 41-36 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	280.0	4.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	610.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19623
Density/Specific Gravity (g/cm³):	1.0108
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11600.0	327.2
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	7517.0	327.1
Potassium (K^+):	10.3	0.3
Magnesium (Mg^{2+}):	6.2	0.5
Calcium (Ca^{2+}):	52.7	2.6
Strontium (Sr^{2+}):	7.3	0.2
Barium (Ba^{2+}):	17.7	0.3
Iron (Fe^{2+}):	31.6	1.1
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	178	N/A

ND = Not Determined

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)**
80°F	15 psi	1.63	10.232	-1.74	0.000	-2.59	0.000	-2.83	0.000
96°F	24 psi	1.50	10.135	-1.70	0.000	-2.59	0.000	-2.77	0.000
111°F	34 psi	1.39	10.025	-1.63	0.000	-2.59	0.000	-2.70	0.000
127°F	43 psi	1.30	9.908	-1.54	0.000	-2.58	0.000	-2.62	0.000
142°F	53 psi	1.22	9.788	-1.44	0.000	-2.57	0.000	-2.53	0.000
158°F	62 psi	1.15	9.671	-1.34	0.000	-2.55	0.000	-2.44	0.000
173°F	72 psi	1.10	9.562	-1.22	0.000	-2.53	0.000	-2.34	0.000
189°F	81 psi	1.05	9.466	-1.10	0.000	-2.51	0.000	-2.23	0.000
204°F	91 psi	1.02	9.385	-0.98	0.000	-2.48	0.000	-2.12	0.000
220°F	100 psi	1.00	9.321	-0.85	0.000	-2.45	0.000	-2.01	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)**
80°F	15 psi	-1.76	0.000	-2.86	0.000	-9.70	0.000	-0.23	0.000
96°F	24 psi	-1.76	0.000	-2.87	0.000	-9.76	0.000	-0.14	0.000
111°F	34 psi	-1.75	0.000	-2.89	0.000	-9.75	0.000	-0.02	0.000
127°F	43 psi	-1.74	0.000	-2.90	0.000	-9.70	0.000	0.10	3.375
142°F	53 psi	-1.72	0.000	-2.90	0.000	-9.64	0.000	0.23	6.959
158°F	62 psi	-1.69	0.000	-2.91	0.000	-9.56	0.000	0.35	9.953
173°F	72 psi	-1.66	0.000	-2.90	0.000	-9.46	0.000	0.48	12.632
189°F	81 psi	-1.62	0.000	-2.90	0.000	-9.36	0.000	0.61	14.750
204°F	91 psi	-1.57	0.000	-2.90	0.000	-9.25	0.000	0.72	16.417
220°F	100 psi	-1.52	0.000	-2.89	0.000	-9.14	0.000	0.84	17.725

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.

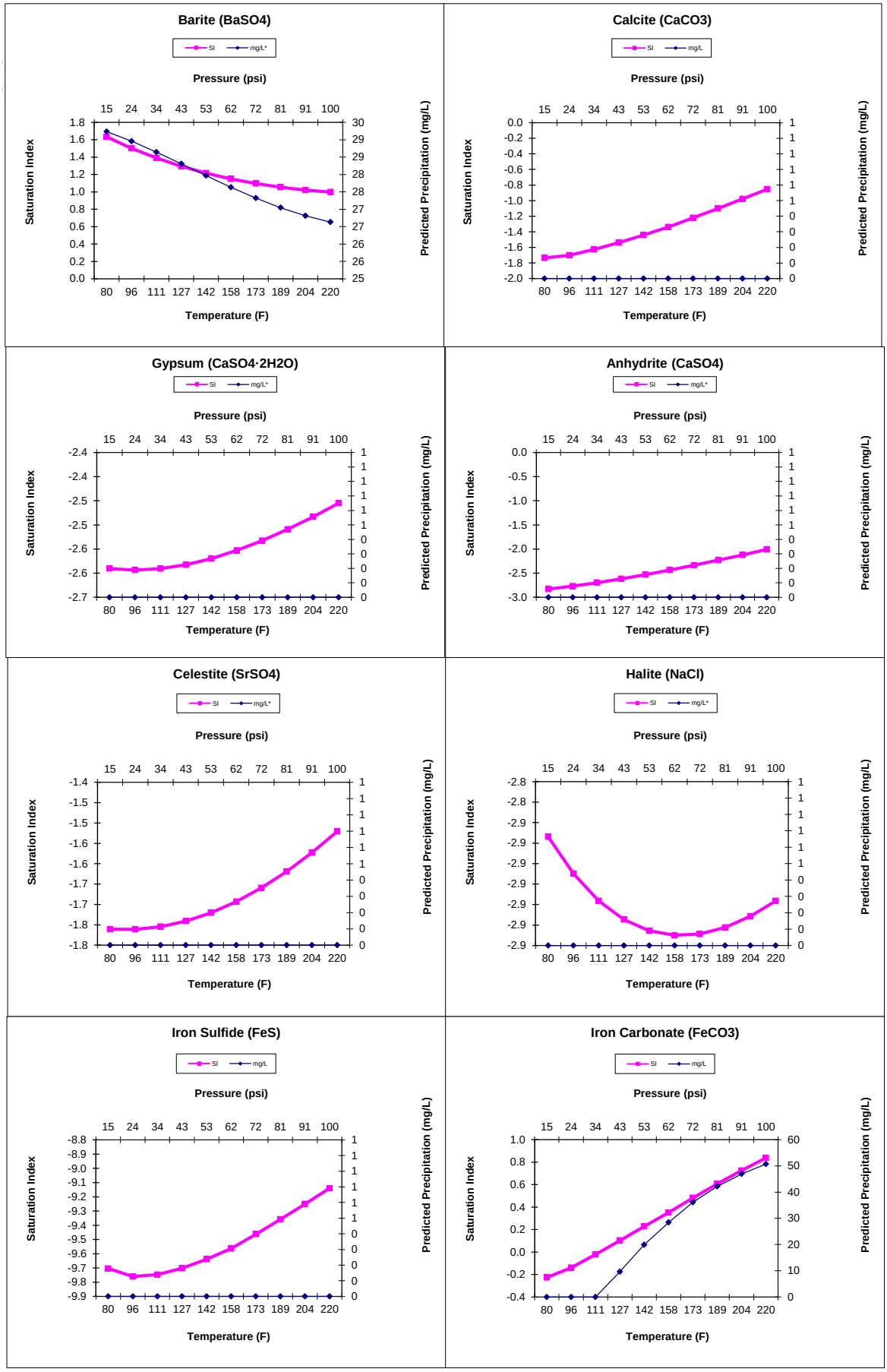
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 41-36 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41B-24D Separator
District:	Four Corners	**Sample ID:**	201201035713
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 41B-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	120.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23566
Density/Specific Gravity (g/cm³):	1.0134
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13500.0	380.8
Sulfate (SO_4^{2-}):	700.0	14.6
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8748.0	380.7
Potassium (K^+):	33.0	0.8
Magnesium (Mg^{2+}):	14.0	1.2
Calcium (Ca^{2+}):	156.0	7.8
Strontium (Sr^{2+}):	12.0	0.3
Barium (Ba^{2+}):	21.0	0.3
Iron (Fe^{2+}):	16.0	0.6
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	477	N/A

ND = Not Determined

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)**
80°F	15 psi	2.46	12.447	-0.18	0.000	-1.35	0.000	-1.59	0.000
96°F	24 psi	2.33	12.432	-0.14	0.000	-1.36	0.000	-1.53	0.000
111°F	34 psi	2.22	12.414	-0.07	0.000	-1.35	0.000	-1.46	0.000
127°F	43 psi	2.12	12.396	0.02	1.404	-1.34	0.000	-1.38	0.000
142°F	53 psi	2.04	12.376	0.12	7.294	-1.33	0.000	-1.29	0.000
158°F	62 psi	1.98	12.357	0.22	13.319	-1.32	0.000	-1.20	0.000
173°F	72 psi	1.92	12.339	0.33	19.567	-1.30	0.000	-1.10	0.000
189°F	81 psi	1.88	12.323	0.44	26.085	-1.27	0.000	-1.00	0.000
204°F	91 psi	1.84	12.309	0.56	32.375	-1.25	0.000	-0.89	0.000
220°F	100 psi	1.82	12.298	0.68	38.415	-1.22	0.000	-0.78	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)**
80°F	15 psi	-0.79	0.000	-2.74	0.000	-8.40	0.000	0.56	7.718
96°F	24 psi	-0.79	0.000	-2.76	0.000	-8.47	0.000	0.65	8.398
111°F	34 psi	-0.78	0.000	-2.77	0.000	-8.49	0.000	0.77	9.114
127°F	43 psi	-0.77	0.000	-2.78	0.000	-8.48	0.000	0.89	9.704
142°F	53 psi	-0.75	0.000	-2.79	0.000	-8.45	0.000	1.01	10.158
158°F	62 psi	-0.72	0.000	-2.79	0.000	-8.41	0.000	1.13	10.499
173°F	72 psi	-0.69	0.000	-2.79	0.000	-8.36	0.000	1.25	10.761
189°F	81 psi	-0.65	0.000	-2.78	0.000	-8.29	0.000	1.37	10.965
204°F	91 psi	-0.61	0.000	-2.78	0.000	-8.22	0.000	1.49	11.114
220°F	100 psi	-0.56	0.000	-2.77	0.000	-8.14	0.000	1.59	11.224

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.

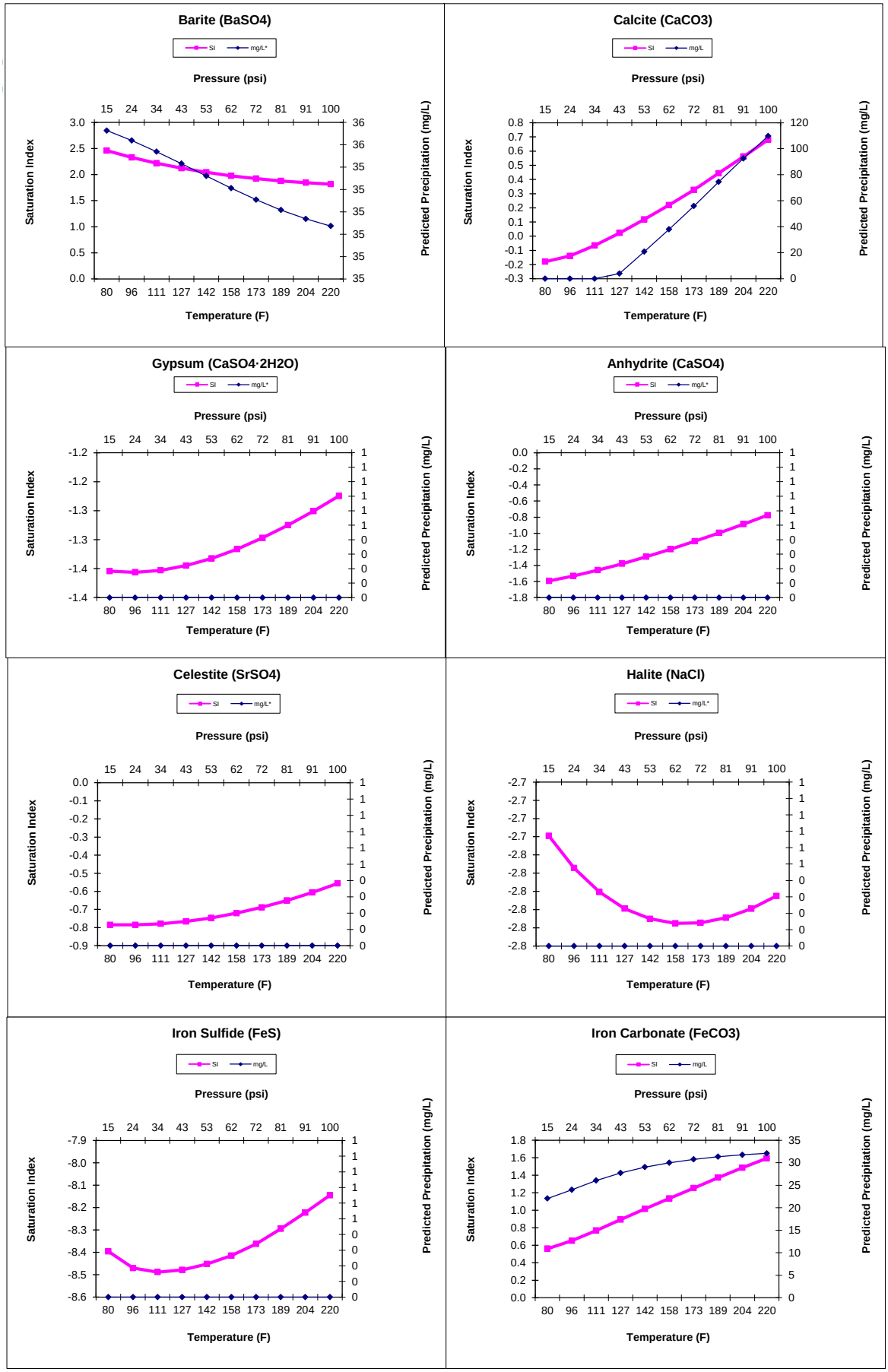
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 41B-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41C-24D Separator
District:	Four Corners	**Sample ID:**	201201035714
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 41C-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	439.0	7.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	250.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24986
Density/Specific Gravity (g/cm³):	1.0143
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13900.0	392.1
Sulfate (SO_4^{2-}):	1400.0	29.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.06	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9007.0	391.9
Potassium (K^+):	36.0	0.9
Magnesium (Mg^{2+}):	14.0	1.2
Calcium (Ca^{2+}):	144.0	7.2
Strontium (Sr^{2+}):	11.0	0.3
Barium (Ba^{2+}):	14.0	0.2
Iron (Fe^{2+}):	21.0	0.8
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	440	N/A

ND = Not Determined

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)**
80°F	15 psi	2.55	8.304	-0.15	0.000	-1.12	0.000	-1.35	0.000
96°F	24 psi	2.42	8.296	-0.11	0.000	-1.12	0.000	-1.29	0.000
111°F	34 psi	2.31	8.287	-0.03	0.000	-1.11	0.000	-1.22	0.000
127°F	43 psi	2.22	8.277	0.06	4.052	-1.10	0.000	-1.14	0.000
142°F	53 psi	2.14	8.266	0.15	10.632	-1.09	0.000	-1.05	0.000
158°F	62 psi	2.07	8.256	0.25	17.327	-1.08	0.000	-0.96	0.000
173°F	72 psi	2.01	8.247	0.36	24.242	-1.06	0.000	-0.86	0.000
189°F	81 psi	1.97	8.238	0.48	31.421	-1.03	0.000	-0.75	0.000
204°F	91 psi	1.94	8.231	0.60	38.325	-1.01	0.000	-0.65	0.000
220°F	100 psi	1.91	8.225	0.72	44.936	-0.99	0.000	-0.54	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)**
80°F	15 psi	-0.55	0.000	-2.72	0.000	-8.28	0.000	0.75	11.742
96°F	24 psi	-0.55	0.000	-2.74	0.000	-8.36	0.000	0.84	12.361
111°F	34 psi	-0.55	0.000	-2.75	0.000	-8.38	0.000	0.96	13.009
127°F	43 psi	-0.53	0.000	-2.76	0.000	-8.37	0.000	1.08	13.541
142°F	53 psi	-0.51	0.000	-2.77	0.000	-8.34	0.000	1.20	13.948
158°F	62 psi	-0.49	0.000	-2.77	0.000	-8.31	0.000	1.32	14.253
173°F	72 psi	-0.46	0.000	-2.77	0.000	-8.26	0.000	1.44	14.486
189°F	81 psi	-0.42	0.000	-2.77	0.000	-8.19	0.000	1.56	14.667
204°F	91 psi	-0.37	0.000	-2.76	0.000	-8.12	0.000	1.67	14.800
220°F	100 psi	-0.32	0.000	-2.75	0.000	-8.04	0.000	1.78	14.897

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.

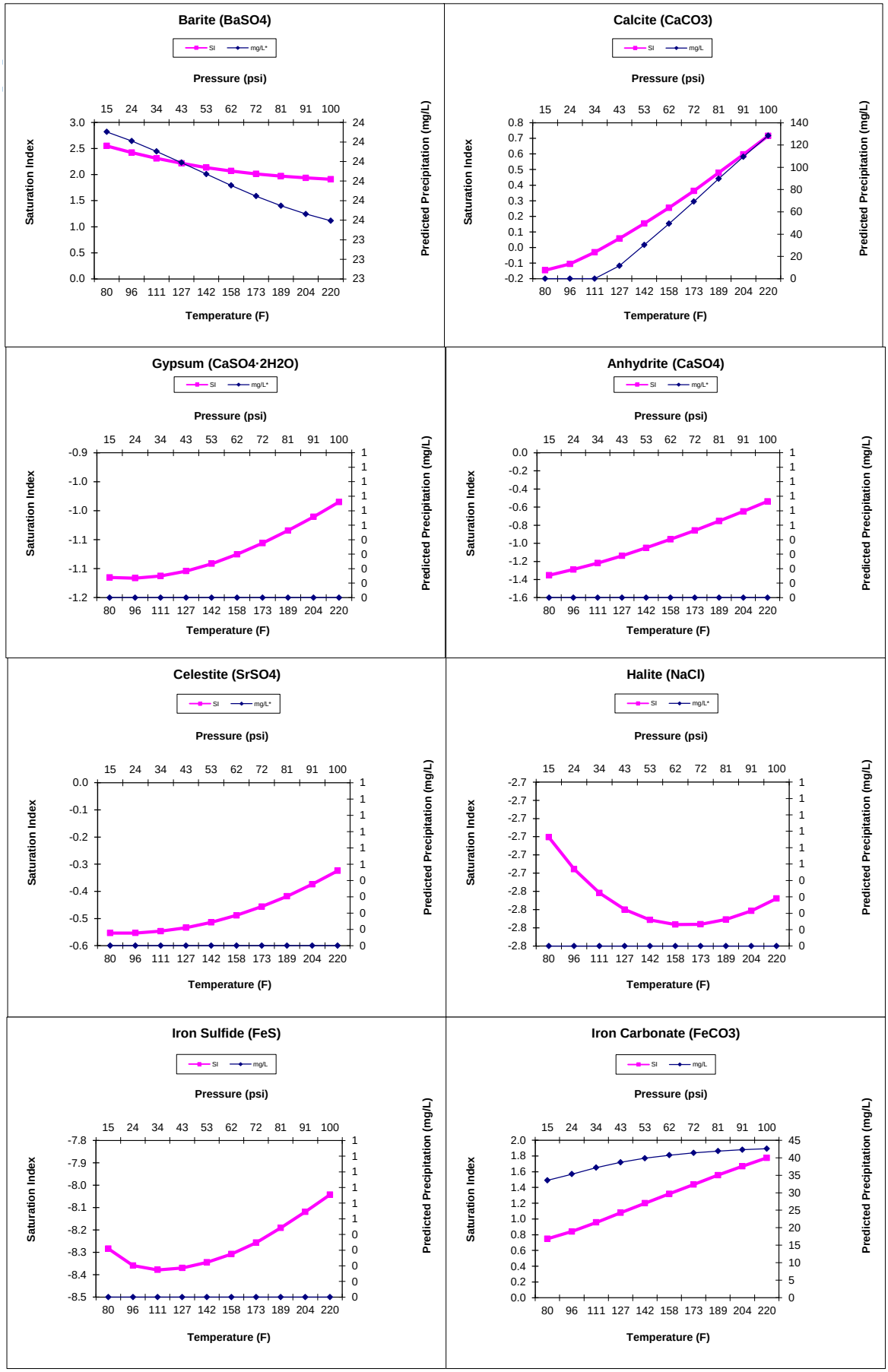
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 41C-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	41D-24D Separator
District:	Four Corners	**Sample ID:**	201201035715
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 41D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	866.0	14.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	210.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24072
Density/Specific Gravity (g/cm³):	1.0137
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13700.0	386.5
Sulfate (SO_4^{2-}):	400.0	8.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8878.0	386.3
Potassium (K^+):	29.0	0.7
Magnesium (Mg^{2+}):	12.0	1.0
Calcium (Ca^{2+}):	118.0	5.9
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	44.0	0.6
Iron (Fe^{2+}):	16.0	0.6
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	387	N/A

ND = Not Determined

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)**
80°F	15 psi	2.54	26.090	0.09	8.656	-1.71	0.000	-1.95	0.000
96°F	24 psi	2.41	26.061	0.12	12.427	-1.71	0.000	-1.88	0.000
111°F	34 psi	2.29	26.029	0.20	19.406	-1.71	0.000	-1.81	0.000
127°F	43 psi	2.20	25.994	0.28	27.357	-1.70	0.000	-1.73	0.000
142°F	53 psi	2.12	25.957	0.38	35.498	-1.69	0.000	-1.65	0.000
158°F	62 psi	2.05	25.921	0.48	43.472	-1.67	0.000	-1.55	0.000
173°F	72 psi	2.00	25.888	0.59	51.417	-1.65	0.000	-1.46	0.000
189°F	81 psi	1.95	25.857	0.71	59.195	-1.63	0.000	-1.35	0.000
204°F	91 psi	1.92	25.831	0.83	66.247	-1.61	0.000	-1.25	0.000
220°F	100 psi	1.89	25.810	0.95	72.564	-1.58	0.000	-1.13	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)**
80°F	15 psi	-1.15	0.000	-2.73	0.000	-8.35	0.000	0.98	10.263
96°F	24 psi	-1.15	0.000	-2.74	0.000	-8.42	0.000	1.07	10.514
111°F	34 psi	-1.15	0.000	-2.76	0.000	-8.44	0.000	1.19	10.772
127°F	43 psi	-1.14	0.000	-2.77	0.000	-8.43	0.000	1.31	10.980
142°F	53 psi	-1.12	0.000	-2.77	0.000	-8.41	0.000	1.43	11.136
158°F	62 psi	-1.09	0.000	-2.77	0.000	-8.37	0.000	1.55	11.251
173°F	72 psi	-1.06	0.000	-2.77	0.000	-8.31	0.000	1.67	11.340
189°F	81 psi	-1.02	0.000	-2.77	0.000	-8.25	0.000	1.79	11.407
204°F	91 psi	-0.98	0.000	-2.77	0.000	-8.17	0.000	1.91	11.456
220°F	100 psi	-0.93	0.000	-2.76	0.000	-8.09	0.000	2.02	11.492

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.

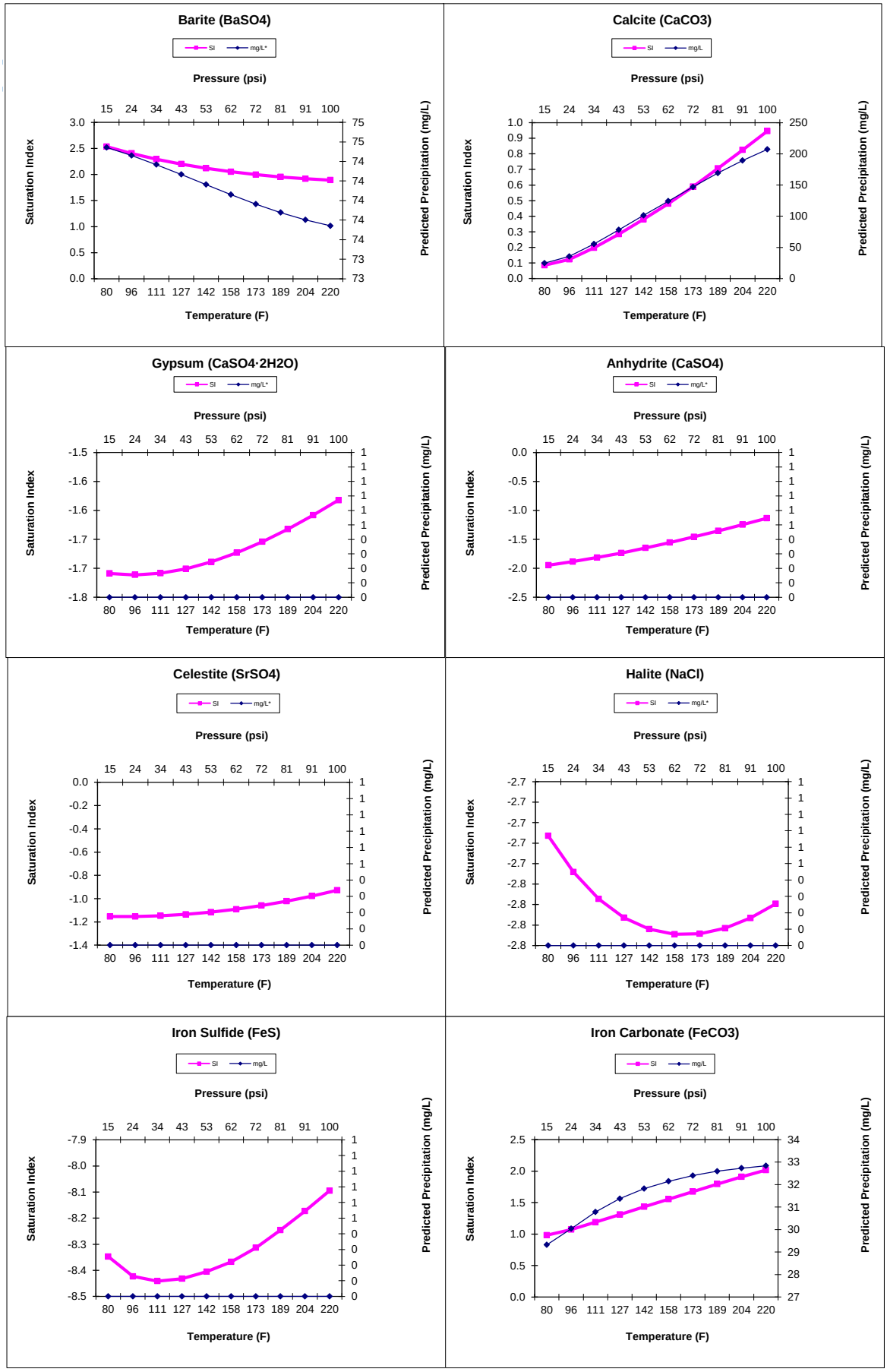
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 41D-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42-12D Separator
District:	Four Corners	**Sample ID:**	201201037398
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 42-12D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.4

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	275.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	33601
Density/Specific Gravity (g/cm³):	1.0202
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	20000.0	564.2
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	12960.0	564.0
Potassium (K^+):	20.4	0.5
Magnesium (Mg^{2+}):	11.6	1.0
Calcium (Ca^{2+}):	77.8	3.9
Strontium (Sr^{2+}):	9.2	0.2
Barium (Ba^{2+}):	23.5	0.3
Iron (Fe^{2+}):	31.8	1.1
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	270	N/A

ND = Not Determined

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)**
80°F	15 psi	1.52	13.501	-1.11	0.000	-2.62	0.000	-2.86	0.000
96°F	24 psi	1.39	13.331	-1.07	0.000	-2.63	0.000	-2.79	0.000
111°F	34 psi	1.28	13.137	-1.00	0.000	-2.62	0.000	-2.72	0.000
127°F	43 psi	1.19	12.926	-0.91	0.000	-2.62	0.000	-2.65	0.000
142°F	53 psi	1.10	12.707	-0.82	0.000	-2.61	0.000	-2.56	0.000
158°F	62 psi	1.03	12.488	-0.72	0.000	-2.59	0.000	-2.47	0.000
173°F	72 psi	0.98	12.277	-0.61	0.000	-2.58	0.000	-2.37	0.000
189°F	81 psi	0.93	12.083	-0.50	0.000	-2.56	0.000	-2.27	0.000
204°F	91 psi	0.89	11.909	-0.39	0.000	-2.54	0.000	-2.17	0.000
220°F	100 psi	0.86	11.762	-0.27	0.000	-2.52	0.000	-2.06	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)**
80°F	15 psi	-1.86	0.000	-2.41	0.000	1.17	2.799	0.22	7.041
96°F	24 psi	-1.87	0.000	-2.43	0.000	1.10	2.759	0.30	9.346
111°F	34 psi	-1.86	0.000	-2.44	0.000	1.11	2.761	0.42	11.948
127°F	43 psi	-1.85	0.000	-2.45	0.000	1.13	2.782	0.54	14.224
142°F	53 psi	-1.84	0.000	-2.46	0.000	1.18	2.810	0.66	16.076
158°F	62 psi	-1.82	0.000	-2.46	0.000	1.24	2.842	0.77	17.536
173°F	72 psi	-1.79	0.000	-2.46	0.000	1.31	2.877	0.89	18.732
189°F	81 psi	-1.76	0.000	-2.46	0.000	1.39	2.910	1.00	19.678
204°F	91 psi	-1.72	0.000	-2.45	0.000	1.48	2.939	1.11	20.393
220°F	100 psi	-1.68	0.000	-2.45	0.000	1.57	2.963	1.21	20.936

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.

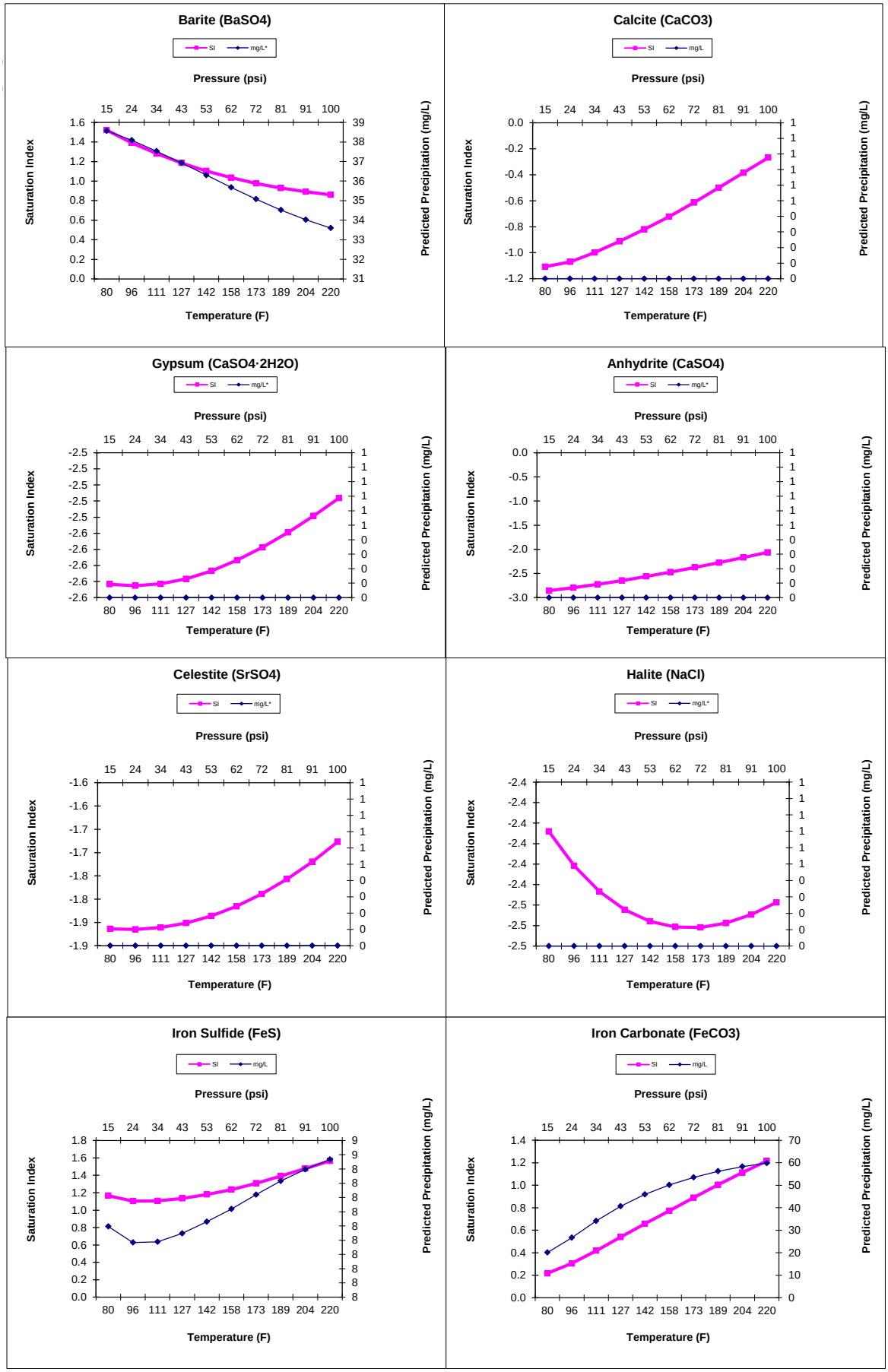
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 42-12D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42A-24D Separator
District:	Four Corners	**Sample ID:**	201201035716
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 42A-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	160.0
aqueous H_2S (ppm):	5.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23542
Density/Specific Gravity (g/cm³):	1.0134
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13800.0	389.3
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8942.0	389.1
Potassium (K^+):	33.0	0.8
Magnesium (Mg^{2+}):	13.0	1.1
Calcium (Ca^{2+}):	114.0	5.7
Strontium (Sr^{2+}):	11.0	0.3
Barium (Ba^{2+}):	18.0	0.3
Iron (Fe^{2+}):	12.0	0.4
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	364	N/A

ND = Not Determined

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)**
80°F	15 psi	1.26	9.938	-0.13	0.000	-2.62	0.000	-2.86	0.000
96°F	24 psi	1.13	9.678	-0.10	0.000	-2.62	0.000	-2.80	0.000
111°F	34 psi	1.02	9.388	-0.03	0.000	-2.62	0.000	-2.73	0.000
127°F	43 psi	0.92	9.081	0.06	4.479	-2.61	0.000	-2.65	0.000
142°F	53 psi	0.84	8.769	0.15	11.457	-2.60	0.000	-2.56	0.000
158°F	62 psi	0.78	8.467	0.25	18.528	-2.59	0.000	-2.47	0.000
173°F	72 psi	0.72	8.186	0.36	25.816	-2.57	0.000	-2.37	0.000
189°F	81 psi	0.68	7.935	0.47	33.303	-2.55	0.000	-2.27	0.000
204°F	91 psi	0.64	7.723	0.59	40.443	-2.52	0.000	-2.16	0.000
220°F	100 psi	0.62	7.553	0.71	47.214	-2.49	0.000	-2.05	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)**
80°F	15 psi	-1.95	0.000	-2.72	0.000	2.25	6.407	0.63	6.437
96°F	24 psi	-1.96	0.000	-2.74	0.000	2.17	6.374	0.72	6.845
111°F	34 psi	-1.95	0.000	-2.75	0.000	2.15	6.366	0.83	7.269
127°F	43 psi	-1.94	0.000	-2.76	0.000	2.15	6.372	0.95	7.614
142°F	53 psi	-1.92	0.000	-2.76	0.000	2.18	6.385	1.08	7.876
158°F	62 psi	-1.89	0.000	-2.77	0.000	2.22	6.403	1.19	8.073
173°F	72 psi	-1.86	0.000	-2.77	0.000	2.27	6.426	1.31	8.223
189°F	81 psi	-1.82	0.000	-2.76	0.000	2.33	6.451	1.43	8.340
204°F	91 psi	-1.78	0.000	-2.76	0.000	2.41	6.474	1.54	8.425
220°F	100 psi	-1.73	0.000	-2.75	0.000	2.48	6.496	1.65	8.488

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.

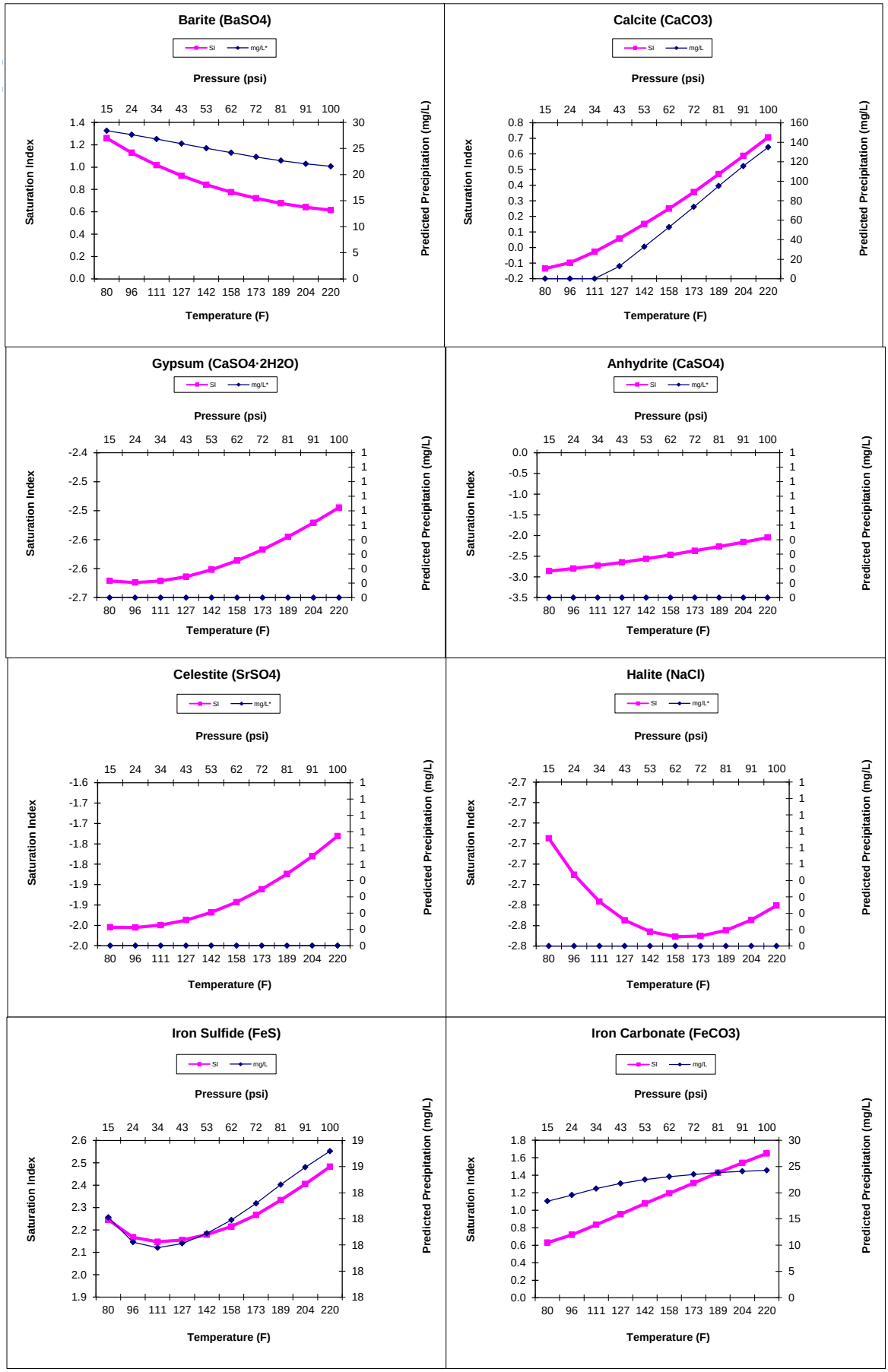
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 42A-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42A-25D Separator
District:	Four Corners	**Sample ID:**	201201036489
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 42A-25D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	610.0	10.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	120.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	15742
Density/Specific Gravity (g/cm³):	1.0081
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9000.0	253.9
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5832.0	253.8
Potassium (K^+):	30.9	0.8
Magnesium (Mg^{2+}):	9.1	0.8
Calcium (Ca^{2+}):	90.4	4.5
Strontium (Sr^{2+}):	8.1	0.2
Barium (Ba^{2+}):	10.7	0.2
Iron (Fe^{2+}):	0.6	0.0
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	281	N/A

ND = Not Determined

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)**
80°F	15 psi	1.68	6.195	-0.63	0.000	-2.09	0.000	-2.33	0.000
96°F	24 psi	1.55	6.146	-0.59	0.000	-2.10	0.000	-2.27	0.000
111°F	34 psi	1.44	6.091	-0.52	0.000	-2.09	0.000	-2.20	0.000
127°F	43 psi	1.34	6.032	-0.43	0.000	-2.08	0.000	-2.12	0.000
142°F	53 psi	1.26	5.973	-0.33	0.000	-2.07	0.000	-2.03	0.000
158°F	62 psi	1.20	5.915	-0.23	0.000	-2.05	0.000	-1.94	0.000
173°F	72 psi	1.15	5.861	-0.11	0.000	-2.03	0.000	-1.83	0.000
189°F	81 psi	1.11	5.815	0.01	0.849	-2.00	0.000	-1.73	0.000
204°F	91 psi	1.08	5.777	0.13	11.247	-1.98	0.000	-1.62	0.000
220°F	100 psi	1.05	5.748	0.26	20.828	-1.95	0.000	-1.50	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)**
80°F	15 psi	-1.46	0.000	-3.06	0.000	-0.31	0.000	-1.03	0.000
96°F	24 psi	-1.46	0.000	-3.08	0.000	-0.37	0.000	-0.94	0.000
111°F	34 psi	-1.45	0.000	-3.09	0.000	-0.36	0.000	-0.82	0.000
127°F	43 psi	-1.44	0.000	-3.10	0.000	-0.33	0.000	-0.69	0.000
142°F	53 psi	-1.41	0.000	-3.11	0.000	-0.27	0.000	-0.56	0.000
158°F	62 psi	-1.38	0.000	-3.11	0.000	-0.21	0.000	-0.44	0.000
173°F	72 psi	-1.35	0.000	-3.11	0.000	-0.12	0.000	-0.31	0.000
189°F	81 psi	-1.30	0.000	-3.11	0.000	-0.03	0.000	-0.18	0.000
204°F	91 psi	-1.25	0.000	-3.10	0.000	0.07	0.045	-0.06	0.000
220°F	100 psi	-1.20	0.000	-3.09	0.000	0.17	0.102	0.06	0.054

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.

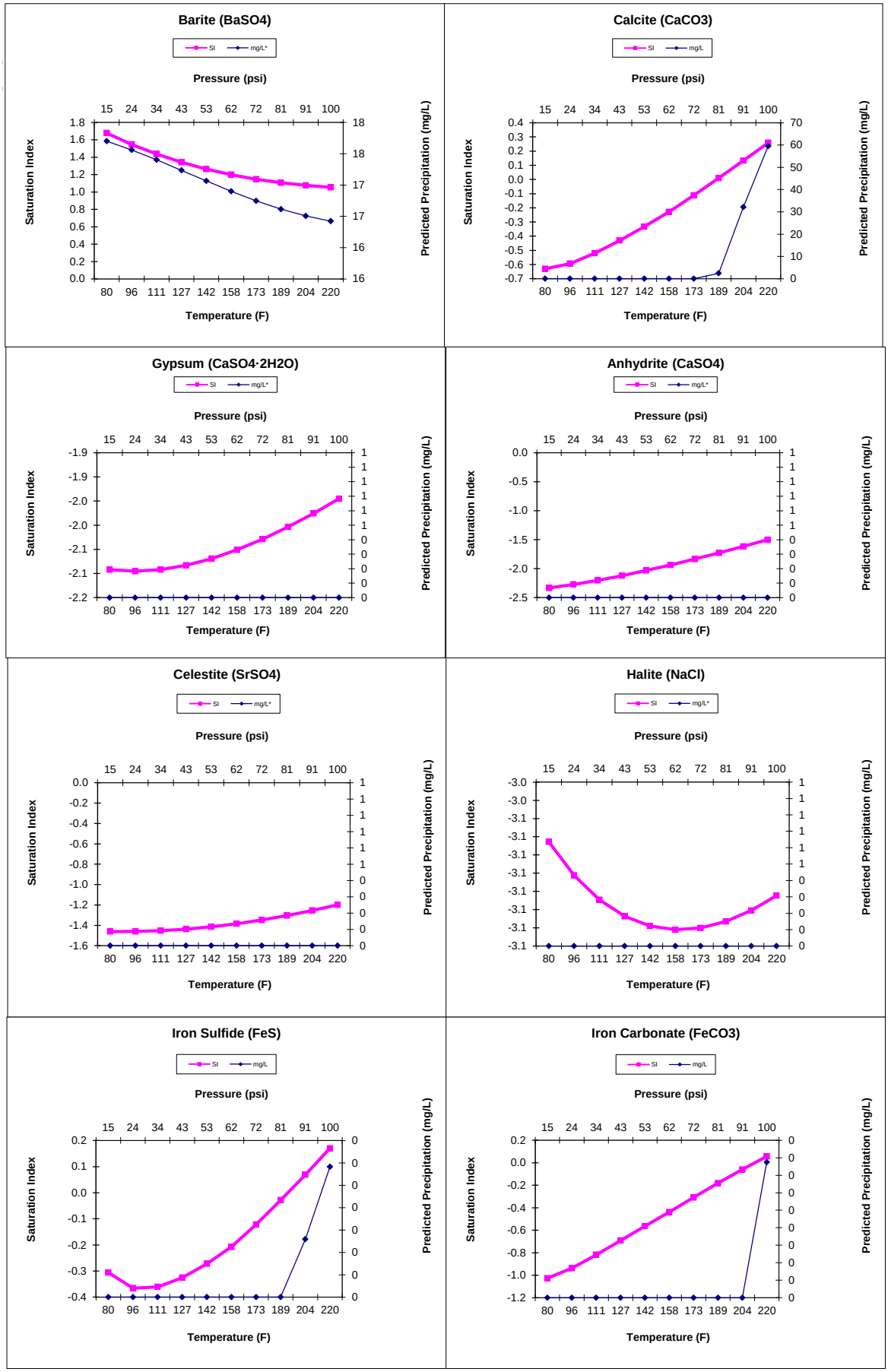
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 42A-25D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42C-24D Separator
District:	Four Corners	**Sample ID:**	201201035741
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 42C-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	671.0	11.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	65.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16985
Density/Specific Gravity (g/cm³):	1.0089
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9800.0	276.4
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6350.0	276.3
Potassium (K^+):	18.0	0.5
Magnesium (Mg^{2+}):	6.0	0.5
Calcium (Ca^{2+}):	64.0	3.2
Strontium (Sr^{2+}):	6.0	0.1
Barium (Ba^{2+}):	12.0	0.2
Iron (Fe^{2+}):	8.0	0.3
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	200	N/A

ND = Not Determined

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)**
80°F	15 psi	1.23	6.635	-0.25	0.000	-2.74	0.000	-2.98	0.000
96°F	24 psi	1.10	6.462	-0.21	0.000	-2.74	0.000	-2.92	0.000
111°F	34 psi	0.98	6.269	-0.13	0.000	-2.74	0.000	-2.85	0.000
127°F	43 psi	0.89	6.064	-0.05	0.000	-2.73	0.000	-2.77	0.000
142°F	53 psi	0.81	5.858	0.05	3.403	-2.72	0.000	-2.68	0.000
158°F	62 psi	0.75	5.659	0.15	9.917	-2.70	0.000	-2.59	0.000
173°F	72 psi	0.69	5.477	0.26	16.407	-2.68	0.000	-2.49	0.000
189°F	81 psi	0.65	5.318	0.38	22.711	-2.66	0.000	-2.38	0.000
204°F	91 psi	0.62	5.188	0.51	28.388	-2.63	0.000	-2.27	0.000
220°F	100 psi	0.60	5.089	0.63	33.424	-2.60	0.000	-2.15	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)**
80°F	15 psi	-2.09	0.000	-2.99	0.000	1.68	2.838	0.62	4.324
96°F	24 psi	-2.09	0.000	-3.01	0.000	1.61	2.809	0.71	4.602
111°F	34 psi	-2.09	0.000	-3.03	0.000	1.60	2.803	0.83	4.888
127°F	43 psi	-2.07	0.000	-3.03	0.000	1.61	2.810	0.95	5.117
142°F	53 psi	-2.05	0.000	-3.04	0.000	1.64	2.823	1.08	5.290
158°F	62 psi	-2.02	0.000	-3.04	0.000	1.68	2.841	1.20	5.417
173°F	72 psi	-1.98	0.000	-3.04	0.000	1.74	2.863	1.33	5.514
189°F	81 psi	-1.94	0.000	-3.04	0.000	1.81	2.886	1.45	5.588
204°F	91 psi	-1.89	0.000	-3.03	0.000	1.89	2.908	1.57	5.641
220°F	100 psi	-1.84	0.000	-3.02	0.000	1.98	2.928	1.69	5.680

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.

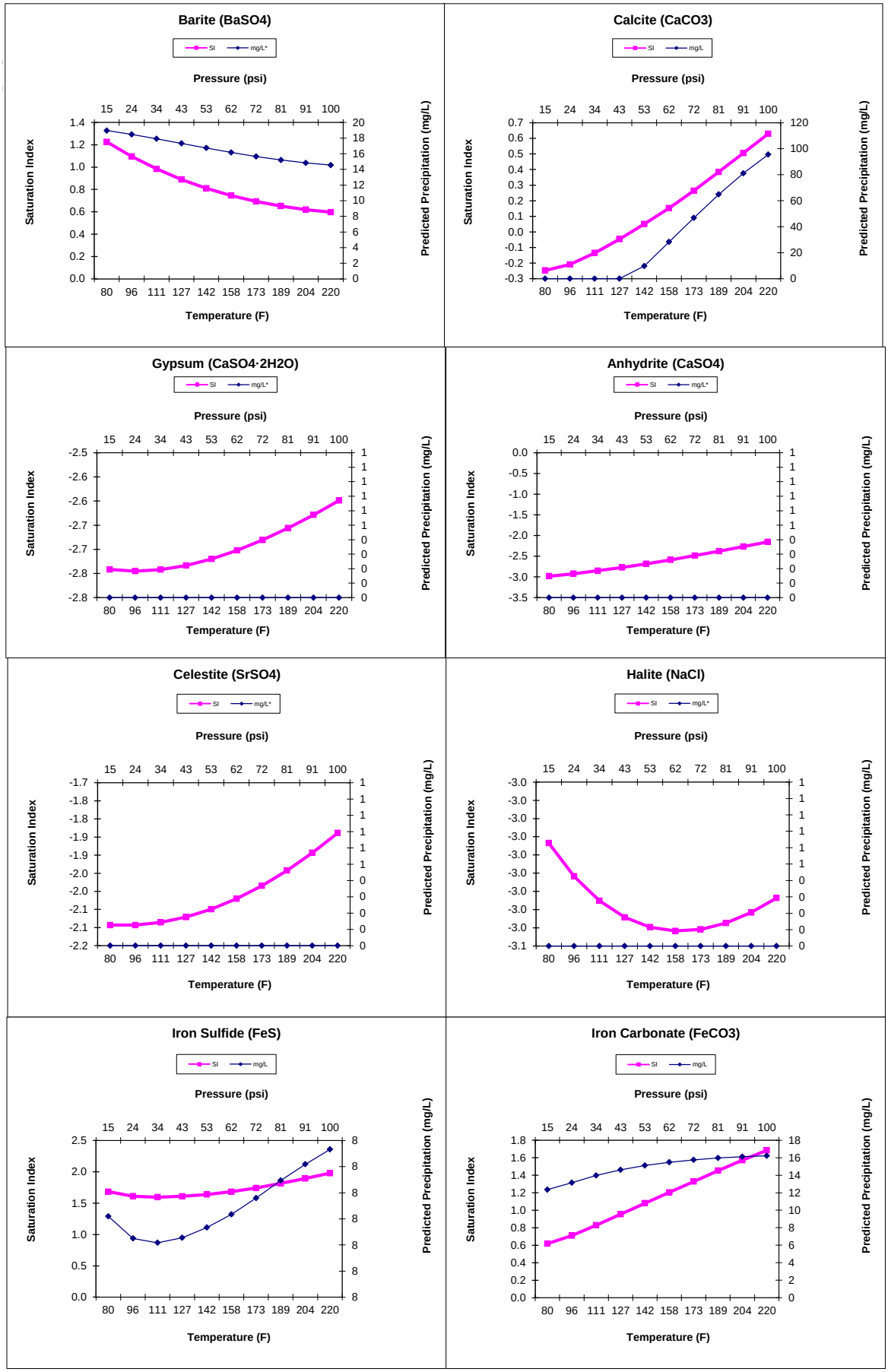
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 42C-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	42D-24D Separator
District:	Four Corners	**Sample ID:**	201201035742
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 42D-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	671.0	11.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16410
Density/Specific Gravity (g/cm³):	1.0085
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9400.0	265.2
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	6091.0	265.1
Potassium (K^+):	30.0	0.8
Magnesium (Mg^{2+}):	11.0	0.9
Calcium (Ca^{2+}):	104.0	5.2
Strontium (Sr^{2+}):	10.0	0.2
Barium (Ba^{2+}):	24.0	0.3
Iron (Fe^{2+}):	19.0	0.7
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	334	N/A

ND = Not Determined

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)**
80°F	15 psi	1.54	13.664	-0.03	0.000	-2.52	0.000	-2.76	0.000
96°F	24 psi	1.41	13.456	0.01	0.638	-2.53	0.000	-2.70	0.000
111°F	34 psi	1.29	13.225	0.08	6.910	-2.52	0.000	-2.63	0.000
127°F	43 psi	1.20	12.981	0.17	14.140	-2.51	0.000	-2.55	0.000
142°F	53 psi	1.12	12.736	0.27	21.637	-2.50	0.000	-2.46	0.000
158°F	62 psi	1.06	12.503	0.37	29.079	-2.48	0.000	-2.37	0.000
173°F	72 psi	1.00	12.290	0.48	36.592	-2.46	0.000	-2.27	0.000
189°F	81 psi	0.96	12.105	0.60	44.059	-2.44	0.000	-2.16	0.000
204°F	91 psi	0.93	11.955	0.72	50.955	-2.41	0.000	-2.05	0.000
220°F	100 psi	0.91	11.841	0.85	57.260	-2.38	0.000	-1.93	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)**
80°F	15 psi	-1.86	0.000	-3.03	0.000	1.76	1.483	1.00	12.170
96°F	24 psi	-1.86	0.000	-3.05	0.000	1.69	1.478	1.09	12.475
111°F	34 psi	-1.86	0.000	-3.06	0.000	1.67	1.476	1.21	12.788
127°F	43 psi	-1.84	0.000	-3.07	0.000	1.69	1.478	1.34	13.040
142°F	53 psi	-1.82	0.000	-3.07	0.000	1.72	1.480	1.46	13.230
158°F	62 psi	-1.79	0.000	-3.08	0.000	1.76	1.484	1.59	13.370
173°F	72 psi	-1.75	0.000	-3.08	0.000	1.82	1.488	1.71	13.476
189°F	81 psi	-1.71	0.000	-3.07	0.000	1.90	1.492	1.84	13.556
204°F	91 psi	-1.66	0.000	-3.07	0.000	1.98	1.496	1.96	13.614
220°F	100 psi	-1.61	0.000	-3.06	0.000	2.06	1.499	2.07	13.656

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.

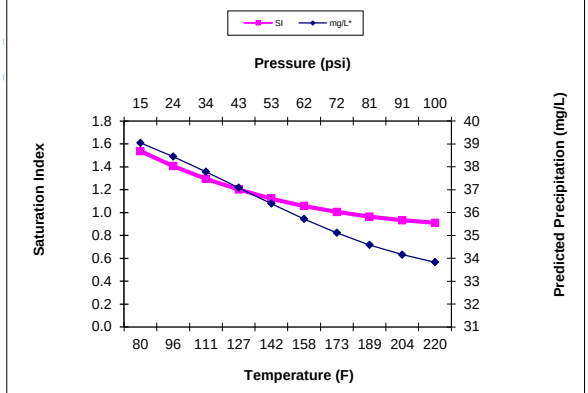
Calculate

ScaleSoftPitzer™ SSP2010

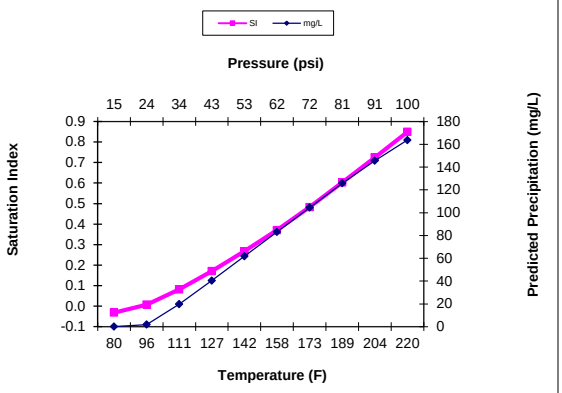
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 42D-24D Separator

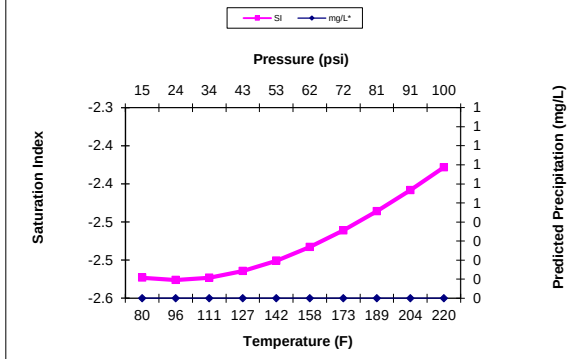
Barite (BaSO4)



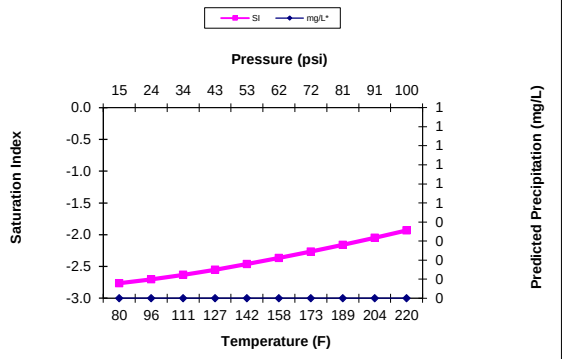
Calcite (CaCO3)



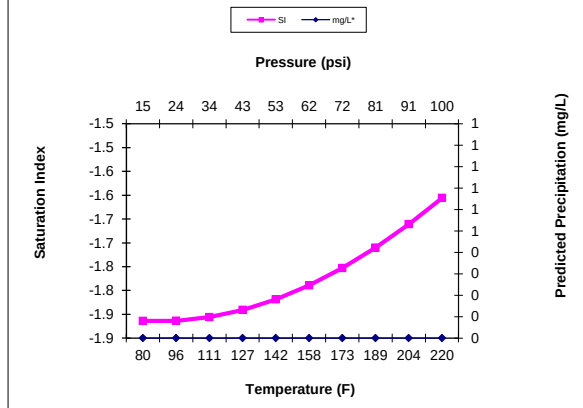
Gypsum (CaSO4·2H2O)



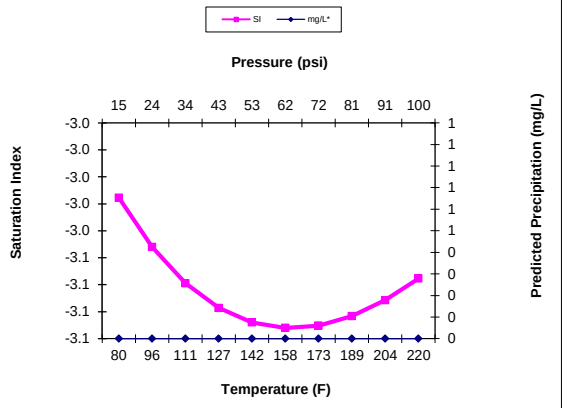
Anhydrite (CaSO4)



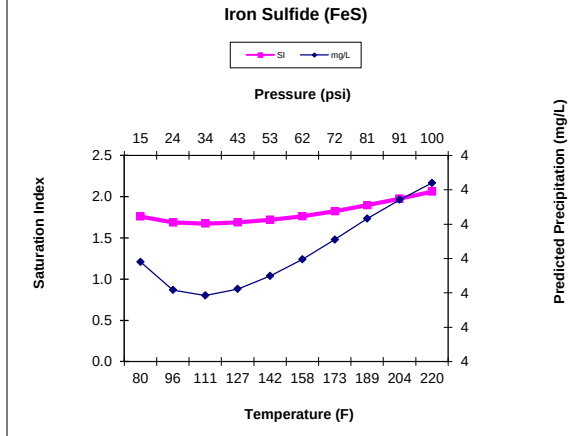
Celestite (SrSO4)



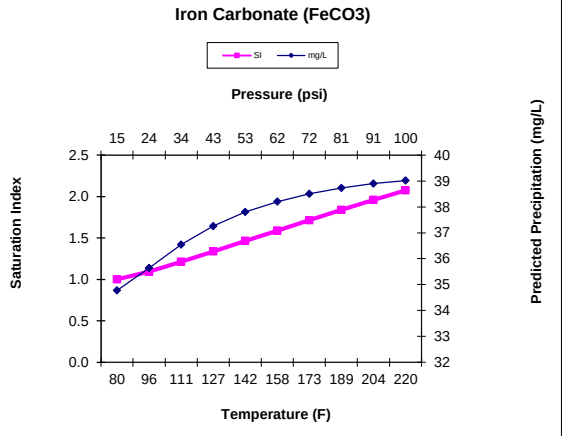
Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	43A-24D Separator
District:	Four Corners	**Sample ID:**	201201035743
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/4/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 43A-24D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	756.0	12.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21161
Density/Specific Gravity (g/cm^3):	1.0118
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12200.0	344.1
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.02

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7906.0	344.0
Potassium (K^+):	28.0	0.7
Magnesium (Mg^{2+}):	9.0	0.7
Calcium (Ca^{2+}):	104.0	5.2
Strontium (Sr^{2+}):	9.0	0.2
Barium (Ba^{2+}):	21.0	0.3
Iron (Fe^{2+}):	28.0	1.0
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	323	N/A

ND = Not Determined

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)**
80°F	15 psi	1.67	12.182	-0.01	0.000	-2.32	0.000	-2.55	0.000
96°F	24 psi	1.54	12.074	0.02	2.232	-2.32	0.000	-2.49	0.000
111°F	34 psi	1.43	11.952	0.10	8.684	-2.32	0.000	-2.42	0.000
127°F	43 psi	1.34	11.822	0.18	16.096	-2.31	0.000	-2.34	0.000
142°F	53 psi	1.26	11.688	0.28	23.747	-2.30	0.000	-2.26	0.000
158°F	62 psi	1.19	11.558	0.38	31.303	-2.28	0.000	-2.16	0.000
173°F	72 psi	1.14	11.435	0.49	38.893	-2.26	0.000	-2.06	0.000
189°F	81 psi	1.09	11.326	0.61	46.388	-2.24	0.000	-1.96	0.000
204°F	91 psi	1.06	11.234	0.73	53.252	-2.21	0.000	-1.85	0.000
220°F	100 psi	1.03	11.161	0.85	59.466	-2.18	0.000	-1.74	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)**
80°F	15 psi	-1.70	0.000	-2.82	0.000	2.38	4.480	1.18	18.644
96°F	24 psi	-1.70	0.000	-2.84	0.000	2.31	4.475	1.27	18.954
111°F	34 psi	-1.70	0.000	-2.85	0.000	2.29	4.473	1.39	19.275
127°F	43 psi	-1.68	0.000	-2.86	0.000	2.30	4.475	1.51	19.534
142°F	53 psi	-1.66	0.000	-2.86	0.000	2.33	4.477	1.63	19.730
158°F	62 psi	-1.64	0.000	-2.87	0.000	2.37	4.480	1.75	19.875
173°F	72 psi	-1.60	0.000	-2.87	0.000	2.42	4.483	1.88	19.985
189°F	81 psi	-1.56	0.000	-2.86	0.000	2.49	4.487	2.00	20.070
204°F	91 psi	-1.52	0.000	-2.86	0.000	2.56	4.491	2.11	20.131
220°F	100 psi	-1.47	0.000	-2.85	0.000	2.65	4.494	2.22	20.176

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.

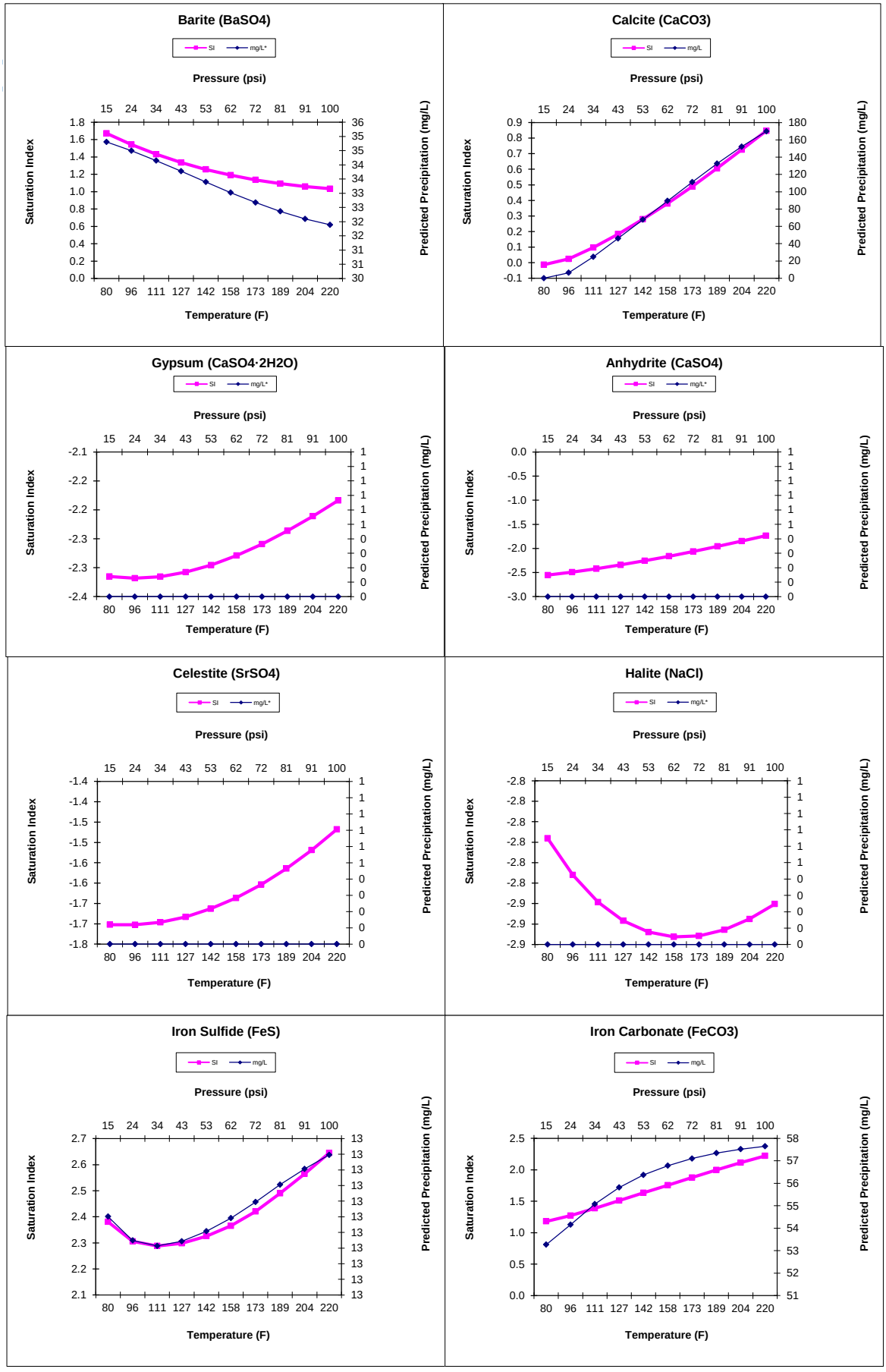
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 43A-24D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	43C-25 Separator
District:	Four Corners	**Sample ID:**	201201036518
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 43C-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.1

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	329.0	5.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	550.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20840
Density/Specific Gravity (g/cm³):	1.0116
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12300.0	347.0
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	7970.0	346.8
Potassium (K^+):	8.2	0.2
Magnesium (Mg^{2+}):	2.2	0.2
Calcium (Ca^{2+}):	22.8	1.1
Strontium (Sr^{2+}):	1.5	0.0
Barium (Ba^{2+}):	2.7	0.0
Iron (Fe^{2+}):	53.4	1.9
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	70	N/A

ND = Not Determined

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)**
80°F	15 psi	0.96	1.413	-1.93	0.000	-2.80	0.000	-3.04	0.000
96°F	24 psi	0.83	1.352	-1.90	0.000	-2.80	0.000	-2.98	0.000
111°F	34 psi	0.72	1.283	-1.83	0.000	-2.80	0.000	-2.91	0.000
127°F	43 psi	0.63	1.209	-1.74	0.000	-2.79	0.000	-2.83	0.000
142°F	53 psi	0.55	1.132	-1.64	0.000	-2.78	0.000	-2.74	0.000
158°F	62 psi	0.48	1.058	-1.54	0.000	-2.76	0.000	-2.64	0.000
173°F	72 psi	0.43	0.988	-1.42	0.000	-2.74	0.000	-2.55	0.000
189°F	81 psi	0.38	0.925	-1.30	0.000	-2.72	0.000	-2.44	0.000
204°F	91 psi	0.35	0.872	-1.18	0.000	-2.69	0.000	-2.33	0.000
220°F	100 psi	0.32	0.830	-1.06	0.000	-2.67	0.000	-2.22	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)**
80°F	15 psi	-2.28	0.000	-2.81	0.000	-9.29	0.000	0.17	7.899
96°F	24 psi	-2.28	0.000	-2.83	0.000	-9.35	0.000	0.26	11.511
111°F	34 psi	-2.28	0.000	-2.84	0.000	-9.34	0.000	0.37	15.854
127°F	43 psi	-2.26	0.000	-2.85	0.000	-9.29	0.000	0.50	19.884
142°F	53 psi	-2.24	0.000	-2.86	0.000	-9.23	0.000	0.62	23.357
158°F	62 psi	-2.22	0.000	-2.86	0.000	-9.16	0.000	0.74	26.252
173°F	72 psi	-2.18	0.000	-2.86	0.000	-9.06	0.000	0.87	28.822
189°F	81 psi	-2.15	0.000	-2.85	0.000	-8.96	0.000	1.00	30.867
204°F	91 psi	-2.10	0.000	-2.85	0.000	-8.86	0.000	1.11	32.474
220°F	100 psi	-2.05	0.000	-2.84	0.000	-8.75	0.000	1.23	33.734

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.

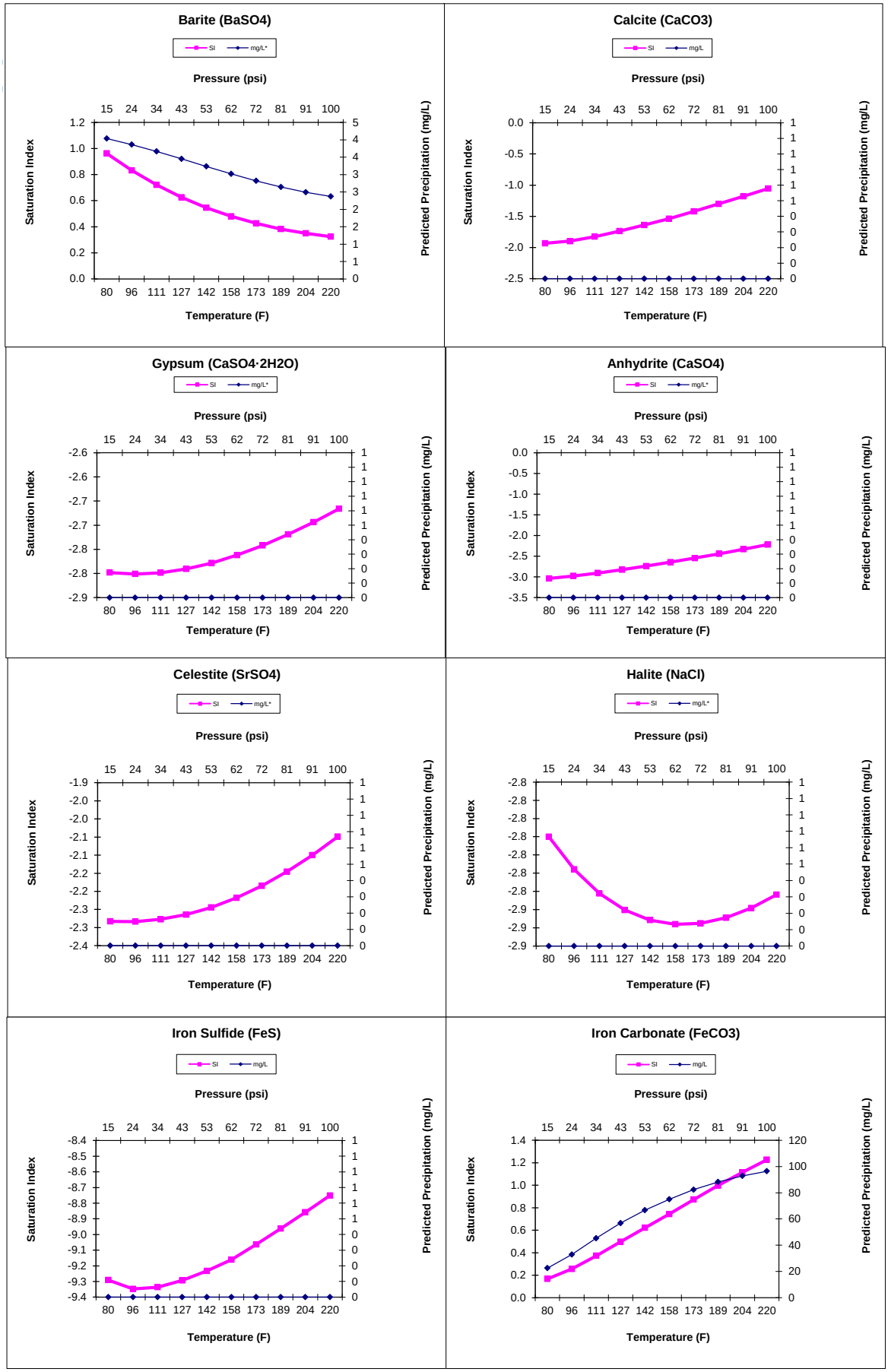
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 43C-25 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	43C-7D Separator
District:	Four Corners	**Sample ID:**	201201036496
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 43C-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.6

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	634.0	10.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	820.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	30523
Density/Specific Gravity (g/cm^3):	1.0183
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	17600.0	496.5
Sulfate (SO_4^{2-}):	400.0	8.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	11405.0	496.3
Potassium (K^+):	30.9	0.8
Magnesium (Mg^{2+}):	19.3	1.6
Calcium (Ca^{2+}):	187.3	9.3
Strontium (Sr^{2+}):	20.5	0.5
Barium (Ba^{2+}):	74.9	1.1
Iron (Fe^{2+}):	148.7	5.3
Manganese (Mn^{2+}):	2.1	0.1
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	626	N/A

ND = Not Determined

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)**
80°F	15 psi	2.66	44.422	-0.27	0.000	-1.61	0.000	-1.85	0.000
96°F	24 psi	2.53	44.383	-0.23	0.000	-1.61	0.000	-1.78	0.000
111°F	34 psi	2.42	44.339	-0.16	0.000	-1.61	0.000	-1.71	0.000
127°F	43 psi	2.32	44.291	-0.07	0.000	-1.60	0.000	-1.63	0.000
142°F	53 psi	2.24	44.240	0.02	2.273	-1.59	0.000	-1.55	0.000
158°F	62 psi	2.17	44.190	0.12	13.465	-1.58	0.000	-1.46	0.000
173°F	72 psi	2.11	44.142	0.23	25.126	-1.56	0.000	-1.36	0.000
189°F	81 psi	2.07	44.098	0.34	36.650	-1.54	0.000	-1.26	0.000
204°F	91 psi	2.03	44.059	0.46	47.533	-1.52	0.000	-1.15	0.000
220°F	100 psi	2.00	44.026	0.58	57.797	-1.50	0.000	-1.05	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)**
80°F	15 psi	-0.89	0.000	-2.52	0.000	-8.00	0.000	1.36	90.805
96°F	24 psi	-0.89	0.000	-2.54	0.000	-8.07	0.000	1.45	93.250
111°F	34 psi	-0.89	0.000	-2.55	0.000	-8.07	0.000	1.57	96.048
127°F	43 psi	-0.88	0.000	-2.56	0.000	-8.05	0.000	1.69	98.507
142°F	53 psi	-0.86	0.000	-2.57	0.000	-8.01	0.000	1.81	100.508
158°F	62 psi	-0.84	0.000	-2.57	0.000	-7.96	0.000	1.92	102.086
173°F	72 psi	-0.81	0.000	-2.57	0.000	-7.89	0.000	2.04	103.370
189°F	81 psi	-0.77	0.000	-2.57	0.000	-7.81	0.000	2.16	104.388
204°F	91 psi	-0.73	0.000	-2.56	0.000	-7.73	0.000	2.27	105.155
220°F	100 psi	-0.69	0.000	-2.56	0.000	-7.65	0.000	2.38	105.735

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.

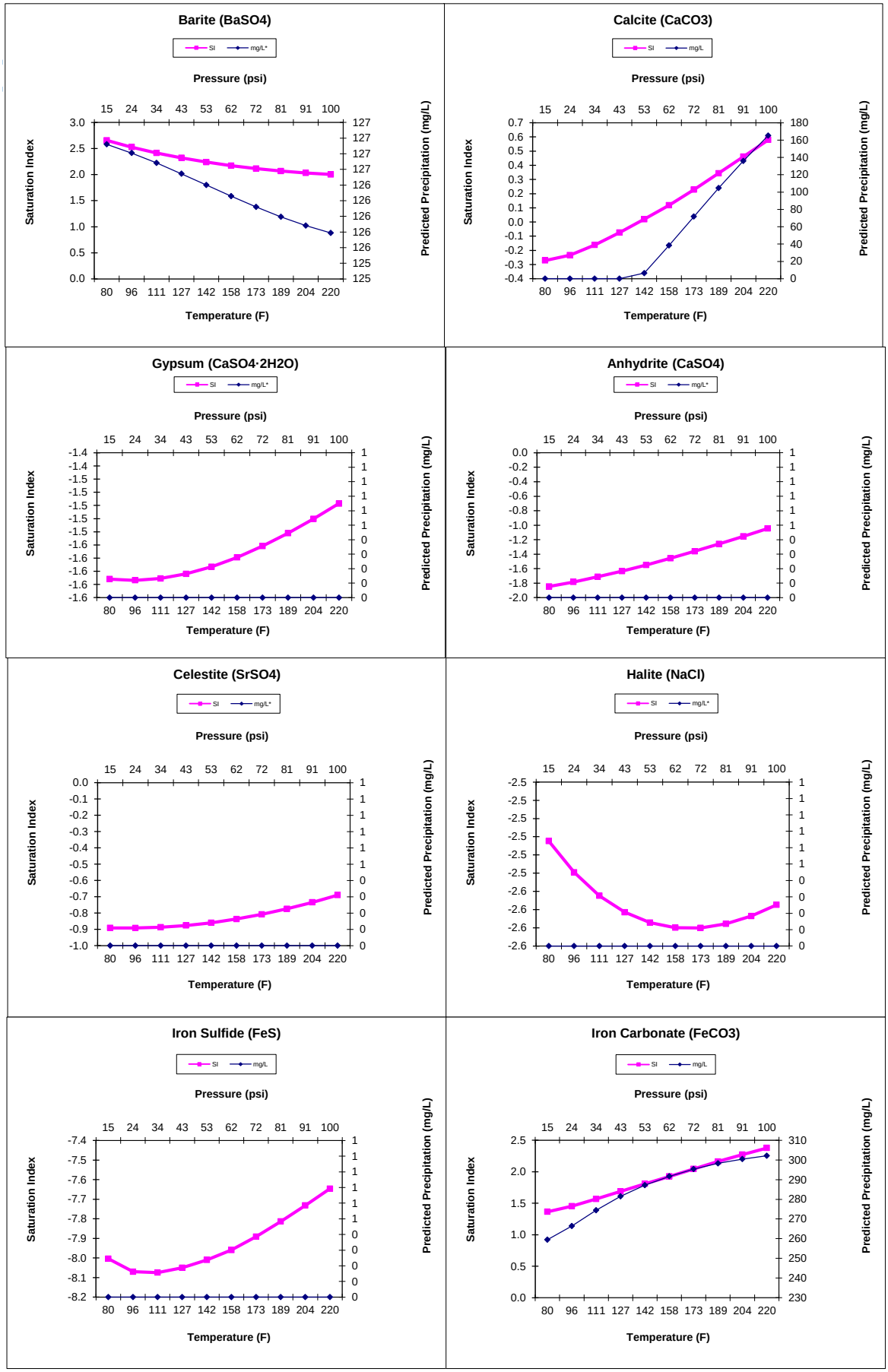
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 43C-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44A-30D Separator
District:	Four Corners	**Sample ID:**	201201037404
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 44A-30D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.2

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	439.0	7.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	350.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16056
Density/Specific Gravity (g/cm^3):	1.0085
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9000.0	253.9
Sulfate (SO_4^{2-}):	350.0	7.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5832.0	253.8
Potassium (K^+):	39.8	1.0
Magnesium (Mg^{2+}):	23.5	1.9
Calcium (Ca^{2+}):	236.0	11.8
Strontium (Sr^{2+}):	20.9	0.5
Barium (Ba^{2+}):	36.2	0.5
Iron (Fe^{2+}):	77.5	2.8
Manganese (Mn^{2+}):	0.9	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	737	N/A

ND = Not Determined

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)**
80°F	15 psi	2.55	21.479	-0.66	0.000	-1.34	0.000	-1.58	0.000
96°F	24 psi	2.42	21.456	-0.63	0.000	-1.34	0.000	-1.52	0.000
111°F	34 psi	2.31	21.430	-0.56	0.000	-1.34	0.000	-1.45	0.000
127°F	43 psi	2.21	21.402	-0.47	0.000	-1.33	0.000	-1.37	0.000
142°F	53 psi	2.13	21.374	-0.37	0.000	-1.32	0.000	-1.28	0.000
158°F	62 psi	2.07	21.346	-0.27	0.000	-1.30	0.000	-1.18	0.000
173°F	72 psi	2.02	21.321	-0.15	0.000	-1.28	0.000	-1.08	0.000
189°F	81 psi	1.98	21.299	-0.03	0.000	-1.25	0.000	-0.98	0.000
204°F	91 psi	1.94	21.281	0.10	9.735	-1.23	0.000	-0.87	0.000
220°F	100 psi	1.92	21.267	0.22	21.447	-1.20	0.000	-0.75	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)**
80°F	15 psi	-0.71	0.000	-3.07	0.000	1.37	4.159	0.60	32.356
96°F	24 psi	-0.71	0.000	-3.09	0.000	1.31	4.127	0.69	35.503
111°F	34 psi	-0.71	0.000	-3.10	0.000	1.32	4.134	0.81	39.246
127°F	43 psi	-0.69	0.000	-3.11	0.000	1.36	4.158	0.94	42.633
142°F	53 psi	-0.67	0.000	-3.11	0.000	1.42	4.188	1.06	45.464
158°F	62 psi	-0.64	0.000	-3.12	0.000	1.50	4.220	1.19	47.746
173°F	72 psi	-0.60	0.000	-3.11	0.000	1.60	4.254	1.32	49.709
189°F	81 psi	-0.56	0.000	-3.11	0.000	1.70	4.282	1.45	51.201
204°F	91 psi	-0.51	0.000	-3.11	0.000	1.80	4.305	1.57	52.332
220°F	100 psi	-0.45	0.000	-3.10	0.000	1.91	4.324	1.68	53.192

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.

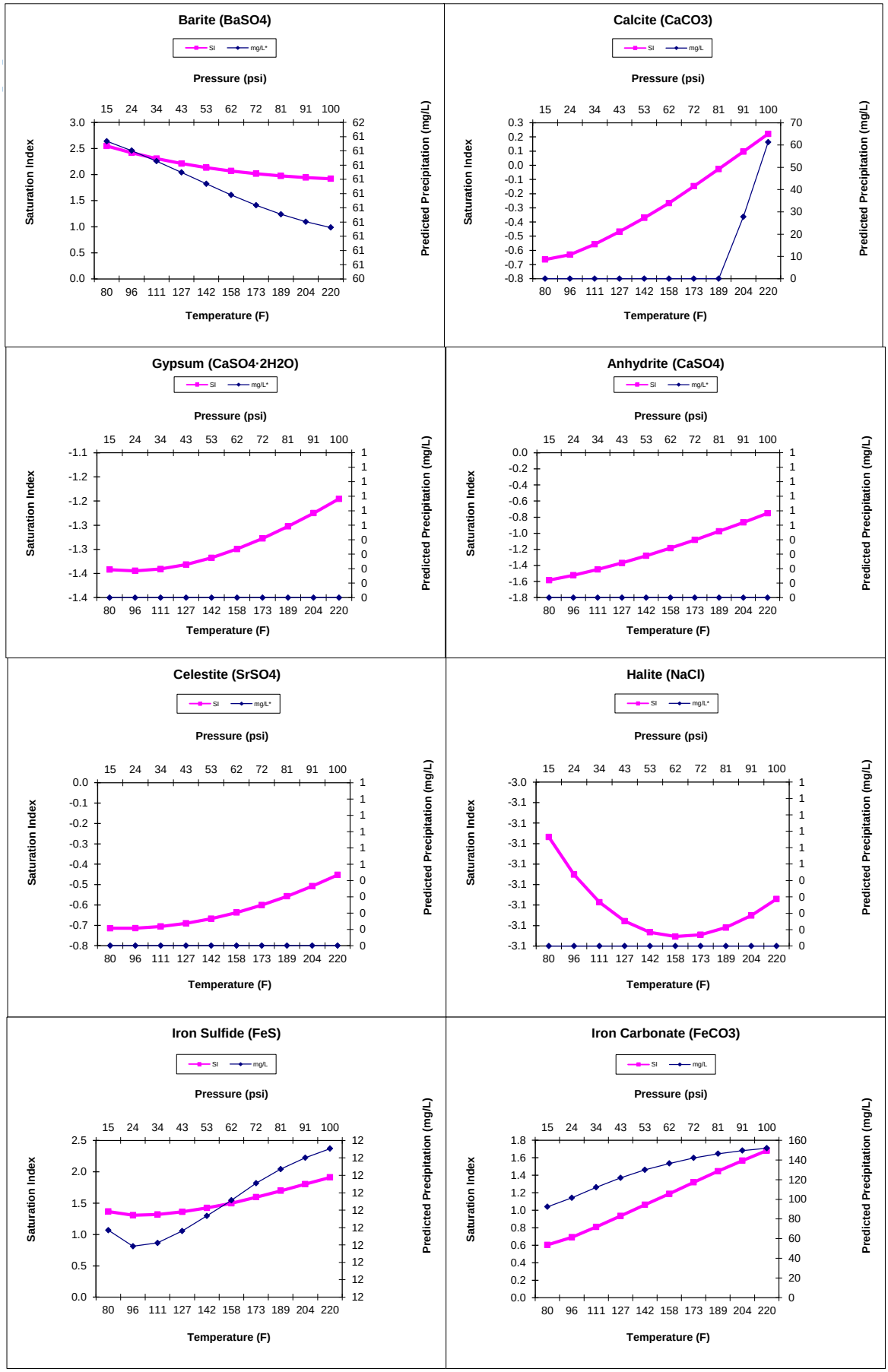
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 44A-30D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44B-7D Separator
District:	Four Corners	**Sample ID:**	201201036481
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 44B-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.5

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	549.0	9.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	350.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	32241
Density/Specific Gravity (g/cm³):	1.0194
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	18700.0	527.5
Sulfate (SO_4^{2-}):	400.0	8.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	1.00	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	12118.0	527.3
Potassium (K^+):	33.1	0.8
Magnesium (Mg^{2+}):	23.1	1.9
Calcium (Ca^{2+}):	254.1	12.7
Strontium (Sr^{2+}):	25.8	0.6
Barium (Ba^{2+}):	97.5	1.4
Iron (Fe^{2+}):	40.0	1.4
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	831	N/A

ND = Not Determined

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)**
80°F	15 psi	2.75	57.883	-0.32	0.000	-1.50	0.000	-1.73	0.000
96°F	24 psi	2.62	57.840	-0.28	0.000	-1.50	0.000	-1.67	0.000
111°F	34 psi	2.51	57.791	-0.21	0.000	-1.50	0.000	-1.60	0.000
127°F	43 psi	2.41	57.738	-0.12	0.000	-1.49	0.000	-1.52	0.000
142°F	53 psi	2.33	57.683	-0.03	0.000	-1.48	0.000	-1.44	0.000
158°F	62 psi	2.26	57.627	0.07	8.422	-1.47	0.000	-1.35	0.000
173°F	72 psi	2.21	57.574	0.18	20.354	-1.45	0.000	-1.25	0.000
189°F	81 psi	2.16	57.525	0.30	32.086	-1.43	0.000	-1.15	0.000
204°F	91 psi	2.12	57.481	0.41	43.139	-1.41	0.000	-1.04	0.000
220°F	100 psi	2.09	57.443	0.53	53.535	-1.39	0.000	-0.94	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)**
80°F	15 psi	-0.81	0.000	-2.47	0.000	-8.74	0.000	0.61	19.720
96°F	24 psi	-0.81	0.000	-2.49	0.000	-8.80	0.000	0.70	21.247
111°F	34 psi	-0.81	0.000	-2.50	0.000	-8.81	0.000	0.81	22.913
127°F	43 psi	-0.80	0.000	-2.51	0.000	-8.78	0.000	0.93	24.308
142°F	53 psi	-0.78	0.000	-2.52	0.000	-8.74	0.000	1.05	25.394
158°F	62 psi	-0.76	0.000	-2.52	0.000	-8.68	0.000	1.17	26.219
173°F	72 psi	-0.73	0.000	-2.52	0.000	-8.61	0.000	1.29	26.876
189°F	81 psi	-0.70	0.000	-2.52	0.000	-8.53	0.000	1.40	27.377
204°F	91 psi	-0.66	0.000	-2.51	0.000	-8.45	0.000	1.51	27.746
220°F	100 psi	-0.61	0.000	-2.51	0.000	-8.36	0.000	1.62	28.022

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.

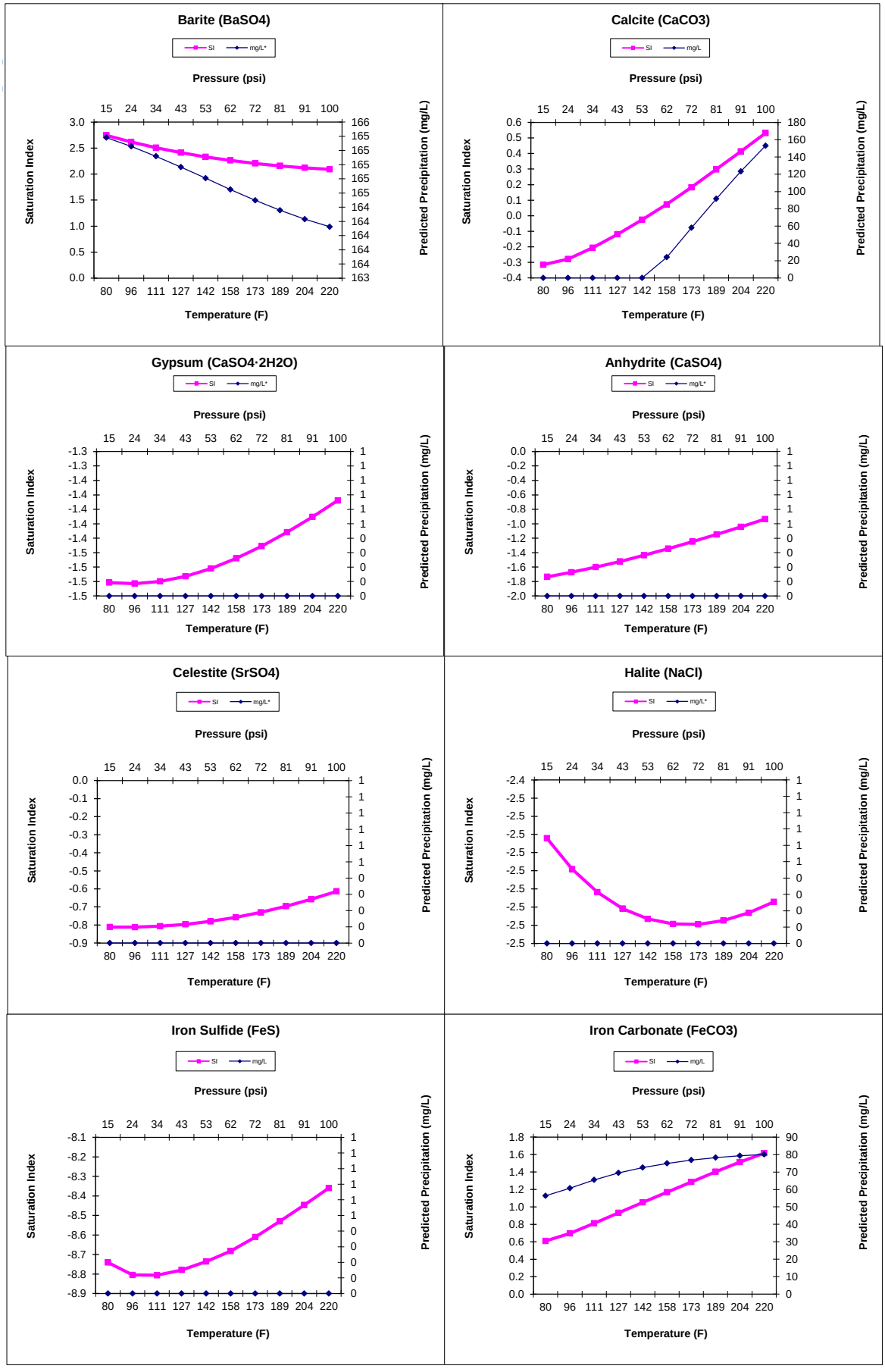
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 44B-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44C-25 Separator
District:	Four Corners	**Sample ID:**	201201036519
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/12/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 44C-25 Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	5.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	410.0
aqueous H_2S (ppm):	ND
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17855
Density/Specific Gravity (g/cm^3):	1.0096
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10400.0	293.4
Sulfate (SO_4^{2-}):	350.0	7.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.03

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6739.0	293.3
Potassium (K^+):	9.2	0.2
Magnesium (Mg^{2+}):	2.2	0.2
Calcium (Ca^{2+}):	23.0	1.1
Strontium (Sr^{2+}):	2.2	0.1
Barium (Ba^{2+}):	3.4	0.0
Iron (Fe^{2+}):	20.7	0.7
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	71	N/A

ND = Not Determined

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)**
80°F	15 psi	1.50	1.946	-2.35	0.000	-2.37	0.000	-2.61	0.000
96°F	24 psi	1.36	1.923	-2.32	0.000	-2.37	0.000	-2.55	0.000
111°F	34 psi	1.25	1.898	-2.25	0.000	-2.37	0.000	-2.48	0.000
127°F	43 psi	1.16	1.870	-2.16	0.000	-2.36	0.000	-2.40	0.000
142°F	53 psi	1.08	1.842	-2.06	0.000	-2.35	0.000	-2.31	0.000
158°F	62 psi	1.01	1.815	-1.95	0.000	-2.33	0.000	-2.22	0.000
173°F	72 psi	0.96	1.790	-1.83	0.000	-2.31	0.000	-2.11	0.000
189°F	81 psi	0.92	1.767	-1.71	0.000	-2.29	0.000	-2.01	0.000
204°F	91 psi	0.89	1.749	-1.58	0.000	-2.26	0.000	-1.90	0.000
220°F	100 psi	0.86	1.734	-1.46	0.000	-2.23	0.000	-1.78	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)**
80°F	15 psi	-1.70	0.000	-2.95	0.000	-10.45	0.000	-0.66	0.000
96°F	24 psi	-1.70	0.000	-2.96	0.000	-10.51	0.000	-0.58	0.000
111°F	34 psi	-1.70	0.000	-2.98	0.000	-10.50	0.000	-0.46	0.000
127°F	43 psi	-1.68	0.000	-2.99	0.000	-10.45	0.000	-0.34	0.000
142°F	53 psi	-1.66	0.000	-2.99	0.000	-10.39	0.000	-0.21	0.000
158°F	62 psi	-1.63	0.000	-2.99	0.000	-10.29	0.000	-0.08	0.000
173°F	72 psi	-1.60	0.000	-2.99	0.000	-10.18	0.000	0.06	1.411
189°F	81 psi	-1.56	0.000	-2.99	0.000	-10.07	0.000	0.18	4.220
204°F	91 psi	-1.51	0.000	-2.98	0.000	-9.95	0.000	0.30	6.435
220°F	100 psi	-1.45	0.000	-2.98	0.000	-9.84	0.000	0.42	8.176

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.

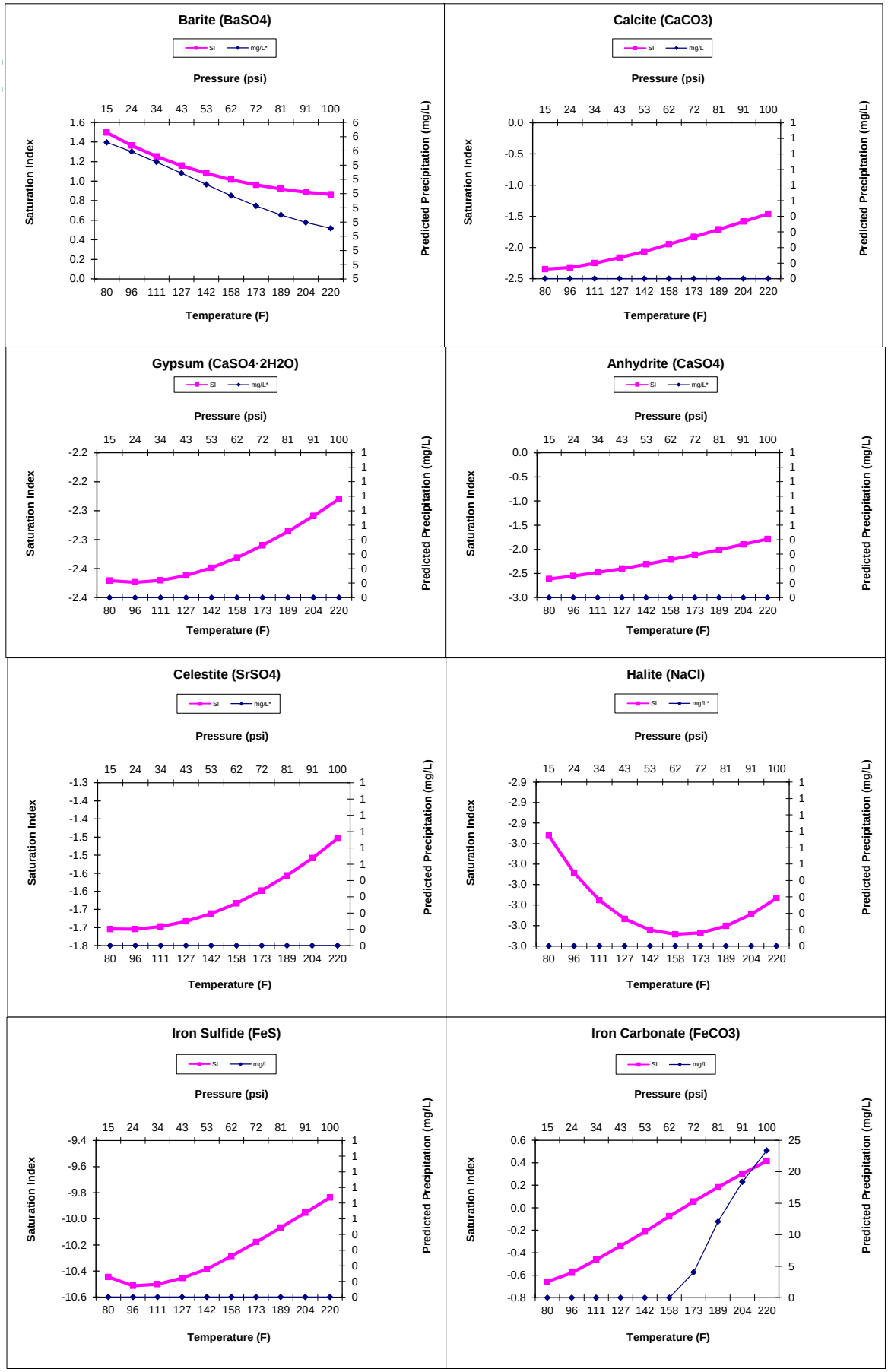
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 44C-25 Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44C-7D Separator
District:	Four Corners	**Sample ID:**	201201036482
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Puckett	**Log Out Date:**	12/17/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 44C-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.7

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	512.0	8.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	30551
Density/Specific Gravity (g/cm³):	1.0183
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	17900.0	504.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	11599.0	504.7
Potassium (K^+):	36.9	0.9
Magnesium (Mg^{2+}):	25.5	2.1
Calcium (Ca^{2+}):	252.7	12.6
Strontium (Sr^{2+}):	29.2	0.7
Barium (Ba^{2+}):	114.9	1.7
Iron (Fe^{2+}):	30.2	1.1
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	854	N/A

ND = Not Determined

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)**
80°F	15 psi	1.94	41.290	-0.14	0.000	-2.38	0.000	-2.62	0.000
96°F	24 psi	1.81	40.891	-0.11	0.000	-2.39	0.000	-2.56	0.000
111°F	34 psi	1.70	40.451	-0.03	0.000	-2.38	0.000	-2.49	0.000
127°F	43 psi	1.61	39.986	0.05	5.303	-2.38	0.000	-2.41	0.000
142°F	53 psi	1.53	39.516	0.15	14.599	-2.37	0.000	-2.32	0.000
158°F	62 psi	1.46	39.060	0.24	23.898	-2.35	0.000	-2.23	0.000
173°F	72 psi	1.40	38.633	0.35	33.475	-2.33	0.000	-2.13	0.000
189°F	81 psi	1.35	38.249	0.46	43.149	-2.31	0.000	-2.03	0.000
204°F	91 psi	1.32	37.916	0.58	52.312	-2.29	0.000	-1.93	0.000
220°F	100 psi	1.29	37.639	0.70	60.969	-2.27	0.000	-1.82	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)**
80°F	15 psi	-1.64	0.000	-2.51	0.000	1.45	1.695	0.66	15.775
96°F	24 psi	-1.64	0.000	-2.52	0.000	1.38	1.683	0.75	16.818
111°F	34 psi	-1.63	0.000	-2.54	0.000	1.37	1.682	0.86	17.929
127°F	43 psi	-1.62	0.000	-2.55	0.000	1.39	1.686	0.99	18.848
142°F	53 psi	-1.60	0.000	-2.55	0.000	1.43	1.692	1.10	19.557
158°F	62 psi	-1.58	0.000	-2.55	0.000	1.47	1.700	1.22	20.091
173°F	72 psi	-1.55	0.000	-2.55	0.000	1.54	1.709	1.34	20.508
189°F	81 psi	-1.52	0.000	-2.55	0.000	1.61	1.718	1.45	20.830
204°F	91 psi	-1.48	0.000	-2.55	0.000	1.69	1.727	1.56	21.067
220°F	100 psi	-1.44	0.000	-2.54	0.000	1.77	1.734	1.67	21.243

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.

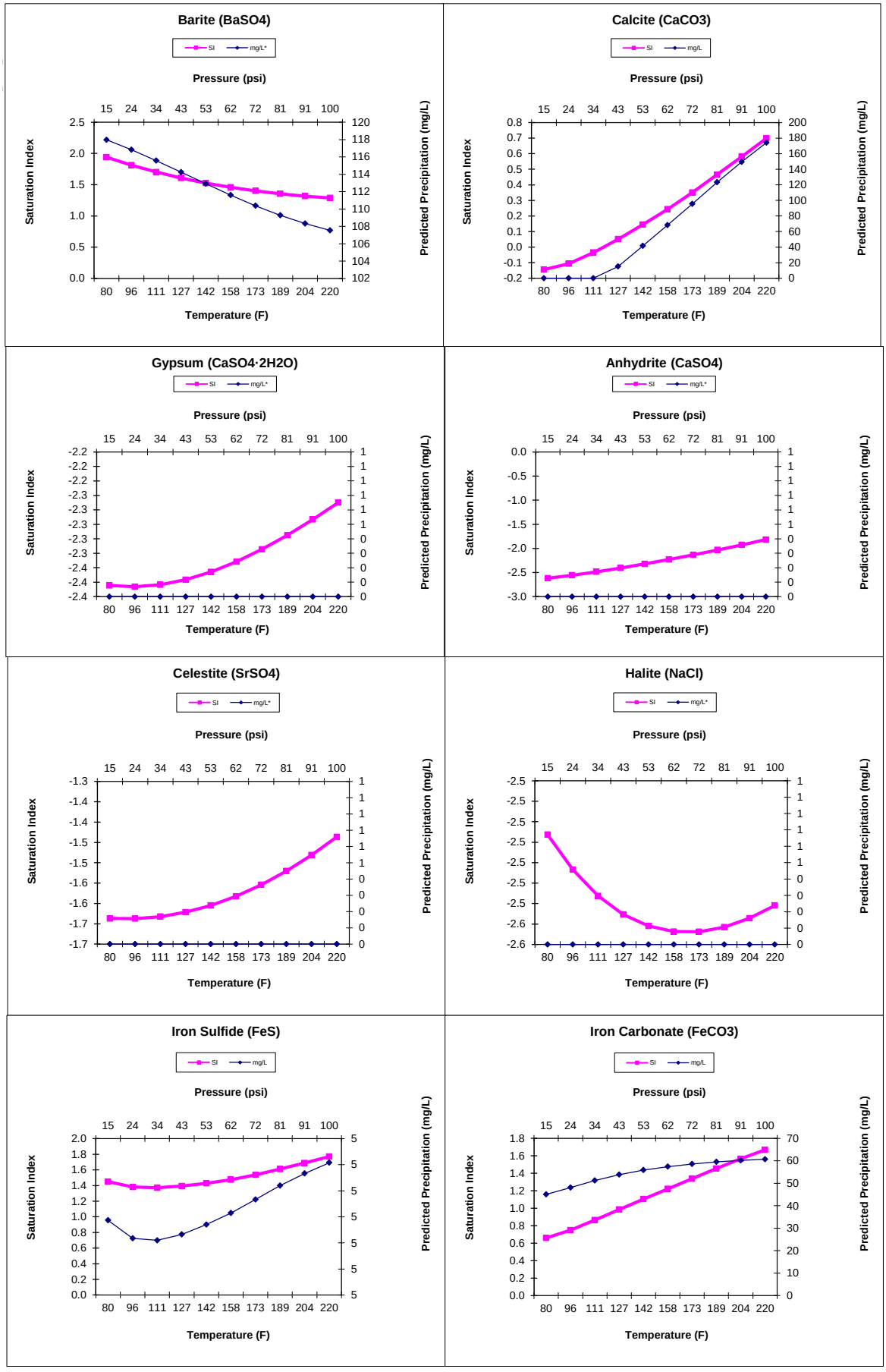
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Puckett, 44C-7D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	44D-30D Separator
District:	Four Corners	**Sample ID:**	201201037405
Sales Rep:	Sean Higgins	**Sample Date:**	12/3/2012
Lease:	Puckett	**Log Out Date:**	12/28/2012
Site Type:		**Analyst:**	NJC
Sample Point Description:			

CAERUS OIL & GAS, Puckett, 44D-30D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	414.0	6.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	200.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17916
Density/Specific Gravity (g/cm^3):	1.0098
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10300.0	290.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.96

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6674.0	290.4
Potassium (K^+):	79.2	2.0
Magnesium (Mg^{2+}):	19.6	1.6
Calcium (Ca^{2+}):	290.9	14.5
Strontium (Sr^{2+}):	22.9	0.5
Barium (Ba^{2+}):	50.3	0.7
Iron (Fe^{2+}):	14.3	0.5
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	871	N/A

ND = Not Determined

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)**
80°F	15 psi	1.81	28.514	-0.52	0.000	-2.13	0.000	-2.37	0.000
96°F	24 psi	1.68	28.077	-0.48	0.000	-2.13	0.000	-2.31	0.000
111°F	34 psi	1.57	27.612	-0.41	0.000	-2.13	0.000	-2.24	0.000
127°F	43 psi	1.47	27.139	-0.32	0.000	-2.12	0.000	-2.16	0.000
142°F	53 psi	1.39	26.680	-0.23	0.000	-2.11	0.000	-2.07	0.000
158°F	62 psi	1.33	26.253	-0.12	0.000	-2.09	0.000	-1.98	0.000
173°F	72 psi	1.27	25.871	-0.01	0.000	-2.07	0.000	-1.87	0.000
189°F	81 psi	1.23	25.543	0.11	10.989	-2.05	0.000	-1.77	0.000
204°F	91 psi	1.20	25.276	0.23	21.995	-2.02	0.000	-1.66	0.000
220°F	100 psi	1.18	25.071	0.36	32.224	-1.99	0.000	-1.55	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)**
80°F	15 psi	-1.55	0.000	-2.96	0.000	0.98	4.582	-0.08	0.000
96°F	24 psi	-1.55	0.000	-2.97	0.000	0.92	4.427	0.01	0.145
111°F	34 psi	-1.54	0.000	-2.99	0.000	0.93	4.454	0.12	2.295
127°F	43 psi	-1.53	0.000	-3.00	0.000	0.97	4.563	0.25	4.127
142°F	53 psi	-1.51	0.000	-3.00	0.000	1.02	4.712	0.38	5.574
158°F	62 psi	-1.48	0.000	-3.00	0.000	1.09	4.877	0.50	6.682
173°F	72 psi	-1.44	0.000	-3.00	0.000	1.18	5.074	0.63	7.580
189°F	81 psi	-1.40	0.000	-3.00	0.000	1.28	5.262	0.75	8.248
204°F	91 psi	-1.35	0.000	-2.99	0.000	1.38	5.432	0.87	8.739
220°F	100 psi	-1.30	0.000	-2.99	0.000	1.48	5.585	0.98	9.103

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.

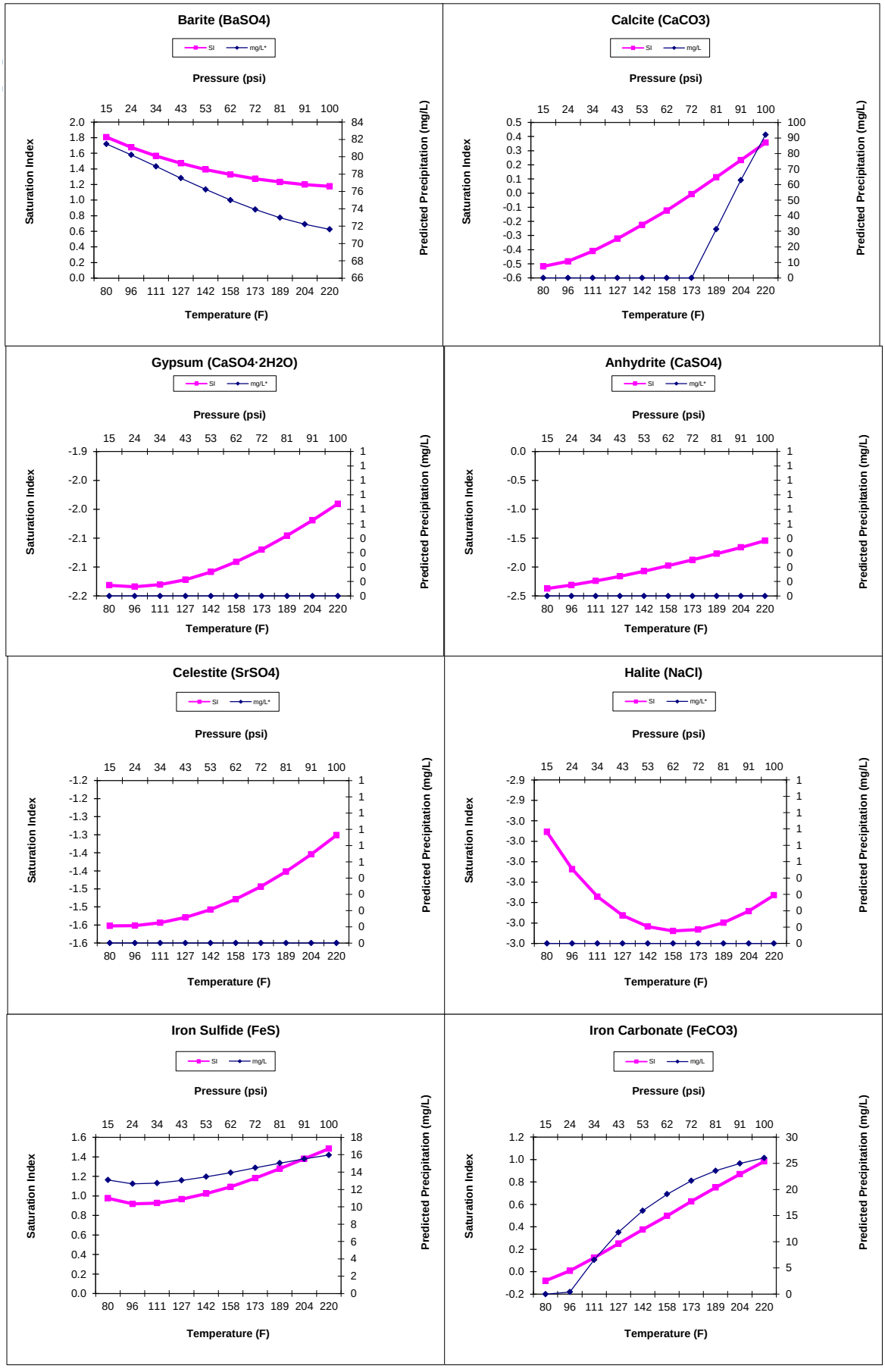
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41246 CAERUS OIL & GAS, Puckett, 44D-30D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13-16D Separator
District:	Four Corners	**Sample ID:**	201201035638
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 13-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	512.0	8.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	430.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	5836
Density/Specific Gravity (g/cm³):	1.0012
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	3100.0	87.4
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:		1.06

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	2009.0	87.4
Potassium (K^+):	16.0	0.4
Magnesium (Mg^{2+}):	4.0	0.3
Calcium (Ca^{2+}):	61.0	3.0
Strontium (Sr^{2+}):	4.0	0.1
Barium (Ba^{2+}):	8.0	0.1
Iron (Fe^{2+}):	21.0	0.8
Manganese (Mn^{2+}):	0.7	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	179	N/A

ND = Not Determined

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)**
80°F	15 psi	1.75	4.670	-0.22	0.000	-2.10	0.000	-2.34	0.000
96°F	24 psi	1.62	4.639	-0.18	0.000	-2.10	0.000	-2.28	0.000
111°F	34 psi	1.51	4.604	-0.10	0.000	-2.09	0.000	-2.21	0.000
127°F	43 psi	1.42	4.568	-0.01	0.000	-2.08	0.000	-2.12	0.000
142°F	53 psi	1.35	4.533	0.09	5.441	-2.06	0.000	-2.03	0.000
158°F	62 psi	1.29	4.500	0.20	11.387	-2.04	0.000	-1.93	0.000
173°F	72 psi	1.24	4.471	0.32	17.312	-2.01	0.000	-1.82	0.000
189°F	81 psi	1.21	4.448	0.45	23.067	-1.98	0.000	-1.71	0.000
204°F	91 psi	1.19	4.431	0.58	28.270	-1.94	0.000	-1.59	0.000
220°F	100 psi	1.17	4.421	0.71	32.903	-1.90	0.000	-1.46	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)**
80°F	15 psi	-1.60	0.000	-3.92	0.000	2.10	2.305	1.11	13.742
96°F	24 psi	-1.60	0.000	-3.94	0.000	2.04	2.301	1.20	14.037
111°F	34 psi	-1.59	0.000	-3.95	0.000	2.03	2.301	1.33	14.337
127°F	43 psi	-1.57	0.000	-3.96	0.000	2.06	2.302	1.46	14.575
142°F	53 psi	-1.54	0.000	-3.96	0.000	2.10	2.305	1.60	14.754
158°F	62 psi	-1.50	0.000	-3.96	0.000	2.16	2.308	1.73	14.884
173°F	72 psi	-1.45	0.000	-3.96	0.000	2.23	2.311	1.87	14.981
189°F	81 psi	-1.40	0.000	-3.96	0.000	2.32	2.315	2.00	15.053
204°F	91 psi	-1.33	0.000	-3.95	0.000	2.41	2.317	2.14	15.105
220°F	100 psi	-1.27	0.000	-3.94	0.000	2.51	2.320	2.26	15.141

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.

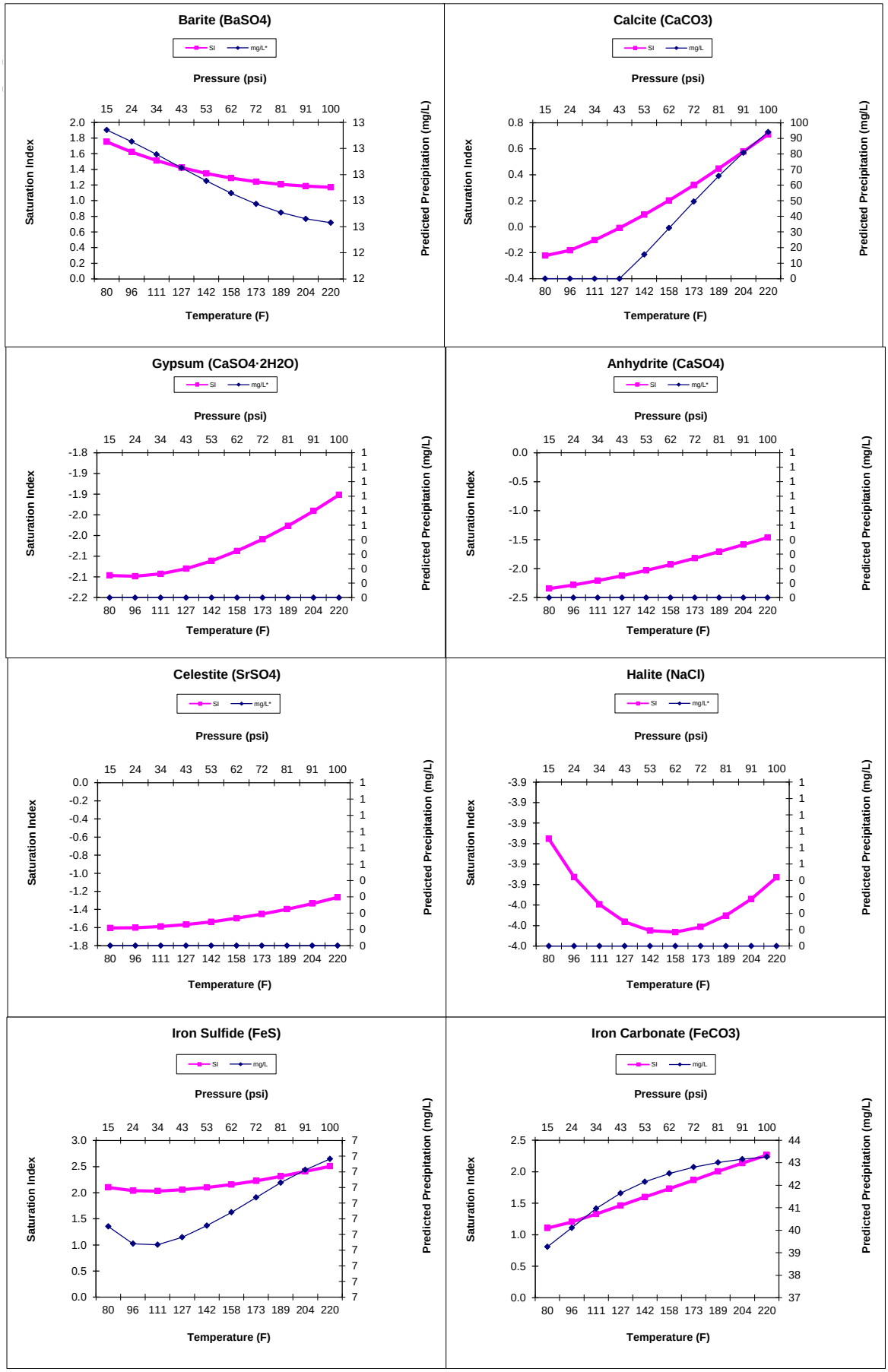
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 13-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13-4D Separator
District:	Four Corners	**Sample ID:**	201201035651
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 13-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	341.0	5.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	130.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	24029
Density/Specific Gravity (g/cm^3):	1.0139
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14100.0	397.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.98	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9137.0	397.6
Potassium (K^+):	76.0	1.9
Magnesium (Mg^{2+}):	21.0	1.7
Calcium (Ca^{2+}):	192.0	9.6
Strontium (Sr^{2+}):	22.0	0.5
Barium (Ba^{2+}):	51.0	0.7
Iron (Fe^{2+}):	39.0	1.4
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	629	N/A

ND = Not Determined

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)**
80°F	15 psi	1.70	28.484	-1.12	0.000	-2.41	0.000	-2.65	0.000
96°F	24 psi	1.57	27.935	-1.08	0.000	-2.42	0.000	-2.59	0.000
111°F	34 psi	1.46	27.353	-1.01	0.000	-2.41	0.000	-2.52	0.000
127°F	43 psi	1.36	26.764	-0.92	0.000	-2.41	0.000	-2.44	0.000
142°F	53 psi	1.28	26.191	-0.83	0.000	-2.39	0.000	-2.35	0.000
158°F	62 psi	1.21	25.654	-0.73	0.000	-2.38	0.000	-2.26	0.000
173°F	72 psi	1.16	25.170	-0.61	0.000	-2.36	0.000	-2.16	0.000
189°F	81 psi	1.11	24.749	-0.49	0.000	-2.34	0.000	-2.06	0.000
204°F	91 psi	1.08	24.398	-0.37	0.000	-2.31	0.000	-1.95	0.000
220°F	100 psi	1.05	24.120	-0.25	0.000	-2.29	0.000	-1.84	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)**
80°F	15 psi	-1.67	0.000	-2.70	0.000	0.55	2.316	-0.08	0.000
96°F	24 psi	-1.67	0.000	-2.72	0.000	0.49	2.162	0.01	0.224
111°F	34 psi	-1.66	0.000	-2.73	0.000	0.50	2.192	0.12	4.817
127°F	43 psi	-1.65	0.000	-2.74	0.000	0.55	2.303	0.24	9.056
142°F	53 psi	-1.63	0.000	-2.75	0.000	0.61	2.445	0.37	12.677
158°F	62 psi	-1.61	0.000	-2.75	0.000	0.68	2.598	0.49	15.700
173°F	72 psi	-1.58	0.000	-2.75	0.000	0.78	2.767	0.61	18.349
189°F	81 psi	-1.54	0.000	-2.75	0.000	0.88	2.908	0.74	20.418
204°F	91 psi	-1.49	0.000	-2.74	0.000	0.98	3.025	0.85	22.030
220°F	100 psi	-1.45	0.000	-2.73	0.000	1.09	3.121	0.96	23.286

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.

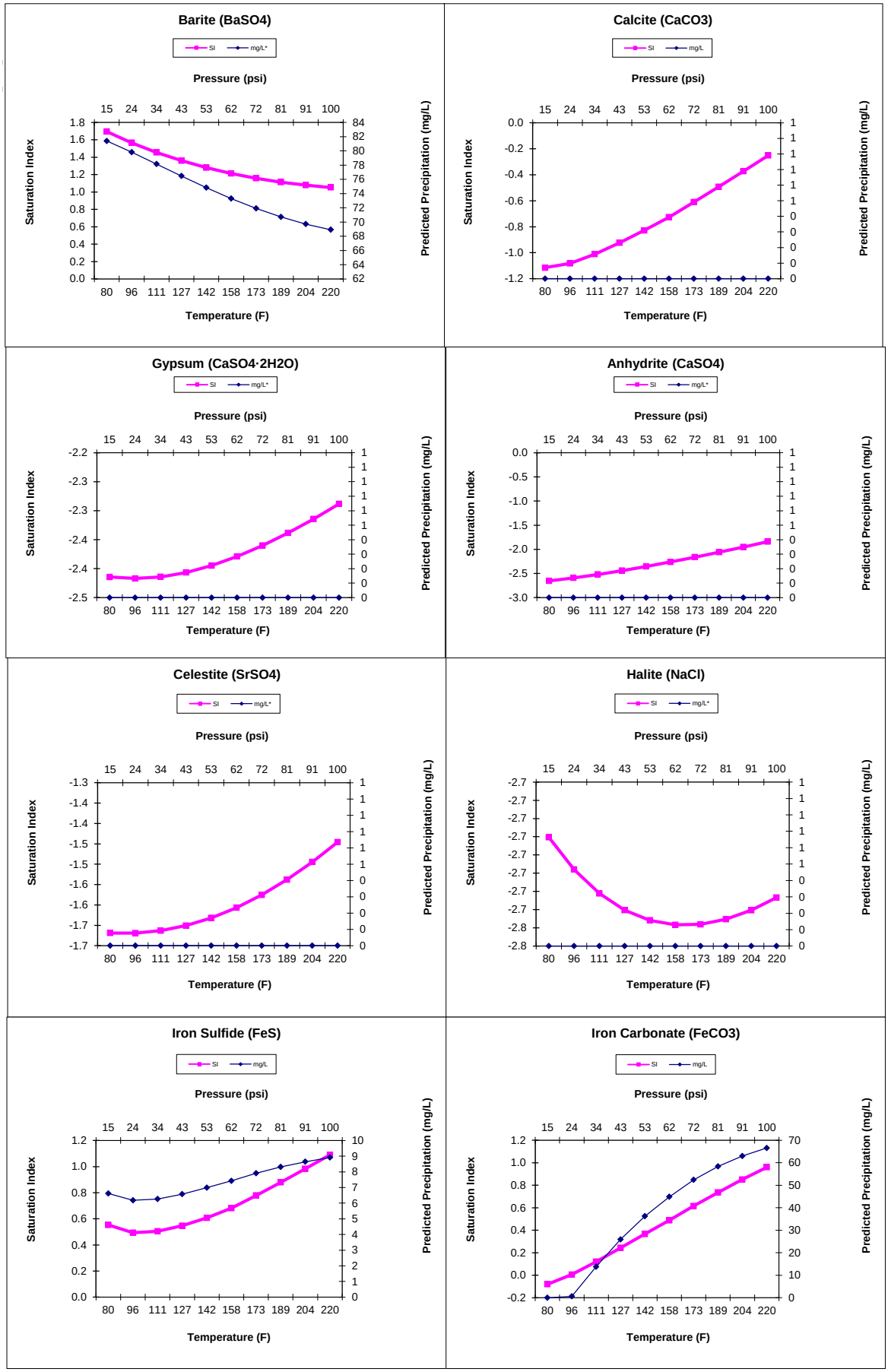
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 13-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13-9D Separator
District:	Four Corners	**Sample ID:**	201201035649
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 13-9D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	122.0	2.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	240.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16574
Density/Specific Gravity (g/cm³):	1.0088
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9500.0	268.0
Sulfate (SO_4^{2-}):	400.0	8.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6156.0	267.9
Potassium (K^+):	60.0	1.5
Magnesium (Mg^{2+}):	15.0	1.2
Calcium (Ca^{2+}):	217.0	10.8
Strontium (Sr^{2+}):	17.0	0.4
Barium (Ba^{2+}):	27.0	0.4
Iron (Fe^{2+}):	59.0	2.1
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	643	N/A

ND = Not Determined

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)**
80°F	15 psi	2.47	16.003	-1.47	0.000	-1.34	0.000	-1.58	0.000
96°F	24 psi	2.34	15.983	-1.43	0.000	-1.34	0.000	-1.52	0.000
111°F	34 psi	2.22	15.960	-1.36	0.000	-1.34	0.000	-1.44	0.000
127°F	43 psi	2.13	15.936	-1.27	0.000	-1.33	0.000	-1.36	0.000
142°F	53 psi	2.05	15.911	-1.18	0.000	-1.31	0.000	-1.28	0.000
158°F	62 psi	1.99	15.887	-1.07	0.000	-1.29	0.000	-1.18	0.000
173°F	72 psi	1.94	15.865	-0.96	0.000	-1.27	0.000	-1.08	0.000
189°F	81 psi	1.89	15.845	-0.84	0.000	-1.25	0.000	-0.97	0.000
204°F	91 psi	1.86	15.829	-0.72	0.000	-1.22	0.000	-0.86	0.000
220°F	100 psi	1.84	15.816	-0.60	0.000	-1.19	0.000	-0.75	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)**
80°F	15 psi	-0.75	0.000	-3.02	0.000	0.95	4.662	-0.31	0.000
96°F	24 psi	-0.75	0.000	-3.04	0.000	0.90	4.545	-0.22	0.000
111°F	34 psi	-0.75	0.000	-3.05	0.000	0.91	4.585	-0.10	0.000
127°F	43 psi	-0.73	0.000	-3.06	0.000	0.96	4.694	0.02	0.635
142°F	53 psi	-0.71	0.000	-3.07	0.000	1.02	4.830	0.15	4.262
158°F	62 psi	-0.68	0.000	-3.07	0.000	1.10	4.971	0.27	7.506
173°F	72 psi	-0.64	0.000	-3.07	0.000	1.19	5.118	0.39	10.539
189°F	81 psi	-0.60	0.000	-3.07	0.000	1.29	5.251	0.52	13.285
204°F	91 psi	-0.55	0.000	-3.06	0.000	1.40	5.361	0.64	15.683
220°F	100 psi	-0.50	0.000	-3.05	0.000	1.51	5.450	0.75	17.786

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.

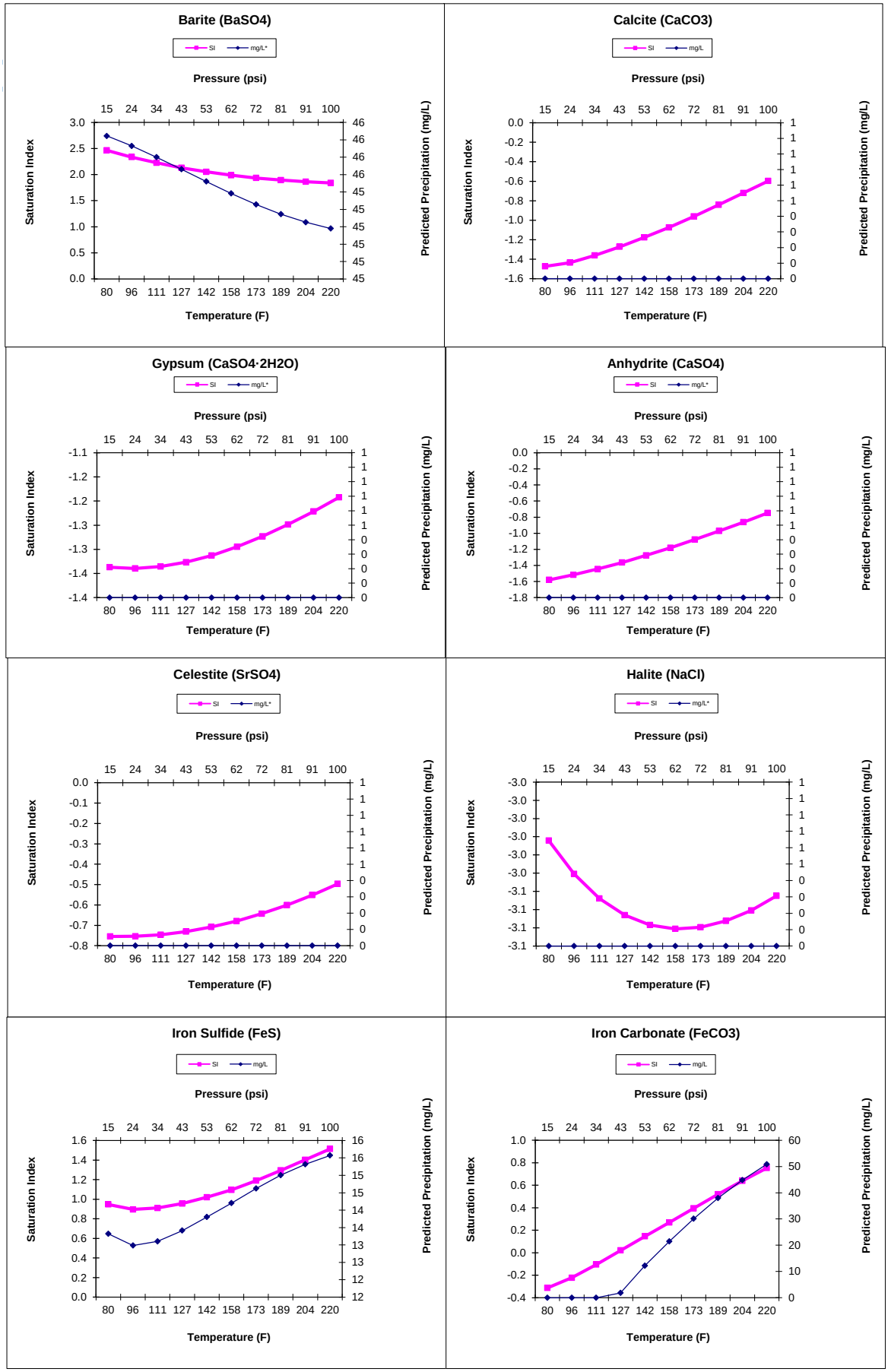
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 13-9D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13-9D Separator
District:	Four Corners	**Sample ID:**	201201035649
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 13-9D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	122.0	2.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	240.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	16574
Density/Specific Gravity (g/cm³):	1.0088
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	9500.0	268.0
Sulfate (SO_4^{2-}):	400.0	8.3
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6156.0	267.9
Potassium (K^+):	60.0	1.5
Magnesium (Mg^{2+}):	15.0	1.2
Calcium (Ca^{2+}):	217.0	10.8
Strontium (Sr^{2+}):	17.0	0.4
Barium (Ba^{2+}):	27.0	0.4
Iron (Fe^{2+}):	59.0	2.1
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	643	N/A

ND = Not Determined

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)**
80°F	15 psi	2.47	16.003	-1.47	0.000	-1.34	0.000	-1.58	0.000
96°F	24 psi	2.34	15.983	-1.43	0.000	-1.34	0.000	-1.52	0.000
111°F	34 psi	2.22	15.960	-1.36	0.000	-1.34	0.000	-1.44	0.000
127°F	43 psi	2.13	15.936	-1.27	0.000	-1.33	0.000	-1.36	0.000
142°F	53 psi	2.05	15.911	-1.18	0.000	-1.31	0.000	-1.28	0.000
158°F	62 psi	1.99	15.887	-1.07	0.000	-1.29	0.000	-1.18	0.000
173°F	72 psi	1.94	15.865	-0.96	0.000	-1.27	0.000	-1.08	0.000
189°F	81 psi	1.89	15.845	-0.84	0.000	-1.25	0.000	-0.97	0.000
204°F	91 psi	1.86	15.829	-0.72	0.000	-1.22	0.000	-0.86	0.000
220°F	100 psi	1.84	15.816	-0.60	0.000	-1.19	0.000	-0.75	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)**
80°F	15 psi	-0.75	0.000	-3.02	0.000	0.95	4.662	-0.31	0.000
96°F	24 psi	-0.75	0.000	-3.04	0.000	0.90	4.545	-0.22	0.000
111°F	34 psi	-0.75	0.000	-3.05	0.000	0.91	4.585	-0.10	0.000
127°F	43 psi	-0.73	0.000	-3.06	0.000	0.96	4.694	0.02	0.635
142°F	53 psi	-0.71	0.000	-3.07	0.000	1.02	4.830	0.15	4.262
158°F	62 psi	-0.68	0.000	-3.07	0.000	1.10	4.971	0.27	7.506
173°F	72 psi	-0.64	0.000	-3.07	0.000	1.19	5.118	0.39	10.539
189°F	81 psi	-0.60	0.000	-3.07	0.000	1.29	5.251	0.52	13.285
204°F	91 psi	-0.55	0.000	-3.06	0.000	1.40	5.361	0.64	15.683
220°F	100 psi	-0.50	0.000	-3.05	0.000	1.51	5.450	0.75	17.786

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.

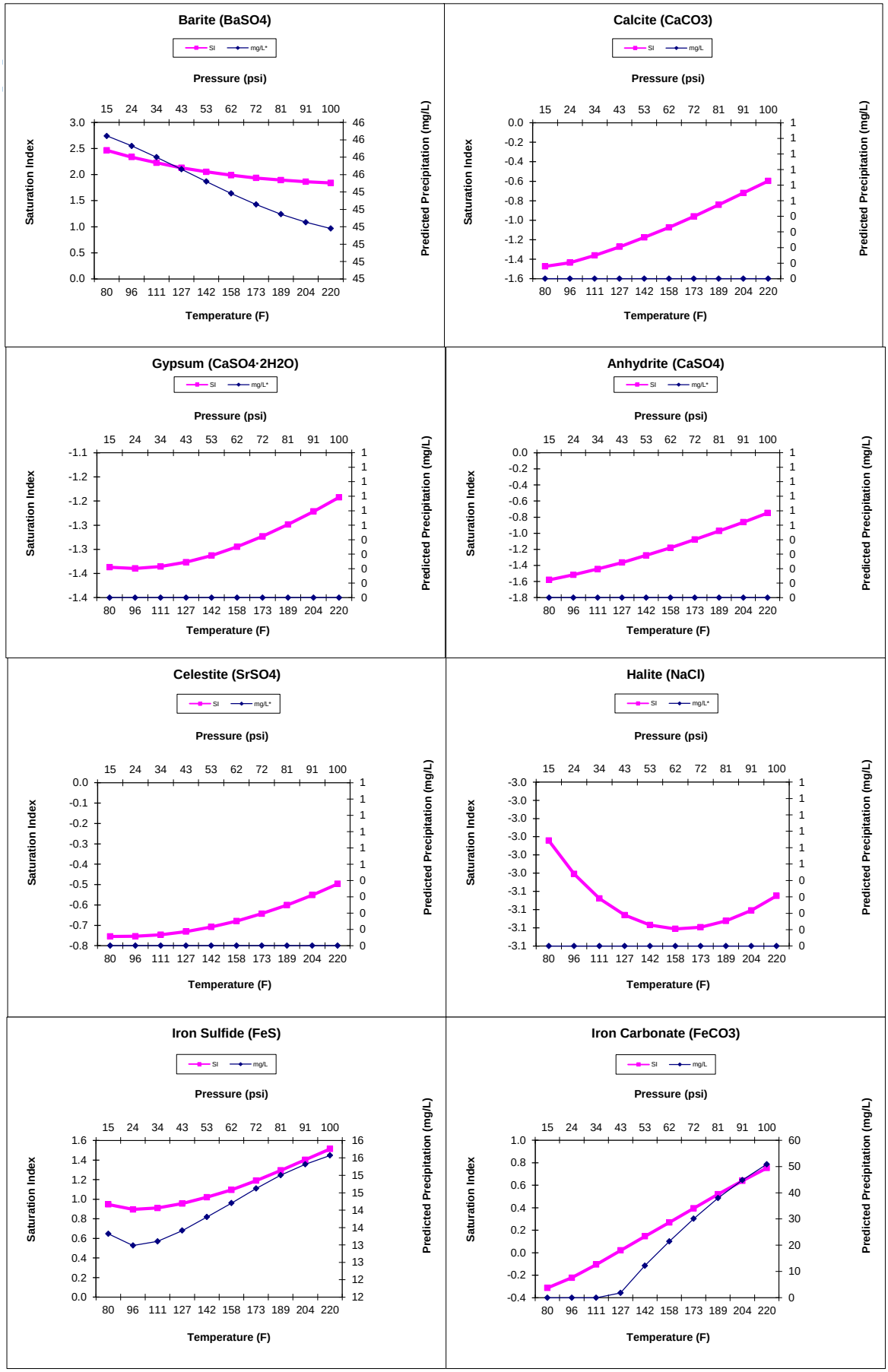
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 13-9D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13B-16D Separator
District:	Four Corners	**Sample ID:**	201201035657
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 13B-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	463.0	7.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20356
Density/Specific Gravity (g/cm³):	1.0113
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11800.0	332.9
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7646.0	332.7
Potassium (K^+):	54.0	1.4
Magnesium (Mg^{2+}):	21.0	1.7
Calcium (Ca^{2+}):	165.0	8.2
Strontium (Sr^{2+}):	19.0	0.4
Barium (Ba^{2+}):	36.0	0.5
Iron (Fe^{2+}):	2.0	0.1
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	547	N/A

ND = Not Determined

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)**
80°F	15 psi	2.09	21.207	-0.03	0.000	-1.94	0.000	-2.18	0.000
96°F	24 psi	1.96	21.135	0.01	0.553	-1.94	0.000	-2.11	0.000
111°F	34 psi	1.85	21.053	0.08	6.128	-1.94	0.000	-2.04	0.000
127°F	43 psi	1.76	20.966	0.17	12.657	-1.93	0.000	-1.96	0.000
142°F	53 psi	1.68	20.877	0.26	19.565	-1.92	0.000	-1.88	0.000
158°F	62 psi	1.61	20.789	0.37	26.585	-1.90	0.000	-1.78	0.000
173°F	72 psi	1.56	20.707	0.47	33.822	-1.88	0.000	-1.68	0.000
189°F	81 psi	1.52	20.635	0.59	41.308	-1.86	0.000	-1.58	0.000
204°F	91 psi	1.48	20.573	0.71	48.491	-1.83	0.000	-1.47	0.000
220°F	100 psi	1.46	20.525	0.83	55.355	-1.80	0.000	-1.36	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)**
80°F	15 psi	-1.19	0.000	-2.85	0.000	0.73	0.706	-0.20	0.000
96°F	24 psi	-1.19	0.000	-2.86	0.000	0.66	0.660	-0.11	0.000
111°F	34 psi	-1.19	0.000	-2.88	0.000	0.64	0.649	0.00	0.015
127°F	43 psi	-1.17	0.000	-2.89	0.000	0.65	0.657	0.13	0.365
142°F	53 psi	-1.15	0.000	-2.89	0.000	0.68	0.676	0.25	0.631
158°F	62 psi	-1.13	0.000	-2.89	0.000	0.72	0.702	0.37	0.828
173°F	72 psi	-1.09	0.000	-2.89	0.000	0.78	0.734	0.49	0.978
189°F	81 psi	-1.05	0.000	-2.89	0.000	0.85	0.773	0.62	1.093
204°F	91 psi	-1.01	0.000	-2.88	0.000	0.92	0.810	0.73	1.177
220°F	100 psi	-0.95	0.000	-2.88	0.000	1.00	0.846	0.84	1.239

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.

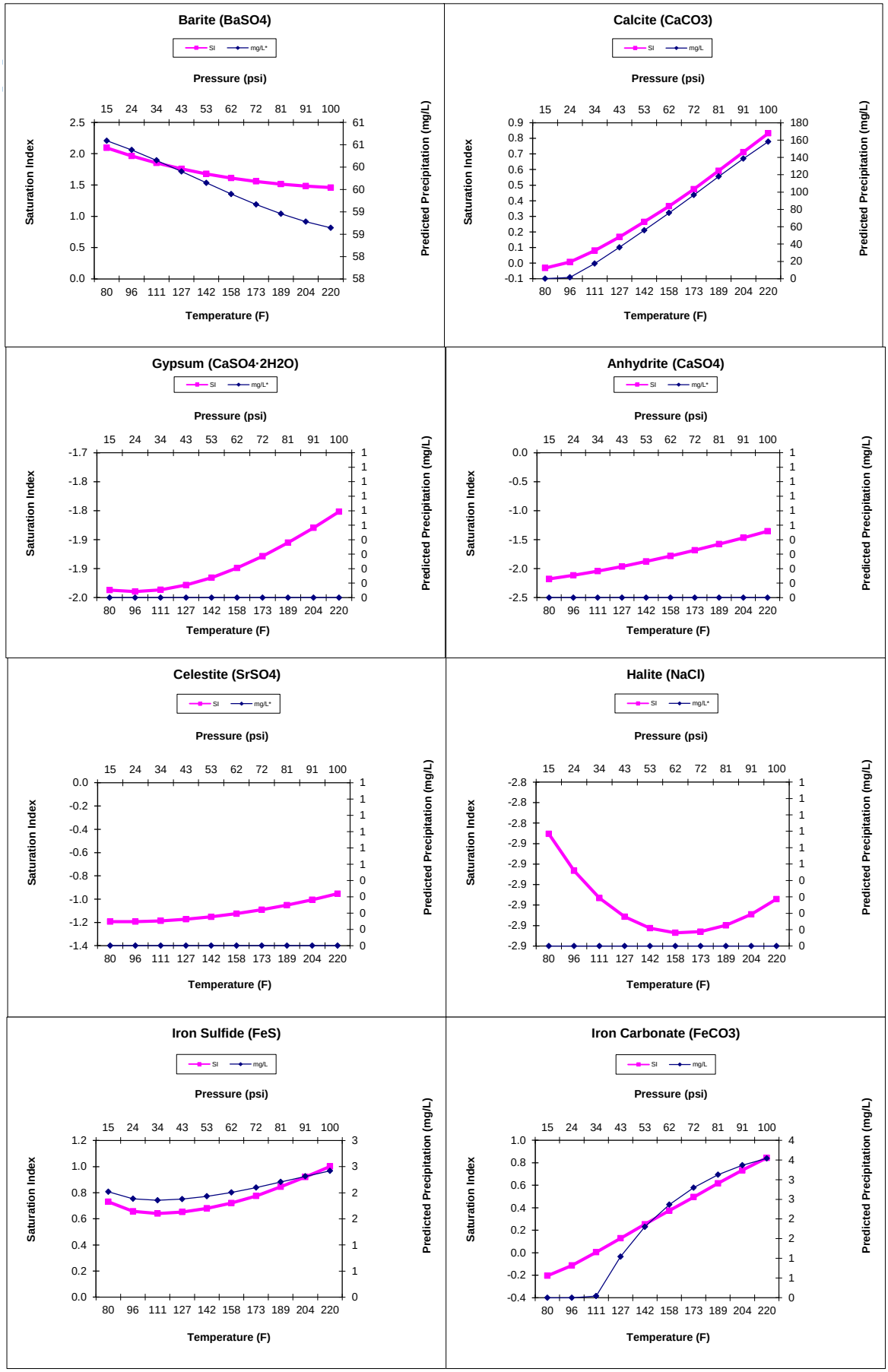
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 13B-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	13D-16D Separator
District:	Four Corners	**Sample ID:**	201201035658
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 13D-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:	
pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	427.0	7.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	120.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21334
Density/Specific Gravity (g/cm³):	1.0121
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12300.0	347.0
Sulfate (SO_4^{2-}):	150.0	3.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.97

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7970.0	346.8
Potassium (K^+):	53.0	1.4
Magnesium (Mg^{2+}):	26.0	2.1
Calcium (Ca^{2+}):	265.0	13.2
Strontium (Sr^{2+}):	28.0	0.6
Barium (Ba^{2+}):	58.0	0.8
Iron (Fe^{2+}):	56.0	2.0
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	844	N/A

ND = Not Determined

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)**
80°F	15 psi	2.27	34.248	0.13	10.327	-1.76	0.000	-2.00	0.000
96°F	24 psi	2.14	34.160	0.17	13.216	-1.76	0.000	-1.94	0.000
111°F	34 psi	2.03	34.062	0.24	18.636	-1.76	0.000	-1.87	0.000
127°F	43 psi	1.94	33.956	0.33	24.957	-1.75	0.000	-1.79	0.000
142°F	53 psi	1.86	33.847	0.43	31.603	-1.74	0.000	-1.70	0.000
158°F	62 psi	1.79	33.741	0.53	38.307	-1.72	0.000	-1.60	0.000
173°F	72 psi	1.74	33.641	0.63	45.147	-1.70	0.000	-1.50	0.000
189°F	81 psi	1.69	33.552	0.75	52.177	-1.68	0.000	-1.40	0.000
204°F	91 psi	1.66	33.476	0.87	58.847	-1.65	0.000	-1.29	0.000
220°F	100 psi	1.63	33.415	0.99	65.144	-1.63	0.000	-1.18	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)**
80°F	15 psi	-1.05	0.000	-2.81	0.000	2.34	2.242	1.20	34.942
96°F	24 psi	-1.05	0.000	-2.83	0.000	2.26	2.240	1.29	35.906
111°F	34 psi	-1.05	0.000	-2.84	0.000	2.25	2.240	1.40	36.937
127°F	43 psi	-1.03	0.000	-2.85	0.000	2.26	2.240	1.53	37.799
142°F	53 psi	-1.01	0.000	-2.86	0.000	2.28	2.241	1.65	38.471
158°F	62 psi	-0.98	0.000	-2.86	0.000	2.32	2.242	1.77	38.980
173°F	72 psi	-0.95	0.000	-2.86	0.000	2.38	2.244	1.89	39.373
189°F	81 psi	-0.91	0.000	-2.86	0.000	2.45	2.245	2.01	39.680
204°F	91 psi	-0.87	0.000	-2.85	0.000	2.52	2.247	2.13	39.906
220°F	100 psi	-0.82	0.000	-2.85	0.000	2.60	2.248	2.24	40.073

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.

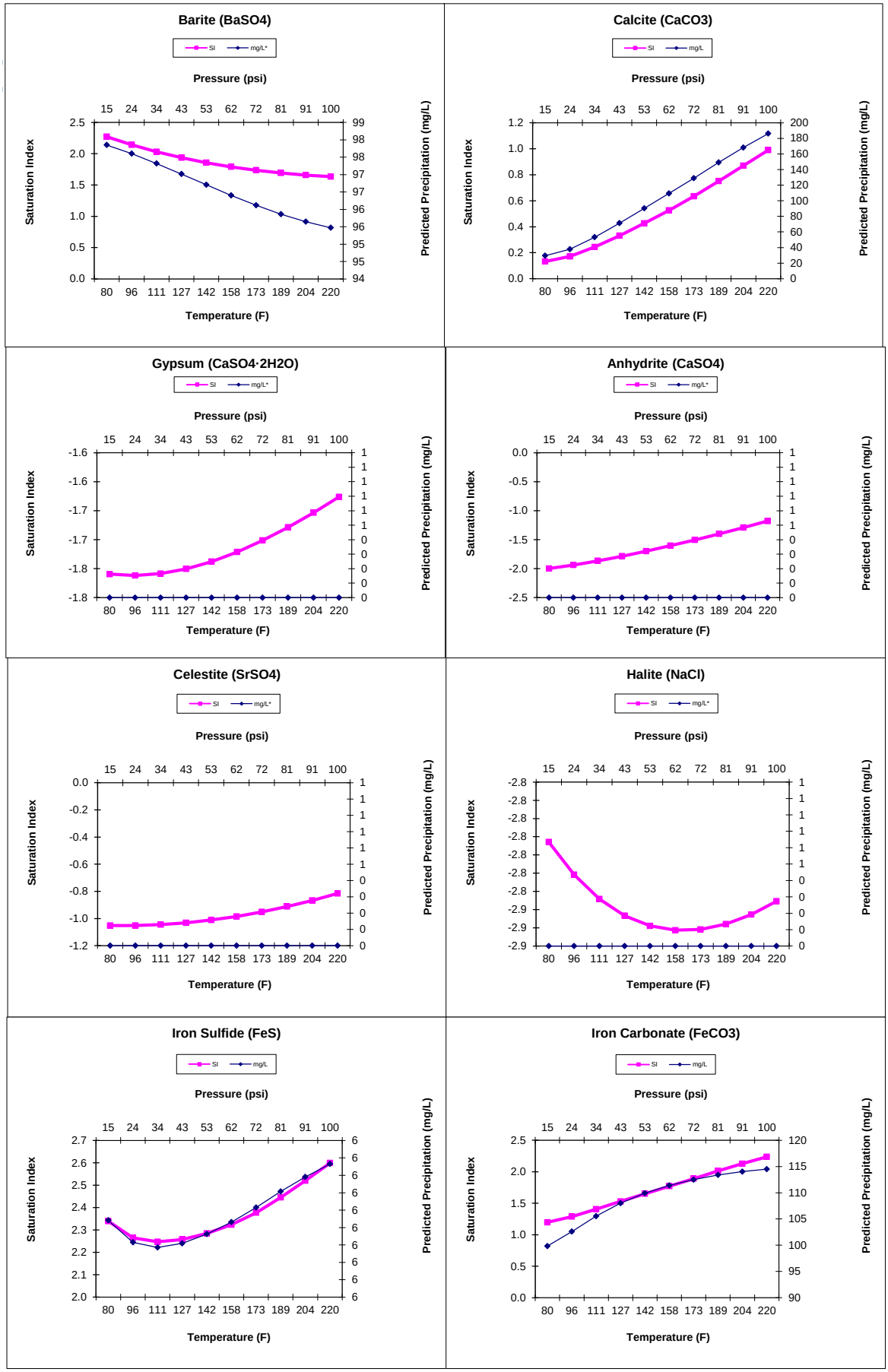
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 13D-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14-16D Separator
District:	Four Corners	**Sample ID:**	201201035639
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 14-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	195.0	3.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	490.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21432
Density/Specific Gravity (g/cm^3):	1.0126
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12100.0	341.3
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.89

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7841.0	341.2
Potassium (K^+):	38.0	1.0
Magnesium (Mg^{2+}):	16.0	1.3
Calcium (Ca^{2+}):	695.0	34.7
Strontium (Sr^{2+}):	35.0	0.8
Barium (Ba^{2+}):	437.0	6.4
Iron (Fe^{2+}):	24.0	0.9
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	2161	N/A

ND = Not Determined

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)**
80°F	15 psi	2.65	42.403	0.19	7.722	-1.85	0.000	-2.09	0.000
96°F	24 psi	2.52	42.363	0.23	9.150	-1.85	0.000	-2.03	0.000
111°F	34 psi	2.41	42.319	0.30	11.838	-1.85	0.000	-1.96	0.000
127°F	43 psi	2.31	42.271	0.39	14.950	-1.84	0.000	-1.88	0.000
142°F	53 psi	2.23	42.222	0.48	18.189	-1.83	0.000	-1.79	0.000
158°F	62 psi	2.17	42.174	0.58	21.414	-1.81	0.000	-1.69	0.000
173°F	72 psi	2.11	42.128	0.68	24.642	-1.79	0.000	-1.59	0.000
189°F	81 psi	2.07	42.087	0.80	27.913	-1.77	0.000	-1.49	0.000
204°F	91 psi	2.04	42.051	0.91	30.953	-1.74	0.000	-1.38	0.000
220°F	100 psi	2.01	42.022	1.03	33.760	-1.72	0.000	-1.27	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)**
80°F	15 psi	-1.46	0.000	-2.83	0.000	1.93	2.219	0.45	8.309
96°F	24 psi	-1.46	0.000	-2.85	0.000	1.86	2.212	0.54	9.544
111°F	34 psi	-1.45	0.000	-2.86	0.000	1.84	2.211	0.66	10.949
127°F	43 psi	-1.44	0.000	-2.87	0.000	1.85	2.212	0.78	12.211
142°F	53 psi	-1.42	0.000	-2.88	0.000	1.87	2.215	0.90	13.266
158°F	62 psi	-1.39	0.000	-2.88	0.000	1.91	2.219	1.02	14.117
173°F	72 psi	-1.36	0.000	-2.88	0.000	1.96	2.223	1.14	14.809
189°F	81 psi	-1.32	0.000	-2.87	0.000	2.03	2.228	1.26	15.379
204°F	91 psi	-1.27	0.000	-2.87	0.000	2.10	2.233	1.37	15.814
220°F	100 psi	-1.22	0.000	-2.86	0.000	2.18	2.237	1.48	16.146

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.

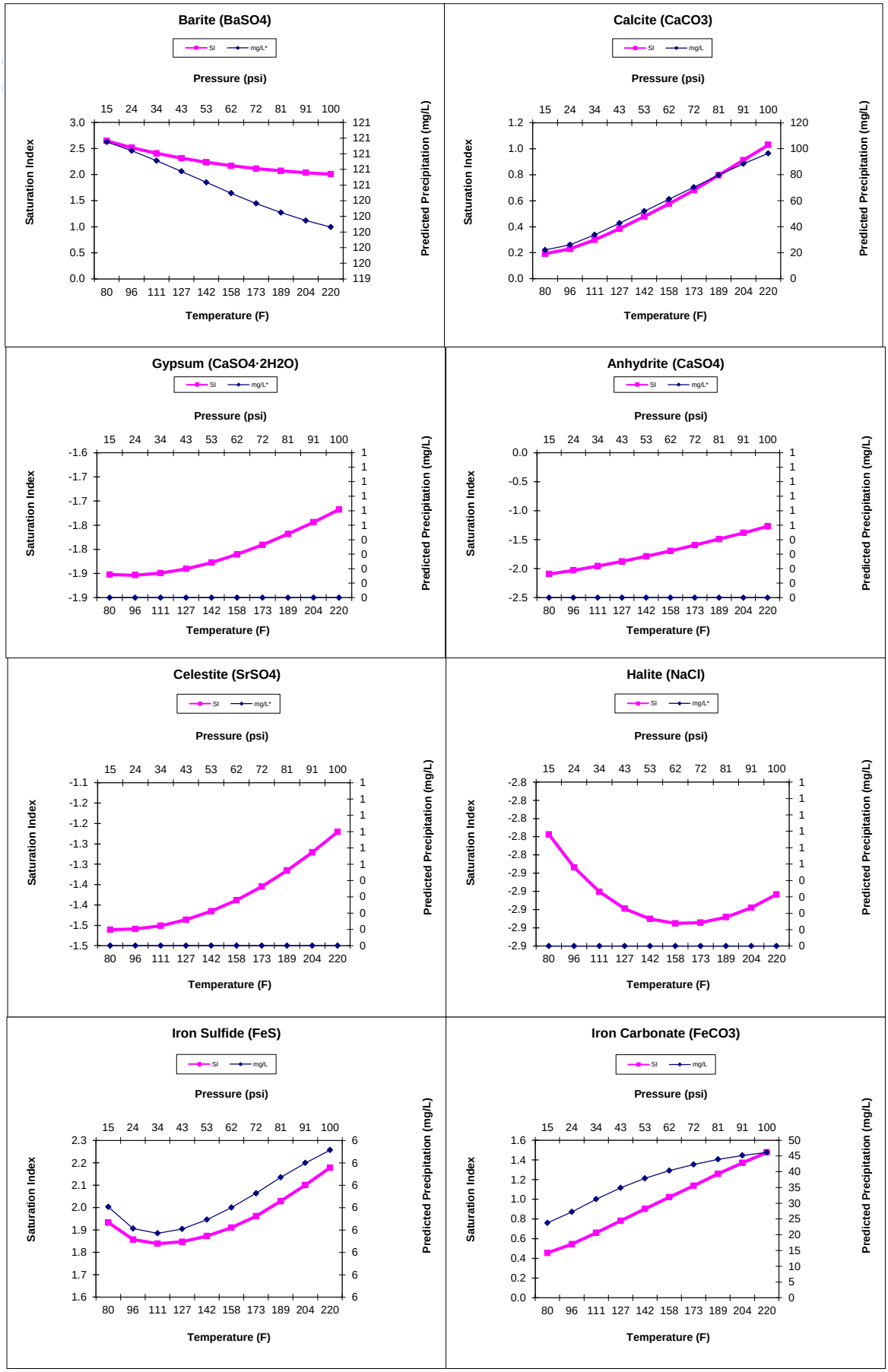
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 14-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14-9D Separator
District:	Four Corners	**Sample ID:**	201201035645
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 14-9D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	231.0	3.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	280.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	9721
Density/Specific Gravity (g/cm^3):	1.0040
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	5600.0	158.0
Sulfate (SO_4^{2-}):	100.0	2.1
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.00

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	3629.0	157.9
Potassium (K^+):	23.0	0.6
Magnesium (Mg^{2+}):	3.0	0.2
Calcium (Ca^{2+}):	55.0	2.7
Strontium (Sr^{2+}):	7.0	0.2
Barium (Ba^{2+}):	41.0	0.6
Iron (Fe^{2+}):	32.0	1.1
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	188	N/A

ND = Not Determined

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)**
80°F	15 psi	2.28	24.207	-1.70	0.000	-2.32	0.000	-2.57	0.000
96°F	24 psi	2.15	24.144	-1.66	0.000	-2.33	0.000	-2.51	0.000
111°F	34 psi	2.03	24.074	-1.59	0.000	-2.32	0.000	-2.43	0.000
127°F	43 psi	1.94	24.000	-1.50	0.000	-2.31	0.000	-2.35	0.000
142°F	53 psi	1.87	23.926	-1.40	0.000	-2.29	0.000	-2.26	0.000
158°F	62 psi	1.80	23.855	-1.29	0.000	-2.27	0.000	-2.16	0.000
173°F	72 psi	1.75	23.792	-1.17	0.000	-2.25	0.000	-2.06	0.000
189°F	81 psi	1.72	23.739	-1.04	0.000	-2.22	0.000	-1.95	0.000
204°F	91 psi	1.69	23.698	-0.92	0.000	-2.19	0.000	-1.83	0.000
220°F	100 psi	1.67	23.670	-0.79	0.000	-2.15	0.000	-1.71	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)**
80°F	15 psi	-1.53	0.000	-3.44	0.000	0.53	2.177	-0.19	0.000
96°F	24 psi	-1.53	0.000	-3.46	0.000	0.48	2.037	-0.10	0.000
111°F	34 psi	-1.52	0.000	-3.47	0.000	0.49	2.088	0.03	0.855
127°F	43 psi	-1.50	0.000	-3.48	0.000	0.55	2.222	0.16	4.733
142°F	53 psi	-1.48	0.000	-3.49	0.000	0.62	2.387	0.29	8.119
158°F	62 psi	-1.44	0.000	-3.49	0.000	0.70	2.556	0.42	10.977
173°F	72 psi	-1.40	0.000	-3.49	0.000	0.81	2.740	0.55	13.539
189°F	81 psi	-1.35	0.000	-3.48	0.000	0.92	2.894	0.69	15.588
204°F	91 psi	-1.29	0.000	-3.48	0.000	1.04	3.018	0.82	17.210
220°F	100 psi	-1.23	0.000	-3.47	0.000	1.16	3.117	0.94	18.486

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.

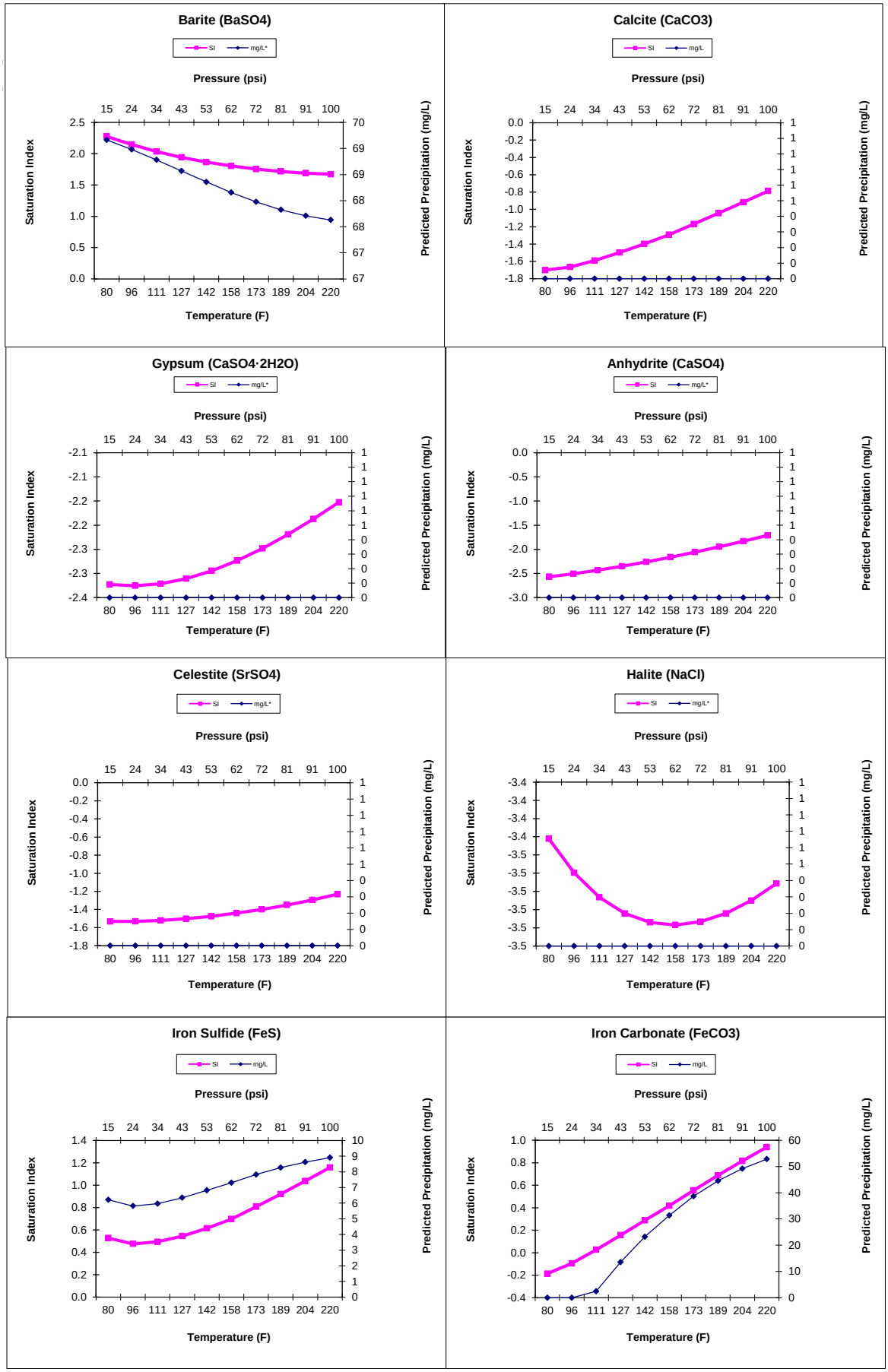
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 14-9D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14A-9D Separator
District:	Four Corners	**Sample ID:**	201201031064
Sales Rep:	Sean Higgins	**Sample Date:**	10/2/2012
Lease:	Unocal-EnCana	**Log Out Date:**	10/12/2012
Site Type:		**Analyst:**	EW
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 14A-9D Separator

Field Data

Initial Temperature (°F):	200
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.3

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	207.0	3.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	160.0
aqueous H_2S (ppm):	0.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	27055
Density/Specific Gravity (g/cm³):	1.0181
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	14000.0	394.9
Sulfate (SO_4^{2-}):	80.0	1.7
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.70	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9072.0	394.8
Potassium (K^+):	262.0	6.7
Magnesium (Mg^{2+}):	420.0	34.6
Calcium (Ca^{2+}):	2496.0	124.6
Strontium (Sr^{2+}):	482.0	11.0
Barium (Ba^{2+}):	1.7	0.0
Iron (Fe^{2+}):	33.0	1.2
Manganese (Mn^{2+}):	0.9	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	8521	N/A

ND = Not Determined

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)**
80°F	15 psi	0.23	0.399	0.99	32.059	-1.29	0.000	-1.53	0.000
93°F	24 psi	0.12	0.237	1.01	32.545	-1.29	0.000	-1.47	0.000
107°F	34 psi	0.03	0.059	1.06	33.899	-1.28	0.000	-1.41	0.000
120°F	43 psi	-0.05	0.000	1.13	35.536	-1.27	0.000	-1.34	0.000
133°F	53 psi	-0.12	0.000	1.20	37.252	-1.26	0.000	-1.26	0.000
147°F	62 psi	-0.18	0.000	1.28	38.955	-1.24	0.000	-1.18	0.000
160°F	72 psi	-0.24	0.000	1.36	40.725	-1.23	0.000	-1.10	0.000
173°F	81 psi	-0.28	0.000	1.45	42.464	-1.21	0.000	-1.01	0.000
187°F	91 psi	-0.31	0.000	1.54	44.070	-1.19	0.000	-0.92	0.000
200°F	100 psi	-0.34	0.000	1.63	45.548	-1.16	0.000	-0.82	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)**
80°F	15 psi	-0.32	0.000	-2.72	0.000	1.87	0.629	0.83	15.523
93°F	24 psi	-0.31	0.000	-2.73	0.000	1.78	0.627	0.90	16.347
107°F	34 psi	-0.30	0.000	-2.75	0.000	1.74	0.626	0.99	17.432
120°F	43 psi	-0.29	0.000	-2.76	0.000	1.73	0.626	1.09	18.476
133°F	53 psi	-0.27	0.000	-2.76	0.000	1.73	0.626	1.19	19.398
147°F	62 psi	-0.25	0.000	-2.77	0.000	1.74	0.626	1.29	20.179
160°F	72 psi	-0.22	0.000	-2.77	0.000	1.77	0.627	1.39	20.867
173°F	81 psi	-0.19	0.000	-2.77	0.000	1.80	0.628	1.49	21.443
187°F	91 psi	-0.15	0.000	-2.77	0.000	1.84	0.629	1.58	21.899
200°F	100 psi	-0.11	0.000	-2.77	0.000	1.89	0.630	1.67	22.262

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.

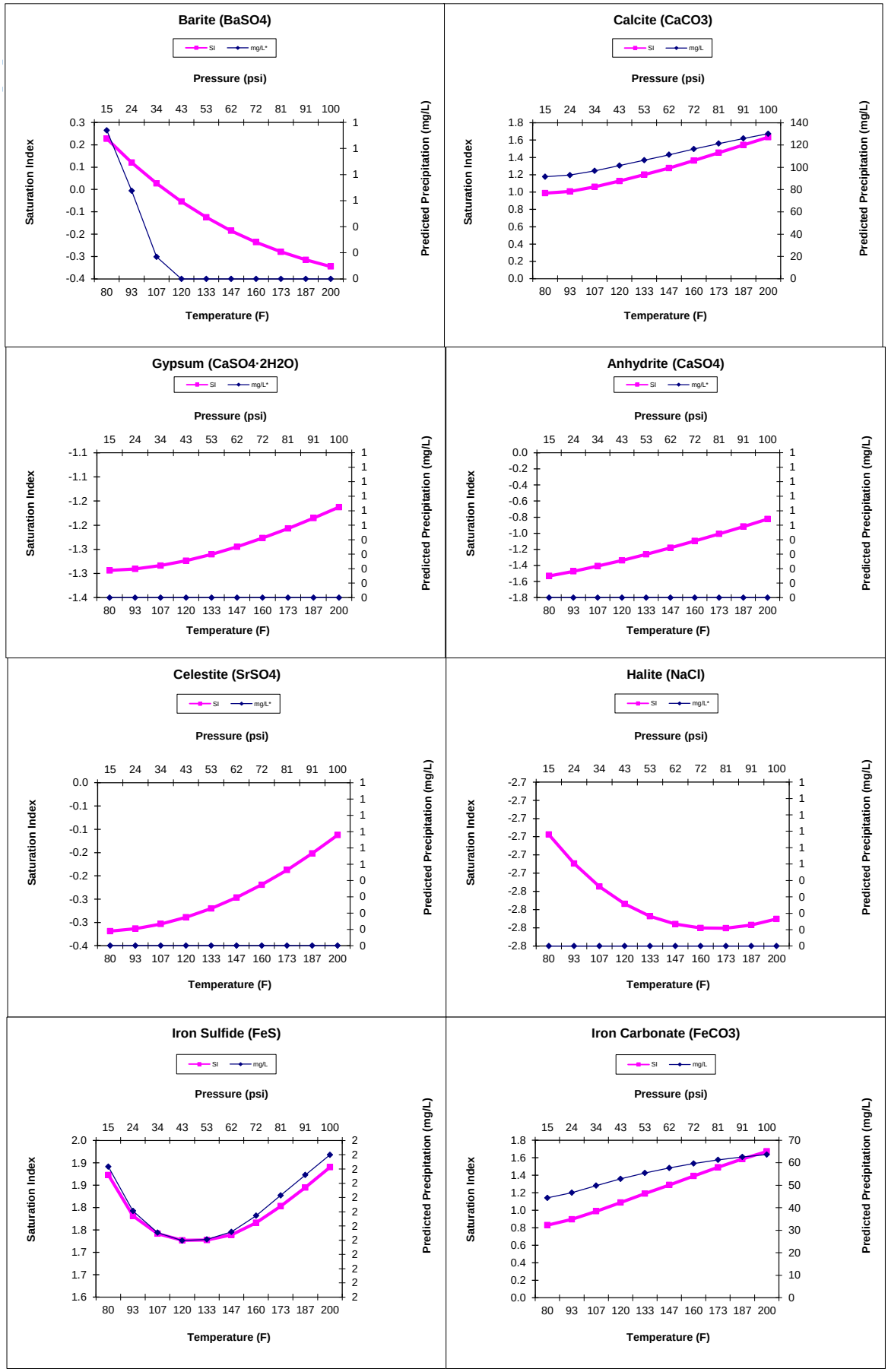
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: SURFACE TEMP=60 DEG/F

Sample ID: 41184 CAERUS OIL & GAS, Unocal-EnCana, 14A-9D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14B-16D Separator
District:	Four Corners	**Sample ID:**	201201035642
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 14B-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	341.0	5.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	13349
Density/Specific Gravity (g/cm³):	1.0064
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	7800.0	220.0
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

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^+):	5054.0	219.9
Potassium (K^+):	19.0	0.5
Magnesium (Mg^{2+}):	7.0	0.6
Calcium (Ca^{2+}):	54.0	2.7
Strontium (Sr^{2+}):	6.0	0.1
Barium (Ba^{2+}):	16.0	0.2
Iron (Fe^{2+}):	2.0	0.1
Manganese (Mn^{2+}):	0.2	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	182	N/A

ND = Not Determined

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)**
80°F	15 psi	1.45	9.086	-0.59	0.000	-2.74	0.000	-2.98	0.000
96°F	24 psi	1.32	8.938	-0.55	0.000	-2.74	0.000	-2.92	0.000
111°F	34 psi	1.21	8.772	-0.48	0.000	-2.74	0.000	-2.85	0.000
127°F	43 psi	1.11	8.598	-0.39	0.000	-2.73	0.000	-2.76	0.000
142°F	53 psi	1.04	8.424	-0.29	0.000	-2.71	0.000	-2.68	0.000
158°F	62 psi	0.97	8.257	-0.19	0.000	-2.69	0.000	-2.58	0.000
173°F	72 psi	0.92	8.107	-0.07	0.000	-2.67	0.000	-2.48	0.000
189°F	81 psi	0.88	7.979	0.05	2.132	-2.64	0.000	-2.37	0.000
204°F	91 psi	0.85	7.876	0.17	7.367	-2.61	0.000	-2.25	0.000
220°F	100 psi	0.83	7.801	0.30	12.335	-2.58	0.000	-2.14	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)**
80°F	15 psi	-2.01	0.000	-3.18	0.000	0.95	0.891	-0.27	0.000
96°F	24 psi	-2.01	0.000	-3.19	0.000	0.88	0.860	-0.18	0.000
111°F	34 psi	-2.00	0.000	-3.21	0.000	0.87	0.855	-0.06	0.000
127°F	43 psi	-1.98	0.000	-3.22	0.000	0.88	0.863	0.07	0.209
142°F	53 psi	-1.96	0.000	-3.22	0.000	0.92	0.878	0.20	0.518
158°F	62 psi	-1.92	0.000	-3.22	0.000	0.96	0.898	0.32	0.748
173°F	72 psi	-1.89	0.000	-3.22	0.000	1.02	0.922	0.45	0.923
189°F	81 psi	-1.84	0.000	-3.22	0.000	1.10	0.948	0.58	1.056
204°F	91 psi	-1.79	0.000	-3.21	0.000	1.18	0.972	0.70	1.152
220°F	100 psi	-1.73	0.000	-3.20	0.000	1.27	0.994	0.81	1.223

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.

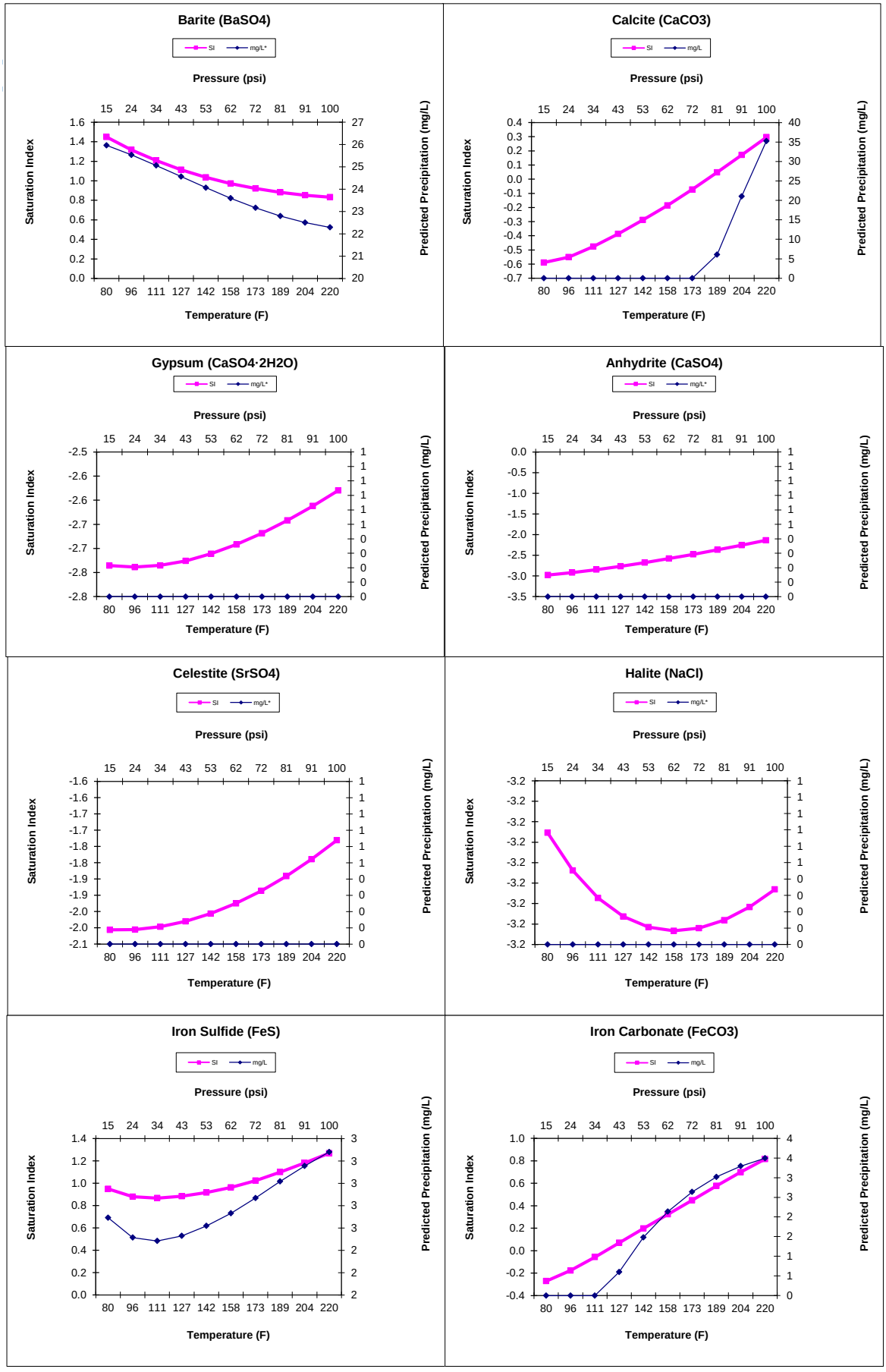
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 14B-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14B-9D Separator
District:	Four Corners	**Sample ID:**	201201035744
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 14B-9D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:	
pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	171.0	2.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	2.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	21804
Density/Specific Gravity (g/cm³):	1.0127
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	12600.0	355.4
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.91	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8165.0	355.3
Potassium (K^+):	57.0	1.5
Magnesium (Mg^{2+}):	36.0	3.0
Calcium (Ca^{2+}):	622.0	31.0
Strontium (Sr^{2+}):	39.0	0.9
Barium (Ba^{2+}):	59.0	0.9
Iron (Fe^{2+}):	4.0	0.1
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1791	N/A

ND = Not Determined

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)**
80°F	15 psi	1.77	32.574	-0.91	0.000	-1.90	0.000	-2.14	0.000
96°F	24 psi	1.65	31.917	-0.87	0.000	-1.90	0.000	-2.08	0.000
111°F	34 psi	1.54	31.244	-0.80	0.000	-1.90	0.000	-2.00	0.000
127°F	43 psi	1.44	30.581	-0.71	0.000	-1.89	0.000	-1.92	0.000
142°F	53 psi	1.36	29.950	-0.62	0.000	-1.88	0.000	-1.84	0.000
158°F	62 psi	1.30	29.370	-0.52	0.000	-1.86	0.000	-1.74	0.000
173°F	72 psi	1.24	28.854	-0.41	0.000	-1.84	0.000	-1.64	0.000
189°F	81 psi	1.20	28.411	-0.29	0.000	-1.82	0.000	-1.54	0.000
204°F	91 psi	1.16	28.044	-0.17	0.000	-1.79	0.000	-1.43	0.000
220°F	100 psi	1.14	27.752	-0.05	0.000	-1.77	0.000	-1.32	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)**
80°F	15 psi	-1.41	0.000	-2.79	0.000	-0.34	0.000	-1.38	0.000
96°F	24 psi	-1.41	0.000	-2.81	0.000	-0.39	0.000	-1.29	0.000
111°F	34 psi	-1.40	0.000	-2.83	0.000	-0.38	0.000	-1.17	0.000
127°F	43 psi	-1.39	0.000	-2.83	0.000	-0.34	0.000	-1.05	0.000
142°F	53 psi	-1.37	0.000	-2.84	0.000	-0.28	0.000	-0.93	0.000
158°F	62 psi	-1.34	0.000	-2.84	0.000	-0.20	0.000	-0.81	0.000
173°F	72 psi	-1.31	0.000	-2.84	0.000	-0.11	0.000	-0.68	0.000
189°F	81 psi	-1.27	0.000	-2.84	0.000	-0.01	0.000	-0.56	0.000
204°F	91 psi	-1.23	0.000	-2.83	0.000	0.10	0.290	-0.45	0.000
220°F	100 psi	-1.18	0.000	-2.83	0.000	0.20	0.579	-0.34	0.000

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.

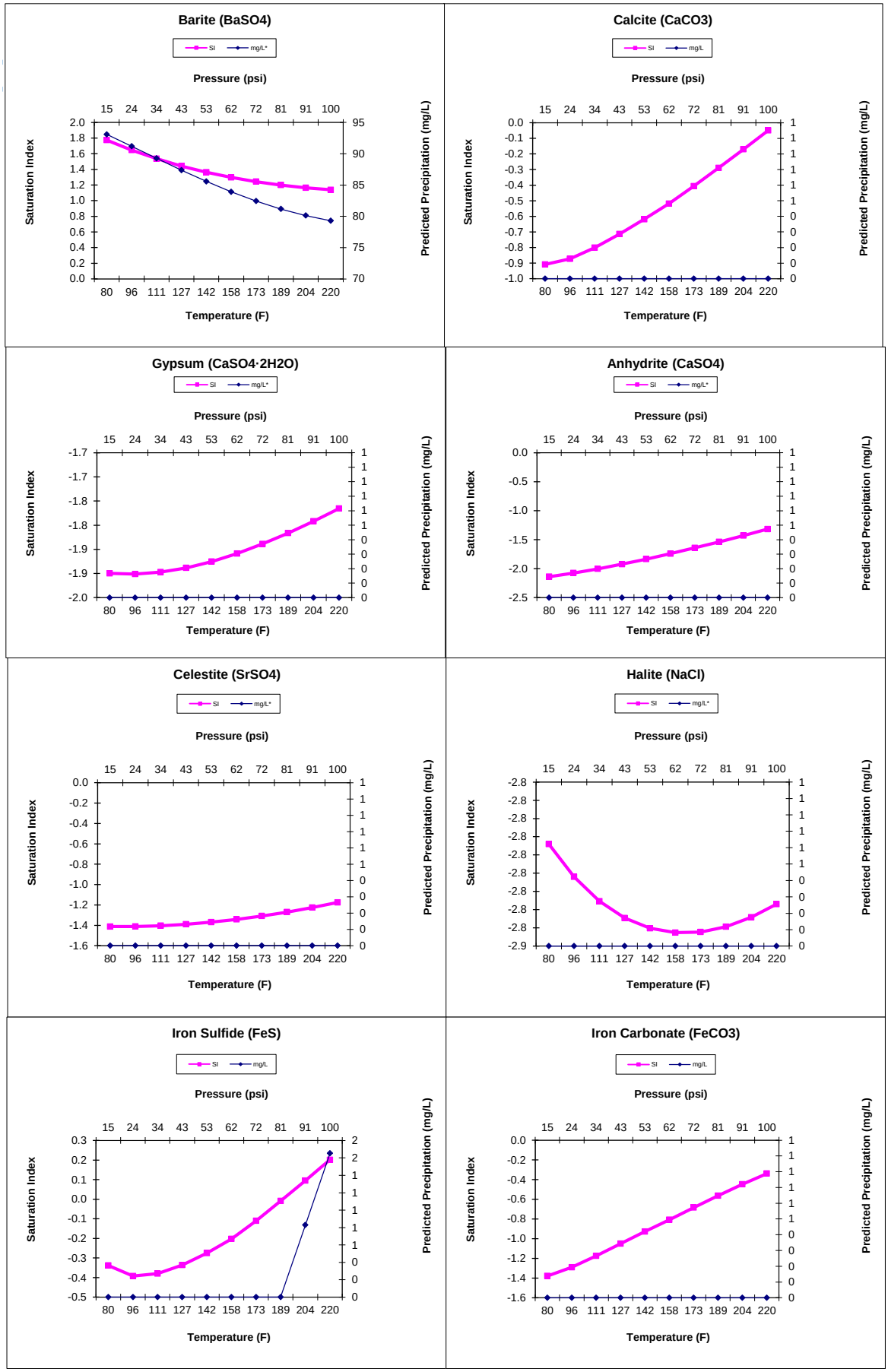
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 14B-9D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14D-16D Separator
District:	Four Corners	**Sample ID:**	201201035641
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 14D-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	378.0	6.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	90.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	19194
Density/Specific Gravity (g/cm³):	1.0105
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11200.0	315.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7258.0	315.8
Potassium (K^+):	43.0	1.1
Magnesium (Mg^{2+}):	16.0	1.3
Calcium (Ca^{2+}):	149.0	7.4
Strontium (Sr^{2+}):	17.0	0.4
Barium (Ba^{2+}):	51.0	0.7
Iron (Fe^{2+}):	32.0	1.1
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	495	N/A

ND = Not Determined

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)**
80°F	15 psi	1.79	28.821	-0.16	0.000	-2.44	0.000	-2.68	0.000
96°F	24 psi	1.66	28.359	-0.12	0.000	-2.44	0.000	-2.62	0.000
111°F	34 psi	1.55	27.867	-0.04	0.000	-2.44	0.000	-2.54	0.000
127°F	43 psi	1.46	27.368	0.04	2.809	-2.43	0.000	-2.46	0.000
142°F	53 psi	1.38	26.884	0.14	8.844	-2.42	0.000	-2.38	0.000
158°F	62 psi	1.31	26.434	0.24	15.015	-2.40	0.000	-2.28	0.000
173°F	72 psi	1.26	26.031	0.35	21.413	-2.38	0.000	-2.18	0.000
189°F	81 psi	1.22	25.686	0.47	28.067	-2.35	0.000	-2.08	0.000
204°F	91 psi	1.18	25.404	0.59	34.480	-2.33	0.000	-1.97	0.000
220°F	100 psi	1.16	25.187	0.71	40.632	-2.30	0.000	-1.85	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)**
80°F	15 psi	-1.70	0.000	-2.89	0.000	2.11	2.240	0.92	18.741
96°F	24 psi	-1.70	0.000	-2.90	0.000	2.04	2.236	1.01	19.519
111°F	34 psi	-1.69	0.000	-2.92	0.000	2.02	2.236	1.13	20.342
127°F	43 psi	-1.67	0.000	-2.93	0.000	2.03	2.236	1.25	21.024
142°F	53 psi	-1.65	0.000	-2.93	0.000	2.06	2.238	1.37	21.551
158°F	62 psi	-1.63	0.000	-2.93	0.000	2.10	2.241	1.49	21.949
173°F	72 psi	-1.59	0.000	-2.93	0.000	2.16	2.243	1.62	22.254
189°F	81 psi	-1.55	0.000	-2.93	0.000	2.23	2.246	1.74	22.492
204°F	91 psi	-1.50	0.000	-2.93	0.000	2.30	2.249	1.85	22.665
220°F	100 psi	-1.45	0.000	-2.92	0.000	2.38	2.251	1.97	22.793

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.

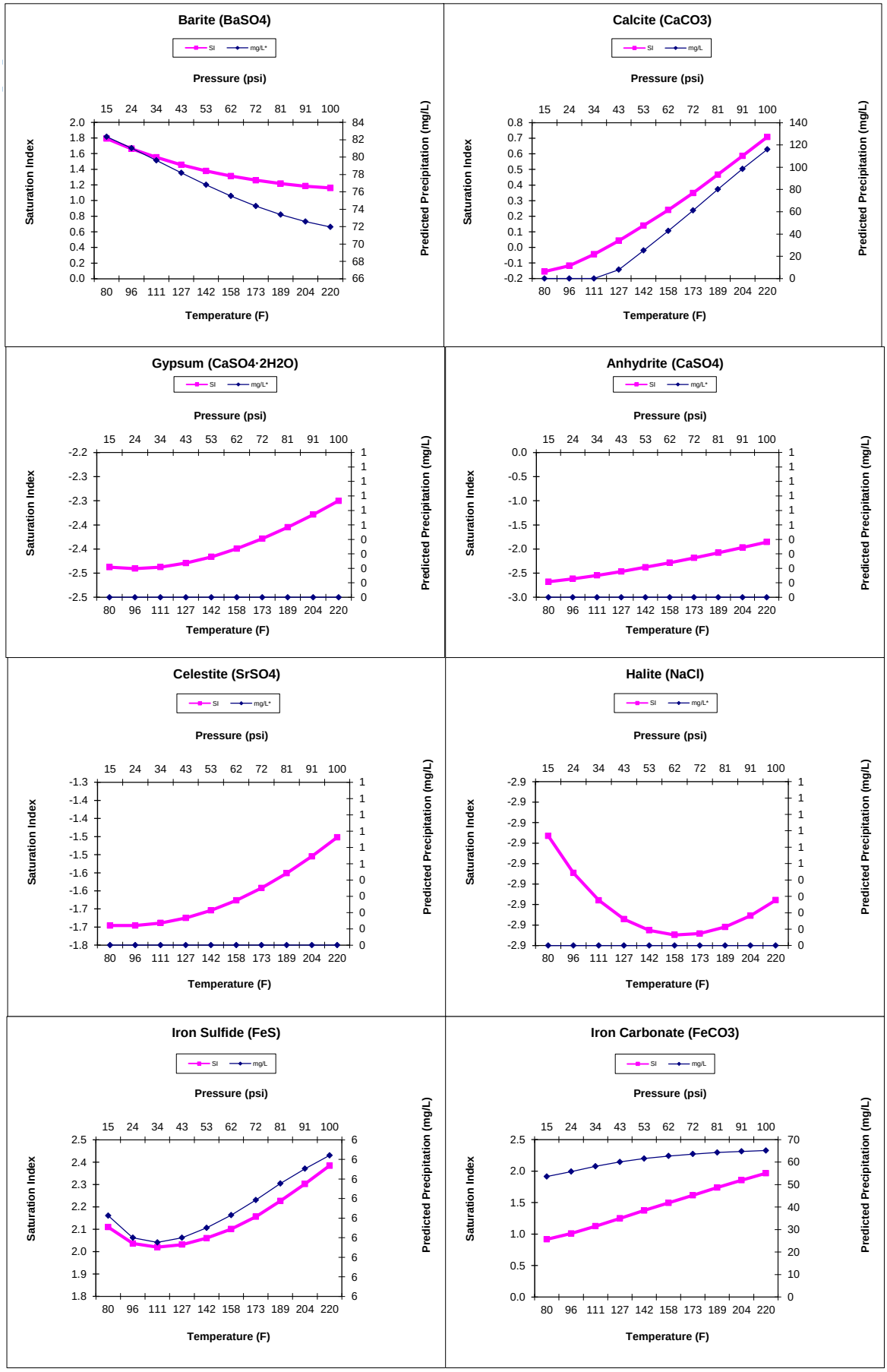
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 14D-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	14D-9D Separator
District:	Four Corners	**Sample ID:**	201201035648
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 14D-9D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	390.0	6.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	90.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	13937
Density/Specific Gravity (g/cm³):	1.0070
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	8000.0	225.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.98	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	5184.0	225.6
Potassium (K^+):	52.0	1.3
Magnesium (Mg^{2+}):	20.0	1.6
Calcium (Ca^{2+}):	167.0	8.3
Strontium (Sr^{2+}):	21.0	0.5
Barium (Ba^{2+}):	43.0	0.6
Iron (Fe^{2+}):	10.0	0.4
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	555	N/A

ND = Not Determined

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)**
80°F	15 psi	1.85	24.712	-1.05	0.000	-2.27	0.000	-2.52	0.000
96°F	24 psi	1.72	24.427	-1.01	0.000	-2.28	0.000	-2.45	0.000
111°F	34 psi	1.61	24.117	-0.94	0.000	-2.27	0.000	-2.38	0.000
127°F	43 psi	1.51	23.796	-0.85	0.000	-2.26	0.000	-2.30	0.000
142°F	53 psi	1.44	23.482	-0.75	0.000	-2.25	0.000	-2.21	0.000
158°F	62 psi	1.37	23.187	-0.64	0.000	-2.23	0.000	-2.12	0.000
173°F	72 psi	1.32	22.924	-0.52	0.000	-2.21	0.000	-2.01	0.000
189°F	81 psi	1.28	22.701	-0.40	0.000	-2.18	0.000	-1.90	0.000
204°F	91 psi	1.25	22.524	-0.28	0.000	-2.15	0.000	-1.79	0.000
220°F	100 psi	1.23	22.393	-0.15	0.000	-2.12	0.000	-1.68	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)**
80°F	15 psi	-1.49	0.000	-3.16	0.000	0.00	0.019	-0.52	0.000
96°F	24 psi	-1.49	0.000	-3.18	0.000	-0.06	0.000	-0.43	0.000
111°F	34 psi	-1.48	0.000	-3.19	0.000	-0.04	0.000	-0.31	0.000
127°F	43 psi	-1.46	0.000	-3.20	0.000	0.01	0.027	-0.18	0.000
142°F	53 psi	-1.44	0.000	-3.20	0.000	0.07	0.325	-0.06	0.000
158°F	62 psi	-1.41	0.000	-3.21	0.000	0.16	0.681	0.07	1.046
173°F	72 psi	-1.37	0.000	-3.20	0.000	0.26	1.070	0.21	2.584
189°F	81 psi	-1.33	0.000	-3.20	0.000	0.37	1.425	0.34	3.718
204°F	91 psi	-1.28	0.000	-3.19	0.000	0.49	1.744	0.46	4.556
220°F	100 psi	-1.22	0.000	-3.19	0.000	0.60	2.028	0.58	5.179

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.

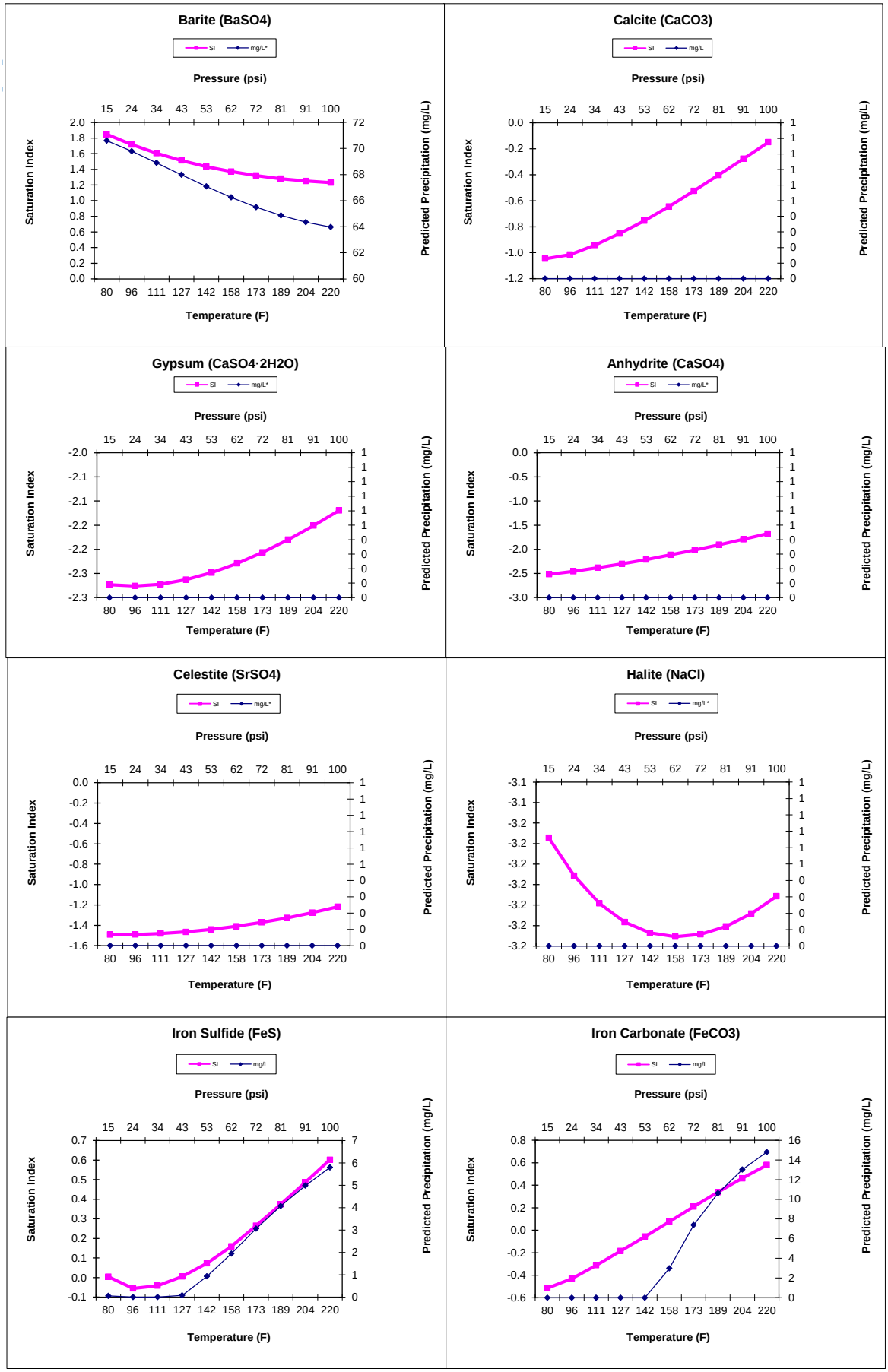
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 14D-9D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23-9D Separator
District:	Four Corners	**Sample ID:**	201201035650
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 23-9D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	110.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	26242
Density/Specific Gravity (g/cm³):	1.0149
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	16500.0	465.4
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.16

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8748.0	380.7
Potassium (K^+):	58.0	1.5
Magnesium (Mg^{2+}):	20.0	1.6
Calcium (Ca^{2+}):	416.0	20.8
Strontium (Sr^{2+}):	29.0	0.7
Barium (Ba^{2+}):	73.0	1.1
Iron (Fe^{2+}):	42.0	1.5
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1209	N/A

ND = Not Determined

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)**
80°F	15 psi	1.82	37.688	-0.80	0.000	-2.10	0.000	-2.34	0.000
96°F	24 psi	1.69	36.845	-0.76	0.000	-2.10	0.000	-2.27	0.000
111°F	34 psi	1.58	36.014	-0.69	0.000	-2.10	0.000	-2.20	0.000
127°F	43 psi	1.49	35.215	-0.60	0.000	-2.09	0.000	-2.12	0.000
142°F	53 psi	1.41	34.469	-0.51	0.000	-2.08	0.000	-2.04	0.000
158°F	62 psi	1.34	33.790	-0.41	0.000	-2.06	0.000	-1.94	0.000
173°F	72 psi	1.29	33.191	-0.29	0.000	-2.04	0.000	-1.85	0.000
189°F	81 psi	1.24	32.677	-0.17	0.000	-2.02	0.000	-1.74	0.000
204°F	91 psi	1.21	32.253	-0.05	0.000	-2.00	0.000	-1.64	0.000
220°F	100 psi	1.18	31.915	0.07	5.887	-1.97	0.000	-1.52	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)**
80°F	15 psi	-1.56	0.000	-2.66	0.000	0.43	1.370	-0.07	0.000
96°F	24 psi	-1.57	0.000	-2.67	0.000	0.38	1.243	0.02	0.643
111°F	34 psi	-1.56	0.000	-2.69	0.000	0.39	1.267	0.13	5.224
127°F	43 psi	-1.55	0.000	-2.69	0.000	0.43	1.356	0.25	9.502
142°F	53 psi	-1.53	0.000	-2.70	0.000	0.49	1.472	0.37	13.211
158°F	62 psi	-1.51	0.000	-2.70	0.000	0.56	1.593	0.49	16.327
173°F	72 psi	-1.48	0.000	-2.70	0.000	0.66	1.731	0.62	19.139
189°F	81 psi	-1.44	0.000	-2.70	0.000	0.75	1.846	0.74	21.376
204°F	91 psi	-1.40	0.000	-2.70	0.000	0.86	1.942	0.85	23.149
220°F	100 psi	-1.35	0.000	-2.69	0.000	0.96	2.019	0.96	24.553

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.

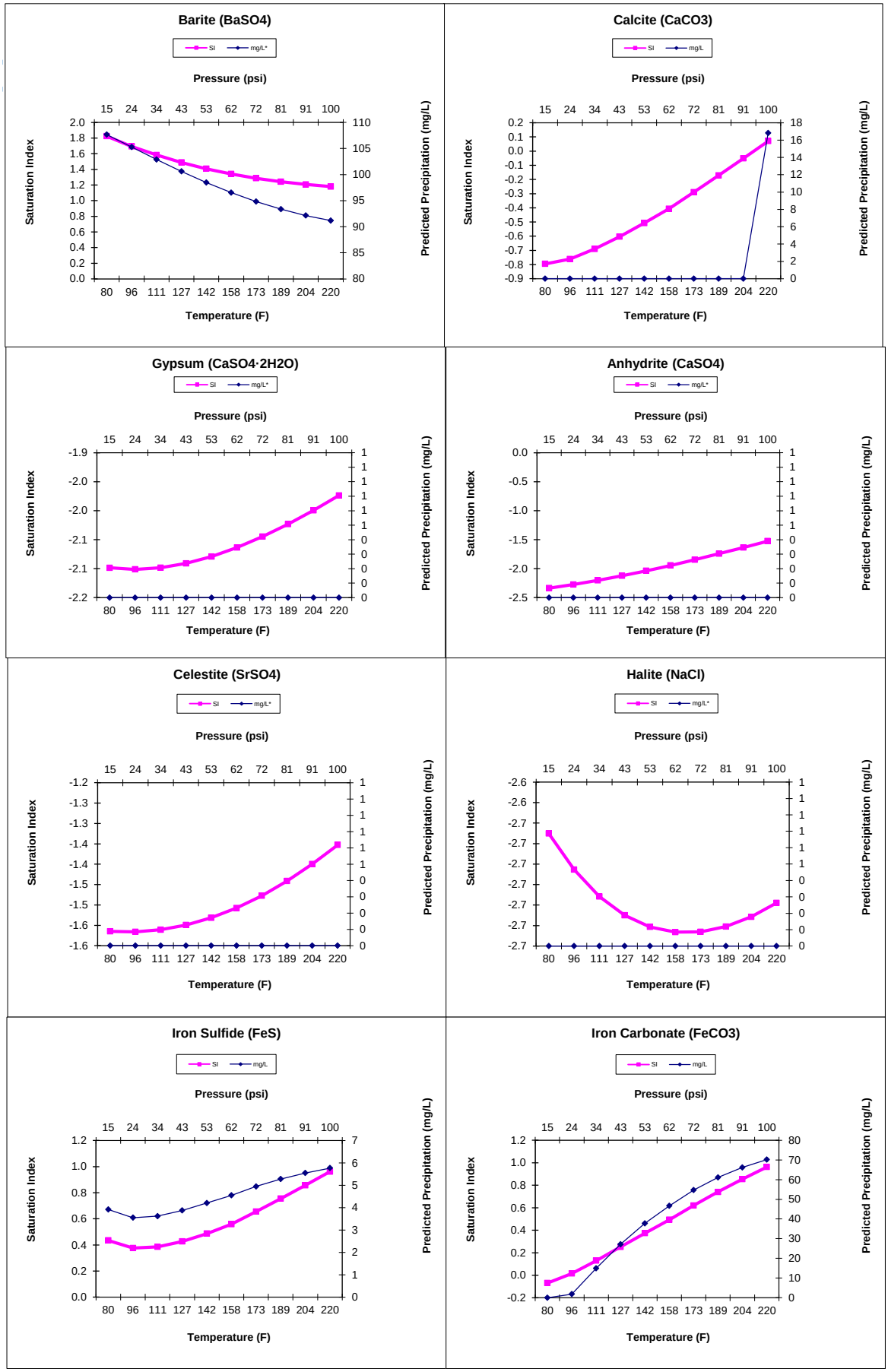
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 23-9D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	UNOCAL 23A-4D SEPARATOR
District:	Four Corners	**Sample ID:**	201201035653
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, UNOCAL 23A-4D SEPARATOR

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	341.0	5.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	95.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	18446
Density/Specific Gravity (g/cm³):	1.0100
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10800.0	304.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.99	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6998.0	304.5
Potassium (K^+):	45.0	1.2
Magnesium (Mg^{2+}):	14.0	1.2
Calcium (Ca^{2+}):	133.0	6.6
Strontium (Sr^{2+}):	16.0	0.4
Barium (Ba^{2+}):	36.0	0.5
Iron (Fe^{2+}):	13.0	0.5
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	435	N/A

ND = Not Determined

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)**
80°F	15 psi	1.66	20.511	-1.24	0.000	-2.47	0.000	-2.71	0.000
96°F	24 psi	1.53	20.212	-1.21	0.000	-2.47	0.000	-2.65	0.000
111°F	34 psi	1.42	19.883	-1.14	0.000	-2.47	0.000	-2.58	0.000
127°F	43 psi	1.33	19.540	-1.05	0.000	-2.46	0.000	-2.50	0.000
142°F	53 psi	1.25	19.199	-0.95	0.000	-2.45	0.000	-2.41	0.000
158°F	62 psi	1.18	18.874	-0.85	0.000	-2.43	0.000	-2.32	0.000
173°F	72 psi	1.13	18.579	-0.73	0.000	-2.41	0.000	-2.21	0.000
189°F	81 psi	1.09	18.323	-0.61	0.000	-2.39	0.000	-2.11	0.000
204°F	91 psi	1.05	18.113	-0.49	0.000	-2.36	0.000	-2.00	0.000
220°F	100 psi	1.03	17.950	-0.36	0.000	-2.33	0.000	-1.89	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)**
80°F	15 psi	-1.71	0.000	-2.92	0.000	0.09	0.449	-0.51	0.000
96°F	24 psi	-1.70	0.000	-2.93	0.000	0.04	0.175	-0.43	0.000
111°F	34 psi	-1.70	0.000	-2.95	0.000	0.05	0.236	-0.31	0.000
127°F	43 psi	-1.68	0.000	-2.96	0.000	0.09	0.447	-0.19	0.000
142°F	53 psi	-1.66	0.000	-2.96	0.000	0.16	0.726	-0.06	0.000
158°F	62 psi	-1.63	0.000	-2.96	0.000	0.24	1.044	0.07	1.143
173°F	72 psi	-1.60	0.000	-2.96	0.000	0.34	1.410	0.20	3.074
189°F	81 psi	-1.56	0.000	-2.96	0.000	0.44	1.741	0.32	4.530
204°F	91 psi	-1.51	0.000	-2.95	0.000	0.55	2.034	0.44	5.629
220°F	100 psi	-1.46	0.000	-2.95	0.000	0.66	2.291	0.55	6.460

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.

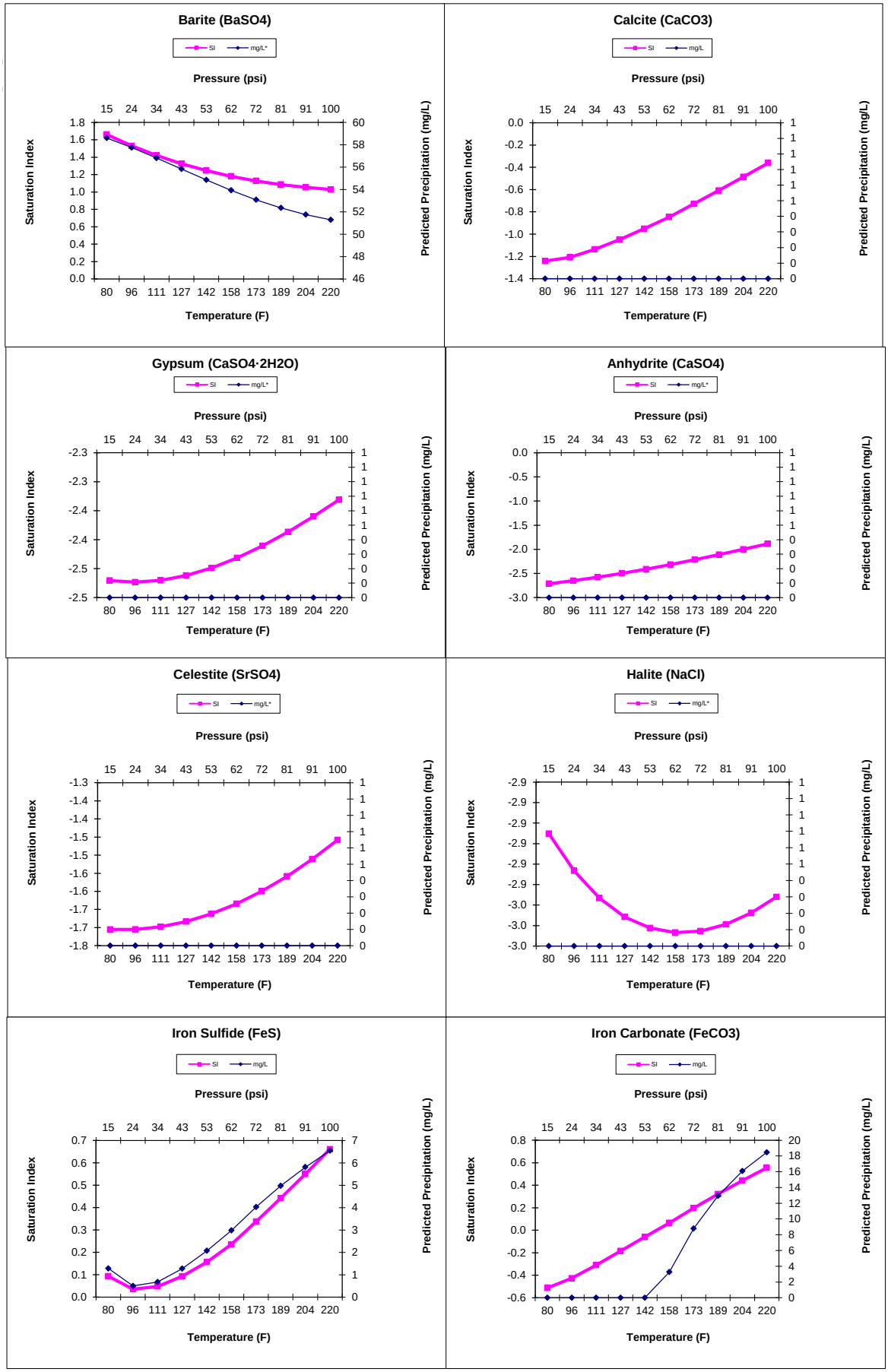
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, UNOCAL 23A-4D SEPARATOR



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23B-16D Separator
District:	Four Corners	**Sample ID:**	201201035659
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 23B-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	585.0	9.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	130.0
aqueous H_2S (ppm):	3.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17630
Density/Specific Gravity (g/cm³):	1.0095
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10100.0	284.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6545.0	284.8
Potassium (K^+):	55.0	1.4
Magnesium (Mg^{2+}):	18.0	1.5
Calcium (Ca^{2+}):	146.0	7.3
Strontium (Sr^{2+}):	18.0	0.4
Barium (Ba^{2+}):	43.0	0.6
Iron (Fe^{2+}):	69.0	2.5
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	491	N/A

ND = Not Determined

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)**
80°F	15 psi	1.75	24.511	0.04	3.841	-2.41	0.000	-2.65	0.000
96°F	24 psi	1.62	24.165	0.08	7.147	-2.42	0.000	-2.59	0.000
111°F	34 psi	1.51	23.789	0.15	13.396	-2.41	0.000	-2.52	0.000
127°F	43 psi	1.42	23.401	0.24	20.685	-2.40	0.000	-2.44	0.000
142°F	53 psi	1.34	23.018	0.34	28.347	-2.39	0.000	-2.35	0.000
158°F	62 psi	1.27	22.657	0.44	36.073	-2.37	0.000	-2.26	0.000
173°F	72 psi	1.22	22.332	0.55	43.997	-2.35	0.000	-2.16	0.000
189°F	81 psi	1.18	22.053	0.67	52.091	-2.33	0.000	-2.05	0.000
204°F	91 psi	1.15	21.826	0.79	59.787	-2.30	0.000	-1.94	0.000
220°F	100 psi	1.12	21.652	0.91	67.072	-2.27	0.000	-1.83	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)**
80°F	15 psi	-1.64	0.000	-2.97	0.000	2.84	5.280	1.48	46.532
96°F	24 psi	-1.64	0.000	-2.99	0.000	2.77	5.279	1.57	47.171
111°F	34 psi	-1.63	0.000	-3.00	0.000	2.75	5.278	1.69	47.842
127°F	43 psi	-1.62	0.000	-3.01	0.000	2.76	5.279	1.81	48.389
142°F	53 psi	-1.60	0.000	-3.02	0.000	2.79	5.279	1.94	48.808
158°F	62 psi	-1.57	0.000	-3.02	0.000	2.83	5.281	2.06	49.120
173°F	72 psi	-1.53	0.000	-3.02	0.000	2.89	5.282	2.18	49.358
189°F	81 psi	-1.49	0.000	-3.02	0.000	2.96	5.283	2.30	49.541
204°F	91 psi	-1.44	0.000	-3.01	0.000	3.04	5.284	2.42	49.675
220°F	100 psi	-1.39	0.000	-3.00	0.000	3.12	5.286	2.53	49.772

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.

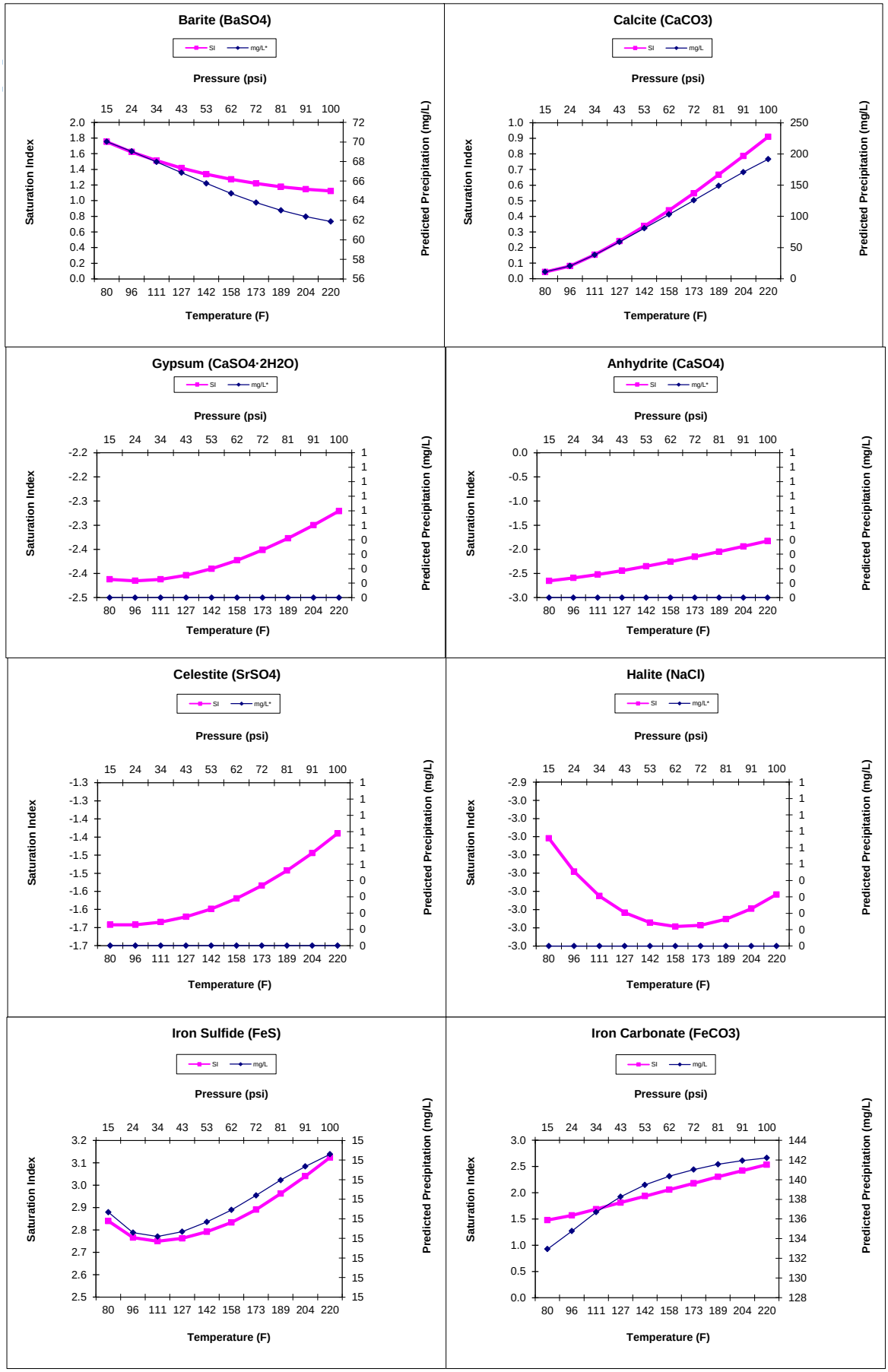
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 23B-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	Unocal 23B-4D Separator
District:	Four Corners	**Sample ID:**	201201035654
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, Unocal 23B-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	256.0	4.2
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17697
Density/Specific Gravity (g/cm^3):	1.0096
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	10300.0	290.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Cations:	mg/L	meq/L
Sodium (Na^+):	6674.0	290.4
Potassium (K^+):	44.0	1.1
Magnesium (Mg^{2+}):	20.0	1.6
Calcium (Ca^{2+}):	268.0	13.4
Strontium (Sr^{2+}):	23.0	0.5
Barium (Ba^{2+}):	60.0	0.9
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	822	N/A

Anion/Cation Ratio:	0.96

ND = Not Determined

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)
80°F	15 psi	1.89	33.517	-1.06	0.000	-2.16	0.000	-2.40	0.000
96°F	24 psi	1.76	32.937	-1.03	0.000	-2.17	0.000	-2.34	0.000
111°F	34 psi	1.65	32.343	-0.96	0.000	-2.16	0.000	-2.27	0.000
127°F	43 psi	1.56	31.760	-0.87	0.000	-2.15	0.000	-2.19	0.000
142°F	53 psi	1.48	31.208	-0.77	0.000	-2.14	0.000	-2.10	0.000
158°F	62 psi	1.41	30.705	-0.67	0.000	-2.12	0.000	-2.01	0.000
173°F	72 psi	1.36	30.263	-0.55	0.000	-2.10	0.000	-1.91	0.000
189°F	81 psi	1.32	29.889	-0.43	0.000	-2.08	0.000	-1.80	0.000
204°F	91 psi	1.28	29.588	-0.31	0.000	-2.05	0.000	-1.69	0.000
220°F	100 psi	1.26	29.359	-0.18	0.000	-2.02	0.000	-1.58	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)
80°F	15 psi	-1.54	0.000	-2.95	0.000	-1.03	0.000	-1.76	0.000
96°F	24 psi	-1.54	0.000	-2.97	0.000	-1.09	0.000	-1.67	0.000
111°F	34 psi	-1.54	0.000	-2.99	0.000	-1.07	0.000	-1.55	0.000
127°F	43 psi	-1.52	0.000	-3.00	0.000	-1.03	0.000	-1.43	0.000
142°F	53 psi	-1.50	0.000	-3.00	0.000	-0.96	0.000	-1.30	0.000
158°F	62 psi	-1.47	0.000	-3.00	0.000	-0.89	0.000	-1.18	0.000
173°F	72 psi	-1.43	0.000	-3.00	0.000	-0.79	0.000	-1.05	0.000
189°F	81 psi	-1.39	0.000	-3.00	0.000	-0.68	0.000	-0.92	0.000
204°F	91 psi	-1.35	0.000	-2.99	0.000	-0.57	0.000	-0.80	0.000
220°F	100 psi	-1.29	0.000	-2.99	0.000	-0.46	0.000	-0.69	0.000

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.

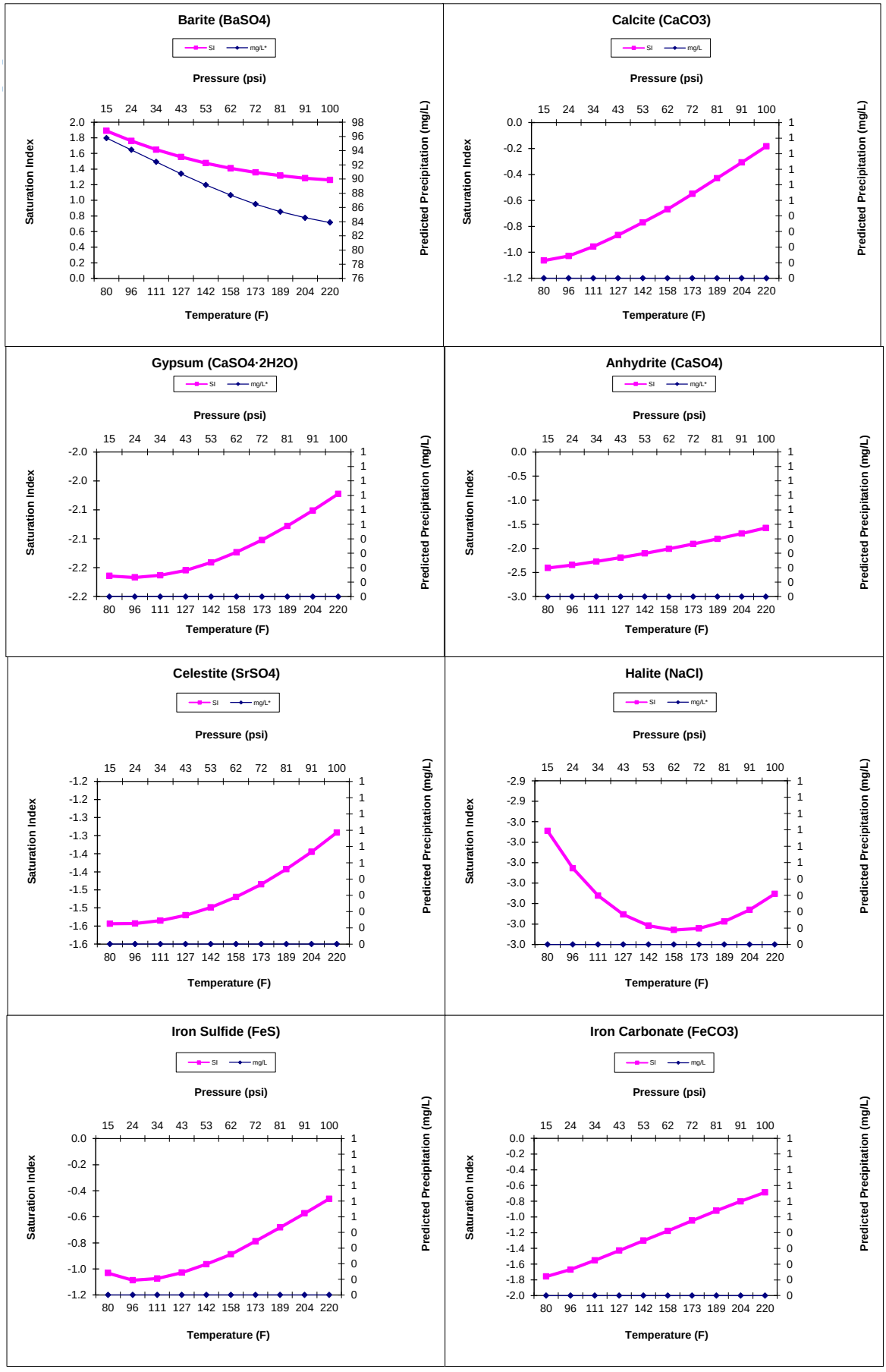
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, Unocal 23B-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	23D-16D Separator
District:	Four Corners	**Sample ID:**	201201035660
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 23D-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	390.0	6.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	20143
Density/Specific Gravity (g/cm^3):	1.0111
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	11800.0	332.9
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	
Anion/Cation Ratio:	0.99	

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	7646.0	332.7
Potassium (K^+):	37.0	0.9
Magnesium (Mg^{2+}):	17.0	1.4
Calcium (Ca^{2+}):	142.0	7.1
Strontium (Sr^{2+}):	16.0	0.4
Barium (Ba^{2+}):	37.0	0.5
Iron (Fe^{2+}):	8.0	0.3
Manganese (Mn^{2+}):	0.4	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	470	N/A

ND = Not Determined

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)**
80°F	15 psi	1.64	21.002	-0.17	0.000	-2.47	0.000	-2.71	0.000
96°F	24 psi	1.51	20.672	-0.13	0.000	-2.48	0.000	-2.65	0.000
111°F	34 psi	1.39	20.310	-0.06	0.000	-2.47	0.000	-2.58	0.000
127°F	43 psi	1.30	19.932	0.02	1.562	-2.47	0.000	-2.50	0.000
142°F	53 psi	1.22	19.556	0.12	7.629	-2.45	0.000	-2.41	0.000
158°F	62 psi	1.15	19.198	0.22	13.843	-2.44	0.000	-2.32	0.000
173°F	72 psi	1.10	18.871	0.33	20.297	-2.42	0.000	-2.22	0.000
189°F	81 psi	1.06	18.587	0.44	27.019	-2.39	0.000	-2.11	0.000
204°F	91 psi	1.02	18.352	0.56	33.510	-2.37	0.000	-2.01	0.000
220°F	100 psi	1.00	18.168	0.68	39.748	-2.34	0.000	-1.89	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)**
80°F	15 psi	-1.74	0.000	-2.84	0.000	1.81	3.856	0.32	2.817
96°F	24 psi	-1.74	0.000	-2.86	0.000	1.73	3.805	0.41	3.348
111°F	34 psi	-1.73	0.000	-2.88	0.000	1.71	3.795	0.52	3.903
127°F	43 psi	-1.72	0.000	-2.88	0.000	1.72	3.805	0.65	4.357
142°F	53 psi	-1.70	0.000	-2.89	0.000	1.75	3.828	0.77	4.706
158°F	62 psi	-1.67	0.000	-2.89	0.000	1.79	3.857	0.89	4.966
173°F	72 psi	-1.64	0.000	-2.89	0.000	1.84	3.895	1.01	5.166
189°F	81 psi	-1.60	0.000	-2.89	0.000	1.91	3.939	1.13	5.321
204°F	91 psi	-1.55	0.000	-2.88	0.000	1.99	3.983	1.25	5.434
220°F	100 psi	-1.50	0.000	-2.88	0.000	2.07	4.025	1.35	5.517

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.

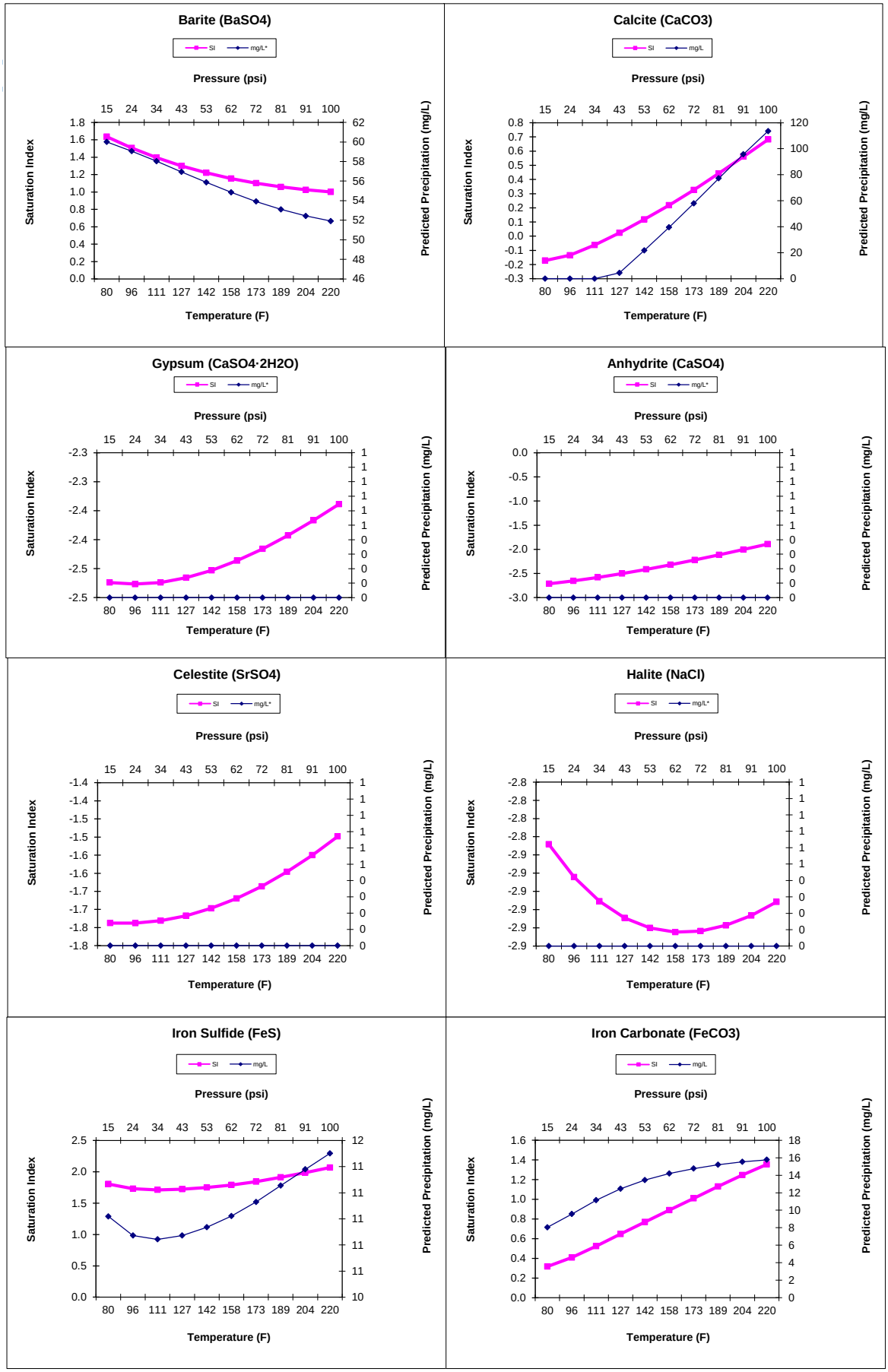
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 23D-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	UNOCAL 23D-4D SEPARATOR
District:	Four Corners	**Sample ID:**	201201035655
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, UNOCAL 23D-4D SEPARATOR

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	390.0	6.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	120.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	26088
Density/Specific Gravity (g/cm³):	1.0153
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15300.0	431.6
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.97

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9914.0	431.4
Potassium (K^+):	64.0	1.6
Magnesium (Mg^{2+}):	21.0	1.7
Calcium (Ca^{2+}):	302.0	15.1
Strontium (Sr^{2+}):	23.0	0.5
Barium (Ba^{2+}):	23.0	0.3
Iron (Fe^{2+}):	0.0	0.0
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	884	N/A

ND = Not Determined

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)**
80°F	15 psi	1.31	12.727	-0.87	0.000	-2.25	0.000	-2.49	0.000
96°F	24 psi	1.18	12.410	-0.84	0.000	-2.25	0.000	-2.43	0.000
111°F	34 psi	1.07	12.059	-0.77	0.000	-2.25	0.000	-2.35	0.000
127°F	43 psi	0.98	11.688	-0.68	0.000	-2.24	0.000	-2.28	0.000
142°F	53 psi	0.90	11.312	-0.59	0.000	-2.23	0.000	-2.19	0.000
158°F	62 psi	0.83	10.946	-0.48	0.000	-2.22	0.000	-2.10	0.000
173°F	72 psi	0.77	10.606	-0.37	0.000	-2.20	0.000	-2.00	0.000
189°F	81 psi	0.73	10.301	-0.25	0.000	-2.18	0.000	-1.90	0.000
204°F	91 psi	0.69	10.040	-0.13	0.000	-2.15	0.000	-1.79	0.000
220°F	100 psi	0.66	9.826	-0.01	0.000	-2.13	0.000	-1.68	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)**
80°F	15 psi	-1.68	0.000	-2.63	0.000	-2.61	0.000	-3.02	0.000
96°F	24 psi	-1.68	0.000	-2.65	0.000	-2.67	0.000	-2.94	0.000
111°F	34 psi	-1.68	0.000	-2.66	0.000	-2.66	0.000	-2.82	0.000
127°F	43 psi	-1.67	0.000	-2.67	0.000	-2.62	0.000	-2.70	0.000
142°F	53 psi	-1.65	0.000	-2.68	0.000	-2.56	0.000	-2.58	0.000
158°F	62 psi	-1.62	0.000	-2.68	0.000	-2.49	0.000	-2.46	0.000
173°F	72 psi	-1.59	0.000	-2.68	0.000	-2.39	0.000	-2.33	0.000
189°F	81 psi	-1.56	0.000	-2.68	0.000	-2.29	0.000	-2.21	0.000
204°F	91 psi	-1.51	0.000	-2.67	0.000	-2.19	0.000	-2.10	0.000
220°F	100 psi	-1.47	0.000	-2.67	0.000	-2.09	0.000	-1.99	0.000

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.

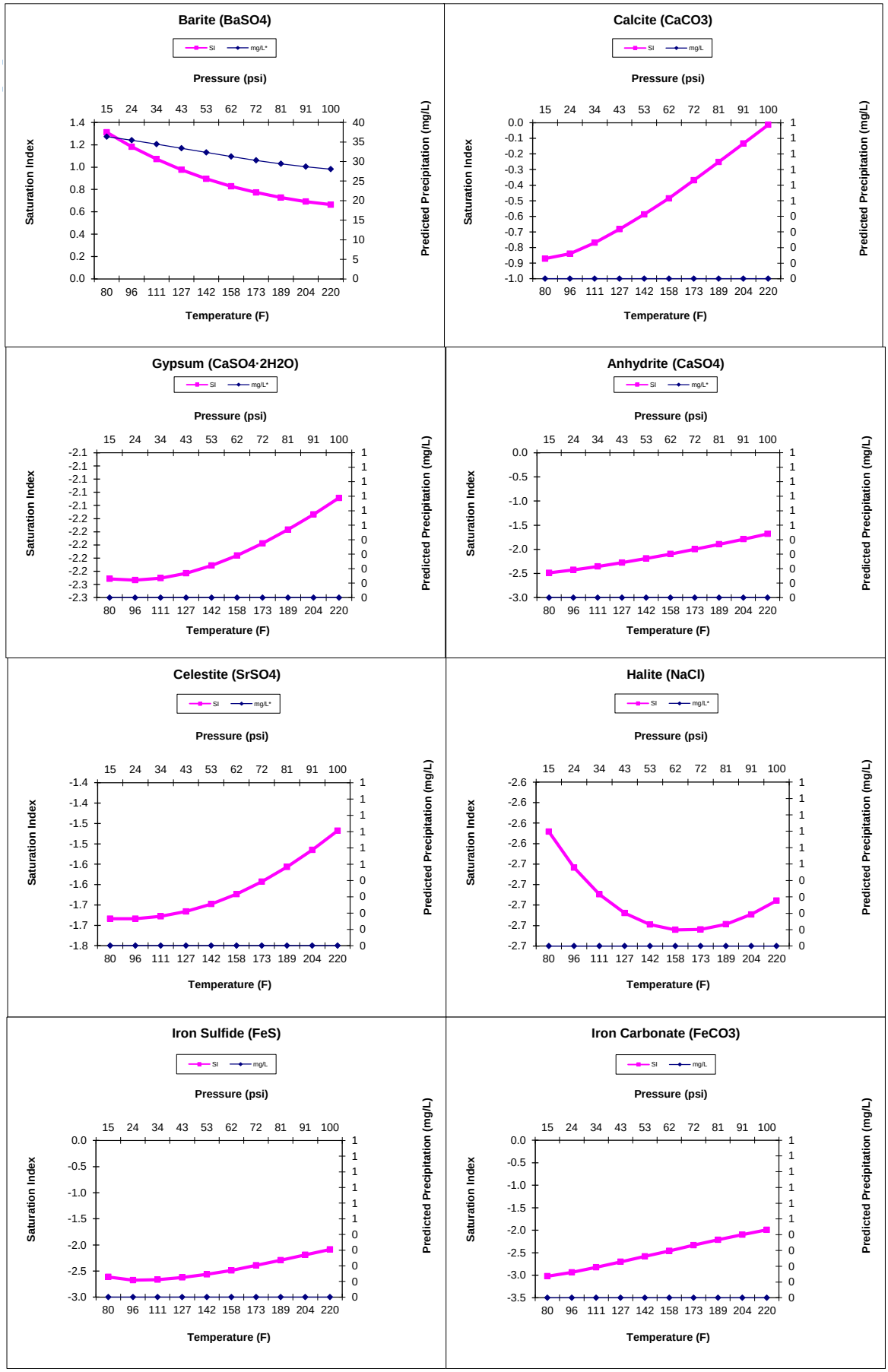
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, UNOCAL 23D-4D SEPARATOR



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24-16D Separator
District:	Four Corners	**Sample ID:**	201201035640
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 24-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	230.0
aqueous H_2S (ppm):	3.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23948
Density/Specific Gravity (g/cm³):	1.0141
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13800.0	389.3
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.94

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8942.0	389.1
Potassium (K^+):	64.0	1.6
Magnesium (Mg^{2+}):	22.0	1.8
Calcium (Ca^{2+}):	356.0	17.8
Strontium (Sr^{2+}):	27.0	0.6
Barium (Ba^{2+}):	285.0	4.2
Iron (Fe^{2+}):	96.0	3.4
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1219	N/A

ND = Not Determined

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)**
80°F	15 psi	2.43	42.308	-0.90	0.000	-2.16	0.000	-2.40	0.000
96°F	24 psi	2.30	42.236	-0.86	0.000	-2.16	0.000	-2.34	0.000
111°F	34 psi	2.19	42.154	-0.79	0.000	-2.16	0.000	-2.26	0.000
127°F	43 psi	2.10	42.066	-0.71	0.000	-2.15	0.000	-2.19	0.000
142°F	53 psi	2.02	41.975	-0.61	0.000	-2.14	0.000	-2.10	0.000
158°F	62 psi	1.95	41.885	-0.51	0.000	-2.12	0.000	-2.00	0.000
173°F	72 psi	1.90	41.800	-0.40	0.000	-2.10	0.000	-1.91	0.000
189°F	81 psi	1.85	41.724	-0.28	0.000	-2.08	0.000	-1.80	0.000
204°F	91 psi	1.82	41.657	-0.16	0.000	-2.06	0.000	-1.70	0.000
220°F	100 psi	1.79	41.603	-0.04	0.000	-2.03	0.000	-1.58	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)**
80°F	15 psi	-1.59	0.000	-2.72	0.000	1.23	6.389	0.26	15.472
96°F	24 psi	-1.59	0.000	-2.74	0.000	1.17	6.311	0.34	19.913
111°F	34 psi	-1.59	0.000	-2.75	0.000	1.18	6.327	0.46	25.467
127°F	43 psi	-1.57	0.000	-2.76	0.000	1.23	6.385	0.58	30.838
142°F	53 psi	-1.55	0.000	-2.77	0.000	1.29	6.458	0.70	35.700
158°F	62 psi	-1.53	0.000	-2.77	0.000	1.36	6.534	0.82	39.992
173°F	72 psi	-1.50	0.000	-2.77	0.000	1.46	6.617	0.95	44.106
189°F	81 psi	-1.46	0.000	-2.77	0.000	1.56	6.687	1.07	47.613
204°F	91 psi	-1.42	0.000	-2.76	0.000	1.66	6.743	1.19	50.608
220°F	100 psi	-1.37	0.000	-2.75	0.000	1.76	6.788	1.29	53.172

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.

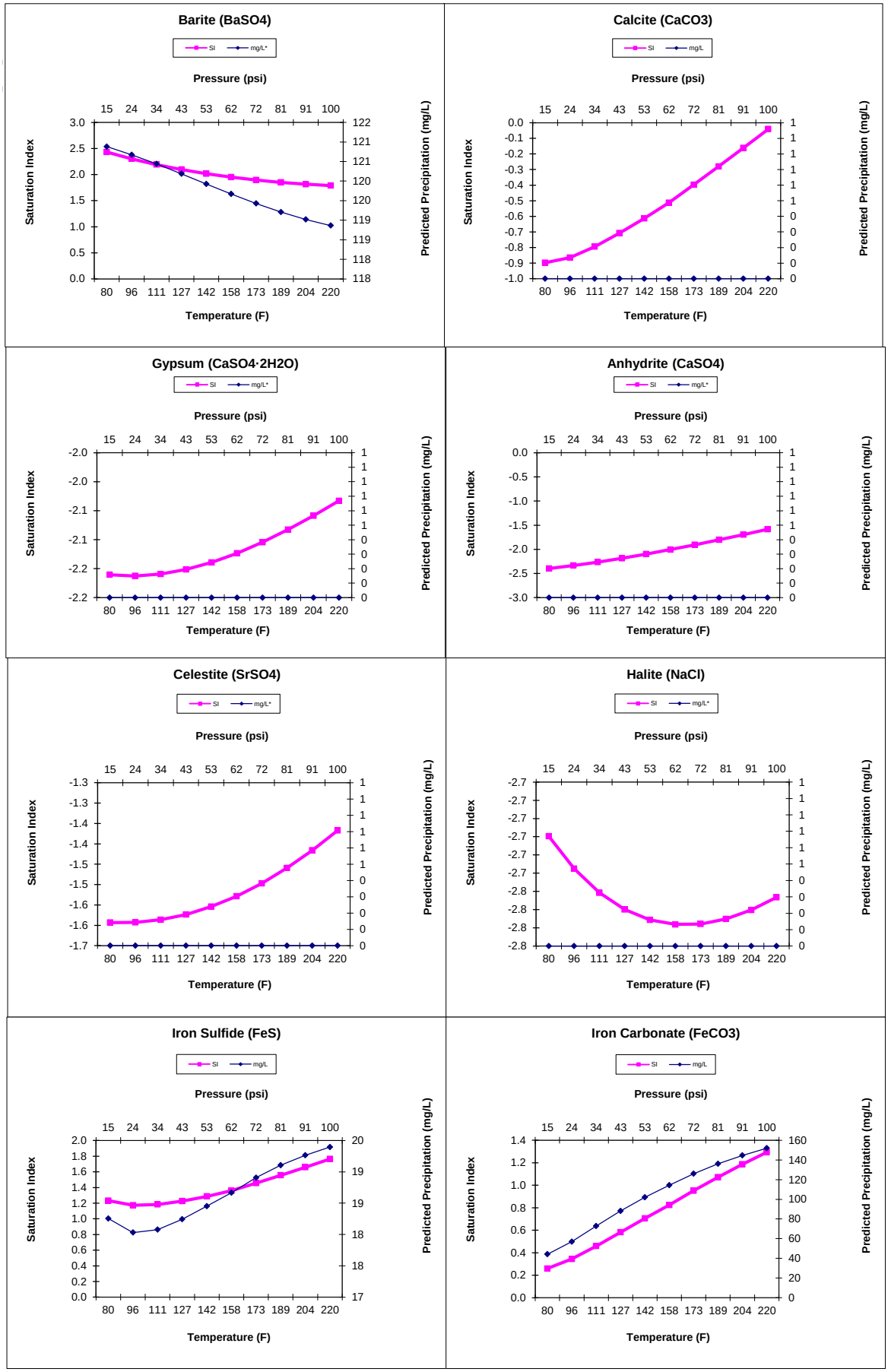
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 24-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24-4D Separator
District:	Four Corners	**Sample ID:**	201201035652
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 24-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	366.0	6.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	150.0
aqueous H_2S (ppm):	2.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	22785
Density/Specific Gravity (g/cm³):	1.0131
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13300.0	375.2
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.97

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8618.0	375.0
Potassium (K^+):	79.0	2.0
Magnesium (Mg^{2+}):	19.0	1.6
Calcium (Ca^{2+}):	258.0	12.9
Strontium (Sr^{2+}):	22.0	0.5
Barium (Ba^{2+}):	63.0	0.9
Iron (Fe^{2+}):	9.0	0.3
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	794	N/A

ND = Not Determined

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)**
80°F	15 psi	1.81	34.413	-0.95	0.000	-2.27	0.000	-2.51	0.000
96°F	24 psi	1.68	33.688	-0.92	0.000	-2.27	0.000	-2.45	0.000
111°F	34 psi	1.57	32.958	-0.85	0.000	-2.27	0.000	-2.37	0.000
127°F	43 psi	1.47	32.248	-0.76	0.000	-2.26	0.000	-2.29	0.000
142°F	53 psi	1.39	31.577	-0.67	0.000	-2.25	0.000	-2.21	0.000
158°F	62 psi	1.33	30.965	-0.56	0.000	-2.23	0.000	-2.11	0.000
173°F	72 psi	1.27	30.424	-0.45	0.000	-2.21	0.000	-2.01	0.000
189°F	81 psi	1.23	29.960	-0.33	0.000	-2.19	0.000	-1.91	0.000
204°F	91 psi	1.19	29.579	-0.21	0.000	-2.17	0.000	-1.80	0.000
220°F	100 psi	1.17	29.279	-0.09	0.000	-2.14	0.000	-1.69	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)**
80°F	15 psi	-1.65	0.000	-2.75	0.000	0.14	0.757	-0.68	0.000
96°F	24 psi	-1.65	0.000	-2.77	0.000	0.08	0.447	-0.59	0.000
111°F	34 psi	-1.65	0.000	-2.78	0.000	0.09	0.503	-0.48	0.000
127°F	43 psi	-1.63	0.000	-2.79	0.000	0.13	0.724	-0.36	0.000
142°F	53 psi	-1.61	0.000	-2.79	0.000	0.19	1.022	-0.23	0.000
158°F	62 psi	-1.59	0.000	-2.80	0.000	0.27	1.369	-0.11	0.000
173°F	72 psi	-1.56	0.000	-2.80	0.000	0.37	1.778	0.02	0.237
189°F	81 psi	-1.52	0.000	-2.79	0.000	0.47	2.157	0.14	1.655
204°F	91 psi	-1.47	0.000	-2.79	0.000	0.58	2.504	0.25	2.724
220°F	100 psi	-1.42	0.000	-2.78	0.000	0.68	2.821	0.36	3.534

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.

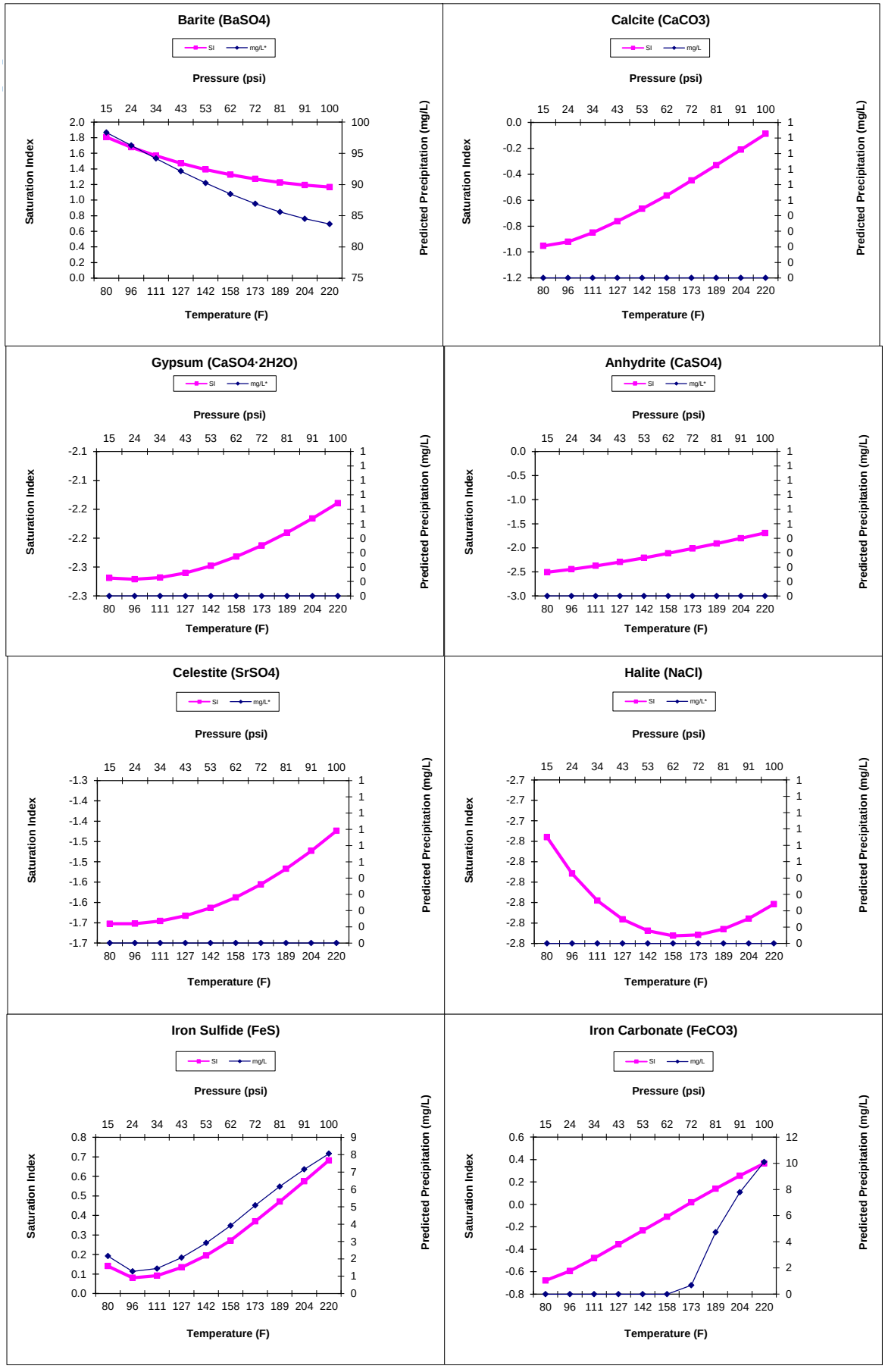
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 24-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24-9DRD Separator
District:	Four Corners	**Sample ID:**	201201035646
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, 24-9DRD Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	183.0	3.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	230.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	18897
Density/Specific Gravity (g/cm³):	1.0108
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10700.0	301.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.88

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6934.0	301.7
Potassium (K^+):	56.0	1.4
Magnesium (Mg^{2+}):	21.0	1.7
Calcium (Ca^{2+}):	747.0	37.3
Strontium (Sr^{2+}):	40.0	0.9
Barium (Ba^{2+}):	85.0	1.2
Iron (Fe^{2+}):	80.0	2.9
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	2062	N/A

ND = Not Determined

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)**
80°F	15 psi	1.98	40.319	-0.78	0.000	-1.78	0.000	-2.02	0.000
96°F	24 psi	1.85	39.724	-0.74	0.000	-1.78	0.000	-1.96	0.000
111°F	34 psi	1.74	39.111	-0.67	0.000	-1.78	0.000	-1.89	0.000
127°F	43 psi	1.65	38.505	-0.58	0.000	-1.77	0.000	-1.81	0.000
142°F	53 psi	1.57	37.927	-0.49	0.000	-1.76	0.000	-1.72	0.000
158°F	62 psi	1.50	37.396	-0.38	0.000	-1.74	0.000	-1.62	0.000
173°F	72 psi	1.45	36.923	-0.27	0.000	-1.72	0.000	-1.52	0.000
189°F	81 psi	1.41	36.518	-0.15	0.000	-1.70	0.000	-1.42	0.000
204°F	91 psi	1.37	36.183	-0.03	0.000	-1.67	0.000	-1.31	0.000
220°F	100 psi	1.35	35.919	0.09	4.884	-1.64	0.000	-1.20	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)**
80°F	15 psi	-1.36	0.000	-2.93	0.000	0.66	1.743	-0.02	0.000
96°F	24 psi	-1.36	0.000	-2.95	0.000	0.61	1.671	0.07	2.980
111°F	34 psi	-1.35	0.000	-2.96	0.000	0.62	1.691	0.19	7.758
127°F	43 psi	-1.34	0.000	-2.97	0.000	0.67	1.750	0.31	12.400
142°F	53 psi	-1.32	0.000	-2.98	0.000	0.73	1.825	0.44	16.642
158°F	62 psi	-1.29	0.000	-2.98	0.000	0.81	1.900	0.56	20.431
173°F	72 psi	-1.25	0.000	-2.98	0.000	0.90	1.981	0.68	24.021
189°F	81 psi	-1.21	0.000	-2.97	0.000	1.01	2.051	0.81	27.219
204°F	91 psi	-1.17	0.000	-2.97	0.000	1.11	2.108	0.93	30.005
220°F	100 psi	-1.12	0.000	-2.96	0.000	1.22	2.153	1.04	32.443

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.

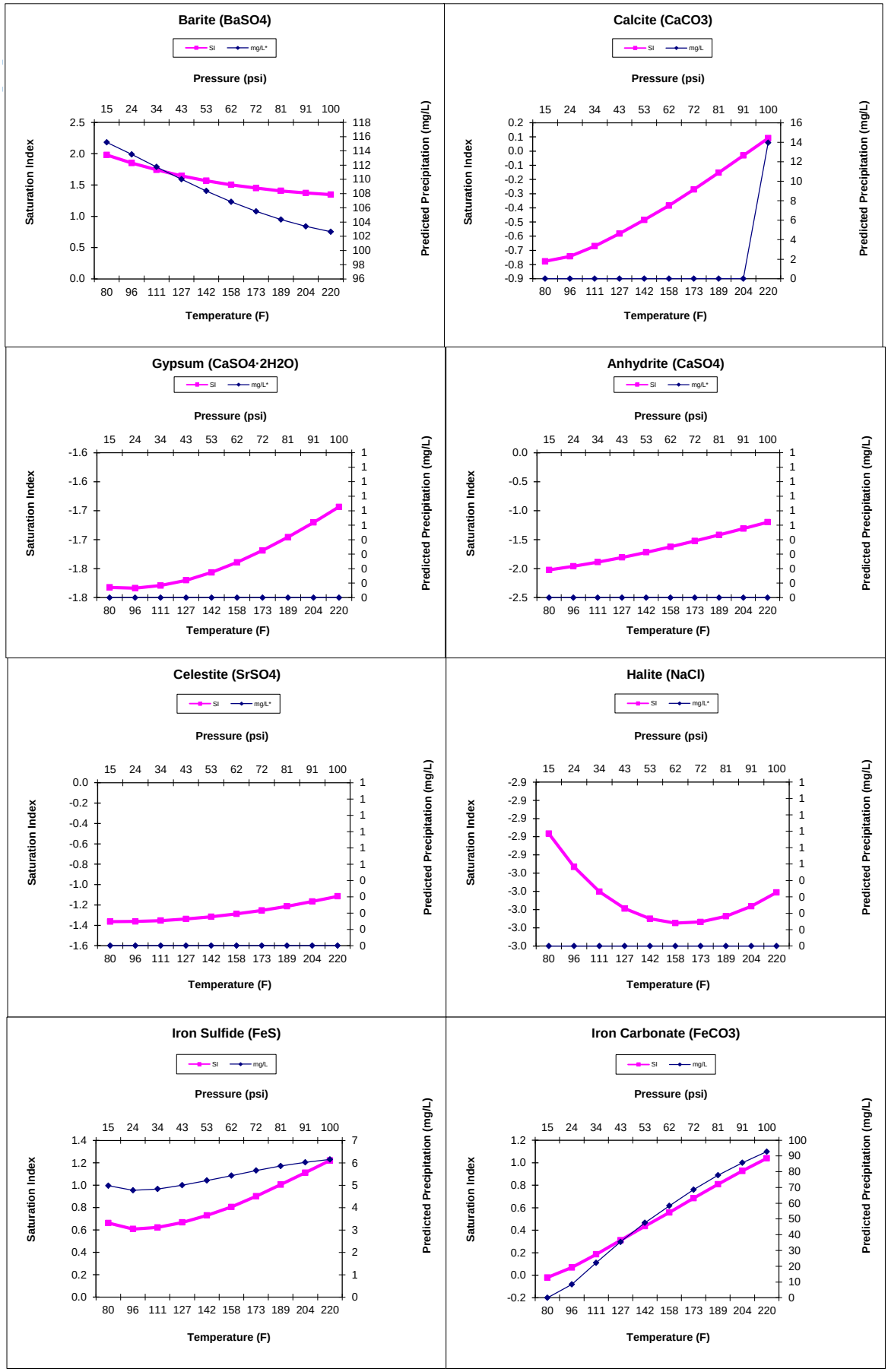
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, 24-9DRD Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24A-16D Separator
District:	Four Corners	**Sample ID:**	201201035661
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 24A-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	475.0	7.8
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	10295
Density/Specific Gravity (g/cm^3):	1.0045
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	5700.0	160.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.96

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	3694.0	160.7
Potassium (K^+):	55.0	1.4
Magnesium (Mg^{2+}):	23.0	1.9
Calcium (Ca^{2+}):	190.0	9.5
Strontium (Sr^{2+}):	23.0	0.5
Barium (Ba^{2+}):	47.0	0.7
Iron (Fe^{2+}):	37.0	1.3
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	630	N/A

ND = Not Determined

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)**
80°F	15 psi	2.00	27.178	0.14	11.673	-2.12	0.000	-2.36	0.000
96°F	24 psi	1.87	26.923	0.18	14.830	-2.12	0.000	-2.30	0.000
111°F	34 psi	1.76	26.646	0.26	20.718	-2.11	0.000	-2.23	0.000
127°F	43 psi	1.66	26.363	0.35	27.575	-2.10	0.000	-2.14	0.000
142°F	53 psi	1.59	26.087	0.45	34.775	-2.09	0.000	-2.05	0.000
158°F	62 psi	1.53	25.831	0.55	42.028	-2.07	0.000	-1.95	0.000
173°F	72 psi	1.48	25.607	0.67	49.436	-2.04	0.000	-1.85	0.000
189°F	81 psi	1.44	25.421	0.79	56.987	-2.01	0.000	-1.74	0.000
204°F	91 psi	1.41	25.277	0.92	64.155	-1.98	0.000	-1.63	0.000
220°F	100 psi	1.39	25.176	1.05	70.930	-1.95	0.000	-1.51	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)**
80°F	15 psi	-1.35	0.000	-3.43	0.000	2.08	1.519	1.20	24.193
96°F	24 psi	-1.35	0.000	-3.45	0.000	2.01	1.517	1.30	24.693
111°F	34 psi	-1.34	0.000	-3.46	0.000	2.00	1.517	1.42	25.210
127°F	43 psi	-1.32	0.000	-3.47	0.000	2.02	1.517	1.55	25.628
142°F	53 psi	-1.30	0.000	-3.48	0.000	2.06	1.519	1.68	25.944
158°F	62 psi	-1.26	0.000	-3.48	0.000	2.11	1.520	1.81	26.177
173°F	72 psi	-1.22	0.000	-3.48	0.000	2.17	1.522	1.94	26.353
189°F	81 psi	-1.17	0.000	-3.47	0.000	2.25	1.524	2.07	26.486
204°F	91 psi	-1.12	0.000	-3.47	0.000	2.34	1.526	2.20	26.582
220°F	100 psi	-1.06	0.000	-3.46	0.000	2.43	1.527	2.32	26.651

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.

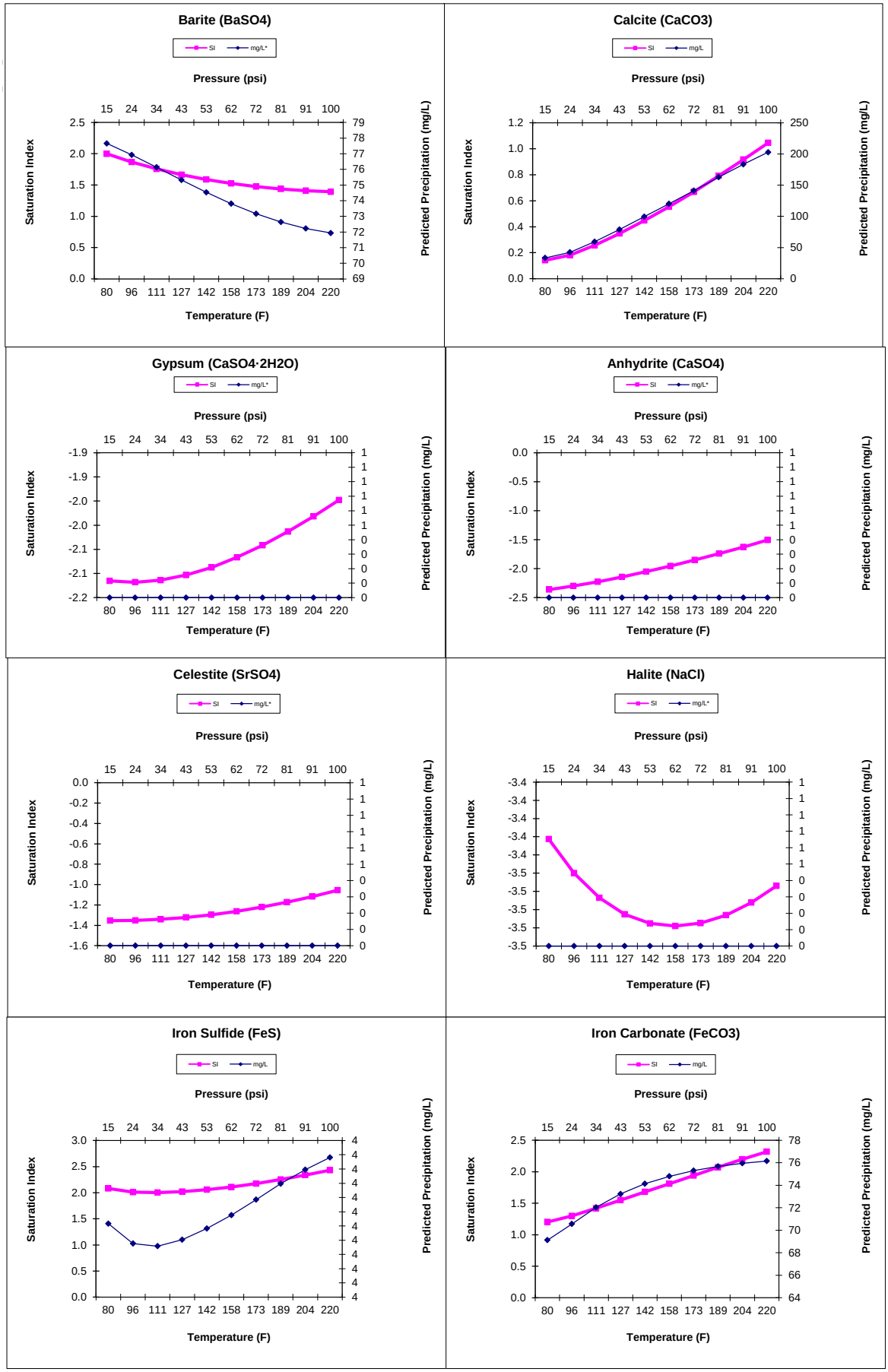
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 24A-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	UNOCAL ENCANA 24B-16D SEPARATOR
District:	Four Corners	**Sample ID:**	201201035644
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, UNOCAL ENCANA 24B-16D SEPARATOR

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	610.0	10.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	130.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	2702
Density/Specific Gravity (g/cm³):	0.9991
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	1000.0	28.2
Sulfate (SO_4^{2-}):	200.0	4.2
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.12

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	648.0	28.2
Potassium (K^+):	45.0	1.2
Magnesium (Mg^{2+}):	15.0	1.2
Calcium (Ca^{2+}):	123.0	6.1
Strontium (Sr^{2+}):	16.0	0.4
Barium (Ba^{2+}):	34.0	0.5
Iron (Fe^{2+}):	11.0	0.4
Manganese (Mn^{2+}):	0.3	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	412	N/A

ND = Not Determined

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)**
80°F	15 psi	2.89	20.194	0.27	23.111	-1.29	0.000	-1.53	0.000
96°F	24 psi	2.76	20.184	0.31	26.452	-1.29	0.000	-1.47	0.000
111°F	34 psi	2.65	20.173	0.39	32.501	-1.28	0.000	-1.39	0.000
127°F	43 psi	2.56	20.161	0.49	39.403	-1.26	0.000	-1.31	0.000
142°F	53 psi	2.49	20.150	0.59	46.495	-1.24	0.000	-1.21	0.000
158°F	62 psi	2.43	20.140	0.70	53.470	-1.22	0.000	-1.11	0.000
173°F	72 psi	2.39	20.131	0.83	60.437	-1.18	0.000	-1.00	0.000
189°F	81 psi	2.36	20.124	0.96	67.247	-1.15	0.000	-0.88	0.000
204°F	91 psi	2.34	20.119	1.09	73.479	-1.11	0.000	-0.76	0.000
220°F	100 psi	2.33	20.117	1.23	79.125	-1.07	0.000	-0.63	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)**
80°F	15 psi	-0.51	0.000	-4.85	0.000	1.93	2.316	1.04	7.181
96°F	24 psi	-0.50	0.000	-4.87	0.000	1.87	2.309	1.14	7.345
111°F	34 psi	-0.48	0.000	-4.88	0.000	1.87	2.309	1.27	7.509
127°F	43 psi	-0.46	0.000	-4.89	0.000	1.90	2.313	1.41	7.639
142°F	53 psi	-0.43	0.000	-4.89	0.000	1.95	2.318	1.55	7.735
158°F	62 psi	-0.38	0.000	-4.89	0.000	2.01	2.324	1.68	7.804
173°F	72 psi	-0.33	0.000	-4.89	0.000	2.09	2.331	1.83	7.855
189°F	81 psi	-0.27	0.000	-4.88	0.000	2.18	2.337	1.97	7.892
204°F	91 psi	-0.20	0.000	-4.87	0.000	2.28	2.343	2.11	7.918
220°F	100 psi	-0.13	0.000	-4.86	0.000	2.39	2.347	2.25	7.937

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.

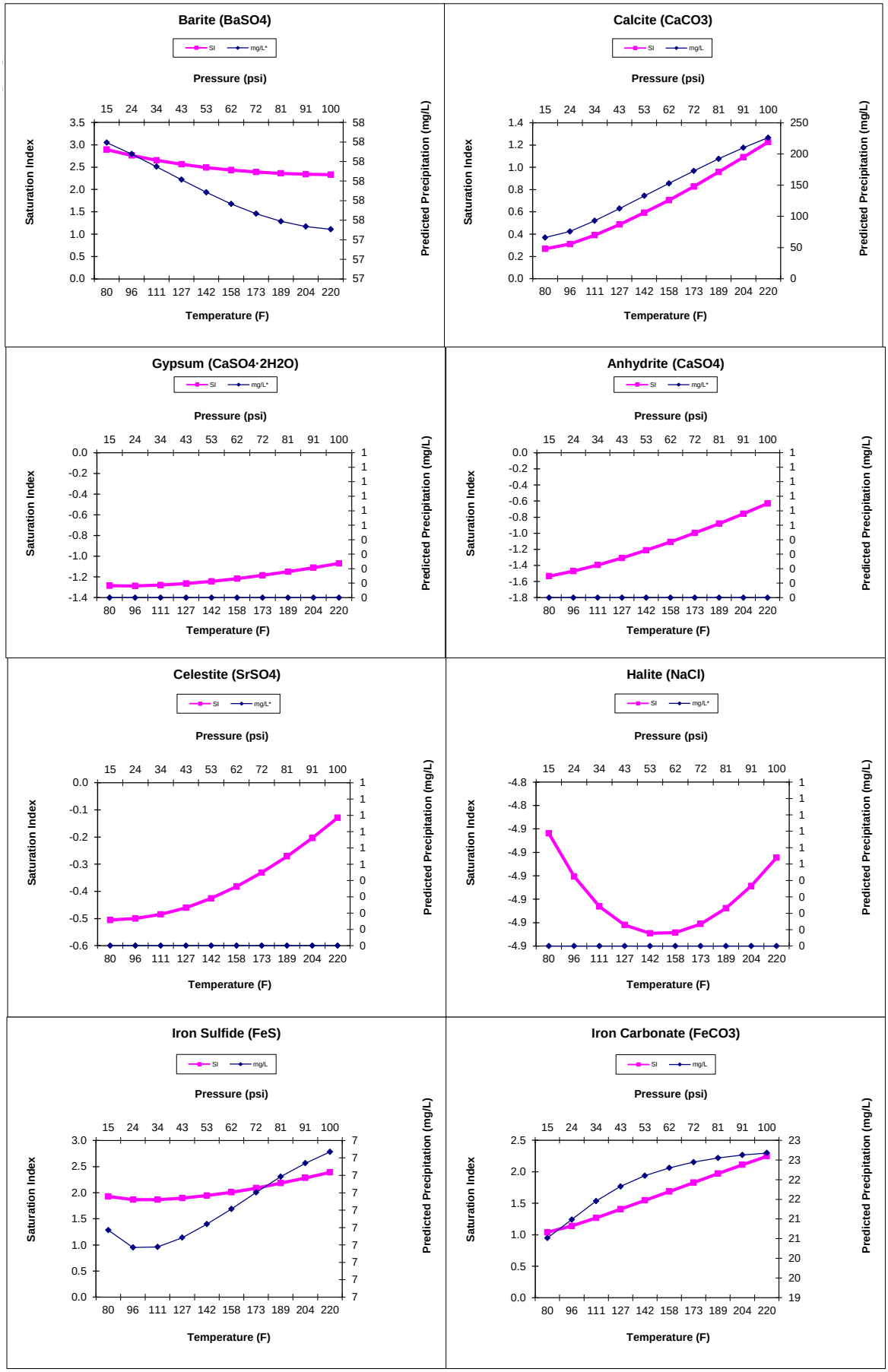
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, UNOCAL ENCANA 24B-16D SEPARATOR



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	Unocal 24B-4D Separator
District:	Four Corners	**Sample ID:**	201201035656
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal, Unocal 24B-4D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	390.0	6.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	130.0
aqueous H_2S (ppm):	1.5
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	17574
Density/Specific Gravity (g/cm³):	1.0095
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	10200.0	287.7
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.98

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	6610.0	287.6
Potassium (K^+):	47.0	1.2
Magnesium (Mg^{2+}):	19.0	1.6
Calcium (Ca^{2+}):	184.0	9.2
Strontium (Sr^{2+}):	20.0	0.5
Barium (Ba^{2+}):	42.0	0.6
Iron (Fe^{2+}):	12.0	0.4
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	592	N/A

ND = Not Determined

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)**
80°F	15 psi	1.74	23.951	-1.04	0.000	-2.32	0.000	-2.56	0.000
96°F	24 psi	1.61	23.615	-1.00	0.000	-2.32	0.000	-2.49	0.000
111°F	34 psi	1.50	23.250	-0.93	0.000	-2.31	0.000	-2.42	0.000
127°F	43 psi	1.41	22.872	-0.84	0.000	-2.31	0.000	-2.34	0.000
142°F	53 psi	1.33	22.499	-0.75	0.000	-2.29	0.000	-2.25	0.000
158°F	62 psi	1.26	22.147	-0.64	0.000	-2.28	0.000	-2.16	0.000
173°F	72 psi	1.21	21.830	-0.52	0.000	-2.25	0.000	-2.06	0.000
189°F	81 psi	1.17	21.557	-0.40	0.000	-2.23	0.000	-1.95	0.000
204°F	91 psi	1.14	21.333	-0.28	0.000	-2.20	0.000	-1.84	0.000
220°F	100 psi	1.11	21.163	-0.15	0.000	-2.17	0.000	-1.73	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)**
80°F	15 psi	-1.60	0.000	-2.96	0.000	0.06	0.310	-0.48	0.000
96°F	24 psi	-1.59	0.000	-2.98	0.000	0.00	0.023	-0.39	0.000
111°F	34 psi	-1.59	0.000	-2.99	0.000	0.02	0.083	-0.28	0.000
127°F	43 psi	-1.57	0.000	-3.00	0.000	0.06	0.299	-0.15	0.000
142°F	53 psi	-1.55	0.000	-3.01	0.000	0.13	0.585	-0.02	0.000
158°F	62 psi	-1.52	0.000	-3.01	0.000	0.21	0.924	0.10	1.654
173°F	72 psi	-1.49	0.000	-3.01	0.000	0.31	1.299	0.23	3.351
189°F	81 psi	-1.44	0.000	-3.01	0.000	0.42	1.639	0.36	4.612
204°F	91 psi	-1.40	0.000	-3.00	0.000	0.53	1.942	0.48	5.553
220°F	100 psi	-1.34	0.000	-2.99	0.000	0.64	2.209	0.60	6.257

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.

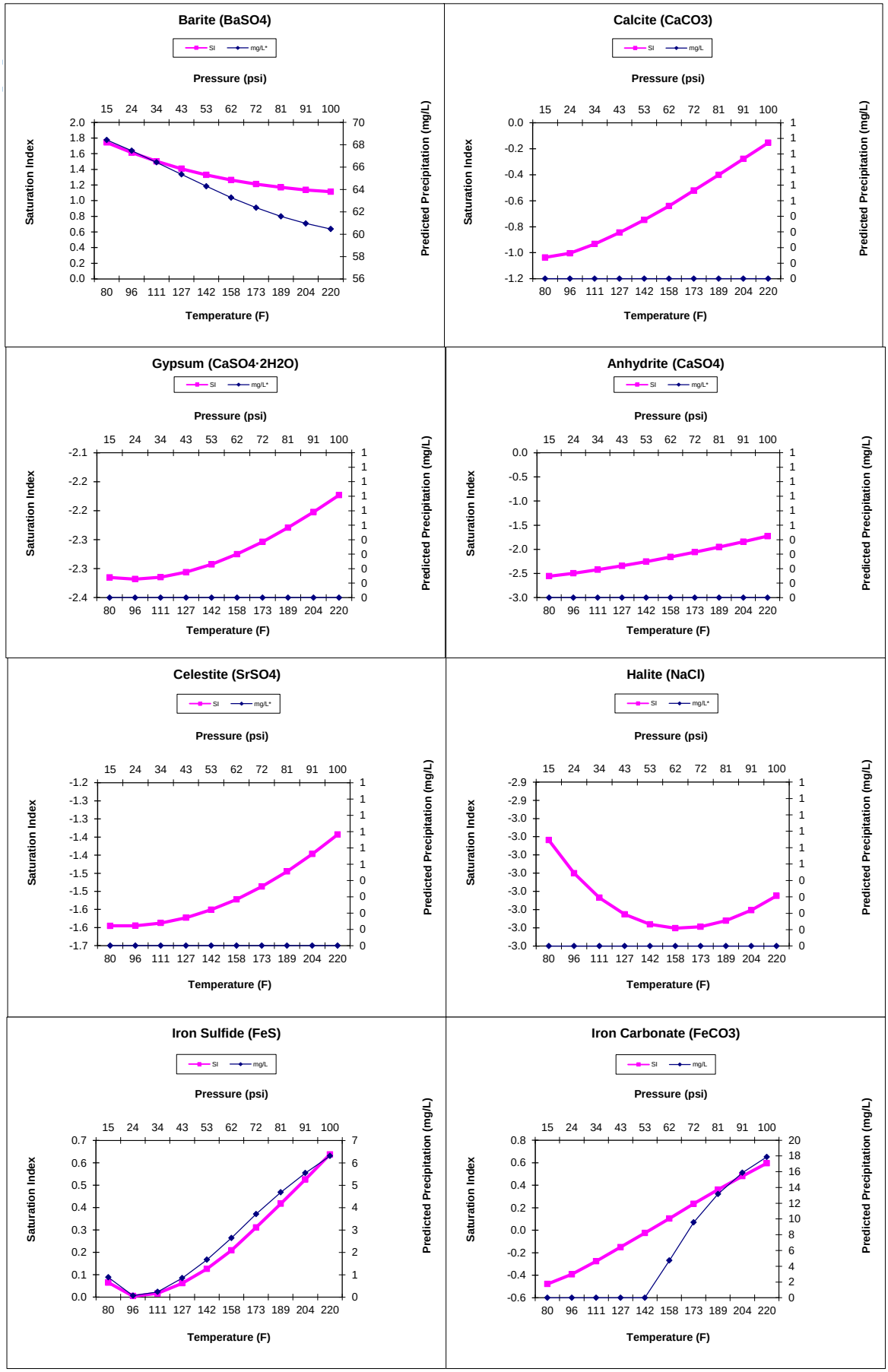
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal, Unocal 24B-4D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24D-16D Separator
District:	Four Corners	**Sample ID:**	201201035643
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 24D-16D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	7.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	390.0	6.4
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	50.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	23011
Density/Specific Gravity (g/cm³):	1.0131
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	13500.0	380.8
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.99

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	8748.0	380.7
Potassium (K^+):	43.0	1.1
Magnesium (Mg^{2+}):	17.0	1.4
Calcium (Ca^{2+}):	145.0	7.2
Strontium (Sr^{2+}):	18.0	0.4
Barium (Ba^{2+}):	38.0	0.6
Iron (Fe^{2+}):	61.0	2.2
Manganese (Mn^{2+}):	0.6	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	481	N/A

ND = Not Determined

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)**
80°F	15 psi	1.59	21.429	-0.17	0.000	-2.52	0.000	-2.75	0.000
96°F	24 psi	1.46	21.048	-0.13	0.000	-2.52	0.000	-2.69	0.000
111°F	34 psi	1.35	20.631	-0.06	0.000	-2.52	0.000	-2.62	0.000
127°F	43 psi	1.25	20.197	0.03	1.633	-2.51	0.000	-2.54	0.000
142°F	53 psi	1.17	19.765	0.12	7.698	-2.50	0.000	-2.46	0.000
158°F	62 psi	1.11	19.352	0.22	13.904	-2.48	0.000	-2.36	0.000
173°F	72 psi	1.05	18.975	0.33	20.346	-2.46	0.000	-2.26	0.000
189°F	81 psi	1.01	18.643	0.44	27.064	-2.44	0.000	-2.16	0.000
204°F	91 psi	0.97	18.365	0.56	33.550	-2.42	0.000	-2.05	0.000
220°F	100 psi	0.95	18.144	0.68	39.786	-2.39	0.000	-1.94	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)**
80°F	15 psi	-1.74	0.000	-2.74	0.000	2.20	1.489	1.18	36.885
96°F	24 psi	-1.74	0.000	-2.75	0.000	2.12	1.487	1.27	38.073
111°F	34 psi	-1.73	0.000	-2.77	0.000	2.10	1.486	1.39	39.366
127°F	43 psi	-1.72	0.000	-2.78	0.000	2.11	1.487	1.51	40.465
142°F	53 psi	-1.70	0.000	-2.78	0.000	2.14	1.487	1.64	41.335
158°F	62 psi	-1.67	0.000	-2.78	0.000	2.18	1.488	1.76	42.003
173°F	72 psi	-1.64	0.000	-2.78	0.000	2.23	1.490	1.87	42.525
189°F	81 psi	-1.60	0.000	-2.78	0.000	2.30	1.491	1.99	42.938
204°F	91 psi	-1.56	0.000	-2.78	0.000	2.37	1.492	2.11	43.244
220°F	100 psi	-1.51	0.000	-2.77	0.000	2.45	1.493	2.22	43.471

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.

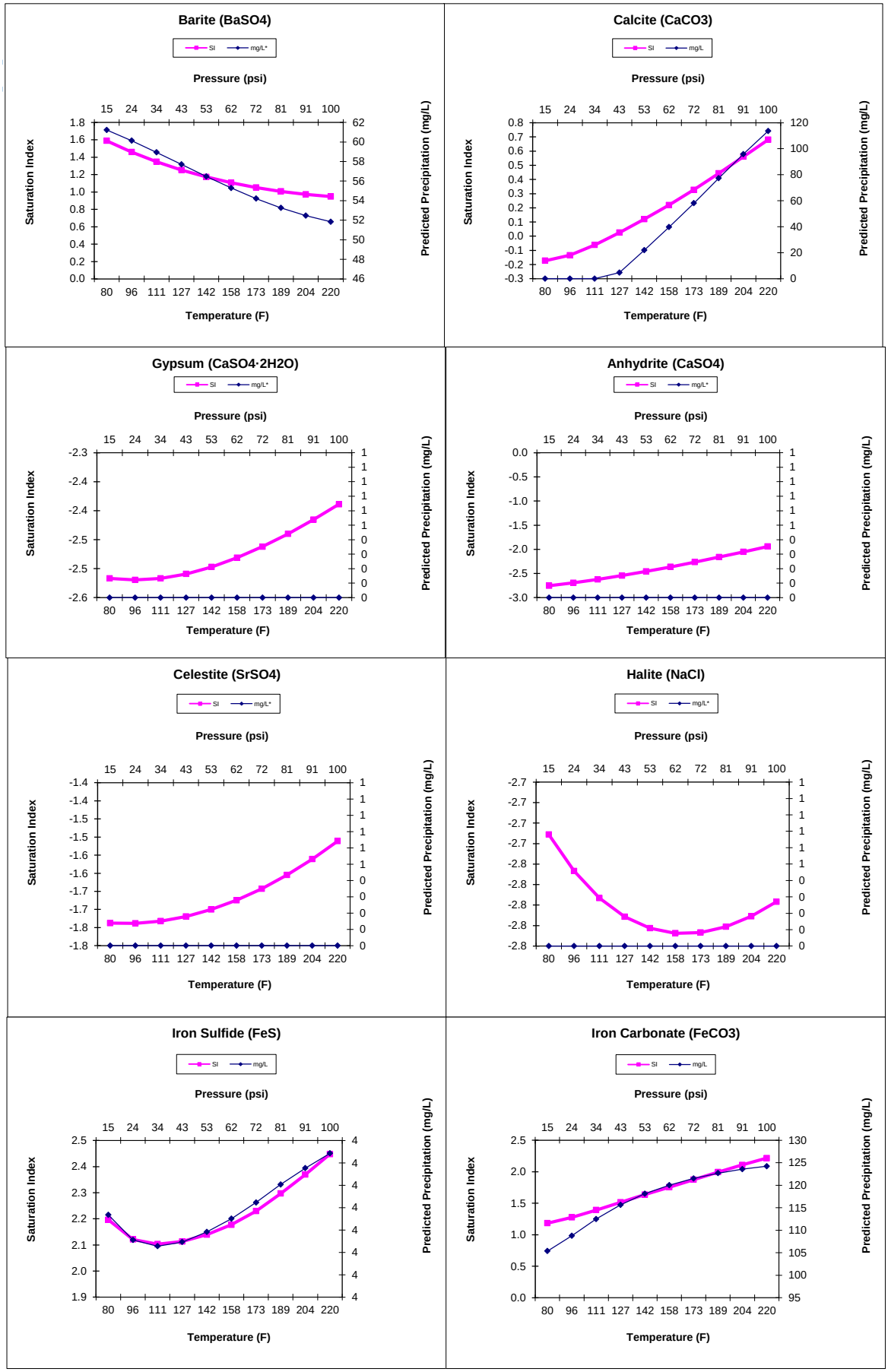
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 24D-16D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	24D-9D Separator
District:	Four Corners	**Sample ID:**	201201035647
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Unocal-EnCana	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Unocal-EnCana, 24D-9D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	**mg/L**	**meq/L**
Bicarbonate (HCO_3^-):	341.0	5.6
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	100.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	25920
Density/Specific Gravity (g/cm^3):	1.0155
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	**mg/L**	**meq/L**
Chloride (Cl^-):	15000.0	423.1
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	**mg/L**	**meq/L**
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	0.93

Cations:	**mg/L**	**meq/L**
Sodium (Na^+):	9720.0	423.0
Potassium (K^+):	56.0	1.4
Magnesium (Mg^{2+}):	37.0	3.0
Calcium (Ca^{2+}):	617.0	30.8
Strontium (Sr^{2+}):	39.0	0.9
Barium (Ba^{2+}):	58.0	0.8
Iron (Fe^{2+}):	1.0	0.0
Manganese (Mn^{2+}):	1.0	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	1782	N/A

ND = Not Determined

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)**
80°F	15 psi	1.70	31.764	-0.63	0.000	-1.96	0.000	-2.20	0.000
96°F	24 psi	1.57	31.054	-0.59	0.000	-1.96	0.000	-2.13	0.000
111°F	34 psi	1.46	30.324	-0.52	0.000	-1.96	0.000	-2.06	0.000
127°F	43 psi	1.37	29.602	-0.44	0.000	-1.95	0.000	-1.98	0.000
142°F	53 psi	1.29	28.912	-0.34	0.000	-1.94	0.000	-1.89	0.000
158°F	62 psi	1.22	28.274	-0.24	0.000	-1.92	0.000	-1.80	0.000
173°F	72 psi	1.16	27.702	-0.13	0.000	-1.90	0.000	-1.70	0.000
189°F	81 psi	1.12	27.204	-0.01	0.000	-1.88	0.000	-1.60	0.000
204°F	91 psi	1.08	26.787	0.11	10.209	-1.86	0.000	-1.49	0.000
220°F	100 psi	1.05	26.449	0.23	20.359	-1.83	0.000	-1.38	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)**
80°F	15 psi	-1.47	0.000	-2.65	0.000	-1.23	0.000	-1.69	0.000
96°F	24 psi	-1.47	0.000	-2.67	0.000	-1.29	0.000	-1.61	0.000
111°F	34 psi	-1.46	0.000	-2.68	0.000	-1.28	0.000	-1.49	0.000
127°F	43 psi	-1.45	0.000	-2.69	0.000	-1.24	0.000	-1.37	0.000
142°F	53 psi	-1.43	0.000	-2.70	0.000	-1.18	0.000	-1.25	0.000
158°F	62 psi	-1.41	0.000	-2.70	0.000	-1.11	0.000	-1.13	0.000
173°F	72 psi	-1.38	0.000	-2.70	0.000	-1.01	0.000	-1.00	0.000
189°F	81 psi	-1.34	0.000	-2.70	0.000	-0.91	0.000	-0.88	0.000
204°F	91 psi	-1.30	0.000	-2.69	0.000	-0.81	0.000	-0.77	0.000
220°F	100 psi	-1.25	0.000	-2.69	0.000	-0.71	0.000	-0.66	0.000

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.

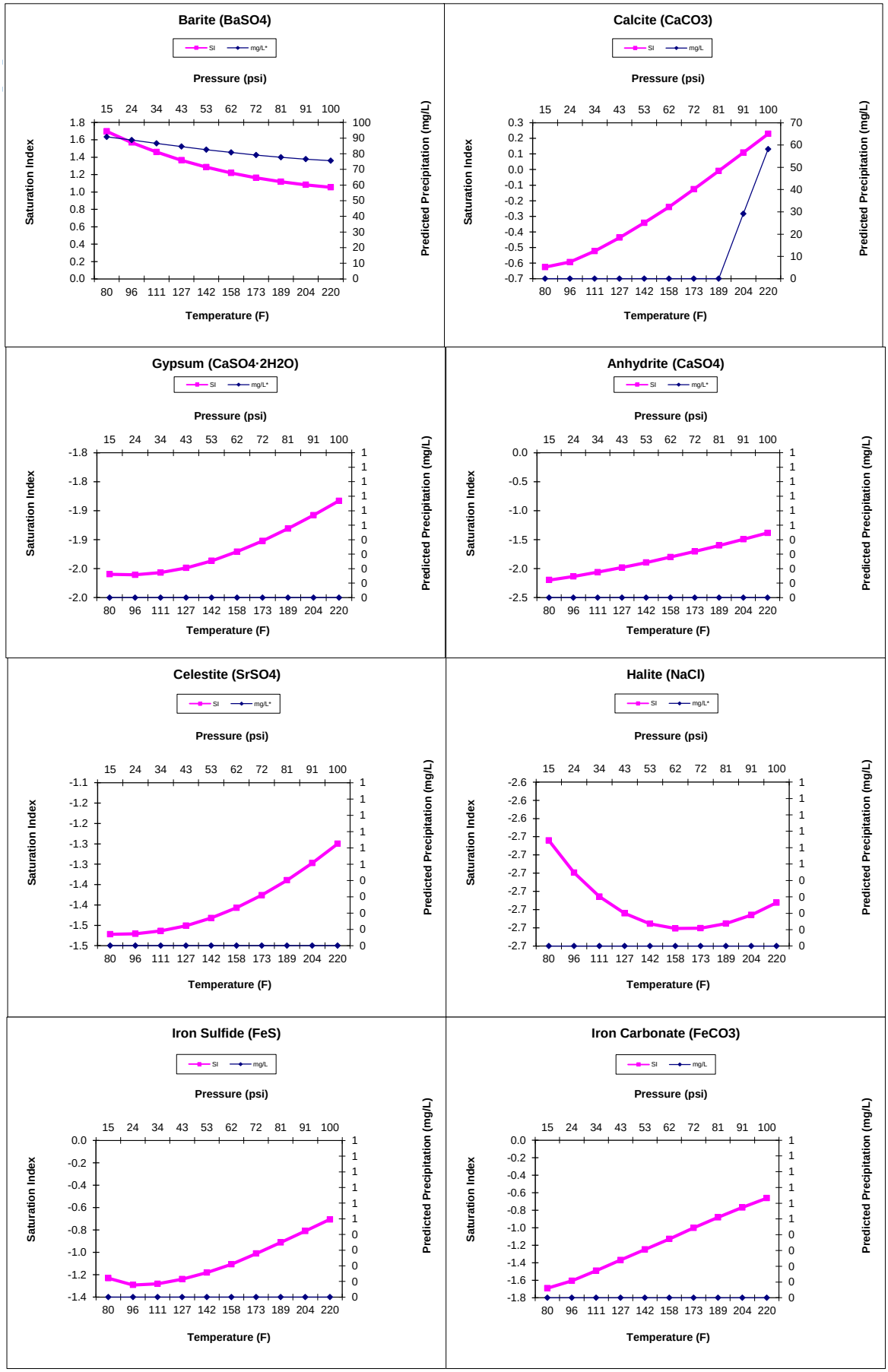
Note 3: Saturation Index predictions on this sheet use pH and alkalinity; $\%CO_2$ is not included in the calculations.

Calculate

ScaleSoftPitzer™ SSP2010

Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Unocal-EnCana, 24D-9D Separator



Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Partial Water Analysis Report

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11D-7D Separator
District:	Four Corners	**Sample ID:**	201201035699
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 11D-7D Separator

Field Data	
Initial Temperature (°F):	1
Final Temperature (°F):	22
Initial Pressure (psi):	220
Final Pressure (psi):	80
pH:	
pH at time of sampling:	6.0

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	5014
Measured Density/Specific Gravity	ND
Conductivity (µmhos):	ND

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	2780.0	78.3
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio: 1.03

Cations:	mg/L	meq/L
Sodium (Na^+):	1801.0	78.6
Potassium (K^+):	9.0	0.2
Magnesium (Mg^{2+}):	2.0	0.2
Calcium (Ca^{2+}):	26.0	1.3
Strontium (Sr^{2+}):	2.0	0.0
Barium (Ba^{2+}):	5.0	0.1
Iron (Fe^{2+}):	34.0	1.2
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	79	

Comments:

Permian Basin Area Laboratory
2101 S Market St. / Building B
Midland, TX. 79703

Report Date: 1/12/2015

Complete Water Analysis Report SSP v.8

Customer:	CAERUS OIL & GAS	**Sample Point Name**	11D-7D Separator
District:	Four Corners	**Sample ID:**	201201035699
Sales Rep:	Sean Higgins	**Sample Date:**	10/30/2012
Lease:	Chevron	**Log Out Date:**	12/3/2012
Site Type:		**Analyst:**	AC
Sample Point Description:			

CAERUS OIL & GAS, Chevron, 11D-7D Separator

Field Data

Initial Temperature (°F):	220
Final Temperature (°F):	80
Initial Pressure (psi):	100
Final Pressure (psi):	15

pH:

pH at time of sampling:	6.0

Alkalinity by Titration:	mg/L	meq/L
Bicarbonate (HCO_3^-):	305.0	5.0
Carbonate (CO_3^{2-}):	ND	
Hydroxide (OH^-):	ND	

aqueous CO_2 (ppm):	180.0
aqueous H_2S (ppm):	1.0
aqueous O_2 (ppb):	ND
Calculated TDS (mg/L):	5014
Density/Specific Gravity (g/cm^3):	1.0007
Measured Density/Specific Gravity	ND
Conductivity (mmhos):	ND
MCF/D:	No Data
BOPD:	No Data
BWPD:	No Data

Analysis of Sample

Anions:	mg/L	meq/L
Chloride (Cl^-):	2780.0	78.4
Sulfate (SO_4^{2-}):	50.0	1.0
Borate (H_3BO_3):	ND	
Fluoride (F^-):	ND	
Bromide (Br^-):	ND	
Nitrite (NO_2^-):	ND	
Nitrate (NO_3^-):	ND	
Phosphate (PO_4^{3-}):	ND	
Silica (SiO_2):	ND	

Organic Acids:	mg/L	meq/L
Formic Acid:	ND	
Acetic Acid:	ND	
Propionic Acid:	ND	
Butyric Acid:	ND	
Valeric Acid:	ND	

Anion/Cation Ratio:	1.04

Cations:	mg/L	meq/L
Sodium (Na^+):	1801.0	78.4
Potassium (K^+):	9.0	0.2
Magnesium (Mg^{2+}):	2.0	0.2
Calcium (Ca^{2+}):	26.0	1.3
Strontium (Sr^{2+}):	2.0	0.0
Barium (Ba^{2+}):	5.0	0.1
Iron (Fe^{2+}):	34.0	1.2
Manganese (Mn^{2+}):	0.5	0.0
Lead (Pb^{2+}):	ND	
Zinc (Zn^{2+}):	ND	
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	
Total Hardness:	79	N/A

ND = Not Determined

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)
80°F	15 psi	1.30	2.816	-1.79	0.000	-2.72	0.000	-2.97	0.000
96°F	24 psi	1.17	2.761	-1.76	0.000	-2.72	0.000	-2.91	0.000
111°F	34 psi	1.06	2.700	-1.68	0.000	-2.72	0.000	-2.83	0.000
127°F	43 psi	0.97	2.638	-1.59	0.000	-2.70	0.000	-2.75	0.000
142°F	53 psi	0.90	2.576	-1.48	0.000	-2.68	0.000	-2.65	0.000
158°F	62 psi	0.84	2.520	-1.37	0.000	-2.66	0.000	-2.55	0.000
173°F	72 psi	0.80	2.471	-1.24	0.000	-2.63	0.000	-2.44	0.000
189°F	81 psi	0.77	2.433	-1.11	0.000	-2.60	0.000	-2.32	0.000
204°F	91 psi	0.74	2.406	-0.98	0.000	-2.56	0.000	-2.20	0.000
220°F	100 psi	0.73	2.390	-0.85	0.000	-2.52	0.000	-2.08	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)
80°F	15 psi	-2.15	0.000	-4.00	0.000	0.46	1.405	0.10	3.439
96°F	24 psi	-2.15	0.000	-4.02	0.000	0.41	1.299	0.19	6.348
111°F	34 psi	-2.14	0.000	-4.03	0.000	0.43	1.342	0.31	9.817
127°F	43 psi	-2.11	0.000	-4.04	0.000	0.49	1.448	0.45	12.955
142°F	53 psi	-2.08	0.000	-4.05	0.000	0.56	1.575	0.58	15.566
158°F	62 psi	-2.04	0.000	-4.05	0.000	0.66	1.710	0.72	17.711
173°F	72 psi	-1.99	0.000	-4.04	0.000	0.77	1.842	0.87	19.461
189°F	81 psi	-1.94	0.000	-4.04	0.000	0.90	1.948	1.01	20.769
204°F	91 psi	-1.87	0.000	-4.03	0.000	1.02	2.032	1.14	21.742
220°F	100 psi	-1.80	0.000	-4.02	0.000	1.15	2.097	1.27	22.465

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.

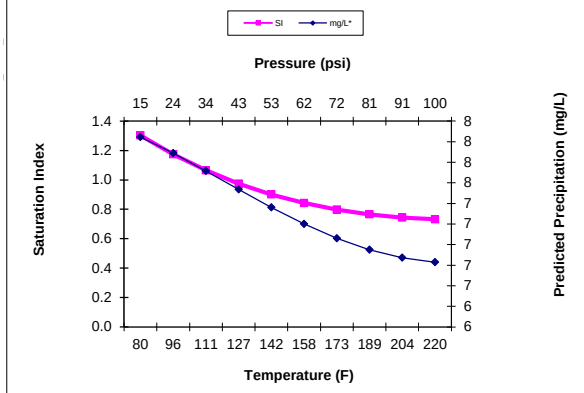
Calculate

ScaleSoftPitzer™ SSP2010

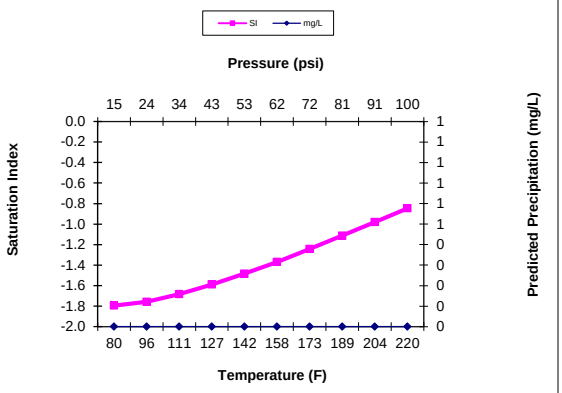
Comments: _____

Sample ID: 41212 CAERUS OIL & GAS, Chevron, 11D-7D Separator

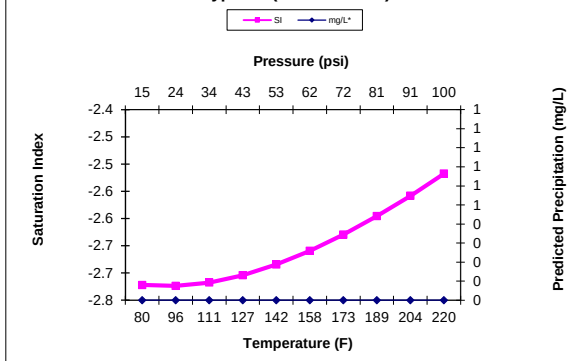
Barite (BaSO4)



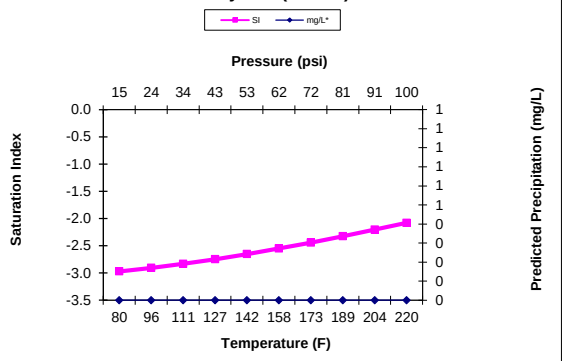
Calcite (CaCO3)



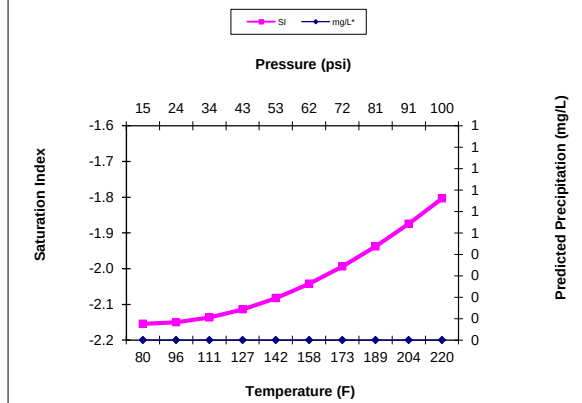
Gypsum (CaSO4·2H2O)



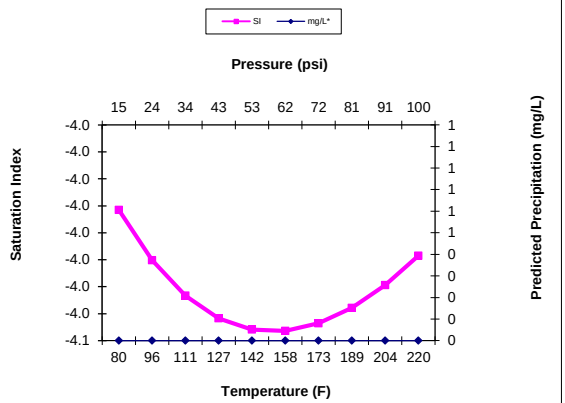
Anhydrite (CaSO4)



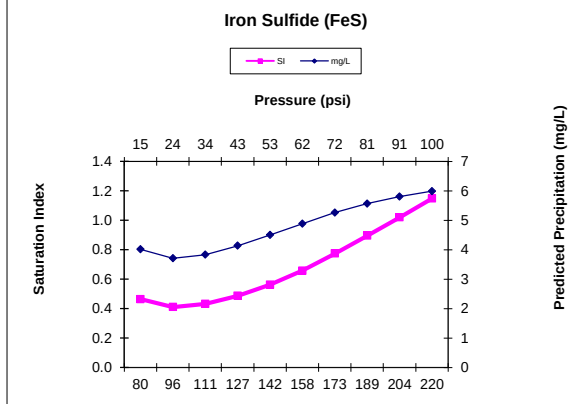
Celestite (SrSO4)



Halite (NaCl)



Iron Sulfide (FeS)



Iron Carbonate (FeCO3)

