JACAM LABORATORIES

DownHole R_X

WATER CHEMISTRY

GREAT WESTERN OPERATING — JBL 34-54 05-123-35269
RYAN GROLL — SEPARATOR

Report Date: 07-10-2013 Sampled: 06-13-2013
Sample #: 4311 at 0000

Sample ID: 42070

CATIONS		ANIONS	
Calcium (as Ca)	643.20	Chloride (as Cl)	18200
Magnesium (as Mg)	121.40	Sulfate (as SO_4)	0.00
Barium (as Ba)	15.10	Bromine (as Br)	0.00
Strontium (as Sr)	87.99	Dissolved CO_2 (as CO_2)	220.00
Sodium (as Na)	10543	Bicarbonate (as HCO_3)	317.00
Potassium (as K)	145.70	Carbonate (as CO_3)	0.00
Lithium (as Li)	9.29	Oxalic acid (as C_2O_4)	0.00
Ammonia (as NH_3)	0.00	Silica (as Si)	0.00
Aluminum (as Al)	0.292	Phosphate(as PO_4)	0.00
Iron (as Fe)	51.04	H_2S (as H_2S)	0.00
Manganese (as Mn)	0.0120	Fluoride (as F)	0.00
Zinc (as Zn)	0.0820	Nitrate (as NO_3)	0.00
Lead (as Pb)	0.00	Boron (as B)	5.35

PARAMETERS

Calculated T.D.S.	30025
Molar Conductivity	41598
Resistivity	24.04
Density(g/mL)	1.02
Pressure(atm)	1.00
pCO_2(atm)	0.0147
pH_2S(atm)	0.00
Temperature (^oF)	120.00
pH	7.20

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DEPOSITION POTENTIAL INDICATORS

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SATURATION LEVEL		MOMENTARY EXCESS (Lbs/1000 Barrels)	
Calcite ($CaCO_3$)	4.04	Calcite ($CaCO_3$)	0.368
Aragonite ($CaCO_3$)	3.42	Aragonite ($CaCO_3$)	0.346
Witherite ($BaCO_3$)	0.0258	Witherite ($BaCO_3$)	-12.87
Strontianite ($SrCO_3$)	1.40	Strontianite ($SrCO_3$)	0.204
Calcium oxalate (CaC_2O_4)	0.00	Calcium oxalate (CaC_2O_4)	-0.0922
Magnesite ($MgCO_3$)	0.948	Magnesite ($MgCO_3$)	-0.0226
Anhydrite ($CaSO_4$)	0.00	Anhydrite ($CaSO_4$)	-882.11
Gypsum ($CaSO_4*2H_2O$)	0.00	Gypsum ($CaSO_4*2H_2O$)	-898.61
Barite ($BaSO_4$)	0.00	Barite ($BaSO_4$)	-3.07
Celestite ($SrSO_4$)	0.00	Celestite ($SrSO_4$)	-111.39
Fluorite (CaF_2)	0.00	Fluorite (CaF_2)	-11.43
Calcium phosphate	0.00	Calcium phosphate	>-0.001
Hydroxyapatite	0.00	Hydroxyapatite	-403.51
Silica (SiO_2)	0.00	Silica (SiO_2)	-69.95
Brucite ($Mg(OH)_2$)	< 0.001	Brucite ($Mg(OH)_2$)	0.0232
Magnesium silicate	0.00	Magnesium silicate	-128.85
Iron hydroxide ($Fe(OH)_3$)	6701	Iron hydroxide ($Fe(OH)_3$)	< 0.001
Strengite ($FePO_4*2H_2O$)	0.00	Strengite ($FePO_4*2H_2O$)	>-0.001
Siderite ($FeCO_3$)	672.69	Siderite ($FeCO_3$)	0.566
Halite (NaCl)	0.00243	Halite (NaCl)	-189405
Thenardite ($Na2SO_4$)	0.00	Thenardite ($Na2SO_4$)	-62494
Iron sulfide (FeS)	0.00	Iron sulfide (FeS)	-0.00787

SIMPLE INDICES		BOUND IONS	TOTAL	FREE
Langelier	0.712	Calcium	643.20	631.89
Ryznar	5.78	Barium	15.10	15.10
Puckorius	4.91	Carbonate	9.60	0.843
Larson-Skold Index	98.83	Phosphate	0.00	0.00
Stiff Davis Index	0.526	Sulfate	0.00	0.00
Oddo-Tomson	0.259			

OPERATING CONDITIONS

Temperature (^oF)	120.00
Time(secs)	0.00

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DownHole SAT™ Water Analysis Report

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SYSTEM IDENTIFICATION

GREAT WESTERN OPERATING
JBL 34-54
RYAN GROLL
SEPARATOR

Sample ID#: 4311
ID: 42070
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at 0000

WATER CHEMISTRY

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Strontium(as Sr)	87.99	Dissolved CO_2(as CO_2)	220.00
Sodium(as Na)	10543	Bicarbonate(as HCO_3)	317.00
Potassium(as K)	145.70	Carbonate(as CO_3)	0.00
Lithium(as Li)	9.29	Silica(as Si)	0.00
Iron(as Fe)	51.04	Phosphate(as PO_4)	0.00
Field Iron(as Fe)	0.00	H_2S (as H_2S)	0.00
Ammonia(as NH_3)	0.00	Fluoride(as F)	0.00
Aluminum(as Al)	0.292	Nitrate(as NO_3)	0.00
Manganese(as Mn)	0.0120	Boron(as B)	5.35
Zinc(as Zn)	0.0820		
Lead(as Pb)	0.00	**PARAMETERS**	
		Temperature(^{O}F)	120.00
Sample pH	7.20	T.D.S.	30025
Conductivity:	41598	Resistivity:	24.04

SCALE AND CORROSION POTENTIAL

Temp.	Press.	Calcite $CaCO_3$		Anhydrite $CaSO_4$		Gypsum $CaSO_4*2H_2O$		Barite $BaSO_4$		Celestite $SrSO_4$		Siderite $FeCO_3$		Mackawenite FeS		CO_2	pCO_2
(^{O}F)	(atm)	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	xSAT	Lbs per 1000 Barrels	(mpy)	(atm)
50.00	0.00	1.16	0.0314	0.00	-1043	0.00	-823.39	0.00	-0.850	0.00	-114.63	121.02	0.266	0.00	-0.00646	0.0428	0.0147
65.45	0.00	1.65	0.114	0.00	-1059	0.00	-855.73	0.00	-1.24	0.00	-118.67	193.47	0.334	0.00	-0.00670	0.0802	0.0147
80.91	0.00	2.24	0.193	0.00	-1038	0.00	-877.66	0.00	-1.71	0.00	-118.52	292.63	0.403	0.00	-0.00697	0.0432	0.0147
96.36	0.00	2.90	0.266	0.00	-986.54	0.00	-889.91	0.00	-2.21	0.00	-116.14	420.10	0.470	0.00	-0.00729	0.0566	0.0147
111.82	0.00	3.62	0.333	0.00	-916.34	0.00	-895.20	0.00	-2.75	0.00	-112.92	575.93	0.532	0.00	-0.00765	0.0593	0.0147
127.27	0.00	4.43	0.399	0.00	-854.09	0.00	-902.36	0.00	-3.37	0.00	-110.17	767.39	0.597	0.00	-0.00808	0.0498	0.0147
142.73	0.00	5.31	0.465	0.00	-801.24	0.00	-912.46	0.00	-4.07	0.00	-107.97	994.72	0.663	0.00	-0.00860	0.0404	0.0147
158.18	0.00	6.24	0.529	0.00	-756.41	0.00	-925.53	0.00	-4.87	0.00	-106.27	1251	0.728	0.00	-0.00924	0.0420	0.0147
173.64	0.00	7.19	0.589	0.00	-718.52	0.00	-941.66	0.00	-5.77	0.00	-105.05	1524	0.791	0.00	-0.0100	0.0435	0.0147
189.09	0.00	8.12	0.643	0.00	-686.70	0.00	-960.98	0.00	-6.78	0.00	-104.28	1791	0.849	0.00	-0.0111	0.0219	0.0147
204.55	0.00	8.95	0.690	0.00	-660.26	0.00	-983.68	0.00	-7.91	0.00	-103.95	2028	0.898	0.00	-0.0124	0.0184	0.0147
220.00	0.171	9.50	0.732	0.00	-650.73	0.00	-1028	0.00	-9.34	0.00	-105.82	2162	0.947	0.00	-0.0146	0.0250	0.0173

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. $\{Ca\}\{CO_3\}/K_{sp}$. pCO_2 (atm) is the partial pressure of CO_2 in the gas phase.
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.