KANSAS CORPORATION COMMISSION
OIL & GAS CONSERVATION DIVISION

1294283

Form U3C
June 2015
Form must be Typed
Form must be completed on a per well basis

ANNUAL REPORT OF PRESSURE MONITORING, FLUID INJECTION AND ENHANCED RECOVERY

Complete all blanks - add pages if needed. Copy to be retained for five (5) years after filing date.

OPERATOR: License # 33999
Name: Linn Operating, Inc.
Address 1: 600 TRAVIS STE 5100
Address 2:
City: HOUSTON State: TX Zip: 77002 + 3018
Contact Person: Shawn Hildreth
Phone: (281) 840-4234
Lease Name: HCU
Well Number: 2231-E

API No.: 15-075-20692-00-00
Permit No: D27643.0
Reporting Year: 2015
(January 1 to December 31)

____ - SE - SE - SE Sec. 22 Twp. 23 S. R. 41 ☐ E ☑ W
(Q/Q/Q/Q)
306 feet from ☐ N / ☑ S Line of Section
313 feet from ☑ E / ☐ W Line of Section
County: Hamilton

I. Injection Fluid:

Type *(Pick one)*: ☐ Fresh Water ☑ Treated Brine ☐ Untreated Brine ☐ Water/Brine
Source: ☑ Produced Water ☐ Other *(Attach list)*
Quality: Total Dissolved Solids: 184446 mg/l Specific Gravity: 1.13 Additives: 15% HCL
(Attach water analysis, if available)

II. Well Data:

Maximum Authorized Injection Pressure: 0 psi Injection Zone: Arbuckle
Maximum Authorized Injection Rate: 2500 barrels per day
Total Number of Enhanced Recovery Injection Wells Covered by this Permit: _____ *(Include TA's)*

III.

Month:	Total Fluid Injected BBL	Maximum Fluid Pressure	Total Gas Injected MCF	Maximum Gas Pressure	# Days of Injection
January	17517	20	0		31
February	13970	20	0		28
March	14195	20	0		31
April	14719	20	0		30
May	14753	20	0		31
June	13843	20	0		30
July	10924	20	0		31
August	12607	20	0		31
September	22745	20	0		30
October	25903	20	0		31
November	15956	20	0		30
December	19508	20	0		31
TOTAL	196640		0		

Submitted Electronically

JACAM LABORATORIES

DownHole R_X

WATER CHEMISTRY

LINN OPERATING
DREW LOTT
HAMILTON KS

HCU 2231 E SWD
TANK

Report Date: 01-22-2016
Sample #: 3076

Sampled: 01-19-2016
at 0000

Sample ID: 117231

CATIONS		ANIONS	
Calcium (as Ca)	5615	Chloride (as Cl)	120600
Magnesium (as Mg)	1887	Sulfate (as SO_4)	1900
Barium (as Ba)	0.819	Bromine (as Br)	0.00
Strontium (as Sr)	125.20	Dissolved CO_2 (as CO_2)	80.00
Sodium (as Na)	60937	Bicarbonate (as HCO_3)	96.00
Potassium (as K)	474.60	Carbonate (as CO_3)	0.00
Lithium (as Li)	9.11	Oxalic acid (as C_2O_4)	0.00
Ammonia (as NH_3)	0.00	Silica (as SiO_2)	0.00
Aluminum (as Al)	0.00	Phosphate(as PO_4)	0.00
Iron (as Fe)	62.72	H_2S (as H_2S)	0.00
Manganese (as Mn)	0.0170	Fluoride (as F)	0.00
Zinc (as Zn)	0.882	Nitrate (as NO_3)	0.00
Lead (as Pb)	0.00	Boron (as B)	4.76

PARAMETERS

Calculated T.D.S.	184446
Molar Conductivity	300331
Resistivity	3.33
Sp.Gr.(g/mL)	1.13
Pressure(atm)	1.00
pCO_2(atm)	0.0104
pH_2S(atm)	0.00
Temperature (^oF)	43.00
pH	6.70

COMMENTS

HAMILTON KS

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

JACAM LABORATORIES

DownHole R_X

DEPOSITION POTENTIAL INDICATORS

LINN OPERATING
DREW LOTT
HAMILTON KS

HCU 2231 E SWD
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SATURATION LEVEL		MOMENTARY EXCESS (Lbs/1000 Barrels)	
Calcite ($CaCO_3$)	0.426	Calcite ($CaCO_3$)	-0.0127
Aragonite ($CaCO_3$)	0.381	Aragonite ($CaCO_3$)	-0.0153
Witherite ($BaCO_3$)	< 0.001	Witherite ($BaCO_3$)	-23.13
Strontianite ($SrCO_3$)	0.0155	Strontianite ($SrCO_3$)	-0.873
Calcium oxalate (CaC_2O_4)	0.00	Calcium oxalate (CaC_2O_4)	-0.00783
Magnesite ($MgCO_3$)	0.119	Magnesite ($MgCO_3$)	-0.0587
Anhydrite ($CaSO_4$)	0.892	Anhydrite ($CaSO_4$)	-35.81
Gypsum ($CaSO_4*2H_2O$)	1.27	Gypsum ($CaSO_4*2H_2O$)	71.96
Barite ($BaSO_4$)	10.00	Barite ($BaSO_4$)	0.436
Celestite ($SrSO_4$)	0.530	Celestite ($SrSO_4$)	-59.55
Fluorite (CaF_2)	0.00	Fluorite (CaF_2)	-2.67
Calcium phosphate	0.00	Calcium phosphate	>-0.001
Hydroxyapatite	0.00	Hydroxyapatite	-242.22
Silica (SiO_2)	0.00	Silica (SiO_2)	-18.66
Brucite ($Mg(OH)_2$)	< 0.001	Brucite ($Mg(OH)_2$)	< 0.001
Magnesium silicate	0.00	Magnesium silicate	-76.43
Iron hydroxide ($Fe(OH)_3$)	5.66	Iron hydroxide ($Fe(OH)_3$)	< 0.001
Strengite ($FePO_4*2H_2O$)	0.00	Strengite ($FePO_4*2H_2O$)	>-0.001
Siderite ($FeCO_3$)	2.21	Siderite ($FeCO_3$)	0.00597
Halite (NaCl)	0.156	Halite (NaCl)	-89212
Thenardite ($Na2SO_4$)	< 0.001	Thenardite ($Na2SO_4$)	-85149
Iron sulfide (FeS)	0.00	Iron sulfide (FeS)	-0.0462

SIMPLE INDICES		BOUND IONS	TOTAL	FREE
Langelier	0.182	Calcium	5615	5349
Ryznar	6.34	Barium	0.819	0.819
Puckorius	5.90	Carbonate	1.29	0.0162
Larson-Skold Index	2564	Phosphate	0.00	0.00
Stiff Davis Index	-0.114	Sulfate	1900	629.56
Oddo-Tomson	-0.968			

OPERATING CONDITIONS

Temperature (^oF)	43.00
Time(secs)	0.00

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

DownHole SAT™ Water Analysis Report

JACAM LABORATORIES

SYSTEM IDENTIFICATION

LINN OPERATING
HCU 2231 E SWD
DREW LOTT
TANK
HAMILTON KS

Sample ID#: 3076
ID: 117231
Report Date: 01-22-2016
Sample Date: 01-19-2016
at 0000

WATER CHEMISTRY

CATIONS

Calcium(as Ca)	5615
Magnesium(as Mg)	1887
Barium(as Ba)	0.819
Strontium(as Sr)	125.20
Sodium(as Na)	60937
Potassium(as K)	474.60
Lithium(as Li)	9.11
Iron(as Fe)	62.72
Field Iron(as Fe)	0.00
Ammonia(as NH_3)	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0170
Zinc(as Zn)	0.882
Lead(as Pb)	0.00
Sample pH	6.70
Conductivity:	300331

ANIONS

Chloride(as Cl)	120600
Sulfate(as SO_4)	1900
Bromine(as Br)	0.00
Dissolved CO_2(as CO_2)	80.00
Bicarbonate(as HCO_3)	96.00
Carbonate(as CO_3)	0.00
Silica(as SiO_2)	0.00
Phosphate(as PO_4)	0.00
H_2S (as H_2S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO_3)	0.00
Boron(as B)	4.76

PARAMETERS

Temperature(°F)	43.00
T.D.S.	184446
Resistivity:	3.33

SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite $CaCO_3$		Anhydrite $CaSO_4$		Gypsum $CaSO_4*2H_2O$		Barite $BaSO_4$		Celestite $SrSO_4$		Siderite $FeCO_3$		Mackawenite FeS		CO_2 (mpy)	pCO_2 (atm)
50.00	0.00	0.500	-0.0104	0.835	-56.22	1.19	51.65	7.81	0.423	0.484	-69.78	2.73	0.00763	0.00	-0.0471	0.0376	0.0104
65.45	0.00	0.682	-0.00583	0.757	-85.64	1.04	11.66	4.75	0.383	0.424	-84.98	4.18	0.0110	0.00	-0.0492	0.0703	0.0104
80.91	0.00	0.882	-0.00194	0.726	-94.59	0.930	-21.57	3.07	0.327	0.394	-92.81	6.03	0.0140	0.00	-0.0516	0.0346	0.0104
96.36	0.00	1.08	0.00117	0.732	-86.43	0.848	-48.26	2.10	0.254	0.378	-96.31	8.17	0.0163	0.00	-0.0543	0.0454	0.0104
111.82	0.00	1.25	0.00341	0.773	-65.83	0.845	-46.51	1.50	0.161	0.369	-97.82	10.43	0.0178	0.00	-0.0575	0.0476	0.0104
127.27	0.00	1.39	0.00489	0.850	-37.70	0.892	-29.19	1.09	0.0383	0.359	-99.75	12.67	0.0186	0.00	-0.0611	0.0399	0.0104
142.73	0.00	1.47	0.00554	0.969	-6.47	0.934	-16.31	0.796	-0.124	0.347	-102.26	14.62	0.0187	0.00	-0.0653	0.0323	0.0104
158.18	0.00	1.48	0.00538	1.14	24.46	0.970	-6.75	0.589	-0.338	0.335	-105.30	15.97	0.0179	0.00	-0.0701	0.0337	0.0104
173.64	0.00	1.43	0.00452	1.39	52.80	1.00	0.297	0.440	-0.615	0.322	-108.86	16.52	0.0165	0.00	-0.0757	0.0349	0.0104
189.09	0.00	1.31	0.00317	1.73	77.29	1.03	5.41	0.332	-0.972	0.309	-112.92	16.25	0.0146	0.00	-0.0824	0.0176	0.0104
204.55	0.00	1.16	0.00159	2.21	97.60	1.05	9.08	0.252	-1.43	0.295	-117.48	15.29	0.0125	0.00	-0.0903	0.0147	0.0104
220.00	0.171	0.969	>-0.001	2.86	115.92	1.05	9.87	0.191	-2.03	0.279	-125.13	13.51	0.0105	0.00	-0.103	0.0201	0.0122
		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		

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.