Contract No:

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INTEROFFICE MEMORANDUM

December 19, 2018

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RSM Track #: 10560

TO: P. W. NORRIS, 241-152H

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EVALUATION OF THE RISK OF SOLIDS FORMATION IN THE 2H EVAPORATOR SYSTEM

Scope

Savannah River Remediation (SRR) Tank Farm Engineering requested technical assistance from the Savannah River National Laboratory (SRNL) to troubleshoot recent and rapid plugging of the 2H Evaporator gravity drain line (GDL) to the Evaporator Drop Tank (currently Tank 38) with unwanted solids of unknown composition and to evaluate the risk of solids formation in the 2H Evaporator system moving forward. The GDL to Tank 38 recently plugged twice within hours of startup, resulting in a one-month shutdown both times. SRNL was asked to simulate current and historic (2016 to 2017) aqueous feed chemistries in the Evaporator Feed Tank (currently Tank 43) using the OLI Systems software to determine the mass of precipitated salts that would be expected to form under 2H Evaporator operating conditions for a range of concentration factors (i.e., evaporator overhead-to-feed volume ratio). A recommended evaporator concentration factor was determined based on the current Tank 43 feed composition to minimize solids formation and extend the time between shutdowns. Current and historic (2016 to 2017) aqueous chemistries in Tank 38 were also evaluated for completeness.

Summary and Recommendations

OLI simulations based on the current Tank 43 aqueous feed composition suggest operating the 2H Evaporator at an overhead-to-feed volume ratio of less than 0.2, rather than the 2016-2017 historical ratio of 0.35-0.38. This is because elevated carbonate alkalinity levels in the Tank 43 feed favor equilibrium formation of three to 13 times the mass of sodium carbonate (Na_2CO_3 or washing soda) solids versus historical, rate-limited sodium aluminum silicate (cancrinite) phases.

- OLI model results point to a distinct difference between the 2016/2017 and 2018 water analysis data for Tank 43 and Tank 38 that will impact solids formation in the evaporator.

This difference manifests itself both in the type (species) and mass of precipitates predicted to form under evaporator operating conditions and upon subsequent cooling in the GDL and Evaporator Drop Tank.

- For all five 2016-2018 Tank 43 samples, the dominant solid predicted to form at evaporator operating conditions (110-113 ^{o}C at 1 atm total pressure) and historical overhead-to-feed volume ratios is Na_2CO_3. Na_2CO_3 will form rapidly and, unlike many solids, its solubility decreases with increasing temperature. Based on Tank 43 data, the OLI model predicts that the evaporator system is undersaturated with respect to sodium nitrate ($NaNO_3$), gibbsite ($Al(OH)_3$), and sodium aluminum silicate (cancrinite) phases.
- As shown Figure 1, the OLI model predicts that significant Na_2CO_3 will begin to form in the evaporator at an overhead-to-feed volume ratio of 0.14 to 0.20 based on the three 2018 Tank 43 samples. This is in sharp contrast to the two 2016 and 2017 Tank 43 samples where Na_2CO_3 begins to precipitate close to a historical overhead-to-feed volume ratio of 0.34 to 0.38 in 2016 and 2017.
- The mass concentration of solids generated under evaporator operating conditions at a recent historical overhead-to-feed volume ratio of 0.36 to 0.38 is shown in Table 1. Solids generation based on the 2018 Tank 43 samples is predicted to range from three to 13 times the mass of solids predicted to form based on the 2016 and 2017 samples, respectively. The best estimate value is approximately six times.
- The cooling profiles for evaporator concentrate (liquid fraction only; solids and vapor removed) based on the 2016, 2017, and 2018 Tank 43 feed samples indicate that cancrinite monohydrate ($Na_8Al_6Si_6O_{24}CO_3.1H_2O$) and sodium oxalate ($Na_2C_2O_4$) solids begin to form at temperatures less than 75 ^{o}C. Figure 2 and Figure 3 display the cooling profiles for Tank 43 samples from 2016 and 2018. This finding suggests that precipitation of sodium aluminum silicate phases will occur in the Evaporator Drop Tank with time and cooling. Based on current silicon levels, the mass concentration of $Na_8Al_6Si_6O_{24}CO_3.1H_2O$ will be approximately 1,000 mg/L compared to several tens of thousands of milligrams per liter for Na_2CO_3.
- According to the OLI simulation, all 2016-2018 surface samples from Tank 38 are saturated with respect to $Na_8Al_6Si_6O_{24}CO_3.1H_2O$ at ambient operating temperature (25 to 40 ^{o}C). This is consistent with the cooling profiles for evaporator concentrate based on the Tank 43 samples.
- Evaporation of the 2018 Tank 38 surface sample (HTF-38-18-78) in the OLI simulation results in $Na_8Al_6Si_6O_{24}CO_3.1H_2O$ precipitation; however, unlike the Tank 43 samples, Na_2CO_3 is not predicted to form. The formation of $Na_8Al_6Si_6O_{24}CO_3.1H_2O$ under

evaporator conditions is likely because the Si/Na mole ratio in surface sample HTF-38-18-78 is approximately an order-of-magnitude higher (0.006) than all other Tank 43 and Tank 38 samples (0.0005 to 0.0008).

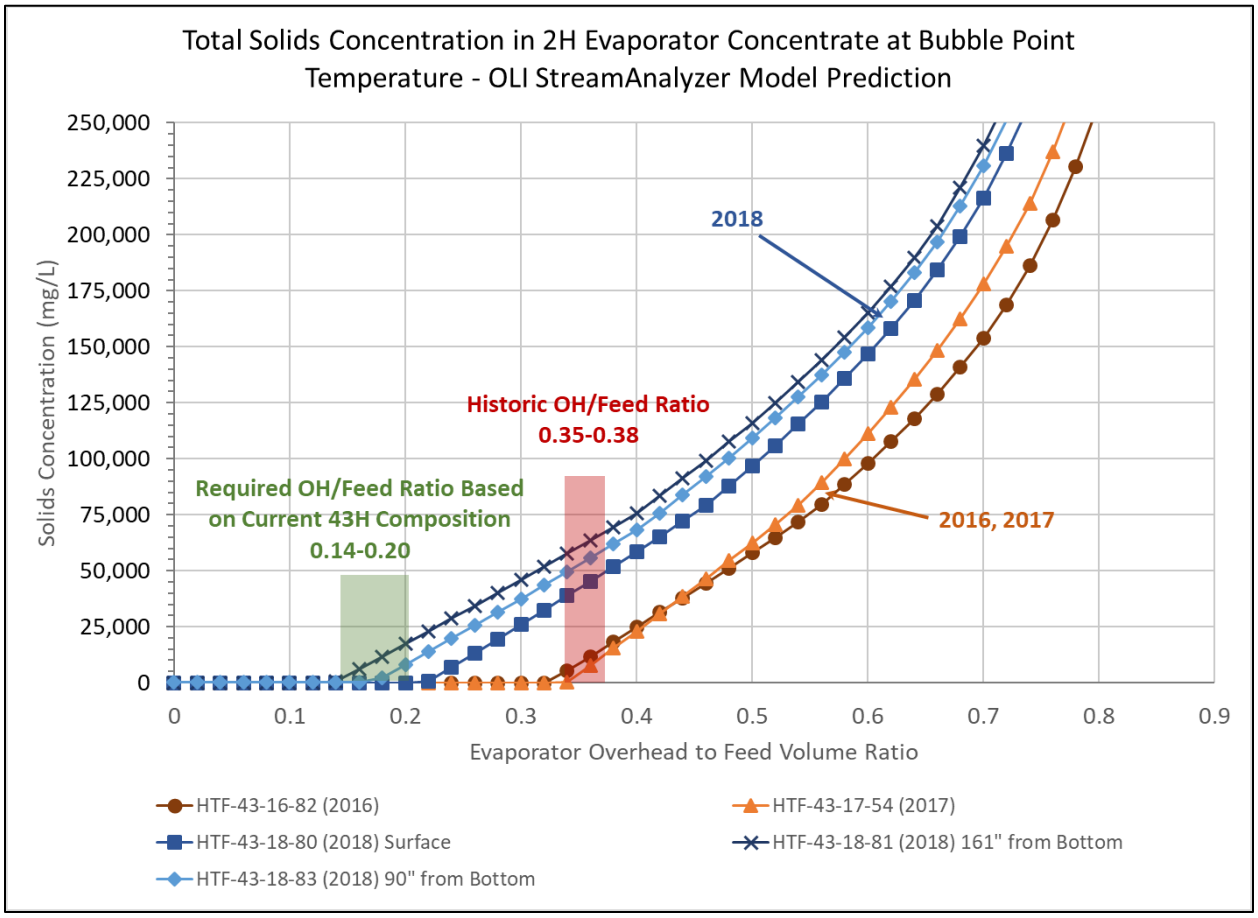

Figure 1. OLI Simulation of Total Solids Concentration in the 2H Evaporator Concentrate at the Bubble Point Temperature and 1 atm Total Pressure.

Tank Compositions for OLI Simulations

The OLI simulations were based on cation and anion analytical data generated by SRNL from 2016 (Hay, 2016), 2017 (Hay et al., 2017), and 2018 (Hay et al., 2018) as part of the annual enrichment control and corrosion control programs for the 2H Evaporator system. Specific data from the Hay et al. reports used as inputs to the OLI model are summarized in Table A-1, Appendix A.

Table 1. Comparison of Average Solids Concentration in Evaporator Concentrate for 2018 vs. 2016/2017 Tank 43 Samples.

Comparison of Average Solids Generation Rate in 2016/2017 vs. 2018			
Year	**OH/Feed**	**Bubble Point Temperature (deg C)**	**Average Solids Concentration in Evaporator at Bubble Point Temperature (mg/L)**
2016	0.38	112	18000
2017	0.35	110	4100
Avg. 2016/2017	0.36	111	9700
2018	0.36	113	55000
Mass Solids 2018/2016:		**3**	Minimum
Mass Solids 2018/2017:		**13**	Maximum
Mass Solids 2018/Avg. 2016/2017		**6**	Best Estimate

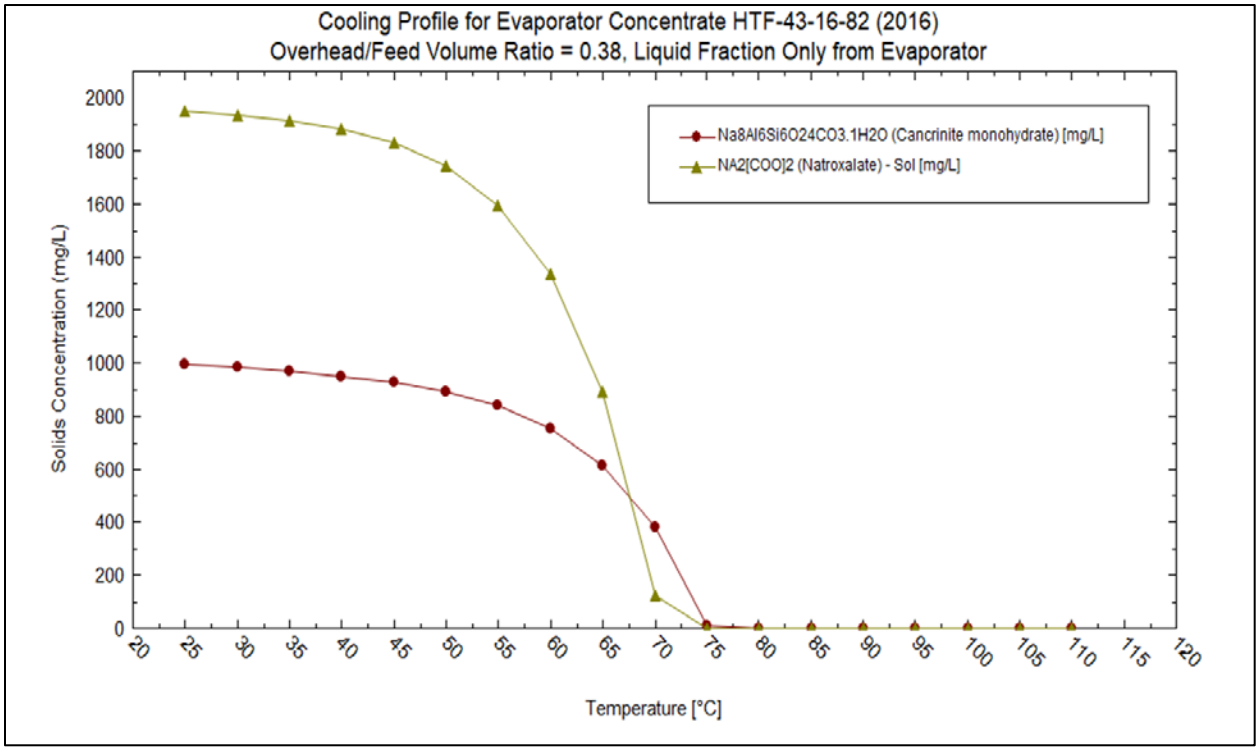

Figure 2. Cooling Profile for Evaporator Concentrate (liquid fraction only) for 2016 Tank 43 Surface Sample HTF-43-16-82 at an Overhead-to-Feed Volume Ratio of 0.38.

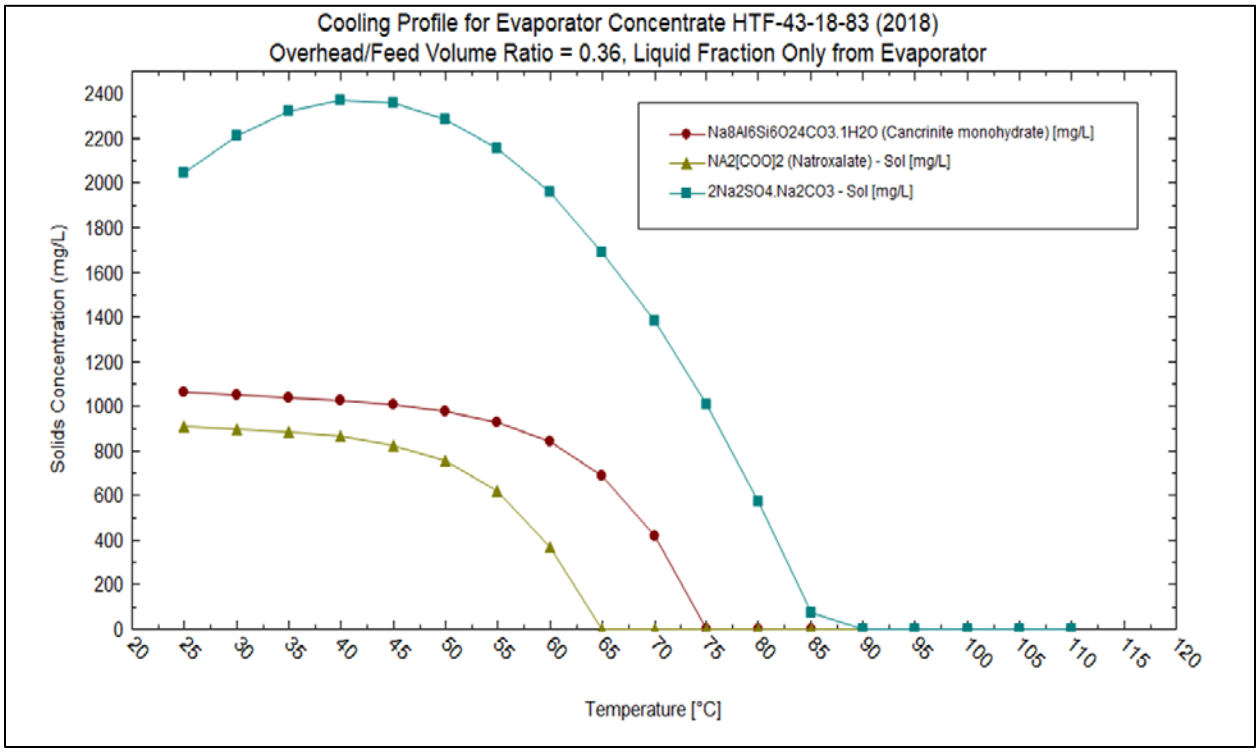

Figure 3. Cooling Profile for Evaporator Concentrate (liquid fraction only) for 2018 Tank 43 Subsurface Sample HTF-43-18-83 at an Overhead-to-Feed Volume Ratio of 0.36.

OLI Studio Model Formulation

The Water Analyzer and Stream Analyzer modules, respectively, within OLI Studio (ver. 9.6.1) were used to reconcile the analyte data from Hay (2016), Hay et al. (2017), and Hay et al. (2018) and then to generate the evaporation and cooling profiles for the Tank 43 and Tank 38 samples. The Mixed Solvent Electrolyte (MSE) thermodynamic framework and associated MSE public database were employed. The default was to include redox chemistry in the MSE chemistry model (Wilmarth et al., 2013); however, redox chemistry had to be deselected in some cases to enable model convergence at the bubble point temperature. This did not impact the dominant Na/Al/Si/O/CO_3 precipitation reactions.

Analytes from the Hay et al. reports were first transformed to an OLI molecular input species as shown in the fourth column of Table A-1, Appendix A. Both molar concentration (mole/L) and mass concentration (mg/L) data for specific analytes from the Hay et al. reports were transformed to the equivalent mass concentration (mg/L) for the specified OLI input species. The OLI input species were chosen based on recommendations by Wilmarth et al. (2013) and Martino et al. (2014) when using the OLI Systems software to simulate liquid waste systems.

The Water Analyzer module was used to reconcile each tank sample for electroneutrality (i.e., charge balance) at 105 °C (close to the bubble point temperature) by adding/subtracting Na^+ ion. Samples were not reconciled for pH because the free OH^- concentration [OH^-] results in a pH greater than 14 at 25 °C. Instead, model-predicted [OH^-] was compared to measured [OH^-] for each tank waste sample to ensure reasonable agreement within the analytical (up to 10%) and tank sampling (unknown, but likely >10%) uncertainties. Each charge-balanced sample was then exported as a molecular stream for further evaluation using the OLI Stream Analyzer. Figure 4 displays an example of a charge-balanced OLI feed stream for Tank 43 sample HTF-43-16-82.

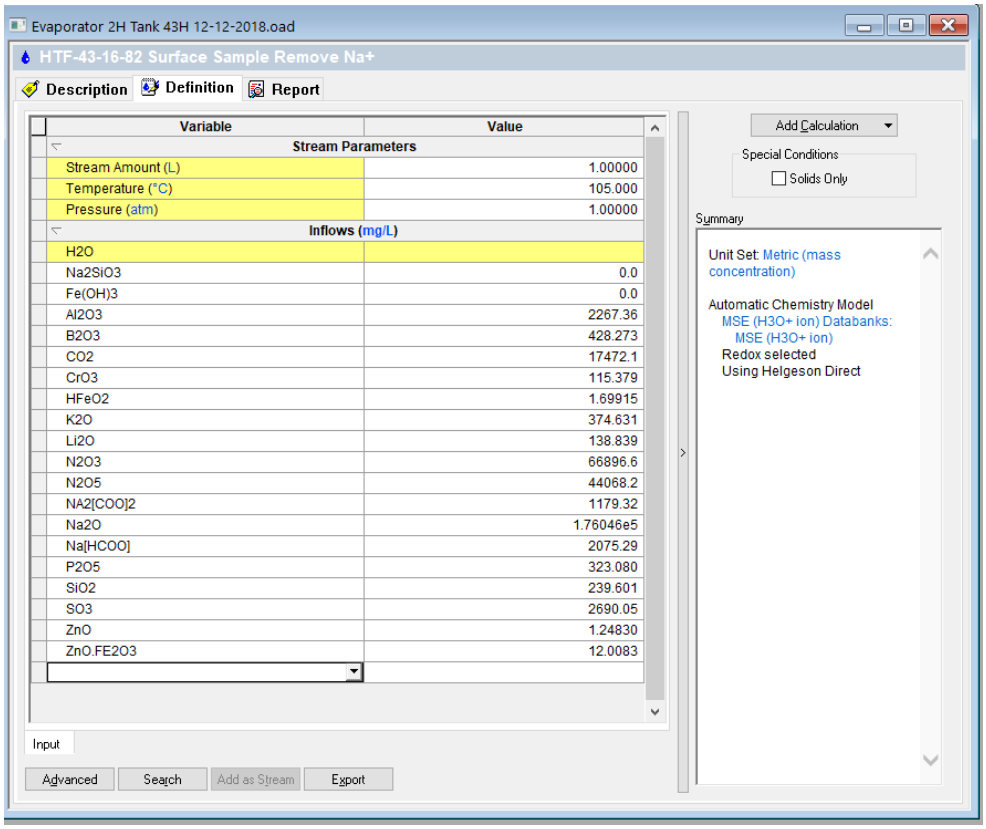

Figure 4. Charge-Balanced OLI Feed Stream for 2016 Tank 43 Sample HTF-43-16-82.

OLI Stream Analyzer simulations of the Tank 43 samples were executed at 1 atm total pressure and the model-predicted bubble point temperature. An isobaric "vapor fraction (vapor/inflow) survey" was conducted to model precipitation (scaling tendency) as a function of the overhead-to-feed ratio (0.00 to 0.80 in steps of 0.02) as shown in Figure 5. Bubble point temperatures for the Tank 43 samples ranged from 105 to 108 °C at the feed concentration and increased to 110 to 115 °C as water was evaporated overhead to the historic overhead-to-feed ratios of 0.35 to 0.38.

In contrast, the bubble point temperature of Tank 38 surface sample (HTF-38-18-78) from 2018 was only 101 ^{o}C owing to its much lower ionic strength.

Cooling profiles for the evaporator concentrate were generated in OLI Stream Analyzer by performing a temperature survey from the bubble point temperature to 25 ^{o}C in -5 ^{o}C steps as shown in Figure 6. The feed stream for the temperature survey was the "liquid only" fraction for the "vapor fraction (vapor/inflow) survey" simulation case of interest (e.g., overhead-to-feed ratio equal to 0.38 for sample HTF-43-16-82).

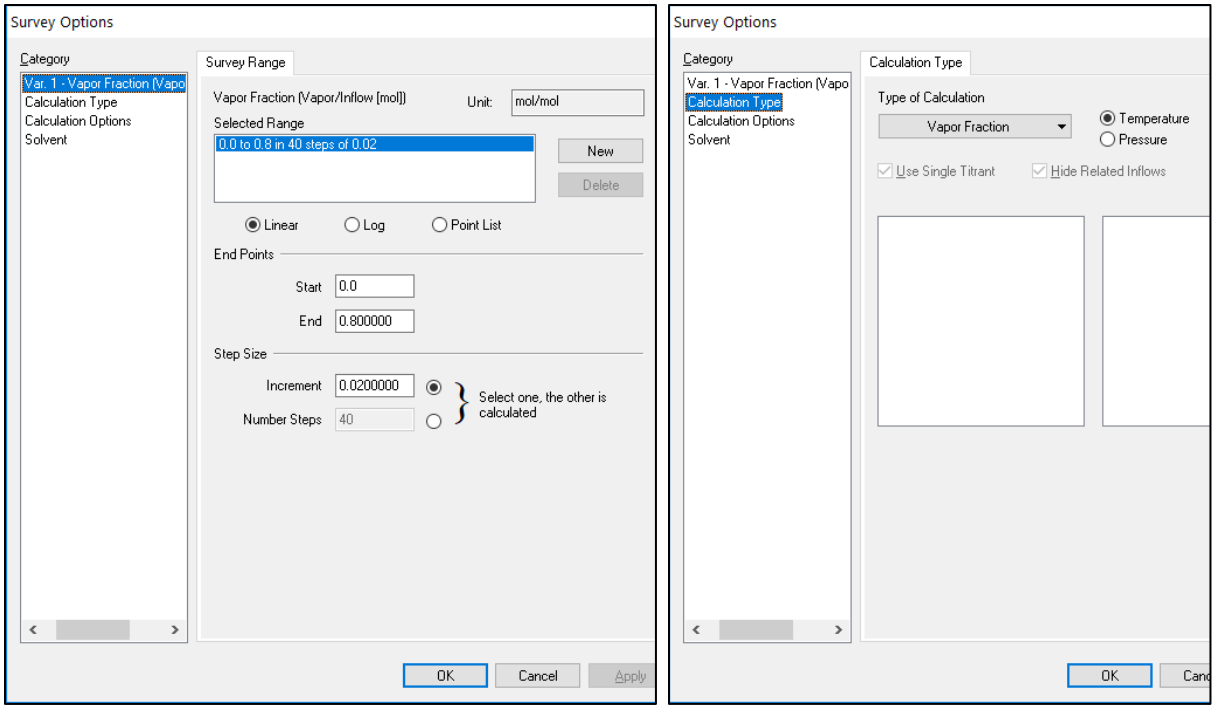

Figure 5. Selection of "Vapor Fraction (Vapor/Inflow) Survey" in OLI Stream Analyzer to Simulate Evaporation at Constant Pressure.

Additional Results

Reported liquid densities for the evaporator concentrate streams from OLI Stream Analyzer are shown in Table 2 and Table 3. The liquid density values for the 2018 Tank 43 samples (1.35 to 1.38 g/cm^3) are higher than the values for the 2016 and 2017 samples (1.31 to 1.32 g/cm^3). Interestingly, Table 3 indicates that the liquid density of the evaporator concentrate for the 2018 samples is approximately 1.3 g/cm^3 at the maximum overhead-to-feed ratio (0.14 to 0.20) to avoid Na_2CO_3 precipitation.

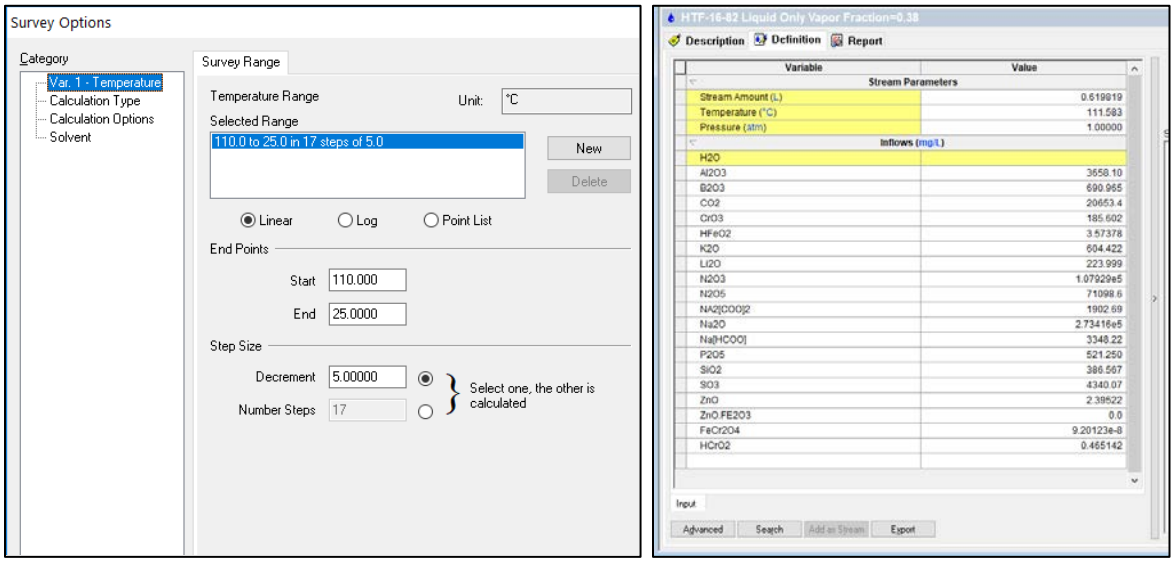

Figure 6. Selection of Temperature Survey in OLI Stream Analyzer to Simulate Cooling Profile for Simulated Evaporator Concentrate Stream HTF-43-16-82.

Table 2. OLI Liquid Density of Evaporator Concentrate for Tank 43 Samples at an Overhead-to-Feed Ratio of 0.36.

Density at Overhead/Feed Ratio = 0.36		
Sample	**Calendar Year**	**Density (g/cc) @ Bubble Point**
HTF-43-16-82	2016	**1.32**
HTF-43-17-54	2017	**1.31**
HTF-43-18-80	2018	**1.35**
HTF-43-18-81	2018	**1.38**
HTF-43-18-83	2018	**1.37**

Table 3. OLI Liquid Density of Evaporator Concentrate for Tank 43 Samples at Maximum Overhead-to-Feed Ratio to Avoid Na_2CO_3 Precipitation.

Sample	Calendar Year	Maximum OH/Feed to Avoid Na_2CO_3 Precipitation	Density (g/cc) at Maximum OH/Feed
HTF-43-18-80	2018	0.20	**1.29**
HTF-43-18-81	2018	0.14	**1.30**
HTF-43-18-83	2018	0.16	**1.30**

Results of the vapor fraction (vapor/inflow) surveys in Stream Analyzer for the five 2016-2018 Tank 43 samples and the 2018 Tank 38 surface sample (HTF-38-18-78) are included in Appendix A, Tables A-2 through A-7. The summary table for each Tank 43 and Tank 38 sample includes the solids scaling tendencies and the mass concentrations for each solid that is predicted to form at the evaporator bubble point temperature. A scaling tendency equal to 1.0 signifies that the solution is saturated with respect to that solid. A scaling tendency much less than 1.0 means that the solution is undersaturated with respect to that solid.

References

Hay, M. (2016) Analysis of Tank 38H (HTF-38-16-80, 81) and Tank 43H (HTF-43-16-82, 83) Samples for Support of the Enrichment Control and Corrosion Control Programs. SRNL-STI-2016-00621, Rev. 0. Savannah River National Laboratory, Aiken, SC. https://sti.srs.gov/fulltext/SRNL-STI-2016-00621.pdf.

Hay, M., Coleman, C. J., and Diprete, D. P. (2017) Analysis of Tank 38H (HTF-38-17-52, -53) and Tank 43H (HTF-43-17-54, -55) Samples for Support of the Enrichment Control and Corrosion Control Programs. SRNL-STI-2017-00472, Rev. 0. Savannah River National Laboratory, Aiken, SC. https://sti.srs.gov/fulltext/SRNL-STI-2017-00472.pdf.

Hay, M., Coleman, C. J., and Diprete, D. P. (2018) Analysis of Tank 38H (HTF-38-18-78, -79) and Tank 43H (HTF-43-18-80, -81, -83) Samples for Support of the Enrichment Control and Corrosion Control Programs. SRNL-STI-2018-00647, Rev. 0. Savannah River National Laboratory, Aiken, SC. https://sti.srs.gov/fulltext/SRNL-STI-2018-00647.pdf.

Martino, C. J., Herman, D. T., Pike, J. A., and Peters, T. B. (2014) Actinide Removal Process Sample Analysis, Chemical Modeling, and Filtration Evaluation. SRNL-STI-2013-00700, Rev. 0. Savannah River National Laboratory, Aiken, SC. https://sti.srs.gov/fulltext/SRNL-STI-2013-00700.pdf.

Wilmarth, W. R., Bush, S. R., Campbell, S. E., Harmon, H. D., Hobbs, D. T., Jain, V., Nash, C. A., Nguyen, Q. L., Pike, J. A., Sherburne, C. B., Smith, S. C., and Taylor-Pashow, K. M. L. (2013) Salt Integrated Project Chemistry Team Report. SRNL-STI-2013-00354/SRR-STI-2013-00375, Rev. 0. Savannah River National Laboratory, Aiken, SC.

Appendix A. OLI Model Input Data

Table A-1. Tank 43 and Tank 38 Input Data for OLI Studio Model.

				Analytical Result		OLI Input	Analytical Result		OLI Input
Ion/Element	MW Ion (g/mole)	OLI Input Species	MW OLI Species	2016 HTF-43-16-82	Analytical Data Units	2016 HTF-43-16-82 (mg/L)	2017 HTF-43-17-54	Analytical Data Units	2017 HTF-43-17-54 (mg/L)
Si	28.085	Na2SiO3	122.06	1.12E+02	mg/L	486.76	131	mg/L	569.34
Fe	55.845	Fe(OH)3	106.87	6.63E+00	mg/L	12.69	5.29	mg/L	0.00
Ca	40.078	Ca+2	40.078	1.54E+00	mg/L	0.00	3.22	mg/L	0.00
K	39.10	K+	39.10	3.11E+02	mg/L	3.11E+02	4.81E+02	mg/L	4.81E+02
Li	6.94	Li+	6.94	6.45E+01	mg/L	6.45E+01	6.09E+01	mg/L	6.09E+01
Na	22.99	Na+	22.99	6.00E+00	M	1.38E+05	5.58E+00	M	1.28E+05
Zn	65.38	Zn+2	65.38	4.26E+00	mg/L	4.26E+00	2.88E+00	mg/L	0.00E+00
OH-	17.01	OH-	17.01	2.18E+00	M	3.71E+04	1.93E+00	M	3.28E+04
F-	19.00	F-	19.00	1.34E-02	M	0.00E+00	1.38E-02	M	0.00E+00
Cl-	35.45	Cl-	35.45	7.18E-03	M	0.00E+00	7.38E-03	M	0.00E+00
NO2-	46.01	NO2-	46.01	1.76E+00	M	8.10E+04	1.57E+00	M	7.22E+04
Br-	79.90	Br-	79.90	1.59E-02	M	0.00E+00	3.27E-03	M	0.00E+00
NO3-	62.00	NO3-	62.00	8.16E-01	M	5.06E+04	8.72E-01	M	5.41E+04
P	30.97	PO4-3	94.97	1.41E+02	mg/L	4.32E+02	1.16E+02	mg/L	3.56E+02
SO4-2	96.06	SO4-2	96.06	3.36E-02	M	3.23E+03	4.43E-02	M	4.26E+03
CO3-2	60.01	CO3-2	60.01	3.97E-01	M	2.38E+04	4.59E-01	M	2.75E+04
Al	26.98	Al(OH)4-1	95.01	1.20E+03	mg/L	4.23E+03	1.71E+03	mg/L	6.02E+03
B	10.81	B(OH)4-1	78.84	1.33E+02	mg/L	9.70E+02	1.25E+02	mg/L	9.12E+02
Cr	52.00	CrO4-2	115.99	6.00E+01	mg/L	1.34E+02	7.09E+01	mg/L	1.58E+02
C2O4-2	88.03	C2O4-2	88.03	8.80E-03	M	7.75E+02	7.96E-03	M	7.01E+02
CHO2-	44.03	HCOO-1	44.03	3.12E-02	M	1.37E+03	2.65E-02	M	1.17E+03
CO3-2/NO3-				4.87E-01			5.26E-01		
CO3-2/Na				6.62E-02			8.23E-02		
Si/Na				6.65E-04			8.36E-04		
	Below quantification limit; therefore, assumed zero								

Table A-1 (cont'd). Tank 43 and Tank 38 Input Data for OLI Studio Model.

				Analytical Result		OLI Input	Analytical Result		OLI Input
Ion/Element	MW Ion (g/mole)	OLI Input Species	MW OLI Species	2018 HTF-43-18-80	Analytical Data Units	2018 HTF-43-18-80 (mg/L)	2018 HTF-43-18-81	Analytical Data Units	2018 HTF-43-18-81 (mg/L)
Si	28.085	Na2SiO3	122.06	108	mg/L	469.38	104	mg/L	451.99
Fe	55.845	Fe(OH)3	106.87	4.09	mg/L	7.83	9.63	mg/L	18.43
Ca	40.078	Ca+2	40.078	4.46	mg/L	4.46	8.55	mg/L	8.55
K	39.10	K+	39.10	3.48E+02	mg/L	3.48E+02	3.96E+02	mg/L	3.96E+02
Li	6.94	Li+	6.94	7.05E+01	mg/L	7.05E+01	7.54E+01	mg/L	7.54E+01
Na	22.99	Na+	22.99	6.28E+00	M	1.44E+05	7.12E+00	M	1.64E+05
Zn	65.38	Zn+2	65.38	1.05E+01	mg/L	0.00E+00	4.12E+01	mg/L	0.00E+00
OH-	17.01	OH-	17.01	2.29E+00	M	3.89E+04	2.63E+00	M	4.47E+04
F-	19.00	F-	19.00	1.07E-02	M	0.00E+00	1.12E-02	M	0.00E+00
Cl-	35.45	Cl-	35.45	5.74E-03	M	0.00E+00	5.98E-03	M	0.00E+00
NO2-	46.01	NO2-	46.01	1.87E+00	M	8.60E+04	2.01E+00	M	9.25E+04
Br-	79.90	Br-	79.90	2.55E-03	M	0.00E+00	2.65E-03	M	0.00E+00
NO3-	62.00	NO3-	62.00	1.03E+00	M	6.39E+04	1.13E+00	M	7.01E+04
P	30.97	PO4-3	94.97	1.48E+02	mg/L	4.54E+02	1.73E+02	mg/L	5.30E+02
SO4-2	96.06	SO4-2	96.06	5.11E-02	M	4.91E+03	5.74E-02	M	5.51E+03
CO3-2	60.01	CO3-2	60.01	5.29E-01	M	3.17E+04	5.65E-01	M	3.39E+04
Al	26.98	Al(OH)4-1	95.01	1.91E+03	mg/L	6.73E+03	2.16E+03	mg/L	7.61E+03
B	10.81	B(OH)4-1	78.84	1.38E+02	mg/L	1.01E+03	1.53E+02	mg/L	1.12E+03
Cr	52.00	CrO4-2	115.99	8.12E+01	mg/L	1.81E+02	9.36E+01	mg/L	2.09E+02
C2O4-2	88.03	C2O4-2	88.03	4.32E-03	M	3.80E+02	4.42E-03	M	3.89E+02
CHO2-	44.03	HCOO-1	44.03	2.97E-02	M	1.31E+03	3.19E-02	M	1.40E+03
CO3-2/NO3-				5.14E-01			5.00E-01		
CO3-2/Na				8.42E-02			7.94E-02		
Si/Na				6.12E-04			5.20E-04		
	Below quantification limit; therefore, assumed zero								

Table A-1 (cont'd). Tank 43 and Tank 38 Input Data for OLI Studio Model.

				Analytical Result		OLI Input	Analytical Result		OLI Input
Ion/Element	MW Ion (g/mole)	OLI Input Species	MW OLI Species	2018 HTF-43-18-83	Analytical Data Units	2018 HTF-43-18-83 (mg/L)	2018 HTF-38-18-78	Analytical Data Units	2018 HTF-38-18-78 (mg/L)
Si	28.085	Na2SiO3	122.06	118	mg/L	512.84	181	mg/L	786.64
Fe	55.845	Fe(OH)3	106.87	24.7	mg/L	47.27	7.14	mg/L	13.66
Ca	40.078	Ca+2	40.078	11.7	mg/L	11.70	0.436	mg/L	0.00
K	39.10	K+	39.10	3.89E+02	mg/L	3.89E+02	2.72E+02	mg/L	0.00E+00
Li	6.94	Li+	6.94	7.37E+01	mg/L	7.37E+01	3.90E+01	mg/L	3.90E+01
Na	22.99	Na+	22.99	6.92E+00	M	1.59E+05	1.09E+00	M	2.51E+04
Zn	65.38	Zn+2	65.38	4.54E+01	mg/L	0.00E+00	9.52E-01	mg/L	9.52E-01
OH-	17.01	OH-	17.01	2.32E+00	M	3.95E+04	3.11E-01	M	5.29E+03
F-	19.00	F-	19.00	1.10E-02	M	0.00E+00	1.09E-02	M	0.00E+00
Cl-	35.45	Cl-	35.45	5.89E-03	M	0.00E+00	5.84E-03	M	0.00E+00
NO2-	46.01	NO2-	46.01	2.09E+00	M	9.62E+04	4.04E-01	M	1.86E+04
Br-	79.90	Br-	79.90	2.61E-03	M	0.00E+00	2.59E-03	M	0.00E+00
NO3-	62.00	NO3-	62.00	1.16E+00	M	7.19E+04	1.54E-01	M	9.55E+03
P	30.97	PO4-3	94.97	1.68E+02	mg/L	5.15E+02	2.18E+02	mg/L	0.00E+00
SO4-2	96.06	SO4-2	96.06	6.08E-02	M	5.84E+03	9.05E-03	M	8.69E+02
CO3-2	60.01	CO3-2	60.01	5.50E-01	M	3.30E+04	1.39E-01	M	8.34E+03
Al	26.98	Al(OH)4-1	95.01	2.12E+03	mg/L	7.47E+03	2.27E+02	mg/L	7.99E+02
B	10.81	B(OH)4-1	78.84	1.48E+02	mg/L	1.08E+03	4.18E+01	mg/L	3.05E+02
Cr	52.00	CrO4-2	115.99	9.18E+01	mg/L	2.05E+02	7.76E+00	mg/L	1.73E+01
C2O4-2	88.03	C2O4-2	88.03	4.23E-03	M	3.72E+02	2.35E-03	M	0.00E+00
CHO2-	44.03	HCOO-1	44.03	3.10E-02	M	1.36E+03	4.60E-03	M	0.00E+00
CO3-2/NO3-				4.74E-01			9.03E-01		
CO3-2/Na				7.95E-02			1.28E-01		
Si/Na				6.07E-04			5.91E-03		
	Below quantification limit; therefore, assumed zero								

Table A-1 (cont'd). Tank 43 and Tank 38 Input Data for OLI Studio Model.

				Analytical Result		OLI Input	Analytical Result		OLI Input
Ion/Element	MW Ion (g/mole)	OLI Input Species	MW OLI Species	2016 HTF-38-16-80	Analytical Data Units	2016 HTF-38-16-80 (mg/L)	2017 HTF-38-17-52	Analytical Data Units	2017 HTF-38-17-52 (mg/L)
Si	28.085	Na2SiO3	122.06	132	mg/L	573.68	168	mg/L	730.14
Fe	55.845	Fe(OH)3	106.87	11.6	mg/L	22.20	6.47	mg/L	0.00
Ca	40.078	Ca+2	40.078	1.54	mg/L	0.00	3.16	mg/L	0.00
K	39.10	K+	39.10	3.31E+02	mg/L	3.31E+02	6.54E+02	mg/L	6.54E+02
Li	6.94	Li+	6.94	7.18E+01	mg/L	7.18E+01	9.02E+01	mg/L	9.02E+01
Na	22.99	Na+	22.99	5.87E+00	M	1.35E+05	7.96E+00	M	1.83E+05
Zn	65.38	Zn+2	65.38	5.37E+00	mg/L	5.37E+00	2.83E+00	mg/L	0.00E+00
OH-	17.01	OH-	17.01	2.49E+00	M	4.23E+04	2.86E+00	M	4.86E+04
F-	19.00	F-	19.00	1.34E-02	M	0.00E+00	1.35E-02	M	0.00E+00
Cl-	35.45	Cl-	35.45	7.16E-03	M	0.00E+00	7.22E-03	M	0.00E+00
NO2-	46.01	NO2-	46.01	2.03E+00	M	9.34E+04	2.31E+00	M	1.06E+05
Br-	79.90	Br-	79.90	1.59E-02	M	0.00E+00	3.20E-03	M	0.00E+00
NO3-	62.00	NO3-	62.00	9.34E-01	M	5.79E+04	1.25E+00	M	7.75E+04
P	30.97	PO4-3	94.97	1.56E+02	mg/L	4.78E+02	1.72E+02	mg/L	5.27E+02
SO4-2	96.06	SO4-2	96.06	3.13E-02	M	3.01E+03	6.13E-02	M	5.89E+03
CO3-2	60.01	CO3-2	60.01	4.39E-01	M	2.63E+04	6.54E-01	M	3.92E+04
Al	26.98	Al(OH)4-1	95.01	1.34E+03	mg/L	4.72E+03	2.52E+03	mg/L	8.87E+03
B	10.81	B(OH)4-1	78.84	1.45E+02	mg/L	1.06E+03	1.81E+02	mg/L	1.32E+03
Cr	52.00	CrO4-2	115.99	6.59E+01	mg/L	1.47E+02	1.04E+02	mg/L	2.32E+02
C2O4-2	88.03	C2O4-2	88.03	8.34E-03	M	7.34E+02	8.39E-03	M	7.39E+02
CHO2-	44.03	HCOO-1	44.03	3.46E-02	M	1.52E+03	3.86E-02	M	1.70E+03
CO3-2/NO3-				4.70E-01			5.23E-01		
CO3-2/Na				7.48E-02			8.22E-02		
Si/Na				8.01E-04			7.51E-04		
	Below quantification limit; therefore, assumed zero								

Table A-2. OLI Stream Analyzer Evaporation Survey Results for 2016 Tank 43 Surface Sample HTF-43-16-82.

					Scaling Tendency								Solids Concentration (mg/L)					
Vapor Fraction (Vapor/Inflow [mol]) [mol/mol]	Volume - Liquid-1 [L] (Y2)	Temperature [°C] (Y2)	Pressure [atm] (Y2)	Density (g/cc)	Na8Al6Si6O24 CO3.2H2O (Cancrinite) Scaling Tendency [ST]	Na8Al6Si6O24 CO3.1H2O (Cancrinite monohydrate) Scaling Tendency [ST]	Na8Al6Si6O24 (OH)2.2H2O (Hydroxycancrinite) Scaling Tendency [ST]	Na6Al6Si6O24 .12H2O (hydrated zeolite A) Scaling Tendency [ST]	Na2CO3.1H2O (Thermonatrite) Scaling Tendency [ST]	Na2CO3 (Natrite) - Sol Scaling Tendency [ST]	Al(OH)3 (Gibbsite) - Scaling Tendency [ST]	2Na2SO4.Na2CO3 - Sol Scaling Tendency [ST]	ZnO.Fe2O3 (Franklinite) [mg/L]	NaFeO2 - Sol [mg/L] (Y2)	Na3PO4 - Sol [mg/L] (Y2)	Na2CO3 (Natrite) - Sol [mg/L] (Y2)	2Na2SO4.Na2CO3 - Sol [mg/L] (Y2)	Total Solids (mg/L)
0.00E+00	1.00E+00	1.06E+02	1.00E+00	1.20E+00	2.27E-04	2.56E-03	2.43E-05	3.98E-10	2.55E-01	2.65E-01	1.95E-03	2.02E-03	1.20E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E+01
2.00E-02	9.81E-01	1.07E+02	1.00E+00	1.21E+00	1.44E-04	1.64E-03	1.63E-05	2.25E-10	2.70E-01	2.83E-01	1.78E-03	2.40E-03	1.22E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E+01
4.00E-02	9.61E-01	1.07E+02	1.00E+00	1.21E+00	8.93E-05	1.02E-03	1.07E-05	1.23E-10	2.86E-01	3.03E-01	1.62E-03	2.87E-03	1.25E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E+01
6.00E-02	9.41E-01	1.07E+02	1.00E+00	1.21E+00	5.36E-05	6.16E-04	6.84E-06	6.50E-11	3.04E-01	3.24E-01	1.46E-03	3.45E-03	1.27E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E+01
8.00E-02	9.21E-01	1.07E+02	1.00E+00	1.22E+00	3.12E-05	3.61E-04	4.25E-06	3.31E-11	3.23E-01	3.48E-01	1.31E-03	4.17E-03	1.30E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E+01
1.00E-01	9.01E-01	1.07E+02	1.00E+00	1.23E+00	1.76E-05	2.05E-04	2.55E-06	1.63E-11	3.44E-01	3.74E-01	1.17E-03	5.07E-03	1.32E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E+01
1.20E-01	8.82E-01	1.07E+02	1.00E+00	1.23E+00	9.55E-06	1.12E-04	1.49E-06	7.65E-12	3.67E-01	4.03E-01	1.04E-03	6.20E-03	1.35E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E+01
1.40E-01	8.62E-01	1.08E+02	1.00E+00	1.24E+00	4.99E-06	5.92E-05	8.35E-07	3.44E-12	3.91E-01	4.35E-01	9.19E-04	7.63E-03	1.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.38E+01
1.60E-01	8.42E-01	1.08E+02	1.00E+00	1.24E+00	2.50E-06	2.99E-05	4.51E-07	1.48E-12	4.19E-01	4.71E-01	8.04E-04	9.46E-03	1.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E+01
1.80E-01	8.22E-01	1.08E+02	1.00E+00	1.25E+00	1.20E-06	1.45E-05	2.33E-07	6.00E-13	4.49E-01	5.11E-01	6.98E-04	1.18E-02	1.44E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E+01
2.00E-01	8.02E-01	1.08E+02	1.00E+00	1.26E+00	5.44E-07	6.65E-06	1.15E-07	2.30E-13	4.81E-01	5.55E-01	6.00E-04	1.49E-02	1.47E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E+01
2.20E-01	7.82E-01	1.09E+02	1.00E+00	1.26E+00	2.35E-07	2.90E-06	5.42E-08	8.30E-14	5.18E-01	6.06E-01	5.11E-04	1.89E-02	1.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E+01
2.40E-01	7.63E-01	1.09E+02	1.00E+00	1.27E+00	9.53E-08	1.19E-06	2.41E-08	2.80E-14	5.58E-01	6.62E-01	4.31E-04	2.42E-02	1.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E+01
2.60E-01	7.43E-01	1.09E+02	1.00E+00	1.28E+00	3.63E-08	4.60E-07	1.01E-08	8.75E-15	6.02E-01	7.26E-01	3.59E-04	3.13E-02	1.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E+01
2.80E-01	7.23E-01	1.10E+02	1.00E+00	1.29E+00	1.29E-08	1.65E-07	3.96E-09	2.52E-15	6.51E-01	7.99E-01	2.95E-04	4.09E-02	1.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.60E+01
3.00E-01	7.03E-01	1.10E+02	1.00E+00	1.29E+00	4.22E-09	5.50E-08	1.44E-09	6.66E-16	7.06E-01	8.83E-01	2.40E-04	5.40E-02	1.64E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E+01
3.20E-01	**6.83E-01**	**1.11E+02**	**1.00E+00**	**1.30E+00**	**1.27E-09**	**1.68E-08**	**4.84E-10**	**1.59E-16**	**7.67E-01**	**9.78E-01**	**1.91E-04**	**7.21E-02**	**1.68E+01**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**1.68E+01**
3.40E-01	6.62E-01	1.11E+02	1.00E+00	1.31E+00	4.50E-10	6.03E-09	2.02E-10	4.95E-17	7.72E-01	1.00E+00	1.57E-04	8.61E-02	1.72E+01	0.00E+00	0.00E+00	5.10E+03	0.00E+00	5.12E+03
3.60E-01	6.41E-01	1.11E+02	1.00E+00	1.32E+00	1.53E-10	2.08E-09	8.30E-11	1.51E-17	7.59E-01	1.00E+00	1.29E-04	1.01E-01	1.77E+01	0.00E+00	0.00E+00	1.16E+04	0.00E+00	1.16E+04
3.80E-01	6.20E-01	1.12E+02	1.00E+00	1.33E+00	4.62E-11	6.37E-10	3.06E-11	4.04E-18	7.45E-01	1.00E+00	1.03E-04	1.19E-01	1.82E+01	0.00E+00	0.00E+00	1.81E+04	0.00E+00	1.82E+04
4.00E-01	5.99E-01	1.12E+02	1.00E+00	1.33E+00	1.21E-11	1.70E-10	9.98E-12	9.29E-19	7.30E-01	1.00E+00	8.07E-05	1.43E-01	1.88E+01	0.00E+00	0.00E+00	2.47E+04	0.00E+00	2.47E+04
4.20E-01	5.78E-01	1.12E+02	1.00E+00	1.34E+00	2.73E-12	3.90E-11	2.83E-12	1.81E-19	7.14E-01	1.00E+00	6.16E-05	1.74E-01	1.93E+01	0.00E+00	0.00E+00	3.13E+04	0.00E+00	3.13E+04
4.40E-01	5.57E-01	1.13E+02	1.00E+00	1.35E+00	5.17E-13	7.52E-12	6.84E-13	2.90E-20	6.96E-01	1.00E+00	4.56E-05	2.14E-01	1.99E+01	0.00E+00	0.00E+00	3.79E+04	0.00E+00	3.79E+04
4.60E-01	5.36E-01	1.14E+02	1.00E+00	1.36E+00	8.00E-14	1.19E-12	1.38E-13	3.75E-21	6.77E-01	1.00E+00	3.27E-05	2.69E-01	2.05E+01	0.00E+00	0.00E+00	4.45E+04	0.00E+00	4.45E+04
4.80E-01	5.15E-01	1.14E+02	1.00E+00	1.38E+00	9.87E-15	1.51E-13	2.27E-14	3.79E-22	6.57E-01	1.00E+00	2.25E-05	3.44E-01	2.11E+01	0.00E+00	0.00E+00	5.12E+04	0.00E+00	5.12E+04
5.00E-01	4.94E-01	1.15E+02	1.00E+00	1.39E+00	9.41E-16	1.47E-14	2.93E-15	2.89E-23	6.34E-01	1.00E+00	1.48E-05	4.48E-01	2.16E+01	0.00E+00	0.00E+00	5.79E+04	0.00E+00	5.80E+04
5.20E-01	4.74E-01	1.16E+02	1.00E+00	1.41E+00	6.65E-17	1.07E-15	2.88E-16	1.59E-24	6.10E-01	1.00E+00	9.28E-06	5.97E-01	2.22E+01	0.00E+00	0.00E+00	6.47E+04	0.00E+00	6.48E+04
5.40E-01	4.53E-01	1.17E+02	1.00E+00	1.42E+00	3.33E-18	5.57E-17	2.05E-17	6.02E-26	5.85E-01	1.00E+00	5.47E-06	8.14E-01	2.27E+01	0.00E+00	0.00E+00	7.17E+04	0.00E+00	7.17E+04
5.60E-01	4.33E-01	1.18E+02	1.00E+00	1.44E+00	1.15E-19	1.99E-18	1.03E-18	1.52E-27	5.57E-01	1.00E+00	3.02E-06	1.00E+00	2.32E+01	0.00E+00	0.00E+00	7.85E+04	9.06E+02	7.94E+04
5.80E-01	4.12E-01	1.19E+02	1.00E+00	1.46E+00	2.60E-21	4.71E-20	3.51E-20	2.45E-29	5.28E-01	1.00E+00	1.55E-06	1.00E+00	2.36E+01	0.00E+00	0.00E+00	8.51E+04	3.34E+03	8.85E+04
6.00E-01	3.91E-01	1.20E+02	1.00E+00	1.48E+00	3.38E-23	6.42E-22	7.06E-22	6.47E-10	4.97E-01	1.00E+00	7.24E-07	1.00E+00	2.38E+01	0.00E+00	0.00E+00	9.20E+04	5.79E+03	9.79E+04
6.20E-01	3.71E-01	1.22E+02	1.00E+00	1.51E+00	2.25E-25	4.52E-24	7.54E-24	6.47E-10	4.64E-01	1.00E+00	3.01E-07	1.00E+00	2.39E+01	0.00E+00	0.00E+00	9.94E+04	8.24E+03	1.08E+05
6.40E-01	3.50E-01	1.23E+02	1.00E+00	1.54E+00	6.70E-28	1.43E-26	3.73E-26	6.47E-10	4.29E-01	1.00E+00	1.09E-07	1.00E+00	2.36E+01	0.00E+00	0.00E+00	1.07E+05	1.07E+04	1.18E+05
6.60E-01	3.29E-01	1.25E+02	1.00E+00	1.57E+00	3.71E-04	1.70E-29	7.15E-29	6.47E-10	3.92E-01	1.00E+00	3.30E-08	1.00E+00	2.29E+01	0.00E+00	0.00E+00	1.16E+05	1.32E+04	1.29E+05
6.80E-01	3.09E-01	1.28E+02	1.00E+00	1.61E+00	3.71E-04	4.14E-03	3.90E-05	6.47E-10	3.52E-01	1.00E+00	8.12E-09	1.00E+00	2.14E+01	0.00E+00	0.00E+00	1.25E+05	1.56E+04	1.41E+05
7.00E-01	2.88E-01	1.30E+02	1.00E+00	1.66E+00	3.71E-04	4.14E-03	3.90E-05	6.47E-10	3.12E-01	1.00E+00	1.53E-09	1.00E+00	1.88E+01	0.00E+00	0.00E+00	1.36E+05	1.81E+04	1.54E+05
7.20E-01	2.67E-01	1.34E+02	1.00E+00	1.72E+00	3.71E-04	4.14E-03	3.90E-05	6.47E-10	2.70E-01	1.00E+00	2.07E-10	1.00E+00	0.00E+00	2.39E+01	3.11E+02	1.47E+05	2.07E+04	1.69E+05
7.40E-01	2.45E-01	1.38E+02	1.00E+00	1.78E+00	3.71E-04	4.14E-03	3.90E-05	6.47E-10	2.28E-01	1.00E+00	1.83E-11	1.00E+00	0.00E+00	3.26E+01	1.63E+03	1.61E+05	2.34E+04	1.86E+05
7.60E-01	2.24E-01	1.42E+02	1.00E+00	1.86E+00	3.71E-04	4.14E-03	3.90E-05	6.47E-10	1.87E-01	1.00E+00	9.00E-13	1.00E+00	0.00E+00	4.17E+01	2.59E+03	1.78E+05	2.62E+04	2.07E+05
7.80E-01	2.02E-01	1.48E+02	1.00E+00	1.97E+00	3.71E-04	4.14E-03	3.90E-05	6.47E-10	1.47E-01	1.00E+00	2.00E-14	1.00E+00	0.00E+00	5.15E+01	3.33E+03	1.98E+05	2.93E+04	2.31E+05
8.00E-01	1.80E-01	1.55E+02	1.00E+00	2.10E+00	3.71E-04	4.14E-03	3.90E-05	6.47E-10	1.09E-01	1.00E+00	1.45E-16	1.00E+00	0.00E+00	6.23E+01	3.97E+03	2.23E+05	3.25E+04	2.59E+05

Table A-3. OLI Stream Analyzer Evaporation Survey Results for 2017 Tank 43 Surface Sample HTF-43-17-54.

					Scaling Tendency								Solids Concentration (mg/L)			
Vapor Fraction (Vapor/Inflow [mol]) [mol/mol]	Volume - Liquid-1 [L] (Y2)	Temperature [°C] (Y2)	Pressure [atm] (Y2)	Density (g/cc)	Na8Al6Si6O24 CO3.2H2O (Cancrinite) Scaling Tendency [ST]	Na8Al6Si6O24 CO3.1H2O (Cancrinite monohydrate) Scaling Tendency [ST]	Na8Al6Si6O24 (OH)2.2H2O (Hydroxycancrinite) Scaling Tendency [ST]	Na6Al6Si6O24 .12H2O (hydrated zeolite A) Scaling Tendency [ST]	Na2CO3.1H2O (Thermonatrite) Scaling Tendency [ST]	Na2CO3 (Natrite) - Sol Scaling Tendency [ST]	Al(OH)3 (Gibbsite) - Scaling Tendency [ST]	2Na2SO4.Na2CO3 - Sol Scaling Tendency [ST]	Na2CO3 (Natrite) - Sol [mg/L] (Y2)	2Na2SO4.Na2CO3 - Sol [mg/L] (Y2)	Na3PO4 - Sol [mg/L] (Y2)	Total Solids (mg/L)
0.00E+00	1.00E+00	1.06E+02	1.00E+00	1.19E+00	4.03E-02	4.45E-01	2.76E-03	8.51E-08	2.52E-01	2.56E-01	4.03E-03	2.99E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.00E-02	9.83E-01	1.06E+02	1.00E+00	1.20E+00	2.66E-02	2.95E-01	1.92E-03	5.02E-08	2.67E-01	2.73E-01	3.71E-03	3.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.00E-02	9.63E-01	1.06E+02	1.00E+00	1.20E+00	1.71E-02	1.91E-01	1.31E-03	2.87E-08	2.83E-01	2.91E-01	3.39E-03	4.20E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6.00E-02	9.44E-01	1.06E+02	1.00E+00	1.21E+00	1.07E-02	1.20E-01	8.68E-04	1.59E-08	2.99E-01	3.11E-01	3.09E-03	5.01E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8.00E-02	9.24E-01	1.07E+02	1.00E+00	1.21E+00	6.48E-03	7.35E-02	5.60E-04	8.54E-09	3.18E-01	3.33E-01	2.80E-03	6.02E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.00E-01	9.04E-01	1.07E+02	1.00E+00	1.22E+00	3.82E-03	4.36E-02	3.52E-04	4.42E-09	3.38E-01	3.58E-01	2.53E-03	7.27E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.20E-01	8.84E-01	1.07E+02	1.00E+00	1.22E+00	2.17E-03	2.50E-02	2.14E-04	2.20E-09	3.60E-01	3.84E-01	2.26E-03	8.83E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.40E-01	8.64E-01	1.07E+02	1.00E+00	1.23E+00	1.19E-03	1.38E-02	1.26E-04	1.05E-09	3.84E-01	4.14E-01	2.02E-03	1.08E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.60E-01	8.44E-01	1.07E+02	1.00E+00	1.23E+00	6.29E-04	7.35E-03	7.14E-05	4.78E-10	4.10E-01	4.47E-01	1.78E-03	1.33E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1.80E-01	8.24E-01	1.08E+02	1.00E+00	1.24E+00	3.18E-04	3.75E-03	3.89E-05	2.07E-10	4.38E-01	4.83E-01	1.56E-03	1.64E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.00E-01	8.05E-01	1.08E+02	1.00E+00	1.25E+00	1.53E-04	1.83E-03	2.03E-05	8.53E-11	4.70E-01	5.24E-01	1.36E-03	2.05E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.20E-01	7.85E-01	1.08E+02	1.00E+00	1.25E+00	7.04E-05	8.47E-04	1.01E-05	3.31E-11	5.04E-01	5.70E-01	1.18E-03	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.40E-01	7.65E-01	1.08E+02	1.00E+00	1.26E+00	3.06E-05	3.72E-04	4.80E-06	1.21E-11	5.43E-01	6.22E-01	1.00E-03	3.28E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.60E-01	7.45E-01	1.09E+02	1.00E+00	1.27E+00	1.25E-05	1.54E-04	2.15E-06	4.11E-12	5.85E-01	6.80E-01	8.48E-04	4.20E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2.80E-01	7.25E-01	1.09E+02	1.00E+00	1.28E+00	4.79E-06	5.96E-05	9.05E-07	1.30E-12	6.32E-01	7.46E-01	7.09E-04	5.43E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.00E-01	7.06E-01	1.09E+02	1.00E+00	1.28E+00	1.70E-06	2.15E-05	3.56E-07	3.77E-13	6.84E-01	8.21E-01	5.84E-04	7.10E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.20E-01	**6.86E-01**	**1.10E+02**	**1.00E+00**	**1.29E+00**	**5.60E-07**	**7.16E-06**	**1.30E-07**	**9.99E-14**	**7.43E-01**	**9.07E-01**	**4.75E-04**	**9.38E-02**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**0.00E+00**
3.40E-01	6.66E-01	1.10E+02	1.00E+00	1.30E+00	1.72E-07	2.23E-06	4.48E-08	2.46E-14	8.04E-01	1.00E+00	3.81E-04	1.24E-01	3.88E+02	0.00E+00	0.00E+00	3.88E+02
3.60E-01	6.44E-01	1.10E+02	1.00E+00	1.31E+00	6.91E-08	9.06E-07	2.14E-08	9.03E-15	7.93E-01	1.00E+00	3.21E-04	1.43E-01	7.84E+03	0.00E+00	0.00E+00	7.84E+03
3.80E-01	6.23E-01	1.11E+02	1.00E+00	1.31E+00	2.49E-08	3.31E-07	9.25E-09	2.95E-15	7.81E-01	1.00E+00	2.65E-04	1.66E-01	1.54E+04	0.00E+00	0.00E+00	1.54E+04
4.00E-01	6.02E-01	1.11E+02	1.00E+00	1.32E+00	7.96E-09	1.07E-07	3.60E-09	8.43E-16	7.67E-01	1.00E+00	2.14E-04	1.95E-01	2.30E+04	0.00E+00	0.00E+00	2.30E+04
4.20E-01	5.80E-01	1.11E+02	1.00E+00	1.33E+00	2.21E-09	3.03E-08	1.23E-09	2.07E-16	7.53E-01	1.00E+00	1.70E-04	2.32E-01	3.07E+04	0.00E+00	0.00E+00	3.07E+04
4.40E-01	5.59E-01	1.12E+02	1.00E+00	1.34E+00	5.26E-10	7.31E-09	3.68E-10	4.29E-17	7.37E-01	1.00E+00	1.31E-04	2.80E-01	3.85E+04	0.00E+00	0.00E+00	3.85E+04
4.60E-01	5.38E-01	1.12E+02	1.00E+00	1.35E+00	1.04E-10	1.48E-09	9.32E-11	7.32E-18	7.20E-01	1.00E+00	9.78E-05	3.44E-01	4.64E+04	0.00E+00	0.00E+00	4.64E+04
4.80E-01	5.17E-01	1.13E+02	1.00E+00	1.36E+00	1.68E-11	2.43E-10	1.96E-11	9.98E-19	7.02E-01	1.00E+00	7.06E-05	4.30E-01	5.44E+04	0.00E+00	0.00E+00	5.44E+04
5.00E-01	4.96E-01	1.13E+02	1.00E+00	1.37E+00	2.15E-12	3.18E-11	3.33E-12	1.05E-19	6.82E-01	1.00E+00	4.90E-05	5.48E-01	6.25E+04	0.00E+00	0.00E+00	6.25E+04
5.20E-01	4.76E-01	1.14E+02	1.00E+00	1.38E+00	2.09E-13	3.17E-12	4.40E-13	8.29E-21	6.60E-01	1.00E+00	3.25E-05	7.13E-01	7.07E+04	0.00E+00	0.00E+00	7.07E+04
5.40E-01	4.55E-01	1.15E+02	1.00E+00	1.40E+00	1.48E-14	2.32E-13	4.36E-14	4.64E-22	6.36E-01	1.00E+00	2.04E-05	9.50E-01	7.90E+04	0.00E+00	0.00E+00	7.90E+04
5.60E-01	4.34E-01	1.16E+02	1.00E+00	1.42E+00	7.85E-16	1.27E-14	3.29E-15	1.89E-23	6.11E-01	1.00E+00	1.22E-05	1.00E+00	8.68E+04	2.33E+03	0.00E+00	8.91E+04
5.80E-01	4.13E-01	1.17E+02	1.00E+00	1.43E+00	2.76E-17	4.61E-16	1.70E-16	4.95E-25	5.84E-01	1.00E+00	6.78E-06	1.00E+00	9.48E+04	5.22E+03	0.00E+00	1.00E+05
6.00E-01	3.92E-01	1.18E+02	1.00E+00	1.45E+00	5.87E-19	1.02E-17	5.49E-18	7.56E-27	5.55E-01	1.00E+00	3.46E-06	1.00E+00	1.03E+05	8.19E+03	0.00E+00	1.11E+05
6.20E-01	3.72E-01	1.19E+02	1.00E+00	1.48E+00	6.85E-21	1.25E-19	1.01E-19	6.03E-29	5.23E-01	1.00E+00	1.59E-06	1.00E+00	1.12E+05	1.12E+04	0.00E+00	1.23E+05
6.40E-01	3.51E-01	1.20E+02	1.00E+00	1.50E+00	3.86E-23	7.43E-22	9.33E-22	1.95E-07	4.89E-01	1.00E+00	6.46E-07	1.00E+00	1.21E+05	1.43E+04	0.00E+00	1.35E+05
6.60E-01	3.30E-01	1.22E+02	1.00E+00	1.53E+00	8.91E-26	1.83E-24	3.70E-24	1.95E-07	4.52E-01	1.00E+00	2.25E-07	1.00E+00	1.31E+05	1.75E+04	0.00E+00	1.48E+05
6.80E-01	3.10E-01	1.24E+02	1.00E+00	1.57E+00	6.81E-29	1.50E-27	5.10E-27	1.95E-07	4.12E-01	1.00E+00	6.46E-08	1.00E+00	1.42E+05	2.07E+04	0.00E+00	1.63E+05
7.00E-01	2.89E-01	1.27E+02	1.00E+00	1.61E+00	9.33E-02	1.00E+00	1.85E-30	1.95E-07	3.71E-01	1.00E+00	1.46E-08	1.00E+00	1.54E+05	2.40E+04	0.00E+00	1.78E+05
7.20E-01	2.69E-01	1.29E+02	1.00E+00	1.66E+00	9.33E-02	1.00E+00	6.02E-03	1.95E-07	3.27E-01	1.00E+00	2.43E-09	1.00E+00	1.67E+05	2.74E+04	0.00E+00	1.95E+05
7.40E-01	2.48E-01	1.33E+02	1.00E+00	1.72E+00	9.33E-02	1.00E+00	6.02E-03	1.95E-07	2.82E-01	1.00E+00	2.72E-10	1.00E+00	1.83E+05	3.10E+04	0.00E+00	2.14E+05
7.60E-01	2.27E-01	1.37E+02	1.00E+00	1.78E+00	9.33E-02	1.00E+00	6.02E-03	1.95E-07	2.36E-01	1.00E+00	1.84E-11	1.00E+00	2.01E+05	3.49E+04	1.11E+03	2.37E+05
7.80E-01	2.06E-01	1.42E+02	1.00E+00	1.87E+00	9.33E-02	1.00E+00	6.02E-03	1.95E-07	1.91E-01	1.00E+00	6.09E-13	1.00E+00	2.23E+05	3.91E+04	2.19E+03	2.64E+05
8.00E-01	1.85E-01	1.48E+02	1.00E+00	1.97E+00	9.33E-02	1.00E+00	6.02E-03	1.95E-07	1.47E-01	1.00E+00	7.43E-15	1.00E+00	2.48E+05	4.38E+04	2.96E+03	2.95E+05

Table A-4. OLI Stream Analyzer Evaporation Survey Results for 2018 Tank 43 Surface Sample HTF-43-18-80.

					Scaling Tendency										Solids Concentration (mg/L)						
Vapor Fraction (Vapor/Inflow [mol]) [mol/mol]	Volume - Liquid [L]	Temperature [°C]	Pressure [atm]	Density (g/cc)	Na8Al6Si6O24CO3.2H2O (Cancrinite) Scaling Tendency	Na8Al6Si6O24CO3.1H2O (Cancrinite monohydrate) Scaling Tendency	Na8Al6Si6O24(OH)2.2H2O (Hydroxycancrinite) Scaling Tendency	Na6Al6Si6O24.12H2O (hydrated zeolite A) Scaling Tendency	Na3PO4 - Sol Scaling Tendency	Na2CO3.1H2O (Thermonatrite) Scaling Tendency	Na2CO3 (Natrite) - Sol Scaling Tendency	Ca5(OH)(PO4)3 (Hydroxypatite) - Sol Scaling Tendency	Al(OH)3 (Gibbsite) - Scaling Tendency	2Na2SO4.Na2CO3 - Sol Scaling Tendency	NaFeO2 - Sol Scaling Tendency	NaFeO2 - Sol [mg/L]	Na3PO4 - Sol [mg/L]	Na2CO3 (Natrite) - Sol [mg/L]	Ca5(OH)(PO4)3 (Hydroxyapatite) - Sol [mg/L]	Ca(OH)2 (Portlandite) - Sol [mg/L]	2Na2SO4.Na2CO3 - Sol [mg/L]	Total Solids (mg/L)
0.00E+00	1.00E+00	1.07E+02	1.00E+00	1.23E+00	6.04E-05	7.05E-04	6.87E-06	4.74E-11	1.06E-03	4.01E-01	4.36E-01	1.00E+00	1.72E-03	9.99E-01	1.22E-02	0.00E+00	0.00E+00	0.00E+00	8.71E+00	0.00E+00	0.00E+00	8.71E+00
2.00E-02	9.81E-01	1.08E+02	1.00E+00	1.24E+00	3.43E-05	4.04E-04	4.16E-06	2.37E-11	1.14E-03	4.24E-01	4.66E-01	1.00E+00	1.54E-03	9.61E-01	1.46E-02	0.00E+00	0.00E+00	0.00E+00	8.83E+00	0.00E+00	0.00E+00	8.83E+00
4.00E-02	9.62E-01	1.08E+02	1.00E+00	1.24E+00	1.89E-05	2.24E-04	2.44E-06	1.14E-11	1.23E-03	4.49E-01	4.99E-01	1.00E+00	1.37E-03	9.23E-01	1.76E-02	0.00E+00	0.00E+00	0.00E+00	8.95E+00	0.00E+00	0.00E+00	8.95E+00
6.00E-02	9.42E-01	1.08E+02	1.00E+00	1.25E+00	1.00E-05	1.20E-04	1.39E-06	5.30E-12	1.33E-03	4.77E-01	5.35E-01	1.00E+00	1.22E-03	8.84E-01	2.13E-02	0.00E+00	0.00E+00	0.00E+00	9.07E+00	0.00E+00	0.00E+00	9.07E+00
8.00E-02	9.22E-01	1.08E+02	1.00E+00	1.25E+00	5.14E-06	6.20E-05	7.64E-07	2.35E-12	1.45E-03	5.07E-01	5.75E-01	1.00E+00	1.07E-03	8.46E-01	2.59E-02	0.00E+00	0.00E+00	0.00E+00	9.20E+00	0.00E+00	0.00E+00	9.20E+00
1.00E-01	9.02E-01	1.08E+02	1.00E+00	1.26E+00	2.53E-06	3.08E-05	4.04E-07	9.97E-13	1.58E-03	5.39E-01	6.19E-01	1.00E+00	9.39E-04	8.07E-01	3.18E-02	0.00E+00	0.00E+00	0.00E+00	9.32E+00	0.00E+00	0.00E+00	9.32E+00
1.20E-01	8.83E-01	1.09E+02	1.00E+00	1.27E+00	1.19E-06	1.47E-05	2.06E-07	4.03E-13	1.73E-03	5.75E-01	6.67E-01	1.00E+00	8.15E-04	7.68E-01	3.92E-02	0.00E+00	0.00E+00	0.00E+00	9.45E+00	0.00E+00	0.00E+00	9.45E+00
1.40E-01	8.63E-01	1.09E+02	1.00E+00	1.27E+00	5.38E-07	6.67E-06	1.00E-07	1.54E-13	1.90E-03	6.13E-01	7.21E-01	1.00E+00	7.02E-04	7.29E-01	4.86E-02	0.00E+00	0.00E+00	0.00E+00	9.58E+00	0.00E+00	0.00E+00	9.58E+00
1.60E-01	8.43E-01	1.09E+02	1.00E+00	1.28E+00	2.30E-07	2.89E-06	4.67E-08	5.57E-14	2.10E-03	6.56E-01	7.82E-01	1.00E+00	5.98E-04	6.90E-01	6.08E-02	0.00E+00	0.00E+00	0.00E+00	9.72E+00	0.00E+00	0.00E+00	9.72E+00
1.80E-01	8.23E-01	1.09E+02	1.00E+00	1.29E+00	9.33E-08	1.18E-06	2.06E-08	1.89E-14	2.32E-03	7.02E-01	8.49E-01	1.00E+00	5.06E-04	6.51E-01	7.66E-02	0.00E+00	0.00E+00	0.00E+00	9.85E+00	0.00E+00	0.00E+00	9.85E+00
2.00E-01	**8.04E-01**	**1.10E+02**	**1.00E+00**	**1.29E+00**	**3.56E-08**	**4.57E-07**	**8.62E-09**	**6.01E-15**	**2.59E-03**	**7.53E-01**	**9.25E-01**	**1.00E+00**	**4.23E-04**	**6.12E-01**	**9.73E-02**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**9.98E+00**	**0.00E+00**	**0.00E+00**	**9.98E+00**
2.20E-01	**7.84E-01**	**1.10E+02**	**1.00E+00**	**1.30E+00**	**1.32E-08**	**1.72E-07**	**3.53E-09**	**1.86E-15**	**2.89E-03**	**8.02E-01**	**1.00E+00**	**1.00E+00**	**3.51E-04**	**5.74E-01**	**1.23E-01**	**0.00E+00**	**0.00E+00**	**6.65E+02**	**1.02E+01**	**0.00E+00**	**0.00E+00**	**6.76E+02**
2.40E-01	7.62E-01	1.10E+02	1.00E+00	1.31E+00	6.08E-09	7.99E-08	1.88E-09	7.92E-16	3.19E-03	7.92E-01	1.00E+00	1.00E+00	3.03E-04	5.36E-01	1.38E-01	0.00E+00	0.00E+00	6.87E+03	1.07E+01	0.00E+00	0.00E+00	6.88E+03
2.60E-01	7.41E-01	1.11E+02	1.00E+00	1.31E+00	2.60E-09	3.45E-08	9.35E-10	3.11E-16	3.55E-03	7.82E-01	1.00E+00	1.00E+00	2.58E-04	5.00E-01	1.57E-01	0.00E+00	0.00E+00	1.31E+04	1.13E+01	0.00E+00	0.00E+00	1.31E+04
2.80E-01	7.20E-01	1.11E+02	1.00E+00	1.32E+00	1.02E-09	1.37E-08	4.32E-10	1.11E-16	3.97E-03	7.71E-01	1.00E+00	1.00E+00	2.17E-04	4.71E-01	1.79E-01	0.00E+00	0.00E+00	1.95E+04	1.19E+01	0.00E+00	0.00E+00	1.95E+04
3.00E-01	6.99E-01	1.11E+02	1.00E+00	1.32E+00	3.63E-10	4.94E-09	1.83E-10	3.59E-17	4.48E-03	7.59E-01	1.00E+00	1.00E+00	1.80E-04	4.41E-01	2.07E-01	0.00E+00	0.00E+00	2.58E+04	1.25E+01	0.00E+00	0.00E+00	2.58E+04
3.20E-01	6.77E-01	1.12E+02	1.00E+00	1.33E+00	1.17E-10	1.61E-09	7.06E-11	1.03E-17	5.08E-03	7.47E-01	1.00E+00	1.00E+00	1.46E-04	4.11E-01	2.41E-01	0.00E+00	0.00E+00	3.23E+04	1.32E+01	0.00E+00	0.00E+00	3.23E+04
3.40E-01	6.56E-01	1.12E+02	1.00E+00	1.34E+00	3.33E-11	4.65E-10	2.45E-11	2.62E-18	5.82E-03	7.33E-01	1.00E+00	1.00E+00	1.16E-04	3.81E-01	2.84E-01	0.00E+00	0.00E+00	3.87E+04	1.39E+01	0.00E+00	0.00E+00	3.87E+04
3.60E-01	6.35E-01	1.12E+02	1.00E+00	1.35E+00	8.35E-12	1.18E-10	7.56E-12	5.76E-19	6.74E-03	7.19E-01	1.00E+00	1.00E+00	9.08E-05	3.51E-01	3.39E-01	0.00E+00	0.00E+00	4.53E+04	1.46E+01	0.00E+00	0.00E+00	4.53E+04
3.80E-01	6.15E-01	1.13E+02	1.00E+00	1.36E+00	1.80E-12	2.61E-11	2.04E-12	1.08E-19	7.87E-03	7.03E-01	1.00E+00	1.00E+00	6.91E-05	3.21E-01	4.09E-01	0.00E+00	0.00E+00	5.18E+04	1.53E+01	0.00E+00	0.00E+00	5.19E+04
4.00E-01	5.94E-01	1.13E+02	1.00E+00	1.37E+00	3.31E-13	4.87E-12	4.74E-13	1.69E-20	9.29E-03	6.86E-01	1.00E+00	1.00E+00	5.11E-05	2.92E-01	5.00E-01	0.00E+00	0.00E+00	5.85E+04	1.61E+01	0.00E+00	0.00E+00	5.85E+04
4.20E-01	5.73E-01	1.14E+02	1.00E+00	1.38E+00	5.04E-14	7.57E-13	9.29E-14	2.17E-21	1.11E-02	6.68E-01	1.00E+00	1.00E+00	3.66E-05	2.63E-01	6.21E-01	0.00E+00	0.00E+00	6.52E+04	1.69E+01	0.00E+00	0.00E+00	6.52E+04
4.40E-01	5.52E-01	1.14E+02	1.00E+00	1.39E+00	6.22E-15	9.57E-14	1.50E-14	2.21E-22	1.35E-02	6.49E-01	1.00E+00	1.00E+00	2.53E-05	2.34E-01	7.84E-01	0.00E+00	0.00E+00	7.20E+04	1.78E+01	0.00E+00	0.00E+00	7.20E+04
4.60E-01	5.32E-01	1.15E+02	1.00E+00	1.40E+00	6.07E-16	9.58E-15	1.95E-15	1.75E-23	1.66E-02	6.28E-01	1.00E+00	1.00E+00	1.68E-05	2.07E-01	1.00E+00	0.00E+00	0.00E+00	7.89E+04	1.87E+01	0.00E+00	5.95E+01	7.90E+04
4.80E-01	5.11E-01	1.16E+02	1.00E+00	1.42E+00	4.85E-17	7.87E-16	2.11E-16	1.12E-24	2.05E-02	6.07E-01	1.00E+00	1.00E+00	1.08E-05	1.80E-01	1.00E+00	0.00E+00	0.00E+00	8.53E+04	1.97E+01	0.00E+00	2.40E+03	8.77E+04
5.00E-01	4.90E-01	1.17E+02	1.00E+00	1.43E+00	2.86E-18	4.78E-17	1.72E-17	5.13E-26	2.58E-02	5.84E-01	1.00E+00	1.00E+00	6.58E-06	1.56E-01	1.00E+00	0.00E+00	0.00E+00	9.18E+04	2.07E+01	0.00E+00	4.80E+03	9.66E+04
5.20E-01	4.70E-01	1.18E+02	1.00E+00	1.45E+00	1.18E-19	2.05E-18	1.01E-18	1.61E-27	3.30E-02	5.59E-01	1.00E+00	1.00E+00	3.77E-06	1.32E-01	1.00E+00	0.00E+00	0.00E+00	9.86E+04	2.18E+01	0.00E+00	7.25E+03	1.06E+05
5.40E-01	4.49E-01	1.19E+02	1.00E+00	1.47E+00	3.25E-21	5.84E-20	4.02E-20	3.24E-29	4.33E-02	5.33E-01	1.00E+00	1.00E+00	2.01E-06	1.11E-01	1.00E+00	0.00E+00	0.00E+00	1.06E+05	2.30E+01	0.00E+00	9.74E+03	1.15E+05
5.60E-01	4.28E-01	1.20E+02	1.00E+00	1.49E+00	5.51E-23	1.03E-21	1.02E-21	1.21E-10	5.87E-02	5.05E-01	1.00E+00	1.00E+00	9.88E-07	9.10E-02	1.00E+00	0.00E+00	0.00E+00	1.13E+05	6.91E+00	1.29E+01	1.23E+04	1.25E+05
5.80E-01	4.08E-01	1.21E+02	1.00E+00	1.51E+00	5.31E-25	1.04E-23	1.51E-23	1.21E-10	8.13E-02	4.75E-01	1.00E+00	3.64E-01	4.40E-07	7.33E-02	1.00E+00	0.00E+00	0.00E+00	1.21E+05	0.00E+00	1.92E+01	1.48E+04	1.36E+05
6.00E-01	3.87E-01	1.23E+02	1.00E+00	1.54E+00	2.60E-27	5.40E-26	1.17E-25	1.21E-10	1.16E-01	4.44E-01	1.00E+00	1.23E-01	1.74E-07	5.76E-02	1.00E+00	0.00E+00	0.00E+00	1.29E+05	0.00E+00	2.05E+01	1.75E+04	1.47E+05
6.20E-01	3.67E-01	1.24E+02	1.00E+00	1.57E+00	5.64E-30	1.25E-28	4.20E-28	1.21E-10	1.70E-01	4.10E-01	1.00E+00	3.88E-02	6.01E-08	4.41E-02	1.00E+00	0.00E+00	0.00E+00	1.38E+05	0.00E+00	2.19E+01	2.01E+04	1.58E+05
6.40E-01	3.46E-01	1.26E+02	1.00E+00	1.60E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	2.61E-01	3.75E-01	1.00E+00	1.15E-02	1.75E-08	3.28E-02	1.00E+00	0.00E+00	0.00E+00	1.48E+05	0.00E+00	2.34E+01	2.28E+04	1.71E+05
6.60E-01	3.26E-01	1.29E+02	1.00E+00	1.64E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	4.16E-01	3.39E-01	1.00E+00	3.16E-03	4.12E-09	2.36E-02	1.00E+00	0.00E+00	0.00E+00	1.59E+05	0.00E+00	2.50E+01	2.56E+04	1.84E+05
6.80E-01	3.05E-01	1.31E+02	1.00E+00	1.69E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	6.95E-01	3.01E-01	1.00E+00	8.16E-04	7.49E-10	1.63E-02	1.00E+00	0.00E+00	0.00E+00	1.71E+05	0.00E+00	2.68E+01	2.85E+04	1.99E+05
7.00E-01	2.84E-01	1.34E+02	1.00E+00	1.74E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	1.00E+00	2.63E-01	1.00E+00	1.08E-04	9.94E-11	1.08E-02	1.00E+00	5.04E+00	4.99E+02	1.84E+05	0.00E+00	2.88E+01	3.15E+04	2.16E+05
7.20E-01	2.63E-01	1.38E+02	1.00E+00	1.80E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	1.00E+00	2.25E-01	1.00E+00	3.90E-06	8.80E-12	6.84E-03	1.00E+00	1.14E+01	1.66E+03	2.00E+05	0.00E+00	3.12E+01	3.48E+04	2.36E+05
7.40E-01	2.43E-01	1.42E+02	1.00E+00	1.87E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	1.00E+00	1.87E-01	1.00E+00	1.12E-07	4.52E-13	4.11E-03	1.00E+00	1.76E+01	2.51E+03	2.18E+05	0.00E+00	3.39E+01	3.83E+04	2.59E+05
7.60E-01	2.22E-01	1.48E+02	1.00E+00	1.96E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	1.00E+00	1.50E-01	1.00E+00	2.63E-09	1.13E-14	2.33E-03	1.00E+00	2.40E+01	3.16E+03	2.39E+05	0.00E+00	3.71E+01	4.22E+04	2.85E+05
7.80E-01	2.01E-01	1.54E+02	1.00E+00	2.06E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	1.00E+00	1.15E-01	1.00E+00	5.21E-11	1.04E-16	1.26E-03	1.00E+00	3.05E+01	3.72E+03	2.64E+05	0.00E+00	4.09E+01	4.62E+04	3.14E+05
8.00E-01	1.82E-01	1.63E+02	1.00E+00	2.18E+00	1.57E-04	1.81E-03	1.74E-05	1.21E-10	1.00E+00	8.28E-02	1.00E+00	9.06E-13	2.25E-19	6.46E-04	1.00E+00	3.74E+01	4.24E+03	2.94E+05	0.00E+00	4.54E+01	5.03E+04	3.48E+05

Table A-5. OLI Stream Analyzer Evaporation Survey Results for 2018 Tank 43 Subsurface (161” from bottom) Sample HTF-43-18-81.

					Scaling Tendency											Solids Concentration (mg/L)						
Vapor Fraction (Vapor/Inflow [mol]) [mol/mol]	Volume - Liquid-1 [L] (Y2)	Temperature [°C] (Y2)	Pressure [atm] (Y2)	Density (g/cc)	Na8Al6Si6O24 CO3.2H2O (Cancrinite) Scaling Tendency	Na8Al6Si6O24 CO3.1H2O (Cancrinite monohydrate) Scaling Tendency	Na8Al6Si6O24 (OH)2.2H2O (Hydroxycancrinite) Scaling Tendency	Na6Al6Si6O24 .12H2O (hydrated zeolite A) Scaling Tendency	Na3PO4 - Sol Scaling Tendency	Na2CO3.1H2O (Thermonatrite) Scaling Tendency	Na2CO3 (Natrite) - Sol Scaling Tendency	Ca5(OH)(PO4)3 (Hydroxypatite) - Sol Scaling Tendency	Al(OH)3 (Gibbsite) - Scaling Tendency	2Na2SO4.Na2CO3 - Sol Scaling Tendency	NaFeO2 - Sol Scaling Tendency	NaFeO2 - Sol [mg/L]	Na3PO4 - Sol [mg/L]	Na2CO3 (Natrite) - Sol [mg/L]	Ca5(OH)(PO4)3 (Hydroxyapatite) - Sol [mg/L]	Ca(OH)2 (Portlandite) - Sol [mg/L]	2Na2SO4.Na2CO3 - Sol [mg/L]	Total Solids (mg/L)
0.00E+00	1.00E+00	1.08E+02	1.00E+00	1.26E+00	1.69E-06	2.05E-05	3.04E-07	6.86E-13	1.62E-03	5.23E-01	6.00E-01	1.00E+00	1.00E-03	3.09E-02	7.11E-02	0.00E+00	0.00E+00	0.00E+00	1.85E+01	0.00E+00	0.00E+00	1.85E+01
2.00E-02	9.82E-01	1.09E+02	1.00E+00	1.26E+00	8.75E-07	1.07E-05	1.69E-07	3.09E-13	1.76E-03	5.54E-01	6.42E-01	1.00E+00	8.85E-04	3.73E-02	7.53E-02	0.00E+00	0.00E+00	0.00E+00	1.88E+01	0.00E+00	0.00E+00	1.88E+01
4.00E-02	9.62E-01	1.09E+02	1.00E+00	1.27E+00	4.38E-07	5.42E-06	9.09E-08	1.34E-13	1.91E-03	5.87E-01	6.89E-01	1.00E+00	7.76E-04	4.53E-02	7.99E-02	0.00E+00	0.00E+00	0.00E+00	1.91E+01	0.00E+00	0.00E+00	1.91E+01
6.00E-02	9.42E-01	1.09E+02	1.00E+00	1.27E+00	2.11E-07	2.63E-06	4.71E-08	5.53E-14	2.09E-03	6.24E-01	7.41E-01	1.00E+00	6.76E-04	5.53E-02	8.49E-02	0.00E+00	0.00E+00	0.00E+00	1.95E+01	0.00E+00	0.00E+00	1.95E+01
8.00E-02	9.23E-01	1.09E+02	1.00E+00	1.28E+00	9.71E-08	1.23E-06	2.35E-08	2.18E-14	2.29E-03	6.63E-01	7.98E-01	1.00E+00	5.84E-04	6.80E-02	9.04E-02	0.00E+00	0.00E+00	0.00E+00	1.98E+01	0.00E+00	0.00E+00	1.98E+01
1.00E-01	9.03E-01	1.10E+02	1.00E+00	1.29E+00	4.28E-08	5.46E-07	1.12E-08	8.14E-15	2.51E-03	7.06E-01	8.61E-01	1.00E+00	5.01E-04	8.41E-02	9.64E-02	0.00E+00	0.00E+00	0.00E+00	2.01E+01	0.00E+00	0.00E+00	2.01E+01
1.20E-01	**8.83E-01**	**1.10E+02**	**1.00E+00**	**1.29E+00**	**1.79E-08**	**2.32E-07**	**5.11E-09**	**2.88E-15**	**2.77E-03**	**7.53E-01**	**9.30E-01**	**1.00E+00**	**4.26E-04**	**1.05E-01**	**1.03E-01**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**2.05E+01**	**0.00E+00**	**0.00E+00**	**2.05E+01**
1.40E-01	**8.63E-01**	**1.10E+02**	**1.00E+00**	**1.30E+00**	**7.35E-09**	**9.60E-08**	**2.30E-09**	**9.98E-16**	**3.07E-03**	**7.97E-01**	**1.00E+00**	**1.00E+00**	**3.60E-04**	**1.30E-01**	**1.10E-01**	**0.00E+00**	**0.00E+00**	**5.64E+02**	**2.09E+01**	**0.00E+00**	**0.00E+00**	**5.85E+02**
1.60E-01	8.42E-01	1.10E+02	1.00E+00	1.31E+00	3.66E-09	4.83E-08	1.31E-09	4.63E-16	3.36E-03	7.88E-01	1.00E+00	1.00E+00	3.15E-04	1.45E-01	1.17E-01	0.00E+00	0.00E+00	6.09E+03	2.17E+01	0.00E+00	0.00E+00	6.11E+03
1.80E-01	8.20E-01	1.11E+02	1.00E+00	1.31E+00	1.72E-09	2.28E-08	7.06E-10	2.01E-16	3.70E-03	7.79E-01	1.00E+00	1.00E+00	2.73E-04	1.62E-01	1.25E-01	0.00E+00	0.00E+00	1.17E+04	2.25E+01	0.00E+00	0.00E+00	1.17E+04
2.00E-01	7.99E-01	1.11E+02	1.00E+00	1.32E+00	7.51E-10	1.01E-08	3.58E-10	8.06E-17	4.10E-03	7.69E-01	1.00E+00	1.00E+00	2.34E-04	1.83E-01	1.34E-01	0.00E+00	0.00E+00	1.73E+04	2.33E+01	0.00E+00	0.00E+00	1.73E+04
2.20E-01	7.78E-01	1.11E+02	1.00E+00	1.32E+00	3.05E-10	4.14E-09	1.70E-10	2.99E-17	4.57E-03	7.58E-01	1.00E+00	1.00E+00	1.98E-04	2.09E-01	1.44E-01	0.00E+00	0.00E+00	2.29E+04	2.42E+01	0.00E+00	0.00E+00	2.29E+04
2.40E-01	7.57E-01	1.12E+02	1.00E+00	1.33E+00	1.14E-10	1.57E-09	7.50E-11	1.01E-17	5.12E-03	7.47E-01	1.00E+00	1.00E+00	1.65E-04	2.39E-01	1.55E-01	0.00E+00	0.00E+00	2.86E+04	2.51E+01	0.00E+00	0.00E+00	2.86E+04
2.60E-01	7.36E-01	1.12E+02	1.00E+00	1.34E+00	3.88E-11	5.41E-10	3.05E-11	3.10E-18	5.78E-03	7.35E-01	1.00E+00	1.00E+00	1.36E-04	2.77E-01	1.67E-01	0.00E+00	0.00E+00	3.43E+04	2.60E+01	0.00E+00	0.00E+00	3.43E+04
2.80E-01	7.15E-01	1.12E+02	1.00E+00	1.34E+00	1.20E-11	1.69E-10	1.13E-11	8.52E-19	6.57E-03	7.22E-01	1.00E+00	1.00E+00	1.10E-04	3.24E-01	1.82E-01	0.00E+00	0.00E+00	4.00E+04	2.70E+01	0.00E+00	0.00E+00	4.01E+04
3.00E-01	6.94E-01	1.13E+02	1.00E+00	1.35E+00	3.30E-12	4.74E-11	3.79E-12	2.07E-19	7.53E-03	7.08E-01	1.00E+00	1.00E+00	8.71E-05	3.82E-01	1.98E-01	0.00E+00	0.00E+00	4.58E+04	2.80E+01	0.00E+00	0.00E+00	4.58E+04
3.20E-01	6.73E-01	1.13E+02	1.00E+00	1.36E+00	8.04E-13	1.17E-11	1.14E-12	4.41E-20	8.70E-03	6.94E-01	1.00E+00	1.00E+00	6.77E-05	4.55E-01	2.16E-01	0.00E+00	0.00E+00	5.16E+04	2.91E+01	0.00E+00	0.00E+00	5.17E+04
3.40E-01	6.52E-01	1.14E+02	1.00E+00	1.37E+00	1.71E-13	2.54E-12	3.01E-13	8.07E-21	1.02E-02	6.78E-01	1.00E+00	1.00E+00	5.14E-05	5.49E-01	2.37E-01	0.00E+00	0.00E+00	5.75E+04	3.02E+01	0.00E+00	0.00E+00	5.75E+04
3.60E-01	6.32E-01	1.14E+02	1.00E+00	1.38E+00	3.12E-14	4.72E-13	6.94E-14	1.25E-21	1.20E-02	6.61E-01	1.00E+00	1.00E+00	3.80E-05	6.70E-01	2.61E-01	0.00E+00	0.00E+00	6.34E+04	3.14E+01	0.00E+00	0.00E+00	6.35E+04
3.80E-01	6.11E-01	1.15E+02	1.00E+00	1.39E+00	4.79E-15	7.42E-14	1.37E-14	1.62E-22	1.43E-02	6.44E-01	1.00E+00	1.00E+00	2.73E-05	8.29E-01	2.90E-01	0.00E+00	0.00E+00	6.94E+04	3.27E+01	0.00E+00	0.00E+00	6.94E+04
4.00E-01	5.90E-01	1.15E+02	1.00E+00	1.40E+00	6.16E-16	9.77E-15	2.29E-15	1.71E-23	1.72E-02	6.25E-01	1.00E+00	1.00E+00	1.90E-05	1.00E+00	3.22E-01	0.00E+00	0.00E+00	7.54E+04	3.40E+01	0.00E+00	3.54E+02	7.57E+04
4.20E-01	5.70E-01	1.16E+02	1.00E+00	1.41E+00	6.75E-17	1.10E-15	3.30E-16	1.53E-24	2.08E-02	6.05E-01	1.00E+00	1.00E+00	1.28E-05	1.00E+00	3.60E-01	0.00E+00	0.00E+00	8.09E+04	3.55E+01	0.00E+00	2.47E+03	8.34E+04
4.40E-01	5.49E-01	1.17E+02	1.00E+00	1.43E+00	5.83E-18	9.74E-17	3.81E-17	1.06E-25	2.54E-02	5.85E-01	1.00E+00	1.00E+00	8.34E-06	1.00E+00	4.04E-01	0.00E+00	0.00E+00	8.66E+04	3.70E+01	0.00E+00	4.63E+03	9.12E+04
4.60E-01	5.28E-01	1.17E+02	1.00E+00	1.44E+00	3.84E-19	6.61E-18	3.42E-18	5.43E-27	3.17E-02	5.63E-01	1.00E+00	1.00E+00	5.17E-06	1.00E+00	4.57E-01	0.00E+00	0.00E+00	9.24E+04	3.86E+01	0.00E+00	6.83E+03	9.93E+04
4.80E-01	5.07E-01	1.18E+02	1.00E+00	1.46E+00	1.85E-20	3.30E-19	2.30E-19	2.00E-28	4.01E-02	5.40E-01	1.00E+00	1.00E+00	3.04E-06	1.00E+00	5.20E-01	0.00E+00	0.00E+00	9.84E+04	4.04E+01	0.00E+00	9.07E+03	1.08E+05
5.00E-01	4.87E-01	1.19E+02	1.00E+00	1.48E+00	6.26E-22	1.16E-20	1.10E-20	4.99E-30	5.29E-02	5.15E-01	1.00E+00	9.19E-01	1.68E-06	1.00E+00	5.96E-01	0.00E+00	0.00E+00	1.05E+05	0.00E+00	3.12E+01	1.13E+04	1.16E+05
5.20E-01	4.66E-01	1.20E+02	1.00E+00	1.50E+00	1.40E-23	2.70E-22	3.60E-22	3.01E-12	6.97E-02	4.89E-01	1.00E+00	3.71E-01	8.62E-07	1.00E+00	6.87E-01	0.00E+00	0.00E+00	1.11E+05	0.00E+00	3.29E+01	1.36E+04	1.25E+05
5.40E-01	4.46E-01	1.22E+02	1.00E+00	1.52E+00	1.94E-25	3.91E-24	7.43E-24	3.01E-12	9.39E-02	4.61E-01	1.00E+00	1.42E-01	4.08E-07	1.00E+00	8.00E-01	0.00E+00	0.00E+00	1.18E+05	0.00E+00	3.47E+01	1.60E+04	1.34E+05
5.60E-01	4.25E-01	1.23E+02	1.00E+00	1.54E+00	1.53E-27	3.25E-26	8.99E-26	3.01E-12	1.30E-01	4.32E-01	1.00E+00	5.17E-02	1.75E-07	1.00E+00	9.39E-01	0.00E+00	0.00E+00	1.26E+05	0.00E+00	3.65E+01	1.83E+04	1.44E+05
5.80E-01	4.05E-01	1.25E+02	1.00E+00	1.57E+00	6.20E-30	1.39E-28	5.75E-28	3.01E-12	1.84E-01	4.02E-01	1.00E+00	1.78E-02	6.68E-08	1.00E+00	1.00E+00	4.78E+00	0.00E+00	1.33E+05	0.00E+00	3.86E+01	2.07E+04	1.54E+05
6.00E-01	3.84E-01	1.27E+02	1.00E+00	1.60E+00	7.63E-06	9.13E-05	1.72E-30	3.01E-12	2.69E-01	3.71E-01	1.00E+00	5.78E-03	2.23E-08	1.00E+00	1.00E+00	1.24E+01	0.00E+00	1.42E+05	0.00E+00	4.08E+01	2.32E+04	1.65E+05
6.20E-01	3.64E-01	1.29E+02	1.00E+00	1.64E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	4.07E-01	3.38E-01	1.00E+00	1.78E-03	6.29E-09	1.00E+00	1.00E+00	2.00E+01	0.00E+00	1.51E+05	0.00E+00	4.32E+01	2.57E+04	1.77E+05
6.40E-01	3.43E-01	1.31E+02	1.00E+00	1.68E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	6.38E-01	3.04E-01	1.00E+00	5.19E-04	1.46E-09	1.00E+00	1.00E+00	2.75E+01	0.00E+00	1.61E+05	0.00E+00	4.59E+01	2.83E+04	1.90E+05
6.60E-01	3.22E-01	1.34E+02	1.00E+00	1.72E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	1.00E+00	2.70E-01	1.00E+00	1.28E-04	2.64E-10	1.00E+00	1.00E+00	3.51E+01	1.11E+02	1.73E+05	0.00E+00	4.89E+01	3.10E+04	2.04E+05
6.80E-01	3.01E-01	1.37E+02	1.00E+00	1.77E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	1.00E+00	2.36E-01	1.00E+00	6.97E-06	3.61E-11	1.00E+00	1.00E+00	4.30E+01	1.31E+03	1.86E+05	0.00E+00	5.23E+01	3.38E+04	2.21E+05
7.00E-01	2.80E-01	1.40E+02	1.00E+00	1.83E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	1.00E+00	2.02E-01	1.00E+00	3.19E-07	3.36E-12	1.00E+00	1.00E+00	5.10E+01	2.22E+03	2.00E+05	0.00E+00	5.63E+01	3.69E+04	2.40E+05
7.20E-01	2.60E-01	1.45E+02	1.00E+00	1.90E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	1.00E+00	1.68E-01	1.00E+00	1.24E-08	1.92E-13	1.00E+00	1.00E+00	5.95E+01	2.93E+03	2.17E+05	0.00E+00	6.08E+01	4.02E+04	2.60E+05
7.40E-01	2.39E-01	1.50E+02	1.00E+00	1.99E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	1.00E+00	1.36E-01	1.00E+00	4.22E-10	5.80E-15	1.00E+00	1.00E+00	6.85E+01	3.50E+03	2.37E+05	0.00E+00	6.61E+01	4.37E+04	2.84E+05
7.60E-01	2.19E-01	1.56E+02	1.00E+00	2.08E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	1.00E+00	1.06E-01	1.00E+00	1.28E-11	7.41E-17	1.00E+00	1.00E+00	7.82E+01	4.02E+03	2.59E+05	0.00E+00	7.22E+01	4.73E+04	3.11E+05
7.80E-01	2.00E-01	1.64E+02	1.00E+00	2.18E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	1.00E+00	7.84E-02	1.00E+00	3.57E-13	2.80E-19	1.00E+00	1.00E+00	8.88E+01	4.51E+03	2.85E+05	0.00E+00	7.91E+01	5.07E+04	3.40E+05
8.00E-01	1.82E-01	1.74E+02	1.00E+00	2.29E+00	7.63E-06	9.13E-05	1.34E-06	3.01E-12	1.00E+00	5.36E-02	1.00E+00	9.40E-15	1.64E-22	1.00E+00	1.00E+00	1.00E+02	5.00E+03	3.14E+05	0.00E+00	8.68E+01	5.29E+04	3.72E+05

Table A-6. OLI Stream Analyzer Evaporation Survey Results for 2018 Tank 43 Subsurface (90” from bottom) Sample HTF-43-18-83.

					Scaling Tendency										Solids Concentration (mg/L)						
Vapor Fraction (Vapor/Inflow [mol]) [mol/mol]	Volume - Liquid-1 [L] (Y2)	Temperature [°C] (Y2)	Pressure [atm] (Y2)	Density (g/cc)	Na8Al6Si6O24CO3.2H2O (Cancrinite) Scaling Tendency	Na8Al6Si6O24CO3.1H2O (Cancrinite monohydrate) Scaling Tendency	Na8Al6Si6O24(OH)2.2H2O (Hydroxycancrinite) Scaling Tendency	Na6Al6Si6O24.12H2O (hydrated zeolite A) Scaling Tendency	Na3PO4 - Sol Scaling Tendency	Na2CO3.1H2O (Thermonatrite) Scaling Tendency	Na2CO3 (Natrite) - Sol Scaling Tendency	Ca5(OH)(PO4)3 (Hydroxypatite) - Sol Scaling Tendency	Al(OH)3 (Gibbsite) - Scaling Tendency	2Na2SO4.Na2CO3 - Sol Scaling Tendency	NaFeO2 - Sol Scaling Tendency	NaFeO2 - Sol [mg/L]	Na3PO4 - Sol [mg/L]	Na2CO3 (Natrite) - Sol [mg/L]	Ca5(OH)(PO4)3 (Hydroxyapatite) - Sol [mg/L]	Ca(OH)2 (Portlandite) - Sol [mg/L]	2Na2SO4.Na2CO3 - Sol [mg/L]	Total Solids (mg/L)
0.00E+00	1.00E+00	1.08E+02	1.00E+00	1.25E+00	7.81E-06	9.35E-05	9.66E-07	4.15E-12	1.45E-03	4.69E-01	5.27E-01	1.00E+00	1.17E-03	2.72E-02	1.68E-01	0.00E+00	0.00E+00	0.00E+00	2.66E+01	0.00E+00	0.00E+00	2.66E+01
2.00E-02	9.82E-01	1.08E+02	1.00E+00	1.26E+00	4.04E-06	4.87E-05	5.33E-07	1.87E-12	1.57E-03	4.97E-01	5.64E-01	1.00E+00	1.03E-03	3.27E-02	1.78E-01	0.00E+00	0.00E+00	0.00E+00	2.71E+01	0.00E+00	0.00E+00	2.71E+01
4.00E-02	9.62E-01	1.08E+02	1.00E+00	1.26E+00	2.01E-06	2.45E-05	2.84E-07	8.13E-13	1.70E-03	5.26E-01	6.04E-01	1.00E+00	9.08E-04	3.95E-02	1.88E-01	0.00E+00	0.00E+00	0.00E+00	2.76E+01	0.00E+00	0.00E+00	2.76E+01
6.00E-02	9.42E-01	1.09E+02	1.00E+00	1.27E+00	9.64E-07	1.18E-05	1.46E-07	3.37E-13	1.85E-03	5.59E-01	6.48E-01	1.00E+00	7.92E-04	4.80E-02	2.00E-01	0.00E+00	0.00E+00	0.00E+00	2.81E+01	0.00E+00	0.00E+00	2.81E+01
8.00E-02	9.23E-01	1.09E+02	1.00E+00	1.27E+00	4.43E-07	5.49E-06	7.20E-08	1.33E-13	2.03E-03	5.94E-01	6.97E-01	1.00E+00	6.85E-04	5.87E-02	2.12E-01	0.00E+00	0.00E+00	0.00E+00	2.86E+01	0.00E+00	0.00E+00	2.86E+01
1.00E-01	9.03E-01	1.09E+02	1.00E+00	1.28E+00	1.94E-07	2.43E-06	3.41E-08	5.00E-14	2.22E-03	6.32E-01	7.50E-01	1.00E+00	5.88E-04	7.22E-02	2.26E-01	0.00E+00	0.00E+00	0.00E+00	2.91E+01	0.00E+00	0.00E+00	2.91E+01
1.20E-01	8.83E-01	1.09E+02	1.00E+00	1.29E+00	8.11E-08	1.03E-06	1.54E-08	1.78E-14	2.44E-03	6.73E-01	8.10E-01	1.00E+00	5.01E-04	8.94E-02	2.41E-01	0.00E+00	0.00E+00	0.00E+00	2.97E+01	0.00E+00	0.00E+00	2.97E+01
1.40E-01	8.64E-01	1.10E+02	1.00E+00	1.29E+00	3.21E-08	4.10E-07	6.62E-09	5.93E-15	2.70E-03	7.18E-01	8.77E-01	1.00E+00	4.22E-04	1.12E-01	2.58E-01	0.00E+00	0.00E+00	0.00E+00	3.03E+01	0.00E+00	0.00E+00	3.03E+01
1.60E-01	**8.44E-01**	**1.10E+02**	**1.00E+00**	**1.30E+00**	**1.20E-08**	**1.55E-07**	**2.69E-09**	**1.86E-15**	**2.99E-03**	**7.67E-01**	**9.51E-01**	**1.00E+00**	**3.52E-04**	**1.40E-01**	**2.76E-01**	**0.00E+00**	**0.00E+00**	**0.00E+00**	**3.09E+01**	**0.00E+00**	**0.00E+00**	**3.09E+01**
1.80E-01	**8.24E-01**	**1.10E+02**	**1.00E+00**	**1.31E+00**	**4.74E-09**	**6.21E-08**	**1.18E-09**	**6.38E-16**	**3.32E-03**	**7.96E-01**	**1.00E+00**	**1.00E+00**	**2.97E-04**	**1.69E-01**	**2.95E-01**	**0.00E+00**	**0.00E+00**	**2.24E+03**	**3.17E+01**	**0.00E+00**	**0.00E+00**	**2.27E+03**
2.00E-01	8.03E-01	1.10E+02	1.00E+00	1.31E+00	2.11E-09	2.79E-08	6.06E-10	2.64E-16	3.65E-03	7.87E-01	1.00E+00	1.00E+00	2.55E-04	1.89E-01	3.15E-01	0.00E+00	0.00E+00	7.97E+03	3.28E+01	0.00E+00	0.00E+00	8.01E+03
2.20E-01	7.81E-01	1.11E+02	1.00E+00	1.32E+00	8.74E-10	1.17E-08	2.90E-10	1.01E-16	4.04E-03	7.77E-01	1.00E+00	1.00E+00	2.17E-04	2.14E-01	3.37E-01	0.00E+00	0.00E+00	1.38E+04	3.39E+01	0.00E+00	0.00E+00	1.38E+04
2.40E-01	7.60E-01	1.11E+02	1.00E+00	1.32E+00	3.33E-10	4.49E-09	1.29E-10	3.51E-17	4.51E-03	7.67E-01	1.00E+00	1.00E+00	1.82E-04	2.43E-01	3.62E-01	0.00E+00	0.00E+00	1.96E+04	3.51E+01	0.00E+00	0.00E+00	1.96E+04
2.60E-01	7.39E-01	1.11E+02	1.00E+00	1.33E+00	1.16E-10	1.58E-09	5.30E-11	1.11E-17	5.05E-03	7.56E-01	1.00E+00	1.00E+00	1.50E-04	2.79E-01	3.90E-01	0.00E+00	0.00E+00	2.55E+04	3.63E+01	0.00E+00	0.00E+00	2.55E+04
2.80E-01	7.18E-01	1.12E+02	1.00E+00	1.34E+00	3.67E-11	5.06E-10	1.99E-11	3.17E-18	5.70E-03	7.44E-01	1.00E+00	1.00E+00	1.22E-04	3.23E-01	4.21E-01	0.00E+00	0.00E+00	3.14E+04	3.76E+01	0.00E+00	0.00E+00	3.14E+04
3.00E-01	6.97E-01	1.12E+02	1.00E+00	1.34E+00	1.04E-11	1.45E-10	6.74E-12	7.99E-19	6.49E-03	7.31E-01	1.00E+00	1.00E+00	9.75E-05	3.77E-01	4.57E-01	0.00E+00	0.00E+00	3.74E+04	3.90E+01	0.00E+00	0.00E+00	3.74E+04
3.20E-01	6.76E-01	1.12E+02	1.00E+00	1.35E+00	2.59E-12	3.68E-11	2.05E-12	1.77E-19	7.45E-03	7.17E-01	1.00E+00	1.00E+00	7.63E-05	4.45E-01	4.97E-01	0.00E+00	0.00E+00	4.34E+04	4.04E+01	0.00E+00	0.00E+00	4.34E+04
3.40E-01	6.56E-01	1.13E+02	1.00E+00	1.36E+00	5.66E-13	8.17E-12	5.49E-13	3.38E-20	8.62E-03	7.03E-01	1.00E+00	1.00E+00	5.83E-05	5.31E-01	5.44E-01	0.00E+00	0.00E+00	4.95E+04	4.20E+01	0.00E+00	0.00E+00	4.95E+04
3.60E-01	6.35E-01	1.13E+02	1.00E+00	1.37E+00	1.06E-13	1.56E-12	1.28E-13	5.48E-21	1.01E-02	6.87E-01	1.00E+00	1.00E+00	4.34E-05	6.42E-01	5.97E-01	0.00E+00	0.00E+00	5.56E+04	4.35E+01	0.00E+00	0.00E+00	5.56E+04
3.80E-01	6.14E-01	1.14E+02	1.00E+00	1.38E+00	1.68E-14	2.52E-13	2.56E-14	7.40E-22	1.19E-02	6.71E-01	1.00E+00	1.00E+00	3.14E-05	7.85E-01	6.58E-01	0.00E+00	0.00E+00	6.18E+04	4.52E+01	0.00E+00	0.00E+00	6.18E+04
4.00E-01	5.94E-01	1.14E+02	1.00E+00	1.39E+00	2.20E-15	3.37E-14	4.30E-15	8.14E-23	1.42E-02	6.53E-01	1.00E+00	1.00E+00	2.20E-05	9.75E-01	7.30E-01	0.00E+00	0.00E+00	6.80E+04	4.70E+01	0.00E+00	0.00E+00	6.81E+04
4.20E-01	5.73E-01	1.15E+02	1.00E+00	1.40E+00	2.47E-16	3.86E-15	6.24E-16	7.60E-24	1.71E-02	6.35E-01	1.00E+00	1.00E+00	1.50E-05	1.00E+00	8.12E-01	0.00E+00	0.00E+00	7.38E+04	4.89E+01	0.00E+00	1.93E+03	7.57E+04
4.40E-01	5.52E-01	1.16E+02	1.00E+00	1.42E+00	2.20E-17	3.54E-16	7.34E-17	5.55E-25	2.08E-02	6.15E-01	1.00E+00	1.00E+00	9.88E-06	1.00E+00	9.08E-01	0.00E+00	0.00E+00	7.95E+04	5.10E+01	0.00E+00	4.17E+03	8.38E+04
4.60E-01	5.31E-01	1.16E+02	1.00E+00	1.43E+00	1.50E-18	2.48E-17	6.71E-18	3.03E-26	2.56E-02	5.95E-01	1.00E+00	1.00E+00	6.19E-06	1.00E+00	1.00E+00	2.01E+00	0.00E+00	8.55E+04	5.31E+01	0.00E+00	6.46E+03	9.20E+04
4.80E-01	5.11E-01	1.17E+02	1.00E+00	1.45E+00	7.54E-20	1.28E-18	4.61E-19	1.19E-27	3.22E-02	5.72E-01	1.00E+00	1.00E+00	3.68E-06	1.00E+00	1.00E+00	1.31E+01	0.00E+00	9.16E+04	5.55E+01	0.00E+00	8.81E+03	1.00E+05
5.00E-01	4.90E-01	1.18E+02	1.00E+00	1.46E+00	2.66E-21	4.67E-20	2.27E-20	3.20E-29	4.11E-02	5.49E-01	1.00E+00	1.00E+00	2.06E-06	1.00E+00	1.00E+00	2.43E+01	0.00E+00	9.79E+04	5.80E+01	0.00E+00	1.12E+04	1.09E+05
5.20E-01	4.70E-01	1.19E+02	1.00E+00	1.48E+00	6.21E-23	1.13E-21	7.58E-22	1.57E-11	5.36E-02	5.24E-01	1.00E+00	1.00E+00	1.08E-06	1.00E+00	1.00E+00	3.56E+01	0.00E+00	1.04E+05	6.07E+01	0.00E+00	1.37E+04	1.18E+05
5.40E-01	4.49E-01	1.20E+02	1.00E+00	1.50E+00	9.02E-25	1.71E-23	1.61E-23	1.57E-11	7.16E-02	4.97E-01	1.00E+00	1.00E+00	5.18E-07	1.00E+00	1.00E+00	4.70E+01	0.00E+00	1.11E+05	6.37E+01	0.00E+00	1.61E+04	1.28E+05
5.60E-01	4.29E-01	1.21E+02	1.00E+00	1.53E+00	7.48E-27	1.49E-25	2.02E-25	1.57E-11	1.01E-01	4.69E-01	1.00E+00	8.77E-01	2.26E-07	1.00E+00	1.00E+00	5.86E+01	0.00E+00	1.19E+05	0.00E+00	4.94E+01	1.87E+04	1.37E+05
5.80E-01	4.08E-01	1.23E+02	1.00E+00	1.55E+00	3.21E-29	6.72E-28	1.34E-27	1.57E-11	1.43E-01	4.39E-01	1.00E+00	3.20E-01	8.84E-08	1.00E+00	1.00E+00	7.05E+01	0.00E+00	1.26E+05	0.00E+00	5.21E+01	2.13E+04	1.48E+05
6.00E-01	3.88E-01	1.24E+02	1.00E+00	1.58E+00	3.03E-05	1.39E-30	4.20E-30	1.57E-11	2.08E-01	4.08E-01	1.00E+00	1.10E-01	3.01E-08	1.00E+00	1.00E+00	8.26E+01	0.00E+00	1.35E+05	0.00E+00	5.51E+01	2.39E+04	1.59E+05
6.20E-01	3.68E-01	1.26E+02	1.00E+00	1.61E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	3.13E-01	3.75E-01	1.00E+00	3.58E-02	8.72E-09	1.00E+00	1.00E+00	9.51E+01	0.00E+00	1.44E+05	0.00E+00	5.84E+01	2.66E+04	1.70E+05
6.40E-01	3.47E-01	1.28E+02	1.00E+00	1.65E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	4.91E-01	3.41E-01	1.00E+00	1.10E-02	2.07E-09	1.00E+00	1.00E+00	1.08E+02	0.00E+00	1.53E+05	0.00E+00	6.20E+01	2.94E+04	1.83E+05
6.60E-01	3.27E-01	1.31E+02	1.00E+00	1.69E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	8.06E-01	3.06E-01	1.00E+00	3.17E-03	3.87E-10	1.00E+00	1.00E+00	1.22E+02	0.00E+00	1.64E+05	0.00E+00	6.60E+01	3.23E+04	1.97E+05
6.80E-01	3.06E-01	1.34E+02	1.00E+00	1.74E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	1.00E+00	2.70E-01	1.00E+00	3.28E-04	5.43E-11	1.00E+00	1.00E+00	1.36E+02	7.96E+02	1.76E+05	0.00E+00	7.05E+01	3.54E+04	2.13E+05
7.00E-01	2.85E-01	1.37E+02	1.00E+00	1.80E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	1.00E+00	2.34E-01	1.00E+00	1.44E-05	5.23E-12	1.00E+00	1.00E+00	1.52E+02	1.86E+03	1.90E+05	0.00E+00	7.57E+01	3.87E+04	2.31E+05
7.20E-01	2.64E-01	1.41E+02	1.00E+00	1.86E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	1.00E+00	1.98E-01	1.00E+00	5.10E-07	3.09E-13	1.00E+00	1.00E+00	1.69E+02	2.66E+03	2.06E+05	0.00E+00	8.17E+01	4.23E+04	2.51E+05
7.40E-01	2.44E-01	1.46E+02	1.00E+00	1.94E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	1.00E+00	1.62E-01	1.00E+00	1.46E-08	9.65E-15	1.00E+00	1.00E+00	1.88E+02	3.28E+03	2.24E+05	0.00E+00	8.86E+01	4.62E+04	2.74E+05
7.60E-01	2.23E-01	1.52E+02	1.00E+00	2.03E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	1.00E+00	1.28E-01	1.00E+00	3.46E-10	1.28E-16	1.00E+00	1.00E+00	2.09E+02	3.80E+03	2.45E+05	0.00E+00	9.68E+01	5.05E+04	3.00E+05
7.80E-01	2.04E-01	1.59E+02	1.00E+00	2.13E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	1.00E+00	9.63E-02	1.00E+00	6.96E-12	5.11E-19	1.00E+00	1.00E+00	2.33E+02	4.29E+03	2.70E+05	0.00E+00	1.06E+02	5.50E+04	3.30E+05
8.00E-01	1.85E-01	1.68E+02	1.00E+00	2.24E+00	3.03E-05	3.57E-04	3.65E-06	1.57E-11	1.00E+00	6.74E-02	1.00E+00	1.23E-13	3.41E-22	1.00E+00	1.00E+00	2.59E+02	4.78E+03	2.98E+05	0.00E+00	1.17E+02	5.91E+04	3.63E+05

Table A-7. OLI Stream Analyzer Evaporation Survey Results for 2018 Tank 38 Surface Sample HTF-38-18-78.

					Scaling Tendency									Solids Concentration (mg/L)			
Vapor Fraction (Vapor/Inflow [mol]) [mol/mol]	Volume - Liquid-1 [L] (Y2)	Temperature [°C] (Y2)	Pressure [atm] (Y2)	Density (g/cc)	Na8Al6Si6O24CO3.2H2O (Cancrinite) Scaling Tendency [ST]	Na8Al6Si6O24CO3.1H2O (Cancrinite monohydrate) Scaling Tendency [ST]	Na8Al6Si6O24(OH)2.2H2O (Hydroxycancrinite) Scaling Tendency [ST]	Na6Al6Si6O24.12H2O (hydrated zeolite A) Scaling Tendency [ST]	Na2CO3.1H2O (Thermonatrite) Scaling Tendency [ST]	Na2CO3 (Natrite) - Sol Scaling Tendency [ST]	Fe(OH)3 (Bernalite) - Scaling Tendency [ST]	Al(OH)3 (Gibbsite) - Scaling Tendency [ST]	2Na2SO4.Na2CO3 - Sol Scaling Tendency [ST]	Na8Al6Si6O24CO3.1H2O (Cancrinite monohydrate) [mg/L] (Y2)	Fe(OH)3 (Bernalite) - Sol [mg/L]	ZnO.Fe2O3 (Franklinite) - Sol [mg/L]	Total Solids (mg/L)
0.00E+00	1.00E+00	1.01E+02	1.00E+00	1.01E+00	1.10E-01	1.00E+00	2.21E-04	5.29E-05	7.13E-03	5.67E-03	1.00E+00	1.57E-02	7.31E-08	7.43E+02	4.18E+00	3.50E+00	7.51E+02
2.00E-02	9.80E-01	1.01E+02	1.00E+00	1.02E+00	1.10E-01	1.00E+00	2.27E-04	4.99E-05	7.48E-03	5.95E-03	1.00E+00	1.54E-02	8.36E-08	7.63E+02	4.27E+00	3.57E+00	7.71E+02
4.00E-02	9.60E-01	1.01E+02	1.00E+00	1.02E+00	1.10E-01	1.00E+00	2.33E-04	4.71E-05	7.85E-03	6.26E-03	1.00E+00	1.52E-02	9.58E-08	7.85E+02	4.37E+00	3.65E+00	7.93E+02
6.00E-02	9.40E-01	1.01E+02	1.00E+00	1.02E+00	1.10E-01	1.00E+00	2.39E-04	4.43E-05	8.25E-03	6.59E-03	1.00E+00	1.49E-02	1.10E-07	8.07E+02	4.47E+00	3.72E+00	8.15E+02
8.00E-02	9.20E-01	1.01E+02	1.00E+00	1.02E+00	1.10E-01	1.00E+00	2.45E-04	4.16E-05	8.69E-03	6.94E-03	1.00E+00	1.47E-02	1.27E-07	8.30E+02	4.57E+00	3.81E+00	8.38E+02
1.00E-01	9.00E-01	1.01E+02	1.00E+00	1.02E+00	1.09E-01	1.00E+00	2.52E-04	3.91E-05	9.15E-03	7.32E-03	1.00E+00	1.44E-02	1.47E-07	8.54E+02	4.68E+00	3.89E+00	8.62E+02
1.20E-01	8.80E-01	1.01E+02	1.00E+00	1.02E+00	1.09E-01	1.00E+00	2.60E-04	3.66E-05	9.66E-03	7.74E-03	1.00E+00	1.41E-02	1.71E-07	8.79E+02	4.80E+00	3.98E+00	8.88E+02
1.40E-01	8.59E-01	1.01E+02	1.00E+00	1.02E+00	1.09E-01	1.00E+00	2.67E-04	3.42E-05	1.02E-02	8.19E-03	1.00E+00	1.39E-02	1.99E-07	9.05E+02	4.92E+00	4.07E+00	9.14E+02
1.60E-01	8.39E-01	1.01E+02	1.00E+00	1.02E+00	1.09E-01	1.00E+00	2.75E-04	3.19E-05	1.08E-02	8.67E-03	1.00E+00	1.36E-02	2.33E-07	9.32E+02	5.04E+00	4.17E+00	9.42E+02
1.80E-01	8.19E-01	1.01E+02	1.00E+00	1.03E+00	1.09E-01	1.00E+00	2.84E-04	2.97E-05	1.14E-02	9.20E-03	1.00E+00	1.33E-02	2.73E-07	9.61E+02	5.17E+00	4.27E+00	9.71E+02
2.00E-01	7.99E-01	1.01E+02	1.00E+00	1.03E+00	1.09E-01	1.00E+00	2.93E-04	2.76E-05	1.21E-02	9.78E-03	1.00E+00	1.30E-02	3.22E-07	9.91E+02	5.31E+00	4.38E+00	1.00E+03
2.20E-01	7.79E-01	1.01E+02	1.00E+00	1.03E+00	1.09E-01	1.00E+00	3.03E-04	2.56E-05	1.29E-02	1.04E-02	1.00E+00	1.27E-02	3.82E-07	1.02E+03	5.45E+00	4.49E+00	1.03E+03
2.40E-01	7.59E-01	1.01E+02	1.00E+00	1.03E+00	1.08E-01	1.00E+00	3.13E-04	2.36E-05	1.37E-02	1.11E-02	1.00E+00	1.25E-02	4.54E-07	1.06E+03	5.61E+00	4.61E+00	1.07E+03
2.60E-01	7.39E-01	1.01E+02	1.00E+00	1.03E+00	1.08E-01	1.00E+00	3.24E-04	2.18E-05	1.46E-02	1.19E-02	1.00E+00	1.22E-02	5.43E-07	1.09E+03	5.76E+00	4.74E+00	1.10E+03
2.80E-01	7.19E-01	1.01E+02	1.00E+00	1.03E+00	1.08E-01	1.00E+00	3.36E-04	2.00E-05	1.56E-02	1.27E-02	1.00E+00	1.19E-02	6.52E-07	1.13E+03	5.93E+00	4.87E+00	1.14E+03
3.00E-01	6.99E-01	1.02E+02	1.00E+00	1.04E+00	1.08E-01	1.00E+00	3.49E-04	1.84E-05	1.67E-02	1.36E-02	1.00E+00	1.16E-02	7.87E-07	1.16E+03	6.11E+00	5.01E+00	1.18E+03
3.20E-01	6.79E-01	1.02E+02	1.00E+00	1.04E+00	1.08E-01	1.00E+00	3.62E-04	1.68E-05	1.79E-02	1.46E-02	1.00E+00	1.12E-02	9.57E-07	1.21E+03	6.29E+00	5.16E+00	1.22E+03
3.40E-01	6.59E-01	1.02E+02	1.00E+00	1.04E+00	1.07E-01	1.00E+00	3.77E-04	1.53E-05	1.93E-02	1.58E-02	1.00E+00	1.09E-02	1.17E-06	1.25E+03	6.48E+00	5.31E+00	1.26E+03
3.60E-01	6.39E-01	1.02E+02	1.00E+00	1.04E+00	1.07E-01	1.00E+00	3.92E-04	1.38E-05	2.08E-02	1.71E-02	1.00E+00	1.06E-02	1.44E-06	1.29E+03	6.69E+00	5.48E+00	1.31E+03
3.80E-01	6.19E-01	1.02E+02	1.00E+00	1.05E+00	1.07E-01	1.00E+00	4.09E-04	1.25E-05	2.24E-02	1.85E-02	1.00E+00	1.03E-02	1.78E-06	1.34E+03	6.90E+00	5.66E+00	1.35E+03
4.00E-01	5.99E-01	1.02E+02	1.00E+00	1.05E+00	1.07E-01	1.00E+00	4.28E-04	1.12E-05	2.43E-02	2.01E-02	1.00E+00	9.91E-03	2.22E-06	1.39E+03	7.13E+00	5.85E+00	1.40E+03
4.20E-01	5.79E-01	1.02E+02	1.00E+00	1.05E+00	1.06E-01	1.00E+00	4.48E-04	1.00E-05	2.64E-02	2.19E-02	1.00E+00	9.56E-03	2.80E-06	1.44E+03	7.37E+00	6.05E+00	1.46E+03
4.40E-01	5.59E-01	1.02E+02	1.00E+00	1.06E+00	1.06E-01	1.00E+00	4.70E-04	8.93E-06	2.88E-02	2.39E-02	1.00E+00	9.20E-03	3.55E-06	1.50E+03	7.62E+00	6.27E+00	1.51E+03
4.60E-01	5.39E-01	1.02E+02	1.00E+00	1.06E+00	1.06E-01	1.00E+00	4.94E-04	7.90E-06	3.14E-02	2.63E-02	1.00E+00	8.83E-03	4.55E-06	1.56E+03	7.89E+00	6.50E+00	1.58E+03
4.80E-01	5.19E-01	1.02E+02	1.00E+00	1.06E+00	1.05E-01	1.00E+00	5.21E-04	6.95E-06	3.45E-02	2.90E-02	1.00E+00	8.44E-03	5.89E-06	1.63E+03	8.17E+00	6.75E+00	1.64E+03
5.00E-01	4.99E-01	1.02E+02	1.00E+00	1.07E+00	1.05E-01	1.00E+00	5.50E-04	6.07E-06	3.80E-02	3.20E-02	1.00E+00	8.05E-03	7.70E-06	1.69E+03	8.47E+00	7.02E+00	1.71E+03
5.20E-01	4.79E-01	1.02E+02	1.00E+00	1.07E+00	1.05E-01	1.00E+00	5.83E-04	5.25E-06	4.20E-02	3.56E-02	1.00E+00	7.65E-03	1.02E-05	1.77E+03	8.78E+00	7.31E+00	1.78E+03
5.40E-01	4.59E-01	1.02E+02	1.00E+00	1.07E+00	1.04E-01	1.00E+00	6.20E-04	4.51E-06	4.67E-02	3.98E-02	1.00E+00	7.24E-03	1.37E-05	1.84E+03	9.10E+00	7.63E+00	1.86E+03
5.60E-01	4.39E-01	1.03E+02	1.00E+00	1.08E+00	1.04E-01	1.00E+00	6.62E-04	3.84E-06	5.22E-02	4.47E-02	1.00E+00	6.81E-03	1.86E-05	1.93E+03	9.44E+00	7.98E+00	1.94E+03
5.80E-01	4.19E-01	1.03E+02	1.00E+00	1.09E+00	1.03E-01	1.00E+00	7.10E-04	3.23E-06	5.86E-02	5.06E-02	1.00E+00	6.37E-03	2.57E-05	2.01E+03	9.79E+00	8.36E+00	2.03E+03
6.00E-01	3.99E-01	1.03E+02	1.00E+00	1.09E+00	1.02E-01	1.00E+00	7.64E-04	2.68E-06	6.62E-02	5.76E-02	1.00E+00	5.92E-03	3.62E-05	2.11E+03	1.02E+01	8.78E+00	2.13E+03
6.20E-01	3.79E-01	1.03E+02	1.00E+00	1.10E+00	1.02E-01	1.00E+00	8.28E-04	2.20E-06	7.54E-02	6.61E-02	1.00E+00	5.46E-03	5.20E-05	2.21E+03	1.05E+01	9.24E+00	2.23E+03
6.40E-01	3.59E-01	1.03E+02	1.00E+00	1.10E+00	1.01E-01	1.00E+00	9.02E-04	1.77E-06	8.64E-02	7.65E-02	1.00E+00	4.99E-03	7.63E-05	2.31E+03	1.09E+01	9.76E+00	2.33E+03
6.60E-01	3.39E-01	1.03E+02	1.00E+00	1.11E+00	1.00E-01	1.00E+00	9.90E-04	1.40E-06	9.99E-02	8.93E-02	1.00E+00	4.51E-03	1.15E-04	2.42E+03	1.12E+01	1.03E+01	2.44E+03
6.80E-01	3.19E-01	1.04E+02	1.00E+00	1.12E+00	9.92E-02	1.00E+00	1.10E-03	1.08E-06	1.17E-01	1.06E-01	1.00E+00	4.02E-03	1.78E-04	2.53E+03	1.15E+01	1.10E+01	2.55E+03
7.00E-01	2.99E-01	1.04E+02	1.00E+00	1.13E+00	9.81E-02	1.00E+00	1.23E-03	8.18E-07	1.38E-01	1.26E-01	1.00E+00	3.53E-03	2.86E-04	2.64E+03	1.17E+01	1.17E+01	2.66E+03
7.20E-01	2.79E-01	1.04E+02	1.00E+00	1.14E+00	9.68E-02	1.00E+00	1.39E-03	5.98E-07	1.64E-01	1.53E-01	1.00E+00	3.04E-03	4.78E-04	2.74E+03	1.18E+01	1.25E+01	2.77E+03
7.40E-01	2.60E-01	1.05E+02	1.00E+00	1.16E+00	9.54E-02	1.00E+00	1.59E-03	4.20E-07	1.99E-01	1.90E-01	1.00E+00	2.55E-03	8.39E-04	2.82E+03	1.17E+01	1.35E+01	2.85E+03
7.60E-01	2.40E-01	1.05E+02	1.00E+00	1.17E+00	9.37E-02	1.00E+00	1.86E-03	2.82E-07	2.46E-01	2.39E-01	1.00E+00	2.08E-03	1.56E-03	2.85E+03	1.11E+01	1.46E+01	2.88E+03
7.80E-01	2.20E-01	1.06E+02	1.00E+00	1.19E+00	9.17E-02	1.00E+00	2.23E-03	1.78E-07	3.09E-01	3.09E-01	1.00E+00	1.63E-03	3.10E-03	2.78E+03	9.87E+00	1.59E+01	2.80E+03
8.00E-01	2.00E-01	1.06E+02	1.00E+00	1.21E+00	8.92E-02	1.00E+00	2.74E-03	1.04E-07	3.98E-01	4.12E-01	1.00E+00	1.22E-03	6.73E-03	2.49E+03	7.38E+00	1.75E+01	2.51E+03

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