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EVALUATION OF A TURBIDITY METER FOR USE AT THE DEFENSE WASTE PROCESSING FACILITY

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EXECUTIVE SUMMARY

Savannah River Remediation's (SRR's) Defense Waste Processing Facility (DWPF) Laboratory currently tests for sludge carry-over into the Recycle Collection Tank (RCT) by evaluating the iron concentration in the Slurry Mix Evaporator Condensate Tank (SMECT) and relating this iron concentration to the amount of sludge solids present. A new method was proposed for detecting the amount of sludge in the SMECT that involves the use of an Optek turbidity sensor. Waste Services Laboratory (WSL) personnel conducted testing on two of these units following a test plan developed by Waste Solidification Engineering (WSE). Both Optek units (SN64217 and SN65164) use sensor model AF16-N and signal converter model series C4000. The sensor body of each unit was modified to hold a standard DWPF 12 cc sample vial, also known as a "peanut" vial. The purpose of this testing was to evaluate the use of this model of turbidity sensor, or meter, to provide a measurement of the sludge solids present in the SMECT based upon samples from that tank.

During discussions of the results from this study by WSE, WSL, and Savannah River National Laboratory (SRNL) personnel, an upper limit on the acceptable level of solids in SMECT samples was set at 0.14 wt%. A "go/no-go" decision criterion was to be developed for the critical turbidity response, which is expressed in concentration units (CUs), for each Optek unit based upon the 0.14 wt% solids value. An acceptable or a "go" decision for the SMECT should reflect the situation that there is an identified risk (e.g. 5%) for a CU response from the Optek unit to be less than the critical CU value when the solids content of the SMECT is actually 0.14 wt% or greater, while a "no-go" determination (i.e., an Optek CU response above the critical CU value, a conservative decision relative to risk) would lead to additional evaluations of the SMECT to better quantify the possible solids content of the tank.

A sludge simulant was used to develop standards for testing both Optek units and to determine the viability of a "go/no-go" CU response for each of the units. Statistical methods were used by SRNL to develop the critical CU value for the "go/no-go" decision for these standards for each Optek unit. Since only one sludge simulant was available for this testing, the sensitivity of these results to other simulants and to actual sludge material is not known. However, limited testing with samples from the actual DWPF process (both SRAT product samples and SMECT samples) demonstrated that the use of the "go/no-go" criteria developed from the sludge simulant testing was conservative for these samples taken from Sludge Batch 7b (SB7b), the sludge batch currently being processed.

While both of the Optek units performed very reliably during this testing, there were statistically significant differences (although small on a practical scale) between the two units. Thus, testing should be conducted on any new unit of this Optek model to qualify it before it is used to support the DWPF operation.

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LIST OF ABBREVIATIONS

CU	Concentration unit (unit of measure for turbidity meter)
DI	Deionized (as in DI water)
DWPF	Defense Waste Processing Facility
JMP	Pronounced "jump", commercial software
LTL	Lower tolerance limit
RCT	Recycle Collection Tank
SB7b	Sludge Batch 7b
SMECT	Slurry Mix Evaporator Condensate Tank
SRAT	Sludge Receipt and Adjustment Tank
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation, LLC
TTR	Technical Task Request
TTQAP	Task Technical and Quality Assurance Plan
WSE	Waste Solidification Engineering
WSL	Waste Services Laboratory

1.0 INTRODUCTION

Savannah River Remediation's (SRR's) Defense Waste Processing Facility (DWPF) Laboratory currently tests for sludge carry-over into the Recycle Collection Tank (RCT) by evaluating the iron concentration in the Slurry Mix Evaporator Condensate Tank (SMECT) and relating this iron concentration to the amount of sludge solids present. A new method was proposed for detecting the amount of sludge in the SMECT that involves the use of a turbidity sensor. SRR's Waste Solidification Engineering (WSE) developed a test plan [1] to evaluate the use of a turbidity sensor, or meter, to provide a measurement of the sludge solids present in the SMECT based upon samples from that tank.

The calibration of the performance of the sensor was to be based on the use of sludge simulants. Different concentrations of the sludge simulant had to be prepared for laboratory testing. WSE issued a Task Technical Request [2] for the Savannah River National Laboratory (SRNL) to provide support in the selection of the concentrations of the sludge simulant to be utilized for calibrating the turbidity sensor and in evaluating the outcome of the calibration process as well as in the development of the procedural steps to complete the calibration. SRNL issued a Task Technical and Quality Assurance Plan (TTQAP) [3] in response to the SRR request, and in accordance with this plan, SRNL supported SRR in the development of the turbidity meter test plan.

The type of turbidity meter that was tested was an Optek inline control unit with a sensor model AF16-N and a signal converter model series C4000. The directions for calibration and operation of this type of meter are provided in the instruction manual for the instrument (Optek Manual – 1004-1004-02 – C4121-US-2012-01-26). The sensor body of the unit was modified to hold a standard DWPF 12 cubic centimeter (cc) sample vial, also known as a "peanut" vial. Two of these units were tested during this study. In this study, the two units are designated as System 1 and System 2. The serial number of System 1 is SN64217, and the serial number of System 2 is SN65164. The measurements generated by this type of turbidity meter are expressed in concentration units (CUs), which range from 0 to 6 in value.

The study activities, outlined in the test plan [1], were conducted by SRR's Waste Services Laboratory (WSL) personnel, and statistical evaluations of the measurements generated by these activities were performed by SRNL personnel. The results from these analyses were reviewed by SRNL, WSE, and WSL personnel to facilitate a decision as to the acceptable performance of the turbidity meter and as to a recommendation for its use by the DWPF Laboratory to support the measurement of the amount of sludge in the SMECT.

The purpose of this report is to document the measurements generated from this study, the results from the statistical analyses of these measurements, and the conclusions made regarding the performance of the turbidity meters evaluated by this testing. JMP Version 9.0.0 was used to support this study [4].

2.0 DISCUSSION

The test plan [1] outlined several activities that were to be conducted to support this investigation into the use of a turbidity meter to support the evaluation of SMECT samples for sludge solids. In the following sections, the measurements generated by these activities are presented and evaluated.

2.1 **Measurements of Standards Prepared from Sludge Simulant**

As outlined in the test plan, WSL personnel prepared concentrations of a sludge simulant, 11-HG8-5869 (which was acquired from SRNL), targeting a range of weight percent (wt%) solids concentrations. These sludge simulant "standards" were then sub-sampled by WSL to prepare a set of peanut vials that were measured by the two turbidity meters (designated as System 1 and System 2) a number of times over a period of several days. The resulting CU data were provided to SRNL for statistical analysis. Table A1 in Appendix A provides the identifiers for these peanut vial samples. The identifier (ID) designates the targeted wt% solids value for the peanut vial, the bottle number (1, 2, or 3) from which the peanut sample was taken and the run number (1, 2, or 3) of the peanut vial from the bottle. The turbidity meter used to conduct the measurement, the date of the measurement, the ambient temperature at the time of the measurement, and the resulting measurement itself (reported in CUs) are also provided as part of the information in Table A1.

2.1.1 *Results from Deionized Water Standards*

Included in Table A1 are the turbidity measurements of the peanut vial samples prepared using deionized (DI) water. Testing protocol item #1 of the test plan [1] indicates that the results from these measurements are to be evaluated to provide insight into the repeatability of each of the turbidity meters and into the variation in the measurements due to differences in the peanut vials.

Exhibit A1 in Appendix A provides a plot of the CU data for these DI standards. The variation in the CU measurements is due to: differences in peanut vials, the position of the peanut vial (specifically, back, forward, left, or right), and day-to-day effects. It may also be noted that System 1 provides larger average CU for the standards than System 2. While the sources of these patterns in the CU data are discernible, the practical impact relative to the performance of these meters for the intended purpose under study appears to be limited. This is evident from the information in Table 1, which provides summary statistics including standard deviations for these measurements by meter including standard deviations.

Table 1. CU Data Summary Statistics for DI Standards

Meter	Standard Wt%	Number of Measurements	CU Average	CU Standard Deviation
System 1	0	72	0.125	0.0354
System 2	0	84	0.106	0.0341

2.1.2 *Relating CUs to wt% for a Sludge Simulant*

One of the primary goals outlined in the test plan was to investigate the relationship between the CU value indicated by the turbidity measurement and the wt% solids value of the standards created from a sludge simulant. The measurements provided in Table A1 allow for this investigation, and Figure 1 provides a plot of the CU versus wt% values for each turbidity unit.

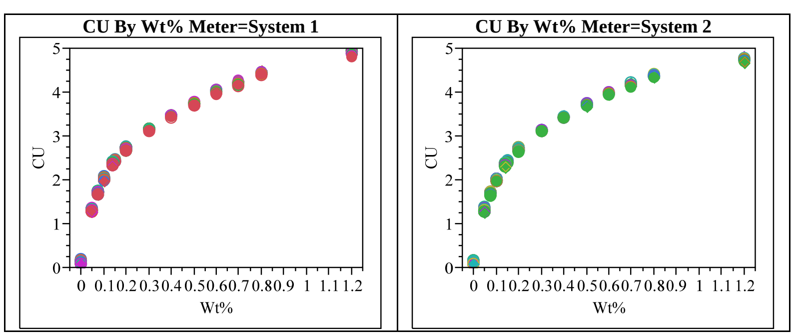


Figure 1. CU versus Simulant wt% by Turbidity Meter

The data of Figure 1 cover all of the measurements of Table A1, and the plots indicate very repeatable CU values for these sludge simulant standards for each of the two meters. However, there is value in taking a closer look at these data. Exhibit A2 in Appendix was prepared to help explore the CU values for each targeted wt% solids value in more detail. In this exhibit, there is a plot of CU measurements for each of the turbidity meters for each of the targeted wt% solids values. The measurements are grouped, as identified on the x-axis, by date and peanut vial ID. The ambient temperature for that date and the bottle and run numbers for the peanut vial are also indicated. A CU value is plotted for each of the four positions used in placing the peanut vial in the turbidity meter. The symbols used in these plots are: ○ – forward (FRWRD), ● – backward (BACK), ◊ – left (LEFT), and ♦ – right (RIGHT). For each of these plots, there are several mechanisms in play that contribute to the variation seen in the CU values for a given wt% solids target. Some of this variation is due to differences in the uniformity of construction among the peanut vials, (i.e., differences in the thickness of the glass walls on the four sides of each peanut vial and differences in the thickness of the glass walls between peanut vials). Given that the turbidity meter passes a beam of light through two opposing sides of a peanut vial during the measurement process, smaller differences are seen between the forward and backward pair and between the left and right pair than between other pairs of CU values for a given peanut vial. While in some instances there are day-to-day differences in the CU measurements of the same peanut vial, these differences do not appear to be temperature related.

2.1.3 *Developing a "Go/No-Go" Criterion*

The major objective of the test plan [1] directing this study is the evaluation of the effectiveness of this model of Optek turbidity meter to identify the presence of solids in a SMECT sample. During discussions of the results from this study by WSE, WSL, and SRNL personnel, an upper limit on the acceptable level of solids in such samples was set at 0.14 wt%.

The question is: Can the CU measurement of a SMECT sample by an Optek unit be used to reliably determine that the solids content of the SMECT sample is no greater than 0.14 wt%? The acceptable or "go" decision from this determination should be made at a high (e.g. 95%) confidence level, while a "no-go" determination would lead to additional evaluations of the SMECT to better understand the possible solids content of the tank.

Thus, the CU measurement of a SMECT sample is to be evaluated to determine:

1. a "go" decision (i.e., an acceptable level of solids in the SMECT sample)
   if the CU value is small enough to indicate a corresponding wt% value for the sample no greater than 0.14 with sufficient (e.g., 95%) confidence. or
2. a "no-go" decision (i.e., a possibly unacceptable level of solids in the SMECT sample)
   if the CU value was large enough so that the "go" decision could not be made with sufficient confidence.

The measurements of the sludge simulant standards of Table A1 were used to evaluate the effectiveness of this model of Optek turbidity meter in making the determination of the solids content of samples of this material. The approach was to develop a statistical model for the relationship between the wt% solids values of the samples and the corresponding CU values for each meter. Recall that these relationships are graphically indicated in Figure 1 and that the variation in the CU measurements for the peanut vials at a given wt% solids value was due to differences among peanut vials, differences in positioning the peanut vials in the instrument, and differences in day-to-day effects as discussed in the previous section.

The modeling approach was one based on how a "go/no-go" decision would be determined for each of the two Optek units on a given day utilizing only one measurement of each of the available peanut vial samples. The modeling approach was also focused on the relationship between the CU measurements and the corresponding wt% solids values for the interval of solids values between 0.05 wt% and 0.3 wt%. This approach was found to provide a linear model in relating the CU response to the natural logarithm of the wt% solids values. Thus, the form of the model was:

$$\text{CU value} = b_0 + b_1 \times \ln(\text{wt\% value}) \tag{1}$$

where b_0 is the term for the y-intercept, b_1 is the term for the slope, and ln(wt% value) is the natural logarithm of the wt% value of the standard peanut vial sample. Exhibit A3 provides the JMP results from fitting this linear model to the CU measurements by turbidity system, by date, by peanut vial position.

Some observations from Exhibit A3 are noteworthy. The results include a "Lack of Fit" evaluation for each of the linear models. A significant "Lack of Fit" for the model (at a 5% significance level) is indicated if the "Prob > F" value in the JMP results is 0.05 or smaller. Out of the 52 fitted models from these data, only 2 yielded a statistically significant lack of fit at the 5% significance level. In addition, the estimated intercepts (the estimations of the b_0 term of the model above) and estimated slopes (the b_1's above) of the fitted models are very similar. Also, the R^2 values for all of the fitted models are at 0.997 or above.

Thus, on any given day with only one CU measurement per peanut vial sample of the sludge simulant, there is a very reliable relationship between the wt% solids values and the CU response for both of the turbidity meters. For any given day, a statistical approach can be used to establish the "go/no-go" decision criterion as described above. This involves the determination of a lower tolerance limit (LTL) for the CU response corresponding to a wt% solids value of 0.14%, and it is based upon an approach described by Miller [5]. The resulting $100(1-\alpha)\%/100(1-\alpha_0)\%$ LTL[a] is for $100(1-\alpha_0)\%$ of the CU values for these standards of the sludge simulate at a confidence of $100(1-\alpha)\%$, and the equation for the LTL for the CUs for peanut vials with a measured wt% of w_i is given by:

$$\mathrm{LTL}_{\mathrm{CU}_i} = b + m \cdot \ln(w_i) - s\left\{\sqrt{pF_\alpha(p, n-p)}\sqrt{\underline{c}_0\left(\mathbf{X}^T\mathbf{X}\right)^{-1}\underline{c}_0{}^T} + z_{1-\alpha_0}\sqrt{\frac{n-p}{\chi^2_{\alpha/2,n-p}}}\right\} \tag{2}$$

where

- $\mathrm{LTL}_{\mathrm{CUi}}$ represents the lower tolerance interval (LTL) for the CU values of peanut vial samples with a wt% measurement of w_i,
- the values for the estimated slope (m) and intercept (b) of the fitted model for the given day and positioning choice for the peanut vial are from the results presented in Exhibit A3,
- s is the root mean square error (RMSE) for the given fitted model, whose value is also available from Exhibit A3,
- $F_\alpha(p,n-p)$ is the $100(1-\alpha)\%$ quantile of the F distribution, which depends on n (the number of data points used to fit this p-parameter (p=2) model), and the desired confidence level for bounding the estimated CU value when the wt% is w_i is represented by $100(1-\alpha)\%$,
- the inverse product-moment matrix is represented by $(\mathbf{X}^T\mathbf{X})^{-1}$ where the product moment matrix contains information describing the data for the independent variable (i.e., the natural

[a] The LTLs were determined using the approach provided on page 124 of Miller. The notation x%/y% LTL, such as 95%/95% LTL, will be used to represent these LTLs. The notation refers to the x% confidence tolerance limit with y% of the CU values being greater than the LTL. The approach is based on a normal probability distribution.

logarithms of the wt% values) used to generate the correlation equation (the wt% values of this matrix for the given linear model are given as part of the information of Table A1),

- $\underline{c}_0$ is the vector, [1 ln(w_i)], containing the natural logarithm of the wt% value, w_i,
- $z_{1-\alpha_0}$ represents the one-sided 100(1–α_0)% percentile point from the standard normal distribution representing the 1–α_0 fraction of the model predictions to be covered, and
- $\chi^2_{\alpha/2, n-p}$ represents the lower (i.e., 100(α/2)%) percentile point of the χ^2 distribution with (n–p) degrees of freedom, used to establish an upper bound for the variance of the CU values around the fitted line.

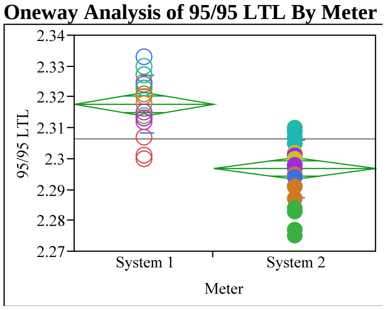
For a given fitted model (i.e., one of the models from Exhibit A3), when equation (2) is evaluated at 95%/95% for a wt% value of 0.14, the resulting LTL value provides a lower tolerance limit for 95% of the CU measurements that are likely to be generated by the given turbidity meter for samples of this sludge simulant with wt% values of 0.14 or greater, and this statement is true with 95% confidence. Thus, if a peanut vial sample of the sludge simulant at an unknown wt% solids concentration were to be measured by the selected turbidity meter and the resulting CU value fall below this LTL, then the conclusion is that the wt% solids value of the sample is no greater than 0.14%, which yields a "go" decision. A CU value at or above the LTL would lead to a "no-go" decision (i.e. the wt% solids content of the sample is not at or below the 0.14% value with sufficient confidence). Table 2 provides the LTL value for each of the fitted models of Exhibit A3.

Table 2. Lower Tolerance Limits (LTLs) for CU Values for Fitted Models

Turbidity System 1			Turbidity System 2	
Data Set	**95/95 LTL**		**Data Set**	**95/95 LTL**
14-Nov-Back	2.301		19-Nov-Back	2.275
14-Nov-Frwrd	2.307		19-Nov-Frwrd	2.277
14-Nov-Left	2.301		19-Nov-Left	2.283
14-Nov-Right	2.3		19-Nov-Right	2.284
19-Nov-Back	2.313		20-Nov-Back	2.294
19-Nov-Frwrd	2.321		20-Nov-Frwrd	2.291
19-Nov-Left	2.314		20-Nov-Left	2.294
19-Nov-Right	2.314		20-Nov-Right	2.294
20-Nov-Back	2.324		21-Nov-Back	2.287
20-Nov-Frwrd	2.333		21-Nov-Frwrd	2.291
20-Nov-Left	2.323		21-Nov-Left	2.301
20-Nov-Right	2.327		21-Nov-Right	2.295
21-Nov-Back	2.318		26-Nov-Back	2.3
21-Nov-Frwrd	2.325		26-Nov-Frwrd	2.3
21-Nov-Left	2.32		26-Nov-Left	2.31
21-Nov-Right	2.321		26-Nov-Right	2.309
26-Nov-Back	2.323		27-Nov-Back	2.301
26-Nov-Frwrd	2.33		27-Nov-Frwrd	2.297
26-Nov-Left	2.327		27-Nov-Left	2.297
26-Nov-Right	2.33		27-Nov-Right	2.298
5-Dec-Back	2.312		3-Dec-Back	2.305
5-Dec-Frwrd	2.315		3-Dec-Frwrd	2.305
5-Dec-Left	2.315		3-Dec-Left	2.302
5-Dec-Right	2.313		3-Dec-Right	2.3
			4-Dec-Back	2.307
			4-Dec-Frwrd	2.305
			4-Dec-Left	2.309
			4-Dec-Right	2.305

Figure 2 provides comparisons of these two sets of LTL values. The figure includes Levene's test for a difference in variation for the two sets of values. The p-value for this test is 0.8575, which indicates that the claim that the variances of the two sets are equal cannot be rejected at a 5% significance level. The figure also contains a statistical comparison of the means of the two sets of LTL values, which does indicate that the means for the two turbidity meters are different at a significant level of 5% (note the p-value indicated in Figure 2 by Prob > |t| is < 0.0001). Thus, even though the variation in these LTL values is comparable for the two meters, the difference between their mean LTL values (2.318 CU for System 1 and 2.297 CU for System 2) is statistically significant.

Oneway Analysis of 95/95 LTL By Meter



Oneway Anova

Summary of Fit

Rsquare	0.562792
Adj Rsquare	0.554047
Root Mean Square Error	0.009317
Mean of Response	2.306596
Observations (or Sum Wgts)	52

t Test

System 2-System 1

Assuming equal variances

Difference	-0.02079	t Ratio	-8.02259
Std Err Dif	0.00259	DF	50
Upper CL Dif	-0.01559	Prob > |t|	<.0001*
Lower CL Dif	-0.02600	Prob > t	1.0000
Confidence	0.95	Prob < t	<.0001*

Tests that the Variances are Equal

Level	**Count**	**Std Dev**	**MeanAbsDif to Mean**	**MeanAbsDif to Median**
System 1	24	0.0093016	0.0075590	0.0075417
System 2	28	0.0093294	0.0072857	0.0072143

Test	**F Ratio**	**DFNum**	**DFDen**	**p-Value**
O'Brien[.5]	0.0003	1	50	0.9873
Brown-Forsythe	0.0416	1	50	0.8392
Levene	0.0326	1	50	0.8575
Bartlett	0.0002	1	.	0.9883
F Test 2-sided	1.0060	27	23	0.9969

Figure 2. Comparison of LTL Values for the Two Turbidity Meters

Note than the % relative standard deviations in these sets of LTL are 100% × 0.0093016/2.318 = 0.4% for System 1 and 100% × 0.0093294/2.297 = 0.4% for System 2. Thus, there is little variation in the LTL results for a particular meter, but there is a statistically significant difference between the two meters.

Exhibit A4 provides the results of an additional investigation into these LTL values. This exhibit, which was generated using JMP [4], provides descriptive statistics as well as a test of the hypothesis of a normal distribution for each set of LTL values. The p-values for this test (indicated by the Prob<W values) are 0.3101 for System 1 and 0.0949 for System 2, and as a result the normal hypothesis for the LTL values cannot be rejected for either turbidity system. Using the normal distribution as a basis, JMP was used to determine a one-sided, lower tolerance interval for each set of LTL values. These values are provided in Exhibit A4, and they are 2.296 CU for turbidity System 1 and 2.276 CU for turbidity System 2. Thus, these are the critical values that would be used for these two turbidity meters to establish a "go/no-go" decision regarding a wt% solids value of 0.14 wt% in measuring peanut samples of the simulated sludge used in this study with the wt% solids of these samples being unknown.

The "go/no-go" decision criterion for the critical turbidity response for System 2 (the installed unit) based upon the 0.14 wt% solids value may be restated as follows. An acceptable or a "go" decision for the SMECT should reflect the situation that there is an identified risk (e.g. 5%) for a CU response from this Optek unit to be less than the critical CU value (2.276 CU) when the solids content of the

SMECT is actually 0.14 wt% or greater, while a “no-go” determination (i.e., an Optek CU response > 2.276 CU) a conservative decision relative to risk) would lead to additional evaluations of the SMECT to better understand the possible solids content of the tank.

2.1.4 *Effect of Time-Delays before Completing Turbidity Measurements*

While the CU measurements discussed so far in this report were completed without any delays between the time the peanut vial sample was shaken and well-mixed, the time the vial was placed in the turbidity meter, and the time a CU value determined, the test plan [1] requested that settling time effects be investigated as part of this study. Table 2 provides the results from this investigation.

Table 2. CU Measurements over Time

Time (sec)	0.05 Wt%	0.1 Wt%	0.15 Wt%	0.2 Wt%	0.4 Wt%	0.8 Wt%
10	1.32	2.01	2.47	2.76	3.48	4.47
20	1.33	2	2.46	2.75	3.47	4.45
30	1.32	2	2.46	2.75	3.46	4.44
40	1.32	1.99	2.45	2.74	3.45	4.42
50	1.32	1.99	2.45	2.74	3.44	4.38
60	1.32	1.99	2.44	2.73	3.43	4.33
70	1.32	1.99	2.44	2.73	3.42	4.25
80	1.32	1.98	2.44	2.73	3.41	4.14
90	1.32	1.98	2.44	2.73	3.4	4
100	1.31	1.98	2.43	2.72	3.39	3.84
110	1.31	1.98	2.43	2.72	3.38	3.66
120	1.31	1.98	2.43	2.72	3.37	3.48
130	1.31	1.98	2.43	2.72	3.35	3.28
140	1.31	1.97	2.42	2.72	3.34	3.11
150	1.31	1.97	2.42	2.71	3.32	2.94
160	1.31	1.97	2.42	2.71	3.3	2.82
170	1.31	1.97	2.42	2.71	3.29	2.73
180	1.31	1.97	2.42	2.71	3.26	2.65
190	1.31	1.97	2.41	2.7	3.23	2.59
200	1.31	1.96	2.41	2.7	3.2	2.52
210	1.31	1.96	2.41	2.69	3.16	2.46
220	1.31	1.96	2.41	2.69	3.13	2.36
230	1.3	1.96	2.41	2.69	3.09	2.31
240	1.3	1.96	2.4	2.69	3.06	2.26
250	1.3	1.96	2.4	2.69	3.03	2.23
260	1.3	1.96	2.4	2.68	3	2.21
270	1.3	1.95	2.4	2.68	2.97	2.17
280	1.3	1.95	2.4	2.68	2.93	2.15
290	1.3	1.95	2.39	2.68	2.89	2.11
300	1.3	1.95	2.39	2.67	2.86	2.07

Exhibit A5 in Appendix A provides a plot these CU responses over time for each of the standards of the simulated sludge used in this study. A review of these plots suggests that sample handling is an issue and that the procedures providing guidance for the completion of these measurements for SMECT samples must ensure that the sample is well-mixed as the peanut vial is introduced into the turbidity meter. Also, note that the results shown here are only for the simulated sludge used in this study and that samples of real sludge material may be more or less sensitive to these timing issues.

2.2 **Differences among Sludge Batches**

Another goal of the test plan [1] was to use a second sludge simulant as part of this study. However, a second simulant was not available, but two sets of standards were developed using a sample of the product material from the Sludge Receipt and Adjustment Tank (SRAT). Table 3 provides the CU measurements for each set of SRAT standards, which were made and measured using the installed turbidity meter (i.e., System 2) on two different days. Measurements of standards at the same wt% values for the sludge simulant are also provided in this table.

Table 3. CU Measurements for SRAT Standards

Day	Standard wt%	SRAT Sample (CU)	Simulant Sample (CU)
1	0.05	1.30	1.31
1	0.10	2.24	2.02
1	0.14	2.65	2.35
2	0.05	1.29	1.31
2	0.10	2.26	2.02
2	0.14	2.77	2.35

Note that while there is good repeatability in these results over both days, the CU measurements for the SRAT material are larger than the CU measurements for their simulant counterparts. Thus, these side-by-side comparisons suggest that any "go/no-go" criteria developed using the CU measurements for the sludge simulant standards may be conservative (i.e., lead to more "no-go" outcomes when the true wt% is actually less than 0.14 wt%) if applied to the CU measurements for the sludge represented by this SRAT product material.

2.3 Additional Side-by-Side Testing

The test plan guiding this study included a series of "side-by-side" testing that was to involve the measurement of standards developed from SRAT samples during the processing of the current sludge batch, Sludge Batch 7b (SB7b). While the results from Section 2.2 provide some feedback on such "side-by-side" (actual versus simulated sludge) comparisons of actual versus simulated sludge, additional "side-by-side" testing involving actual SMECT samples was conducted by WSL personnel as part of this study. The turbidity measurement results from this testing are provided in Table 4.

Table 4. CU Measurements of SMECT Samples

DATE	7-Dec-12	9-Dec-12	11-Dec-12	13-Dec-12	17-Dec-12	19-Dec-12	20-Dec-12	22-Dec-12	26-Dec-12	27-Dec-12
LIMS ID	200015581	200015590	200015601	200015614	200015655	200015662	200015686	200015697	200015716	200015721
Batch	4060	4061	4062	4063	4065	4066	4067	4067	4068	4069
Fe_MA corr 1 mg/L	381	188	<121	<119	<120	<121	<127	<123	<124	941
Fe_MA corr 2 mg/L	298	191	128	<118	<122	<114	<127	<115	<118	956
Average mg/L	339	190	<128	<119	<122	<121	<127	<123	<124	949
Turbidity CU										
rep 1	3.76	2.94	2.27	1.76	0.58	1.15	1.51	1.51	1.11	4.74
rep 2	3.78	2.92	2.28	------	0.63	1.08	1.54	1.54	1.11	3.78
Average CU	3.77	2.93	2.28	1.76	0.61	1.12	1.53	1.53	1.11	4.26
Standard Open [0.14wt%]	2.34	2.34	2.33	2.34	2.32	2.36	2.36	2.34	2.36	2.34
Standard Close [0.14wt%]	2.34	2.34	2.35	2.34	2.33	2.36	2.36	2.37	2.35	2.35

Two SMECT samples were measured using the installed meter on each of the days indicated in this table. Measurements of a 0.14 wt% standard prepared from the sludge simulant used for this study which were made at the beginning and the end of each measurement set are also provided in this table. These measurements were made using the installed turbidity meter, i.e., System 2. The laboratory information management system (LIMS) identifier (ID) and batch number for the results are also provided in the table along with the iron (Fe) elemental measurement from each mixed acid (MA) prepared SMECT sample. The Fe numbers are the critical points of comparison for this testing.

Recall that when the "go/no-go" decision yields a "no-go" outcome, additional testing in the form of Fe measurements is to be conducted for the SMECT samples. Using the 2.276 CU value developed above as the "go/no-go" decision point for System 2 (for the sludge simulant), the data shaded in green in Table 4 would have been "go" decisions while the data shaded in red would have been "no-go" situations, which would have required Fe measurements for the corresponding SMECT samples. Also note that for all of the "go" situations (i.e., those in green), the corresponding Fe measurements are below detection, which implies minimal sludge content (i.e., an acceptable amount of solids content) for these situations. A closer look at the Fe results from Table 4 indicates a sludge carry-over into the SMECT on 7-Dec with the sludge solids in the SMECT being diluted during subsequent processing until a second sludge carry-over on 27-Dec. Significantly, the System 2 turbidity measurements for these SMECT samples reliably mimic the pattern revealed by the Fe measurements, with the "go/no-go" decision point (i.e., the 2.276 CU value) conservatively protecting the operation from an incorrect "go" decision.

3.0 SUMMARY

The DWPF Laboratory currently tests for sludge carry-over into the RCT by evaluating the iron concentration in the SMECT and relating this iron concentration to the amount of sludge solids present. A new method was proposed for detecting the amount of sludge in the SMECT that involves the use of an Optek turbidity sensor. WSL personnel conducted testing on two of these units following a test plan developed by WSE. Both Optek units (SN64217 and SN65164) use sensor model AF16-N and signal converter model series C4000. The sensor body of each unit was modified to hold a standard DWPF 12 cc sample vial, also known as a "peanut" vial. The purpose of this testing was to evaluate the use of this model of turbidity sensor, or meter, to provide a measurement of the sludge solids present in the SMECT based upon samples from that tank.

During discussions of the results from this study by WSE, WSL, and SRNL personnel, an upper limit on the acceptable level of solids in SMECT samples was set at 0.14 wt%. A "go/no-go" decision criterion was developed for the critical turbidity response, which is expressed in concentrations units (CUs), for each Optek unit based upon the 0.14 wt% solids value. An acceptable or "go" decision for the SMECT should reflect the situation that there is an identified risk (e.g. 5%) for a CU response from the Optek unit less than the critical CU value when the solids content of the SMECT is actually 0.14 wt% or greater, while a "no-go" determination (i.e., an Optek CU response above the critical CU value, a conservative decision relative to risk) would lead to additional evaluations of the SMECT to better quantify the possible solids content of the tank.

A sludge simulant was used to develop standards for testing both Optek units and to determine the viability of a "go/no-go" CU response for each of the units. Statistical methods were used by SRNL to develop the critical CU value for the "go/no-go" decision for these standards for each Optek unit. Since only one sludge simulant was available for this testing, the sensitivity of these results to other simulants and to actual sludge material is not known. However, limited testing with samples from the actual DWPF process (both SRAT product samples and SMECT samples) demonstrated that the use of the "go/no-go" criteria developed from the sludge simulant testing was conservative for these samples taken from the sludge batch currently being processed, SB7b.

Also, while both of the two Optek units performed very reliably during this testing, there were statistically significant differences (although small on a practical scale) between the two units. Thus, testing should be conducted on any new unit of this Optek model to qualify its performance before it is used to support the DWPF operation.

4.0 REFERENCES

[1] Behrouzi, A.M., “Test Plan: Turbidity Meter Testing,” SRR-WSE-2012-00208, November 16, 2012.

[2] Behrouzi, A.M., “Technical Task Request: Inputs for Turbidity Meter Testing and Data Analysis,” HLW-DWPF-TTR-2013-0007, November 8, 2012.

[3] Edwards, T.B., “Task Technical and Quality Assurance Plan: Inputs for Turbidity Meter Testing and Data Analysis,” SRNL-RP-2012-00821, November 14, 2012.

[4] JMP® Version 9.0.0, SAS Institute Inc., Cary, NC, 2010.

[5] Miller, R.G., *Simultaneous Statistical Inference,* Second Edition, Springer-Verlag, New York, 1989.

APPENDIX A. SUPPLEMENTAL TABLES AND EXHIBITS

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 1	DI 1-1	0	1	1	14-Nov	73	0.09	0.09	0.1	0.1
System 1	DI 1-1	0	1	1	19-Nov	73	0.09	0.09	0.11	0.12
System 1	DI 1-1	0	1	1	20-Nov	63	0.09	0.1	0.11	0.12
System 1	DI 1-1	0	1	1	21-Nov	70	0.09	0.08	0.11	0.11
System 1	DI 1-1	0	1	1	26-Nov	70	0.08	0.08	0.11	0.12
System 1	DI 1-1	0	1	1	5-Dec	74	0.09	0.08	0.08	0.09
System 1	DI 1-2	0	1	2	14-Nov	73	0.14	0.17	0.16	0.16
System 1	DI 1-2	0	1	2	19-Nov	73	0.13	0.15	0.1	0.08
System 1	DI 1-2	0	1	2	20-Nov	63	0.12	0.15	0.1	0.08
System 1	DI 1-2	0	1	2	21-Nov	70	0.12	0.14	0.09	0.08
System 1	DI 1-2	0	1	2	26-Nov	70	0.12	0.13	0.09	0.08
System 1	DI 1-2	0	1	2	5-Dec	74	0.11	0.13	0.08	0.07
System 1	DI 1-3	0	1	3	14-Nov	73	0.13	0.17	0.16	0.17
System 1	DI 1-3	0	1	3	19-Nov	73	0.13	0.18	0.17	0.18
System 1	DI 1-3	0	1	3	20-Nov	63	0.14	0.19	0.16	0.18
System 1	DI 1-3	0	1	3	21-Nov	70	0.13	0.17	0.16	0.18
System 1	DI 1-3	0	1	3	26-Nov	70	0.13	0.18	0.17	0.18
System 1	DI 1-3	0	1	3	5-Dec	74	0.14	0.18	0.15	0.17
System 1	0.05 1-1	0.05	1	1	14-Nov	73	1.3	1.3	1.28	1.27
System 1	0.05 1-1	0.05	1	1	19-Nov	73	1.31	1.31	1.29	1.3
System 1	0.05 1-1	0.05	1	1	20-Nov	63	1.32	1.33	1.3	1.3
System 1	0.05 1-1	0.05	1	1	21-Nov	70	1.32	1.33	1.3	1.3
System 1	0.05 1-1	0.05	1	1	26-Nov	70	1.33	1.34	1.3	1.3
System 1	0.05 1-1	0.05	1	1	5-Dec	74	1.31	1.32	1.31	1.29
System 1	0.05 1-2	0.05	1	2	14-Nov	73	1.28	1.28	1.29	1.28
System 1	0.05 1-2	0.05	1	2	19-Nov	73	1.28	1.29	1.3	1.29
System 1	0.05 1-2	0.05	1	2	20-Nov	63	1.3	1.31	1.33	1.31
System 1	0.05 1-2	0.05	1	2	21-Nov	70	1.29	1.3	1.31	1.31
System 1	0.05 1-2	0.05	1	2	26-Nov	70	1.3	1.31	1.32	1.32
System 1	0.05 1-2	0.05	1	2	5-Dec	74	1.31	1.31	1.32	1.32
System 1	0.05 1-3	0.05	1	3	14-Nov	73	1.28	1.28	1.29	1.28
System 1	0.05 1-3	0.05	1	3	19-Nov	73	1.31	1.32	1.3	1.29
System 1	0.05 1-3	0.05	1	3	20-Nov	63	1.32	1.33	1.31	1.32
System 1	0.05 1-3	0.05	1	3	21-Nov	70	1.32	1.33	1.32	1.33
System 1	0.05 1-3	0.05	1	3	26-Nov	70	1.31	1.33	1.33	1.33
System 1	0.05 1-3	0.05	1	3	5-Dec	74	1.31	1.32	1.3	1.3
System 1	0.05 2-1	0.05	2	1	14-Nov	73	1.29	1.28	1.29	1.31
System 1	0.05 2-1	0.05	2	1	19-Nov	73	1.3	1.31	1.31	1.3
System 1	0.05 2-1	0.05	2	1	20-Nov	63	1.31	1.31	1.31	1.32
System 1	0.05 2-1	0.05	2	1	21-Nov	70	1.31	1.31	1.32	1.31
System 1	0.05 2-1	0.05	2	1	26-Nov	70	1.32	1.32	1.33	1.33
System 1	0.05 2-1	0.05	2	1	5-Dec	74	1.3	1.29	1.3	1.31
System 1	0.05 2-2	0.05	2	2	14-Nov	73	1.3	1.31	1.31	1.3
System 1	0.05 2-2	0.05	2	2	19-Nov	73	1.31	1.31	1.34	1.33
System 1	0.05 2-2	0.05	2	2	20-Nov	63	1.32	1.32	1.36	1.34
System 1	0.05 2-2	0.05	2	2	21-Nov	70	1.33	1.31	1.35	1.34
System 1	0.05 2-2	0.05	2	2	26-Nov	70	1.33	1.3	1.37	1.35
System 1	0.05 2-2	0.05	2	2	5-Dec	74	1.36	1.36	1.34	1.33
System 1	0.05 2-3	0.05	2	3	14-Nov	73	1.3	1.28	1.29	1.28
System 1	0.05 2-3	0.05	2	3	19-Nov	73	1.32	1.32	1.3	1.31
System 1	0.05 2-3	0.05	2	3	20-Nov	63	1.33	1.33	1.32	1.32
System 1	0.05 2-3	0.05	2	3	21-Nov	70	1.31	1.33	1.32	1.31
System 1	0.05 2-3	0.05	2	3	26-Nov	70	1.33	1.34	1.32	1.32
System 1	0.05 2-3	0.05	2	3	5-Dec	74	1.31	1.31	1.3	1.29
System 1	0.05 3-1	0.05	3	1	14-Nov	73	1.28	1.29	1.29	1.29
System 1	0.05 3-1	0.05	3	1	19-Nov	73	1.3	1.31	1.31	1.31
System 1	0.05 3-1	0.05	3	1	20-Nov	63	1.31	1.33	1.32	1.32
System 1	0.05 3-1	0.05	3	1	21-Nov	70	1.3	1.32	1.31	1.32
System 1	0.05 3-1	0.05	3	1	26-Nov	70	1.31	1.32	1.32	1.33
System 1	0.05 3-1	0.05	3	1	5-Dec	74	1.29	1.29	1.3	1.3
System 1	0.05 3-2	0.05	3	2	14-Nov	73	1.29	1.3	1.3	1.29
System 1	0.05 3-2	0.05	3	2	19-Nov	73	1.32	1.32	1.33	1.31
System 1	0.05 3-2	0.05	3	2	20-Nov	63	1.33	1.33	1.34	1.33
System 1	0.05 3-2	0.05	3	2	21-Nov	70	1.32	1.33	1.33	1.32
System 1	0.05 3-2	0.05	3	2	26-Nov	70	1.34	1.34	1.34	1.33
System 1	0.05 3-2	0.05	3	2	5-Dec	74	1.33	1.32	1.33	1.31
System 1	0.05 3-3	0.05	3	3	14-Nov	73	1.28	1.29	1.28	1.27

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 1	0.05 3-3	0.05	3	3	19-Nov	73	1.31	1.31	1.3	1.29
System 1	0.05 3-3	0.05	3	3	20-Nov	63	1.32	1.32	1.31	1.3
System 1	0.05 3-3	0.05	3	3	21-Nov	70	1.31	1.31	1.31	1.29
System 1	0.05 3-3	0.05	3	3	26-Nov	70	1.32	1.32	1.32	1.3
System 1	0.05 3-3	0.05	3	3	5-Dec	74	1.3	1.3	1.28	1.28
System 1	0.075 1-1	0.075	1	1	14-Nov	73	1.7	1.71	1.71	1.7
System 1	0.075 1-1	0.075	1	1	19-Nov	73	1.73	1.73	1.72	1.73
System 1	0.075 1-1	0.075	1	1	20-Nov	63	1.73	1.73	1.74	1.74
System 1	0.075 1-1	0.075	1	1	21-Nov	70	1.73	1.74	1.74	1.74
System 1	0.075 1-1	0.075	1	1	26-Nov	70	1.75	1.74	1.74	1.75
System 1	0.075 1-1	0.075	1	1	5-Dec	74	1.71	1.7	1.72	1.71
System 1	0.075 1-2	0.075	1	2	14-Nov	73	1.66	1.67	1.66	1.66
System 1	0.075 1-2	0.075	1	2	19-Nov	73	1.67	1.68	1.67	1.67
System 1	0.075 1-2	0.075	1	2	20-Nov	63	1.69	1.69	1.68	1.69
System 1	0.075 1-2	0.075	1	2	21-Nov	70	1.67	1.68	1.67	1.68
System 1	0.075 1-2	0.075	1	2	26-Nov	70	1.67	1.68	1.68	1.69
System 1	0.075 1-2	0.075	1	2	5-Dec	74	1.67	1.68	1.68	1.67
System 1	0.075 1-3	0.075	1	3	14-Nov	73	1.69	1.71	1.7	1.7
System 1	0.075 1-3	0.075	1	3	19-Nov	73	1.72	1.72	1.71	1.71
System 1	0.075 1-3	0.075	1	3	20-Nov	63	1.73	1.73	1.72	1.71
System 1	0.075 1-3	0.075	1	3	21-Nov	70	1.72	1.73	1.73	1.71
System 1	0.075 1-3	0.075	1	3	26-Nov	70	1.73	1.74	1.74	1.72
System 1	0.075 1-3	0.075	1	3	5-Dec	74	1.72	1.73	1.72	1.7
System 1	0.075 2-1	0.075	2	1	14-Nov	73	1.72	1.7	1.7	1.7
System 1	0.075 2-1	0.075	2	1	19-Nov	73	1.73	1.71	1.7	1.72
System 1	0.075 2-1	0.075	2	1	20-Nov	63	1.73	1.73	1.72	1.73
System 1	0.075 2-1	0.075	2	1	21-Nov	70	1.74	1.72	1.71	1.72
System 1	0.075 2-1	0.075	2	1	26-Nov	70	1.75	1.73	1.73	1.74
System 1	0.075 2-1	0.075	2	1	5-Dec	74	1.72	1.7	1.69	1.71
System 1	0.075 2-2	0.075	2	2	14-Nov	73	1.72	1.73	1.71	1.71
System 1	0.075 2-2	0.075	2	2	19-Nov	73	1.74	1.74	1.72	1.71
System 1	0.075 2-2	0.075	2	2	20-Nov	63	1.75	1.75	1.73	1.72
System 1	0.075 2-2	0.075	2	2	21-Nov	70	1.75	1.74	1.73	1.72
System 1	0.075 2-2	0.075	2	2	26-Nov	70	1.76	1.76	1.74	1.73
System 1	0.075 2-2	0.075	2	2	5-Dec	74	1.73	1.72	1.72	1.72
System 1	0.075 2-3	0.075	2	3	14-Nov	73	1.71	1.71	1.71	1.71
System 1	0.075 2-3	0.075	2	3	19-Nov	73	1.73	1.72	1.73	1.73
System 1	0.075 2-3	0.075	2	3	20-Nov	63	1.74	1.73	1.74	1.73
System 1	0.075 2-3	0.075	2	3	21-Nov	70	1.72	1.73	1.73	1.73
System 1	0.075 2-3	0.075	2	3	26-Nov	70	1.74	1.74	1.74	1.74
System 1	0.075 2-3	0.075	2	3	5-Dec	74	1.71	1.72	1.71	1.72
System 1	0.075 3-1	0.075	3	1	14-Nov	73	1.71	1.71	1.71	1.72
System 1	0.075 3-1	0.075	3	1	19-Nov	73	1.71	1.72	1.73	1.72
System 1	0.075 3-1	0.075	3	1	20-Nov	63	1.72	1.73	1.73	1.74
System 1	0.075 3-1	0.075	3	1	21-Nov	70	1.71	1.73	1.73	1.73
System 1	0.075 3-1	0.075	3	1	26-Nov	70	1.72	1.74	1.75	1.72
System 1	0.075 3-1	0.075	3	1	5-Dec	74	1.71	1.71	1.72	1.72
System 1	0.075 3-2	0.075	3	2	14-Nov	73	1.71	1.72	1.72	1.72
System 1	0.075 3-2	0.075	3	2	19-Nov	73	1.73	1.72	1.74	1.74
System 1	0.075 3-2	0.075	3	2	20-Nov	63	1.73	1.73	1.74	1.73
System 1	0.075 3-2	0.075	3	2	21-Nov	70	1.74	1.73	1.75	1.74
System 1	0.075 3-2	0.075	3	2	26-Nov	70	1.74	1.74	1.75	1.75
System 1	0.075 3-2	0.075	3	2	5-Dec	74	1.71	1.7	1.72	1.71
System 1	0.075 3-3	0.075	3	3	14-Nov	73	1.7	1.71	1.72	1.72
System 1	0.075 3-3	0.075	3	3	19-Nov	73	1.72	1.71	1.72	1.72
System 1	0.075 3-3	0.075	3	3	20-Nov	63	1.72	1.72	1.73	1.72
System 1	0.075 3-3	0.075	3	3	21-Nov	70	1.71	1.72	1.73	1.72
System 1	0.075 3-3	0.075	3	3	26-Nov	70	1.73	1.73	1.74	1.73
System 1	0.075 3-3	0.075	3	3	5-Dec	74	1.71	1.71	1.72	1.71
System 1	0.1 1-1	0.1	1	1	14-Nov	73	2.02	2.03	2.03	2
System 1	0.1 1-1	0.1	1	1	19-Nov	73	2.04	2.04	2.03	2.02
System 1	0.1 1-1	0.1	1	1	20-Nov	63	2.02	2.05	2.04	2.02
System 1	0.1 1-1	0.1	1	1	21-Nov	70	2.04	2.05	2.05	2.03
System 1	0.1 1-1	0.1	1	1	26-Nov	70	2.05	2.05	2.05	2.03
System 1	0.1 1-1	0.1	1	1	5-Dec	74	2.02	2.03	2.03	2.02
System 1	0.1 1-2	0.1	1	2	14-Nov	73	2.01	2.02	1.97	2
System 1	0.1 1-2	0.1	1	2	19-Nov	73	2.02	2.04	1.98	2.01
System 1	0.1 1-2	0.1	1	2	20-Nov	63	2.02	2.05	2	2.02
System 1	0.1 1-2	0.1	1	2	21-Nov	70	2.01	2.05	1.99	2.02
System 1	0.1 1-2	0.1	1	2	26-Nov	70	2.03	2.06	2.01	2.02
System 1	0.1 1-2	0.1	1	2	5-Dec	74	2.02	2.02	1.98	2

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 1	0.1 1-3	0.1	1	3	14-Nov	73	1.99	2	2.01	2.01
System 1	0.1 1-3	0.1	1	3	19-Nov	73	2	2	2	2.01
System 1	0.1 1-3	0.1	1	3	20-Nov	63	2	2	2.02	2.01
System 1	0.1 1-3	0.1	1	3	21-Nov	70	2.01	2.01	2.01	2
System 1	0.1 1-3	0.1	1	3	26-Nov	70	2.02	2.02	2.02	2.02
System 1	0.1 1-3	0.1	1	3	5-Dec	74	1.98	1.99	2.01	2
System 1	0.1 2-1	0.1	2	1	14-Nov	73	2	2.01	1.98	1.98
System 1	0.1 2-1	0.1	2	1	19-Nov	73	2.01	2.03	2	2
System 1	0.1 2-1	0.1	2	1	20-Nov	63	2.04	2.04	2.02	2.02
System 1	0.1 2-1	0.1	2	1	21-Nov	70	2.04	2.04	2.03	2.02
System 1	0.1 2-1	0.1	2	1	26-Nov	70	2.04	2.05	2.04	2.03
System 1	0.1 2-1	0.1	2	1	5-Dec	74	2.03	2.03	2.02	2.02
System 1	0.1 2-2	0.1	2	2	14-Nov	73	2.01	2.02	2.02	2.01
System 1	0.1 2-2	0.1	2	2	19-Nov	73	2.03	2.03	2.03	2.03
System 1	0.1 2-2	0.1	2	2	20-Nov	63	2.04	2.03	2.04	2.03
System 1	0.1 2-2	0.1	2	2	21-Nov	70	2.04	2.04	2.04	2.04
System 1	0.1 2-2	0.1	2	2	26-Nov	70	2.04	2.05	2.05	2.04
System 1	0.1 2-2	0.1	2	2	5-Dec	74	2.04	2.03	2.05	2.05
System 1	0.1 2-3	0.1	2	3	14-Nov	73	2.03	2.03	2.01	2.01
System 1	0.1 2-3	0.1	2	3	19-Nov	73	2.04	2.05	2.02	2.03
System 1	0.1 2-3	0.1	2	3	20-Nov	63	2.05	2.07	2.04	2.03
System 1	0.1 2-3	0.1	2	3	21-Nov	70	2.05	2.06	2.03	2.03
System 1	0.1 2-3	0.1	2	3	26-Nov	70	2.06	2.08	2.04	2.04
System 1	0.1 2-3	0.1	2	3	5-Dec	74	2.06	2.05	2.03	2.03
System 1	0.1 3-1	0.1	3	1	14-Nov	73	2	2	1.99	1.97
System 1	0.1 3-1	0.1	3	1	19-Nov	73	1.99	2.01	1.99	2
System 1	0.1 3-1	0.1	3	1	20-Nov	63	2	2.02	2.01	2.01
System 1	0.1 3-1	0.1	3	1	21-Nov	70	2.01	2.01	2	2
System 1	0.1 3-1	0.1	3	1	26-Nov	70	2.02	2.03	2.02	2.01
System 1	0.1 3-1	0.1	3	1	5-Dec	74	2.01	2	2	2.01
System 1	0.1 3-2	0.1	3	2	14-Nov	73	2	2.01	2.02	2.02
System 1	0.1 3-2	0.1	3	2	19-Nov	73	2.01	2.02	2.02	2.02
System 1	0.1 3-2	0.1	3	2	20-Nov	63	2.04	2.04	2.05	2.05
System 1	0.1 3-2	0.1	3	2	21-Nov	70	2.03	2.05	2.05	2.04
System 1	0.1 3-2	0.1	3	2	26-Nov	70	2.04	2.04	2.06	2.05
System 1	0.1 3-2	0.1	3	2	5-Dec	74	2.02	2.02	2.03	2.02
System 1	0.1 3-3	0.1	3	3	14-Nov	73	1.99	1.99	1.99	2
System 1	0.1 3-3	0.1	3	3	19-Nov	73	1.98	2	2	2.01
System 1	0.1 3-3	0.1	3	3	20-Nov	63	1.98	2.01	2.01	2.02
System 1	0.1 3-3	0.1	3	3	21-Nov	70	1.99	2	2.01	2
System 1	0.1 3-3	0.1	3	3	26-Nov	70	2	2.02	2.02	2.02
System 1	0.1 3-3	0.1	3	3	5-Dec	74	2	2.01	2.02	2.02
System 1	0.14 1-1	0.14	1	1	14-Nov	73	2.35	2.36	2.35	2.33
System 1	0.14 1-1	0.14	1	1	19-Nov	73	2.38	2.38	2.36	2.35
System 1	0.14 1-1	0.14	1	1	20-Nov	63	2.39	2.4	2.38	2.37
System 1	0.14 1-1	0.14	1	1	21-Nov	70	2.39	2.4	2.39	2.38
System 1	0.14 1-1	0.14	1	1	26-Nov	70	2.41	2.4	2.39	2.38
System 1	0.14 1-1	0.14	1	1	5-Dec	74	2.39	2.4	2.37	2.35
System 1	0.14 1-2	0.14	1	2	14-Nov	73	2.33	2.34	2.33	2.32
System 1	0.14 1-2	0.14	1	2	19-Nov	73	2.35	2.37	2.37	2.35
System 1	0.14 1-2	0.14	1	2	20-Nov	63	2.37	2.38	2.38	2.36
System 1	0.14 1-2	0.14	1	2	21-Nov	70	2.36	2.38	2.38	2.35
System 1	0.14 1-2	0.14	1	2	26-Nov	70	2.37	2.39	2.39	2.37
System 1	0.14 1-2	0.14	1	2	5-Dec	74	2.35	2.38	2.36	2.33
System 1	0.14 1-3	0.14	1	3	14-Nov	73	2.36	2.36	2.33	2.32
System 1	0.14 1-3	0.14	1	3	19-Nov	73	2.37	2.37	2.35	2.34
System 1	0.14 1-3	0.14	1	3	20-Nov	63	2.38	2.39	2.37	2.34
System 1	0.14 1-3	0.14	1	3	21-Nov	70	2.38	2.4	2.36	2.34
System 1	0.14 1-3	0.14	1	3	26-Nov	70	2.39	2.41	2.39	2.36
System 1	0.14 1-3	0.14	1	3	5-Dec	74	2.37	2.37	2.34	2.33
System 1	0.14 2-1	0.14	2	1	14-Nov	73	2.32	2.34	2.34	2.34
System 1	0.14 2-1	0.14	2	1	19-Nov	73	2.35	2.36	2.36	2.36
System 1	0.14 2-1	0.14	2	1	20-Nov	63	2.36	2.38	2.38	2.37
System 1	0.14 2-1	0.14	2	1	21-Nov	70	2.36	2.37	2.38	2.37
System 1	0.14 2-1	0.14	2	1	26-Nov	70	2.37	2.38	2.37	2.38
System 1	0.14 2-1	0.14	2	1	5-Dec	74	2.35	2.35	2.35	2.35
System 1	0.14 2-2	0.14	2	2	14-Nov	73	2.32	2.33	2.32	2.31
System 1	0.14 2-2	0.14	2	2	19-Nov	73	2.33	2.35	2.34	2.32
System 1	0.14 2-2	0.14	2	2	20-Nov	63	2.35	2.36	2.35	2.34
System 1	0.14 2-2	0.14	2	2	21-Nov	70	2.34	2.35	2.34	2.34
System 1	0.14 2-2	0.14	2	2	26-Nov	70	2.35	2.36	2.35	2.34

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 1	0.14 2-2	0.14	2	2	5-Dec	74	2.35	2.34	2.34	2.32
System 1	0.14 2-3	0.14	2	3	14-Nov	73	2.36	2.37	2.35	2.35
System 1	0.14 2-3	0.14	2	3	19-Nov	73	2.39	2.4	2.38	2.38
System 1	0.14 2-3	0.14	2	3	20-Nov	63	2.39	2.39	2.41	2.38
System 1	0.14 2-3	0.14	2	3	21-Nov	70	2.38	2.39	2.4	2.4
System 1	0.14 2-3	0.14	2	3	26-Nov	70	2.39	2.41	2.4	2.41
System 1	0.14 2-3	0.14	2	3	5-Dec	74	2.37	2.39	2.36	2.38
System 1	0.14 3-1	0.14	3	1	14-Nov	73	2.33	2.35	2.37	2.37
System 1	0.14 3-1	0.14	3	1	19-Nov	73	2.36	2.37	2.39	2.39
System 1	0.14 3-1	0.14	3	1	20-Nov	63	2.37	2.38	2.4	2.4
System 1	0.14 3-1	0.14	3	1	21-Nov	70	2.38	2.4	2.39	2.38
System 1	0.14 3-1	0.14	3	1	26-Nov	70	2.38	2.39	2.41	2.4
System 1	0.14 3-1	0.14	3	1	5-Dec	74	2.35	2.37	2.38	2.38
System 1	0.14 3-2	0.14	3	2	14-Nov	73	2.36	2.37	2.36	2.36
System 1	0.14 3-2	0.14	3	2	19-Nov	73	2.38	2.39	2.39	2.38
System 1	0.14 3-2	0.14	3	2	20-Nov	63	2.4	2.41	2.41	2.4
System 1	0.14 3-2	0.14	3	2	21-Nov	70	2.38	2.39	2.39	2.39
System 1	0.14 3-2	0.14	3	2	26-Nov	70	2.4	2.41	2.4	2.39
System 1	0.14 3-2	0.14	3	2	5-Dec	74	2.39	2.39	2.38	2.38
System 1	0.14 3-3	0.14	3	3	14-Nov	73	2.36	2.36	2.36	2.35
System 1	0.14 3-3	0.14	3	3	19-Nov	73	2.38	2.38	2.38	2.37
System 1	0.14 3-3	0.14	3	3	20-Nov	63	2.39	2.39	2.39	2.39
System 1	0.14 3-3	0.14	3	3	21-Nov	70	2.39	2.4	2.39	2.38
System 1	0.14 3-3	0.14	3	3	26-Nov	70	2.39	2.4	2.4	2.39
System 1	0.14 3-3	0.14	3	3	5-Dec	74	2.37	2.39	2.38	2.38
System 1	0.15	0.15	1	1	14-Nov	73	2.43	2.42	2.43	2.43
System 1	0.15	0.15	1	1	19-Nov	73	2.45	2.43	2.43	2.45
System 1	0.15	0.15	1	1	20-Nov	63	2.46	2.45	2.45	2.46
System 1	0.15	0.15	1	1	21-Nov	70	2.46	2.45	2.44	2.46
System 1	0.15	0.15	1	1	26-Nov	70	2.47	2.47	2.45	2.46
System 1	0.15	0.15	1	1	5-Dec	74	2.46	2.43	2.45	2.46
System 1	0.2 1-1	0.2	1	1	14-Nov	73	2.7	2.7	2.71	2.71
System 1	0.2 1-1	0.2	1	1	19-Nov	73	2.71	2.72	2.73	2.73
System 1	0.2 1-1	0.2	1	1	20-Nov	63	2.72	2.73	2.74	2.74
System 1	0.2 1-1	0.2	1	1	21-Nov	70	2.71	2.72	2.74	2.73
System 1	0.2 1-1	0.2	1	1	26-Nov	70	2.71	2.73	2.75	2.72
System 1	0.2 1-1	0.2	1	1	5-Dec	74	2.72	2.72	2.73	2.73
System 1	0.2 1-2	0.2	1	2	14-Nov	73	2.69	2.69	2.69	2.69
System 1	0.2 1-2	0.2	1	2	19-Nov	73	2.7	2.71	2.71	2.7
System 1	0.2 1-2	0.2	1	2	20-Nov	63	2.71	2.72	2.7	2.71
System 1	0.2 1-2	0.2	1	2	21-Nov	70	2.71	2.72	2.71	2.71
System 1	0.2 1-2	0.2	1	2	26-Nov	70	2.72	2.72	2.71	2.72
System 1	0.2 1-2	0.2	1	2	5-Dec	74	2.71	2.7	2.7	2.7
System 1	0.2 1-3	0.2	1	3	14-Nov	73	2.72	2.72	2.69	2.69
System 1	0.2 1-3	0.2	1	3	19-Nov	73	2.74	2.71	2.71	2.71
System 1	0.2 1-3	0.2	1	3	20-Nov	63	2.75	2.75	2.72	2.72
System 1	0.2 1-3	0.2	1	3	21-Nov	70	2.75	2.75	2.72	2.72
System 1	0.2 1-3	0.2	1	3	26-Nov	70	2.77	2.76	2.73	2.73
System 1	0.2 1-3	0.2	1	3	5-Dec	74	2.75	2.75	2.72	2.73
System 1	0.2 2-1	0.2	2	1	14-Nov	73	2.69	2.7	2.71	2.71
System 1	0.2 2-1	0.2	2	1	19-Nov	73	2.73	2.73	2.73	2.73
System 1	0.2 2-1	0.2	2	1	20-Nov	63	2.74	2.74	2.74	2.73
System 1	0.2 2-1	0.2	2	1	21-Nov	70	2.74	2.73	2.74	2.74
System 1	0.2 2-1	0.2	2	1	26-Nov	70	2.75	2.74	2.76	2.75
System 1	0.2 2-1	0.2	2	1	5-Dec	74	2.73	2.74	2.75	2.74
System 1	0.2 2-2	0.2	2	2	14-Nov	73	2.71	2.71	2.69	2.69
System 1	0.2 2-2	0.2	2	2	19-Nov	73	2.74	2.74	2.72	2.72
System 1	0.2 2-2	0.2	2	2	20-Nov	63	2.75	2.75	2.73	2.73
System 1	0.2 2-2	0.2	2	2	21-Nov	70	2.75	2.76	2.73	2.73
System 1	0.2 2-2	0.2	2	2	26-Nov	70	2.76	2.76	2.74	2.75
System 1	0.2 2-2	0.2	2	2	5-Dec	74	2.76	2.76	2.75	2.75
System 1	0.2 2-3	0.2	2	3	14-Nov	73	2.7	2.7	2.72	2.72
System 1	0.2 2-3	0.2	2	3	19-Nov	73	2.73	2.73	2.75	2.75
System 1	0.2 2-3	0.2	2	3	20-Nov	63	2.73	2.74	2.76	2.76
System 1	0.2 2-3	0.2	2	3	21-Nov	70	2.73	2.74	2.76	2.75
System 1	0.2 2-3	0.2	2	3	26-Nov	70	2.73	2.74	2.76	2.76
System 1	0.2 2-3	0.2	2	3	5-Dec	74	2.74	2.74	2.77	2.76
System 1	0.2 3-1	0.2	3	1	14-Nov	73	2.69	2.7	2.7	2.71
System 1	0.2 3-1	0.2	3	1	19-Nov	73	2.73	2.73	2.74	2.74
System 1	0.2 3-1	0.2	3	1	20-Nov	63	2.74	2.74	2.75	2.74
System 1	0.2 3-1	0.2	3	1	21-Nov	70	2.74	2.75	2.75	2.75

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 1	0.2 3-1	0.2	3	1	26-Nov	70	2.75	2.76	2.76	2.76
System 1	0.2 3-1	0.2	3	1	5-Dec	74	2.71	2.75	2.76	2.76
System 1	0.2 3-2	0.2	3	2	14-Nov	73	2.69	2.7	2.68	2.69
System 1	0.2 3-2	0.2	3	2	19-Nov	73	2.71	2.72	2.7	2.7
System 1	0.2 3-2	0.2	3	2	20-Nov	63	2.72	2.74	2.71	2.72
System 1	0.2 3-2	0.2	3	2	21-Nov	70	2.71	2.73	2.71	2.71
System 1	0.2 3-2	0.2	3	2	26-Nov	70	2.73	2.74	2.72	2.73
System 1	0.2 3-2	0.2	3	2	5-Dec	74	2.72	2.73	2.7	2.71
System 1	0.2 3-3	0.2	3	3	14-Nov	73	2.67	2.67	2.68	2.69
System 1	0.2 3-3	0.2	3	3	19-Nov	73	2.68	2.68	2.7	2.69
System 1	0.2 3-3	0.2	3	3	20-Nov	63	2.69	2.69	2.71	2.71
System 1	0.2 3-3	0.2	3	3	21-Nov	70	2.68	2.68	2.7	2.7
System 1	0.2 3-3	0.2	3	3	26-Nov	70	2.68	2.68	2.69	2.7
System 1	0.2 3-3	0.2	3	3	5-Dec	74	2.69	2.69	2.71	2.71
System 1	0.3	0.3	1	1	14-Nov	73	3.12	3.12	3.13	3.13
System 1	0.3	0.3	1	1	19-Nov	73	3.14	3.16	3.16	3.16
System 1	0.3	0.3	1	1	20-Nov	63	3.16	3.17	3.18	3.17
System 1	0.3	0.3	1	1	21-Nov	70	3.17	3.17	3.18	3.17
System 1	0.3	0.3	1	1	26-Nov	70	3.16	3.18	3.19	3.18
System 1	0.3	0.3	1	1	5-Dec	74	3.17	3.18	3.18	3.18
System 1	0.4	0.4	1	1	14-Nov	73	3.44	3.43	3.46	3.46
System 1	0.4	0.4	1	1	19-Nov	73	3.45	3.46	3.49	3.48
System 1	0.4	0.4	1	1	20-Nov	63	3.46	3.47	3.5	3.49
System 1	0.4	0.4	1	1	21-Nov	70	3.46	3.46	3.49	3.49
System 1	0.4	0.4	1	1	26-Nov	70	3.46	3.46	3.5	3.49
System 1	0.4	0.4	1	1	5-Dec	74	3.47	3.46	3.49	3.49
System 1	0.5	0.5	1	1	14-Nov	73	3.7	3.69	3.69	3.7
System 1	0.5	0.5	1	1	19-Nov	73	3.74	3.73	3.73	3.74
System 1	0.5	0.5	1	1	20-Nov	63	3.76	3.75	3.75	3.76
System 1	0.5	0.5	1	1	21-Nov	70	3.75	3.74	3.75	3.75
System 1	0.5	0.5	1	1	26-Nov	70	3.76	3.75	3.76	3.77
System 1	0.5	0.5	1	1	5-Dec	74	3.78	3.77	3.76	3.77
System 1	0.6	0.6	1	1	14-Nov	73	3.95	3.96	3.96	3.96
System 1	0.6	0.6	1	1	19-Nov	73	3.99	4	3.99	4
System 1	0.6	0.6	1	1	20-Nov	63	4.03	4.03	4.02	4.02
System 1	0.6	0.6	1	1	21-Nov	70	4.02	4.04	4.02	4.01
System 1	0.6	0.6	1	1	26-Nov	70	4.03	4.05	4.03	4.03
System 1	0.6	0.6	1	1	5-Dec	74	4.04	4.05	4.03	4.04
System 1	0.7	0.7	1	1	14-Nov	73	4.18	4.13	4.17	4.18
System 1	0.7	0.7	1	1	19-Nov	73	4.23	4.17	4.22	4.23
System 1	0.7	0.7	1	1	20-Nov	63	4.25	4.2	4.24	4.25
System 1	0.7	0.7	1	1	21-Nov	70	4.24	4.2	4.24	4.25
System 1	0.7	0.7	1	1	26-Nov	70	4.26	4.22	4.25	4.26
System 1	0.7	0.7	1	1	5-Dec	74	4.27	4.22	4.26	4.26
System 1	0.8	0.8	1	1	14-Nov	73	4.41	4.4	4.43	4.42
System 1	0.8	0.8	1	1	19-Nov	73	4.44	4.43	4.48	4.44
System 1	0.8	0.8	1	1	20-Nov	63	4.46	4.45	4.48	4.45
System 1	0.8	0.8	1	1	21-Nov	70	4.47	4.43	4.49	4.45
System 1	0.8	0.8	1	1	26-Nov	70	4.48	4.45	4.5	4.46
System 1	0.8	0.8	1	1	5-Dec	74	4.46	4.44	4.48	4.44
System 1	1.2	1.2	1	1	14-Nov	73	4.8	4.89	4.85	4.87
System 1	1.2	1.2	1	1	19-Nov	73	4.85	4.94	4.88	4.91
System 1	1.2	1.2	1	1	20-Nov	63	4.86	4.95	4.94	4.92
System 1	1.2	1.2	1	1	21-Nov	70	4.87	4.95	4.92	4.93
System 1	1.2	1.2	1	1	26-Nov	70	4.87	4.97	4.94	4.96
System 1	1.2	1.2	1	1	5-Dec	74	4.82	4.89	4.86	4.83
System 2	DI 1-1	0	1	1	19-Nov	73	0.09	0.09	0.07	0.07
System 2	DI 1-1	0	1	1	20-Nov	63	0.09	0.09	0.07	0.07
System 2	DI 1-1	0	1	1	21-Nov	70	0.09	0.09	0.07	0.07
System 2	DI 1-1	0	1	1	26-Nov	70	0.09	0.09	0.07	0.07
System 2	DI 1-1	0	1	1	27-Nov	73	0.09	0.09	0.07	0.07
System 2	DI 1-1	0	1	1	3-Dec	73	0.1	0.08	0.07	0.07
System 2	DI 1-1	0	1	1	4-Dec	70	0.1	0.1	0.07	0.07
System 2	DI 1-2	0	1	2	19-Nov	73	0.11	0.12	0.09	0.08
System 2	DI 1-2	0	1	2	20-Nov	63	0.12	0.12	0.09	0.08
System 2	DI 1-2	0	1	2	21-Nov	70	0.13	0.12	0.08	0.08
System 2	DI 1-2	0	1	2	26-Nov	70	0.12	0.12	0.08	0.08
System 2	DI 1-2	0	1	2	27-Nov	73	0.13	0.12	0.08	0.08
System 2	DI 1-2	0	1	2	3-Dec	73	0.13	0.12	0.08	0.08
System 2	DI 1-2	0	1	2	4-Dec	70	0.13	0.13	0.08	0.08
System 2	DI 1-3	0	1	3	19-Nov	73	0.17	0.16	0.1	0.08

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 2	DI 1-3	0	1	3	20-Nov	63	0.17	0.17	0.09	0.08
System 2	DI 1-3	0	1	3	21-Nov	70	0.17	0.16	0.1	0.09
System 2	DI 1-3	0	1	3	26-Nov	70	0.17	0.16	0.1	0.09
System 2	DI 1-3	0	1	3	27-Nov	73	0.18	0.18	0.11	0.1
System 2	DI 1-3	0	1	3	3-Dec	73	0.18	0.17	0.11	0.1
System 2	DI 1-3	0	1	3	4-Dec	70	0.18	0.17	0.11	0.1
System 2	0.05 1-1	0.05	1	1	19-Nov	73	1.29	1.29	1.27	1.27
System 2	0.05 1-1	0.05	1	1	20-Nov	63	1.29	1.29	1.28	1.29
System 2	0.05 1-1	0.05	1	1	21-Nov	70	1.3	1.29	1.29	1.28
System 2	0.05 1-1	0.05	1	1	26-Nov	70	1.31	1.3	1.28	1.3
System 2	0.05 1-1	0.05	1	1	27-Nov	73	1.31	1.31	1.27	1.29
System 2	0.05 1-1	0.05	1	1	3-Dec	73	1.31	1.31	1.29	1.3
System 2	0.05 1-1	0.05	1	1	4-Dec	70	1.3	1.31	1.29	1.29
System 2	0.05 1-2	0.05	1	2	19-Nov	73	1.27	1.27	1.29	1.28
System 2	0.05 1-2	0.05	1	2	20-Nov	63	1.28	1.28	1.3	1.3
System 2	0.05 1-2	0.05	1	2	21-Nov	70	1.28	1.28	1.3	1.3
System 2	0.05 1-2	0.05	1	2	26-Nov	70	1.3	1.3	1.31	1.32
System 2	0.05 1-2	0.05	1	2	27-Nov	73	1.29	1.29	1.29	1.29
System 2	0.05 1-2	0.05	1	2	3-Dec	73	1.3	1.3	1.32	1.33
System 2	0.05 1-2	0.05	1	2	4-Dec	70	1.31	1.31	1.32	1.31
System 2	0.05 1-3	0.05	1	3	19-Nov	73	1.28	1.28	1.26	1.26
System 2	0.05 1-3	0.05	1	3	20-Nov	63	1.3	1.3	1.28	1.27
System 2	0.05 1-3	0.05	1	3	21-Nov	70	1.31	1.29	1.27	1.27
System 2	0.05 1-3	0.05	1	3	26-Nov	70	1.31	1.31	1.31	1.28
System 2	0.05 1-3	0.05	1	3	27-Nov	73	1.29	1.28	1.31	1.29
System 2	0.05 1-3	0.05	1	3	3-Dec	73	1.31	1.3	1.31	1.28
System 2	0.05 1-3	0.05	1	3	4-Dec	70	1.31	1.3	1.28	1.28
System 2	0.05 2-1	0.05	2	1	19-Nov	73	1.27	1.29	1.28	1.28
System 2	0.05 2-1	0.05	2	1	20-Nov	63	1.27	1.29	1.29	1.29
System 2	0.05 2-1	0.05	2	1	21-Nov	70	1.28	1.28	1.29	1.29
System 2	0.05 2-1	0.05	2	1	26-Nov	70	1.29	1.3	1.3	1.3
System 2	0.05 2-1	0.05	2	1	27-Nov	73	1.3	1.28	1.3	1.31
System 2	0.05 2-1	0.05	2	1	3-Dec	73	1.3	1.29	1.3	1.3
System 2	0.05 2-1	0.05	2	1	4-Dec	70	1.29	1.29	1.29	1.29
System 2	0.05 2-2	0.05	2	2	19-Nov	73	1.33	1.33	1.29	1.3
System 2	0.05 2-2	0.05	2	2	20-Nov	63	1.35	1.35	1.31	1.32
System 2	0.05 2-2	0.05	2	2	21-Nov	70	1.36	1.36	1.32	1.32
System 2	0.05 2-2	0.05	2	2	26-Nov	70	1.37	1.38	1.32	1.33
System 2	0.05 2-2	0.05	2	2	27-Nov	73	1.35	1.36	1.31	1.33
System 2	0.05 2-2	0.05	2	2	3-Dec	73	1.37	1.37	1.31	1.34
System 2	0.05 2-2	0.05	2	2	4-Dec	70	1.36	1.37	1.31	1.33
System 2	0.05 2-3	0.05	2	3	19-Nov	73	1.27	1.27	1.28	1.27
System 2	0.05 2-3	0.05	2	3	20-Nov	63	1.29	1.28	1.28	1.28
System 2	0.05 2-3	0.05	2	3	21-Nov	70	1.29	1.28	1.28	1.28
System 2	0.05 2-3	0.05	2	3	26-Nov	70	1.3	1.29	1.3	1.3
System 2	0.05 2-3	0.05	2	3	27-Nov	73	1.3	1.3	1.29	1.3
System 2	0.05 2-3	0.05	2	3	3-Dec	73	1.3	1.3	1.28	1.29
System 2	0.05 2-3	0.05	2	3	4-Dec	70	1.3	1.3	1.29	1.3
System 2	0.05 3-1	0.05	3	1	19-Nov	73	1.28	1.28	1.29	1.29
System 2	0.05 3-1	0.05	3	1	20-Nov	63	1.28	1.29	1.3	1.29
System 2	0.05 3-1	0.05	3	1	21-Nov	70	1.39	1.29	1.3	1.29
System 2	0.05 3-1	0.05	3	1	26-Nov	70	1.3	1.3	1.31	1.3
System 2	0.05 3-1	0.05	3	1	27-Nov	73	1.29	1.3	1.28	1.27
System 2	0.05 3-1	0.05	3	1	3-Dec	73	1.29	1.3	1.3	1.29
System 2	0.05 3-1	0.05	3	1	4-Dec	70	1.29	1.3	1.3	1.29
System 2	0.05 3-2	0.05	3	2	19-Nov	73	1.29	1.29	1.28	1.29
System 2	0.05 3-2	0.05	3	2	20-Nov	63	1.3	1.31	1.3	1.3
System 2	0.05 3-2	0.05	3	2	21-Nov	70	1.31	1.31	1.3	1.31
System 2	0.05 3-2	0.05	3	2	26-Nov	70	1.32	1.31	1.32	1.32
System 2	0.05 3-2	0.05	3	2	27-Nov	73	1.31	1.31	1.32	1.31
System 2	0.05 3-2	0.05	3	2	3-Dec	73	1.31	1.31	1.31	1.31
System 2	0.05 3-2	0.05	3	2	4-Dec	70	1.31	1.31	1.3	1.31
System 2	0.05 3-3	0.05	3	3	19-Nov	73	1.28	1.29	1.27	1.28
System 2	0.05 3-3	0.05	3	3	20-Nov	63	1.29	1.3	1.28	1.29
System 2	0.05 3-3	0.05	3	3	21-Nov	70	1.3	1.32	1.29	1.29
System 2	0.05 3-3	0.05	3	3	26-Nov	70	1.3	1.32	1.3	1.3
System 2	0.05 3-3	0.05	3	3	27-Nov	73	1.28	1.29	1.27	1.27
System 2	0.05 3-3	0.05	3	3	3-Dec	73	1.29	1.3	1.28	1.28
System 2	0.05 3-3	0.05	3	3	4-Dec	70	1.29	1.31	1.28	1.29
System 2	0.075 1-1	0.075	1	1	19-Nov	73	1.67	1.66	1.68	1.68
System 2	0.075 1-1	0.075	1	1	20-Nov	63	1.68	1.68	1.71	1.69

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 2	0.075 1-1	0.075	1	1	21-Nov	70	1.69	1.7	1.7	1.71
System 2	0.075 1-1	0.075	1	1	26-Nov	70	1.7	1.7	1.73	1.71
System 2	0.075 1-1	0.075	1	1	27-Nov	73	1.69	1.69	1.7	1.7
System 2	0.075 1-1	0.075	1	1	3-Dec	73	1.7	1.7	1.71	1.7
System 2	0.075 1-1	0.075	1	1	4-Dec	70	1.69	1.7	1.71	1.7
System 2	0.075 1-2	0.075	1	2	19-Nov	73	1.64	1.65	1.65	1.65
System 2	0.075 1-2	0.075	1	2	20-Nov	63	1.66	1.67	1.67	1.67
System 2	0.075 1-2	0.075	1	2	21-Nov	70	1.68	1.67	1.69	1.67
System 2	0.075 1-2	0.075	1	2	26-Nov	70	1.68	1.68	1.68	1.69
System 2	0.075 1-2	0.075	1	2	27-Nov	73	1.67	1.67	1.67	1.67
System 2	0.075 1-2	0.075	1	2	3-Dec	73	1.68	1.68	1.66	1.67
System 2	0.075 1-2	0.075	1	2	4-Dec	70	1.68	1.67	1.68	1.68
System 2	0.075 1-3	0.075	1	3	19-Nov	73	1.69	1.68	1.67	1.69
System 2	0.075 1-3	0.075	1	3	20-Nov	63	1.7	1.69	1.7	1.69
System 2	0.075 1-3	0.075	1	3	21-Nov	70	1.7	1.7	1.69	1.69
System 2	0.075 1-3	0.075	1	3	26-Nov	70	1.71	1.72	1.7	1.72
System 2	0.075 1-3	0.075	1	3	27-Nov	73	1.71	1.72	1.7	1.7
System 2	0.075 1-3	0.075	1	3	3-Dec	73	1.7	1.71	1.69	1.71
System 2	0.075 1-3	0.075	1	3	4-Dec	70	1.71	1.7	1.69	1.7
System 2	0.075 2-1	0.075	2	1	19-Nov	73	1.67	1.68	1.68	1.67
System 2	0.075 2-1	0.075	2	1	20-Nov	63	1.7	1.72	1.7	1.7
System 2	0.075 2-1	0.075	2	1	21-Nov	70	1.7	1.72	1.7	1.69
System 2	0.075 2-1	0.075	2	1	26-Nov	70	1.71	1.73	1.72	1.71
System 2	0.075 2-1	0.075	2	1	27-Nov	73	1.7	1.73	1.71	1.69
System 2	0.075 2-1	0.075	2	1	3-Dec	73	1.7	1.72	1.7	1.69
System 2	0.075 2-1	0.075	2	1	4-Dec	70	1.7	1.71	1.7	1.69
System 2	0.075 2-2	0.075	2	2	19-Nov	73	1.7	1.72	1.69	1.7
System 2	0.075 2-2	0.075	2	2	20-Nov	63	1.72	1.73	1.71	1.72
System 2	0.075 2-2	0.075	2	2	21-Nov	70	1.73	1.73	1.71	1.72
System 2	0.075 2-2	0.075	2	2	26-Nov	70	1.74	1.73	1.72	1.73
System 2	0.075 2-2	0.075	2	2	27-Nov	73	1.73	1.73	1.72	1.72
System 2	0.075 2-2	0.075	2	2	3-Dec	73	1.74	1.73	1.72	1.72
System 2	0.075 2-2	0.075	2	2	4-Dec	70	1.72	1.72	1.71	1.71
System 2	0.075 2-3	0.075	2	3	19-Nov	73	1.69	1.69	1.71	1.69
System 2	0.075 2-3	0.075	2	3	20-Nov	63	1.71	1.71	1.71	1.71
System 2	0.075 2-3	0.075	2	3	21-Nov	70	1.71	1.72	1.72	1.71
System 2	0.075 2-3	0.075	2	3	26-Nov	70	1.71	1.73	1.74	1.73
System 2	0.075 2-3	0.075	2	3	27-Nov	73	1.71	1.73	1.71	1.72
System 2	0.075 2-3	0.075	2	3	3-Dec	73	1.73	1.72	1.71	1.71
System 2	0.075 2-3	0.075	2	3	4-Dec	70	1.7	1.72	1.71	1.7
System 2	0.075 3-1	0.075	3	1	19-Nov	73	1.69	1.68	1.7	1.69
System 2	0.075 3-1	0.075	3	1	20-Nov	63	1.7	1.7	1.71	1.71
System 2	0.075 3-1	0.075	3	1	21-Nov	70	1.7	1.69	1.71	1.71
System 2	0.075 3-1	0.075	3	1	26-Nov	70	1.71	1.71	1.73	1.72
System 2	0.075 3-1	0.075	3	1	27-Nov	73	1.71	1.71	1.73	1.72
System 2	0.075 3-1	0.075	3	1	3-Dec	73	1.71	1.71	1.71	1.72
System 2	0.075 3-1	0.075	3	1	4-Dec	70	1.7	1.7	1.71	1.71
System 2	0.075 3-2	0.075	3	2	19-Nov	73	1.67	1.69	1.7	1.7
System 2	0.075 3-2	0.075	3	2	20-Nov	63	1.7	1.71	1.73	1.72
System 2	0.075 3-2	0.075	3	2	21-Nov	70	1.71	1.71	1.73	1.73
System 2	0.075 3-2	0.075	3	2	26-Nov	70	1.72	1.73	1.74	1.75
System 2	0.075 3-2	0.075	3	2	27-Nov	73	1.7	1.7	1.73	1.72
System 2	0.075 3-2	0.075	3	2	3-Dec	73	1.71	1.71	1.74	1.73
System 2	0.075 3-2	0.075	3	2	4-Dec	70	1.71	1.7	1.73	1.73
System 2	0.075 3-3	0.075	3	3	19-Nov	73	1.67	1.68	1.68	1.68
System 2	0.075 3-3	0.075	3	3	20-Nov	63	1.7	1.7	1.69	1.7
System 2	0.075 3-3	0.075	3	3	21-Nov	70	1.7	1.7	1.7	1.7
System 2	0.075 3-3	0.075	3	3	26-Nov	70	1.71	1.72	1.71	1.71
System 2	0.075 3-3	0.075	3	3	27-Nov	73	1.71	1.71	1.71	1.71
System 2	0.075 3-3	0.075	3	3	3-Dec	73	1.71	1.71	1.72	1.72
System 2	0.075 3-3	0.075	3	3	4-Dec	70	1.7	1.7	1.71	1.7
System 2	0.1 1-1	0.1	1	1	19-Nov	73	2.01	2.01	2	2
System 2	0.1 1-1	0.1	1	1	20-Nov	63	2.02	2.02	2	2.01
System 2	0.1 1-1	0.1	1	1	21-Nov	70	2.02	2.03	2.01	2.01
System 2	0.1 1-1	0.1	1	1	26-Nov	70	2.03	2.04	2.02	2.02
System 2	0.1 1-1	0.1	1	1	27-Nov	73	2.04	2.03	2.01	2.01
System 2	0.1 1-1	0.1	1	1	3-Dec	73	2.03	2.03	2.02	2.01
System 2	0.1 1-1	0.1	1	1	4-Dec	70	2.03	2.03	2.02	2.02
System 2	0.1 1-2	0.1	1	2	19-Nov	73	1.99	1.99	1.99	1.96
System 2	0.1 1-2	0.1	1	2	20-Nov	63	2.01	2.01	1.99	1.96
System 2	0.1 1-2	0.1	1	2	21-Nov	70	2.01	2.01	2	1.96

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 2	0.1 1-2	0.1	1	2	26-Nov	70	2.03	2.02	2.01	1.98
System 2	0.1 1-2	0.1	1	2	27-Nov	73	2.01	2	1.99	1.96
System 2	0.1 1-2	0.1	1	2	3-Dec	73	2.03	2.01	1.99	1.96
System 2	0.1 1-2	0.1	1	2	4-Dec	70	2.02	2.01	2	1.97
System 2	0.1 1-3	0.1	1	3	19-Nov	73	1.96	1.97	1.98	1.97
System 2	0.1 1-3	0.1	1	3	20-Nov	63	1.97	1.97	1.99	1.99
System 2	0.1 1-3	0.1	1	3	21-Nov	70	1.98	1.98	1.99	2
System 2	0.1 1-3	0.1	1	3	26-Nov	70	1.99	1.99	2	2
System 2	0.1 1-3	0.1	1	3	27-Nov	73	1.97	1.97	1.99	1.98
System 2	0.1 1-3	0.1	1	3	3-Dec	73	1.97	1.98	1.99	1.98
System 2	0.1 1-3	0.1	1	3	4-Dec	70	1.99	1.98	1.99	1.99
System 2	0.1 2-1	0.1	2	1	19-Nov	73	1.97	1.98	1.97	1.97
System 2	0.1 2-1	0.1	2	1	20-Nov	63	2	2	1.98	1.98
System 2	0.1 2-1	0.1	2	1	21-Nov	70	2.01	2	1.99	1.99
System 2	0.1 2-1	0.1	2	1	26-Nov	70	2.02	2.02	2	2
System 2	0.1 2-1	0.1	2	1	27-Nov	73	2.01	2.01	1.98	1.99
System 2	0.1 2-1	0.1	2	1	3-Dec	73	2.02	2.01	2	1.99
System 2	0.1 2-1	0.1	2	1	4-Dec	70	2.02	2.02	2	2.01
System 2	0.1 2-2	0.1	2	2	19-Nov	73	1.99	2.01	2	2.01
System 2	0.1 2-2	0.1	2	2	20-Nov	63	2.02	2.03	2.01	2.01
System 2	0.1 2-2	0.1	2	2	21-Nov	70	2.02	2.03	2.02	2.01
System 2	0.1 2-2	0.1	2	2	26-Nov	70	2.02	2.04	2.03	2.03
System 2	0.1 2-2	0.1	2	2	27-Nov	73	2.03	2.03	2.01	2.01
System 2	0.1 2-2	0.1	2	2	3-Dec	73	2.03	2.03	2.02	2.02
System 2	0.1 2-2	0.1	2	2	4-Dec	70	2.02	2.02	2.02	2.01
System 2	0.1 2-3	0.1	2	3	19-Nov	73	2.01	2.02	2	2
System 2	0.1 2-3	0.1	2	3	20-Nov	63	2.03	2.02	2.01	2.01
System 2	0.1 2-3	0.1	2	3	21-Nov	70	2.03	2.03	2.02	2.02
System 2	0.1 2-3	0.1	2	3	26-Nov	70	2.04	2.04	2.02	2.03
System 2	0.1 2-3	0.1	2	3	27-Nov	73	2.02	2.02	2.01	2.02
System 2	0.1 2-3	0.1	2	3	3-Dec	73	2.03	2.03	2.03	2.02
System 2	0.1 2-3	0.1	2	3	4-Dec	70	2.02	2.03	2	2
System 2	0.1 3-1	0.1	3	1	19-Nov	73	1.97	1.97	1.98	1.97
System 2	0.1 3-1	0.1	3	1	20-Nov	63	1.99	1.98	1.98	1.98
System 2	0.1 3-1	0.1	3	1	21-Nov	70	1.99	1.98	2	1.99
System 2	0.1 3-1	0.1	3	1	26-Nov	70	2	2	2.01	2
System 2	0.1 3-1	0.1	3	1	27-Nov	73	1.98	1.98	1.99	1.99
System 2	0.1 3-1	0.1	3	1	3-Dec	73	2	1.99	2	1.98
System 2	0.1 3-1	0.1	3	1	4-Dec	70	1.99	1.99	1.99	1.98
System 2	0.1 3-2	0.1	3	2	19-Nov	73	1.97	2	1.99	2
System 2	0.1 3-2	0.1	3	2	20-Nov	63	2.02	2.02	2.01	1.99
System 2	0.1 3-2	0.1	3	2	21-Nov	70	2.01	2.01	2.01	2.01
System 2	0.1 3-2	0.1	3	2	26-Nov	70	2.02	2.03	2.02	2.02
System 2	0.1 3-2	0.1	3	2	27-Nov	73	2	2.01	2.01	1.98
System 2	0.1 3-2	0.1	3	2	3-Dec	73	2.02	2.01	2.01	2.02
System 2	0.1 3-2	0.1	3	2	4-Dec	70	2	2.01	2.01	1.99
System 2	0.1 3-3	0.1	3	3	19-Nov	73	1.95	1.97	1.97	1.97
System 2	0.1 3-3	0.1	3	3	20-Nov	63	1.97	1.97	1.99	1.98
System 2	0.1 3-3	0.1	3	3	21-Nov	70	1.97	1.97	1.98	1.98
System 2	0.1 3-3	0.1	3	3	26-Nov	70	1.98	2	2	2
System 2	0.1 3-3	0.1	3	3	27-Nov	73	2	1.98	1.98	1.99
System 2	0.1 3-3	0.1	3	3	3-Dec	73	1.99	1.98	1.99	2
System 2	0.1 3-3	0.1	3	3	4-Dec	70	2	1.98	2	2
System 2	0.14 1-1	0.14	1	1	19-Nov	73	2.35	2.37	2.31	2.32
System 2	0.14 1-1	0.14	1	1	20-Nov	63	2.37	2.37	2.33	2.33
System 2	0.14 1-1	0.14	1	1	21-Nov	70	2.37	2.37	2.33	2.33
System 2	0.14 1-1	0.14	1	1	26-Nov	70	2.39	2.39	2.35	2.36
System 2	0.14 1-1	0.14	1	1	27-Nov	73	2.38	2.39	2.35	2.34
System 2	0.14 1-1	0.14	1	1	3-Dec	73	2.39	2.38	2.33	2.35
System 2	0.14 1-1	0.14	1	1	4-Dec	70	2.38	2.38	2.35	2.35
System 2	0.14 1-2	0.14	1	2	19-Nov	73	2.32	2.32	2.3	2.31
System 2	0.14 1-2	0.14	1	2	20-Nov	63	2.34	2.33	2.31	2.32
System 2	0.14 1-2	0.14	1	2	21-Nov	70	2.34	2.34	2.32	2.33
System 2	0.14 1-2	0.14	1	2	26-Nov	70	2.35	2.34	2.34	2.34
System 2	0.14 1-2	0.14	1	2	27-Nov	73	2.34	2.33	2.33	2.33
System 2	0.14 1-2	0.14	1	2	3-Dec	73	2.35	2.34	2.33	2.34
System 2	0.14 1-2	0.14	1	2	4-Dec	70	2.33	2.34	2.33	2.33
System 2	0.14 1-3	0.14	1	3	19-Nov	73	2.32	2.3	2.29	2.31
System 2	0.14 1-3	0.14	1	3	20-Nov	63	2.35	2.34	2.31	2.32
System 2	0.14 1-3	0.14	1	3	21-Nov	70	2.35	2.35	2.31	2.32
System 2	0.14 1-3	0.14	1	3	26-Nov	70	2.36	2.37	2.32	2.34

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 2	0.14 1-3	0.14	1	3	27-Nov	73	2.35	2.36	2.32	2.33
System 2	0.14 1-3	0.14	1	3	3-Dec	73	2.37	2.35	2.33	2.33
System 2	0.14 1-3	0.14	1	3	4-Dec	70	2.37	2.37	2.33	2.34
System 2	0.14 2-1	0.14	2	1	19-Nov	73	2.31	2.31	2.33	2.32
System 2	0.14 2-1	0.14	2	1	20-Nov	63	2.33	2.33	2.35	2.34
System 2	0.14 2-1	0.14	2	1	21-Nov	70	2.34	2.34	2.35	2.35
System 2	0.14 2-1	0.14	2	1	26-Nov	70	2.34	2.34	2.36	2.36
System 2	0.14 2-1	0.14	2	1	27-Nov	73	2.35	2.35	2.36	2.34
System 2	0.14 2-1	0.14	2	1	3-Dec	73	2.34	2.35	2.36	2.35
System 2	0.14 2-1	0.14	2	1	4-Dec	70	2.35	2.36	2.33	2.34
System 2	0.14 2-2	0.14	2	2	19-Nov	73	2.31	2.32	2.32	2.31
System 2	0.14 2-2	0.14	2	2	20-Nov	63	2.34	2.34	2.31	2.32
System 2	0.14 2-2	0.14	2	2	21-Nov	70	2.34	2.33	2.33	2.32
System 2	0.14 2-2	0.14	2	2	26-Nov	70	2.35	2.35	2.32	2.32
System 2	0.14 2-2	0.14	2	2	27-Nov	73	2.33	2.32	2.31	2.32
System 2	0.14 2-2	0.14	2	2	3-Dec	73	2.34	2.33	2.3	2.32
System 2	0.14 2-2	0.14	2	2	4-Dec	70	2.34	2.34	2.32	2.32
System 2	0.14 2-3	0.14	2	3	19-Nov	73	2.35	2.34	2.33	2.34
System 2	0.14 2-3	0.14	2	3	20-Nov	63	2.36	2.36	2.35	2.34
System 2	0.14 2-3	0.14	2	3	21-Nov	70	2.37	2.37	2.36	2.35
System 2	0.14 2-3	0.14	2	3	26-Nov	70	2.38	2.37	2.37	2.35
System 2	0.14 2-3	0.14	2	3	27-Nov	73	2.35	2.36	2.32	2.34
System 2	0.14 2-3	0.14	2	3	3-Dec	73	2.38	2.37	2.37	2.38
System 2	0.14 2-3	0.14	2	3	4-Dec	70	2.38	2.37	2.37	2.37
System 2	0.14 3-1	0.14	3	1	19-Nov	73	2.33	2.33	2.35	2.35
System 2	0.14 3-1	0.14	3	1	20-Nov	63	2.35	2.35	2.37	2.37
System 2	0.14 3-1	0.14	3	1	21-Nov	70	2.36	2.35	2.37	2.36
System 2	0.14 3-1	0.14	3	1	26-Nov	70	2.36	2.37	2.39	2.38
System 2	0.14 3-1	0.14	3	1	27-Nov	73	2.35	2.36	2.36	2.37
System 2	0.14 3-1	0.14	3	1	3-Dec	73	2.36	2.35	2.37	2.38
System 2	0.14 3-1	0.14	3	1	4-Dec	70	2.36	2.35	2.37	2.37
System 2	0.14 3-2	0.14	3	2	19-Nov	73	2.36	2.36	2.35	2.35
System 2	0.14 3-2	0.14	3	2	20-Nov	63	2.38	2.37	2.37	2.37
System 2	0.14 3-2	0.14	3	2	21-Nov	70	2.38	2.37	2.37	2.37
System 2	0.14 3-2	0.14	3	2	26-Nov	70	2.39	2.38	2.38	2.38
System 2	0.14 3-2	0.14	3	2	27-Nov	73	2.39	2.39	2.38	2.38
System 2	0.14 3-2	0.14	3	2	3-Dec	73	2.38	2.38	2.38	2.37
System 2	0.14 3-2	0.14	3	2	4-Dec	70	2.38	2.38	2.38	2.38
System 2	0.14 3-3	0.14	3	3	19-Nov	73	2.34	2.35	2.35	2.35
System 2	0.14 3-3	0.14	3	3	20-Nov	63	2.36	2.36	2.36	2.36
System 2	0.14 3-3	0.14	3	3	21-Nov	70	2.37	2.37	2.35	2.36
System 2	0.14 3-3	0.14	3	3	26-Nov	70	2.37	2.38	2.37	2.36
System 2	0.14 3-3	0.14	3	3	27-Nov	73	2.37	2.37	2.37	2.36
System 2	0.14 3-3	0.14	3	3	3-Dec	73	2.37	2.37	2.37	2.37
System 2	0.14 3-3	0.14	3	3	4-Dec	70	2.37	2.37	2.36	2.37
System 2	0.15	0.15	1	1	19-Nov	73	2.41	2.4	2.43	2.41
System 2	0.15	0.15	1	1	20-Nov	63	2.42	2.42	2.43	2.42
System 2	0.15	0.15	1	1	21-Nov	70	2.43	2.43	2.43	2.43
System 2	0.15	0.15	1	1	26-Nov	70	2.43	2.44	2.44	2.43
System 2	0.15	0.15	1	1	27-Nov	73	2.43	2.44	2.45	2.43
System 2	0.15	0.15	1	1	3-Dec	73	2.45	2.44	2.45	2.43
System 2	0.15	0.15	1	1	4-Dec	70	2.44	2.44	2.46	2.43
System 2	0.2 1-1	0.2	1	1	19-Nov	73	2.69	2.7	2.7	2.71
System 2	0.2 1-1	0.2	1	1	20-Nov	63	2.7	2.7	2.71	2.71
System 2	0.2 1-1	0.2	1	1	21-Nov	70	2.69	2.7	2.71	2.71
System 2	0.2 1-1	0.2	1	1	26-Nov	70	2.69	2.71	2.72	2.73
System 2	0.2 1-1	0.2	1	1	27-Nov	73	2.71	2.71	2.72	2.72
System 2	0.2 1-1	0.2	1	1	3-Dec	73	2.71	2.71	2.72	2.72
System 2	0.2 1-1	0.2	1	1	4-Dec	70	2.71	2.72	2.73	2.73
System 2	0.2 1-2	0.2	1	2	19-Nov	73	2.68	2.67	2.67	2.66
System 2	0.2 1-2	0.2	1	2	20-Nov	63	2.69	2.68	2.68	2.67
System 2	0.2 1-2	0.2	1	2	21-Nov	70	2.69	2.68	2.68	2.67
System 2	0.2 1-2	0.2	1	2	26-Nov	70	2.69	2.69	2.69	2.68
System 2	0.2 1-2	0.2	1	2	27-Nov	73	2.7	2.7	2.7	2.69
System 2	0.2 1-2	0.2	1	2	3-Dec	73	2.71	2.7	2.69	2.69
System 2	0.2 1-2	0.2	1	2	4-Dec	70	2.69	2.7	2.7	2.69
System 2	0.2 1-3	0.2	1	3	19-Nov	73	2.69	2.69	2.68	2.68
System 2	0.2 1-3	0.2	1	3	20-Nov	63	2.7	2.7	2.69	2.69
System 2	0.2 1-3	0.2	1	3	21-Nov	70	2.71	2.71	2.69	2.7
System 2	0.2 1-3	0.2	1	3	26-Nov	70	2.71	2.71	2.7	2.71
System 2	0.2 1-3	0.2	1	3	27-Nov	73	2.72	2.73	2.7	2.7

Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 2	0.2 1-3	0.2	1	3	3-Dec	73	2.73	2.74	2.71	2.71
System 2	0.2 1-3	0.2	1	3	4-Dec	70	2.73	2.73	2.71	2.71
System 2	0.2 2-1	0.2	2	1	19-Nov	73	2.69	2.7	2.7	2.69
System 2	0.2 2-1	0.2	2	1	20-Nov	63	2.71	2.71	2.7	2.71
System 2	0.2 2-1	0.2	2	1	21-Nov	70	2.71	2.7	2.71	2.7
System 2	0.2 2-1	0.2	2	1	26-Nov	70	2.72	2.72	2.73	2.72
System 2	0.2 2-1	0.2	2	1	27-Nov	73	2.72	2.73	2.72	2.73
System 2	0.2 2-1	0.2	2	1	3-Dec	73	2.73	2.73	2.73	2.73
System 2	0.2 2-1	0.2	2	1	4-Dec	70	2.72	2.73	2.73	2.73
System 2	0.2 2-2	0.2	2	2	19-Nov	73	2.7	2.72	2.7	2.69
System 2	0.2 2-2	0.2	2	2	20-Nov	63	2.72	2.72	2.7	2.7
System 2	0.2 2-2	0.2	2	2	21-Nov	70	2.72	2.72	2.71	2.7
System 2	0.2 2-2	0.2	2	2	26-Nov	70	2.73	2.72	2.72	2.72
System 2	0.2 2-2	0.2	2	2	27-Nov	73	2.74	2.73	2.72	2.72
System 2	0.2 2-2	0.2	2	2	3-Dec	73	2.75	2.75	2.73	2.74
System 2	0.2 2-2	0.2	2	2	4-Dec	70	2.74	2.75	2.74	2.73
System 2	0.2 2-3	0.2	2	3	19-Nov	73	2.69	2.7	2.73	2.72
System 2	0.2 2-3	0.2	2	3	20-Nov	63	2.71	2.7	2.74	2.73
System 2	0.2 2-3	0.2	2	3	21-Nov	70	2.71	2.71	2.74	2.73
System 2	0.2 2-3	0.2	2	3	26-Nov	70	2.72	2.72	2.74	2.73
System 2	0.2 2-3	0.2	2	3	27-Nov	73	2.71	2.72	2.75	2.74
System 2	0.2 2-3	0.2	2	3	3-Dec	73	2.72	2.73	2.74	2.75
System 2	0.2 2-3	0.2	2	3	4-Dec	70	2.72	2.72	2.74	2.75
System 2	0.2 3-1	0.2	3	1	19-Nov	73	2.68	2.69	2.69	2.7
System 2	0.2 3-1	0.2	3	1	20-Nov	63	2.7	2.69	2.7	2.7
System 2	0.2 3-1	0.2	3	1	21-Nov	70	2.7	2.7	2.71	2.71
System 2	0.2 3-1	0.2	3	1	26-Nov	70	2.71	2.72	2.72	2.72
System 2	0.2 3-1	0.2	3	1	27-Nov	73	2.72	2.72	2.72	2.72
System 2	0.2 3-1	0.2	3	1	3-Dec	73	2.73	2.73	2.74	2.73
System 2	0.2 3-1	0.2	3	1	4-Dec	70	2.73	2.73	2.74	2.73
System 2	0.2 3-2	0.2	3	2	19-Nov	73	2.69	2.68	2.66	2.67
System 2	0.2 3-2	0.2	3	2	20-Nov	63	2.7	2.69	2.67	2.68
System 2	0.2 3-2	0.2	3	2	21-Nov	70	2.7	2.69	2.68	2.67
System 2	0.2 3-2	0.2	3	2	26-Nov	70	2.71	2.69	2.69	2.68
System 2	0.2 3-2	0.2	3	2	27-Nov	73	2.7	2.7	2.68	2.68
System 2	0.2 3-2	0.2	3	2	3-Dec	73	2.71	2.71	2.69	2.69
System 2	0.2 3-2	0.2	3	2	4-Dec	70	2.71	2.71	2.69	2.69
System 2	0.2 3-3	0.2	3	3	19-Nov	73	2.64	2.65	2.67	2.67
System 2	0.2 3-3	0.2	3	3	20-Nov	63	2.67	2.66	2.68	2.68
System 2	0.2 3-3	0.2	3	3	21-Nov	70	2.66	2.66	2.68	2.68
System 2	0.2 3-3	0.2	3	3	26-Nov	70	2.66	2.67	2.69	2.69
System 2	0.2 3-3	0.2	3	3	27-Nov	73	2.67	2.67	2.68	2.7
System 2	0.2 3-3	0.2	3	3	3-Dec	73	2.67	2.67	2.7	2.7
System 2	0.2 3-3	0.2	3	3	4-Dec	70	2.68	2.68	2.69	2.7
System 2	0.3	0.3	1	1	19-Nov	73	3.1	3.1	3.11	3.12
System 2	0.3	0.3	1	1	20-Nov	63	3.11	3.11	3.12	3.13
System 2	0.3	0.3	1	1	21-Nov	70	3.11	3.11	3.13	3.13
System 2	0.3	0.3	1	1	26-Nov	70	3.12	3.13	3.14	3.14
System 2	0.3	0.3	1	1	27-Nov	73	3.14	3.13	3.14	3.15
System 2	0.3	0.3	1	1	3-Dec	73	3.14	3.14	3.15	3.16
System 2	0.3	0.3	1	1	4-Dec	70	3.14	3.14	3.15	3.16
System 2	0.4	0.4	1	1	19-Nov	73	3.41	3.42	3.44	3.44
System 2	0.4	0.4	1	1	20-Nov	63	3.43	3.43	3.46	3.45
System 2	0.4	0.4	1	1	21-Nov	70	3.42	3.43	3.45	3.45
System 2	0.4	0.4	1	1	26-Nov	70	3.43	3.43	3.46	3.45
System 2	0.4	0.4	1	1	27-Nov	73	3.44	3.43	3.46	3.46
System 2	0.4	0.4	1	1	3-Dec	73	3.45	3.44	3.47	3.47
System 2	0.4	0.4	1	1	4-Dec	70	3.45	3.44	3.47	3.47
System 2	0.5	0.5	1	1	19-Nov	73	3.69	3.7	3.68	3.68
System 2	0.5	0.5	1	1	20-Nov	63	3.7	3.71	3.7	3.69
System 2	0.5	0.5	1	1	21-Nov	70	3.71	3.72	3.71	3.7
System 2	0.5	0.5	1	1	26-Nov	70	3.72	3.73	3.72	3.71
System 2	0.5	0.5	1	1	27-Nov	73	3.74	3.74	3.73	3.72
System 2	0.5	0.5	1	1	3-Dec	73	3.75	3.75	3.74	3.73
System 2	0.5	0.5	1	1	4-Dec	70	3.75	3.75	3.74	3.73
System 2	0.6	0.6	1	1	19-Nov	73	3.95	3.95	3.95	3.94
System 2	0.6	0.6	1	1	20-Nov	63	3.96	3.96	3.96	3.95
System 2	0.6	0.6	1	1	21-Nov	70	3.96	3.96	3.97	3.96
System 2	0.6	0.6	1	1	26-Nov	70	3.97	3.98	3.99	3.97
System 2	0.6	0.6	1	1	27-Nov	73	4	4	3.98	3.99
System 2	0.6	0.6	1	1	3-Dec	73	4.01	4.01	4.01	4

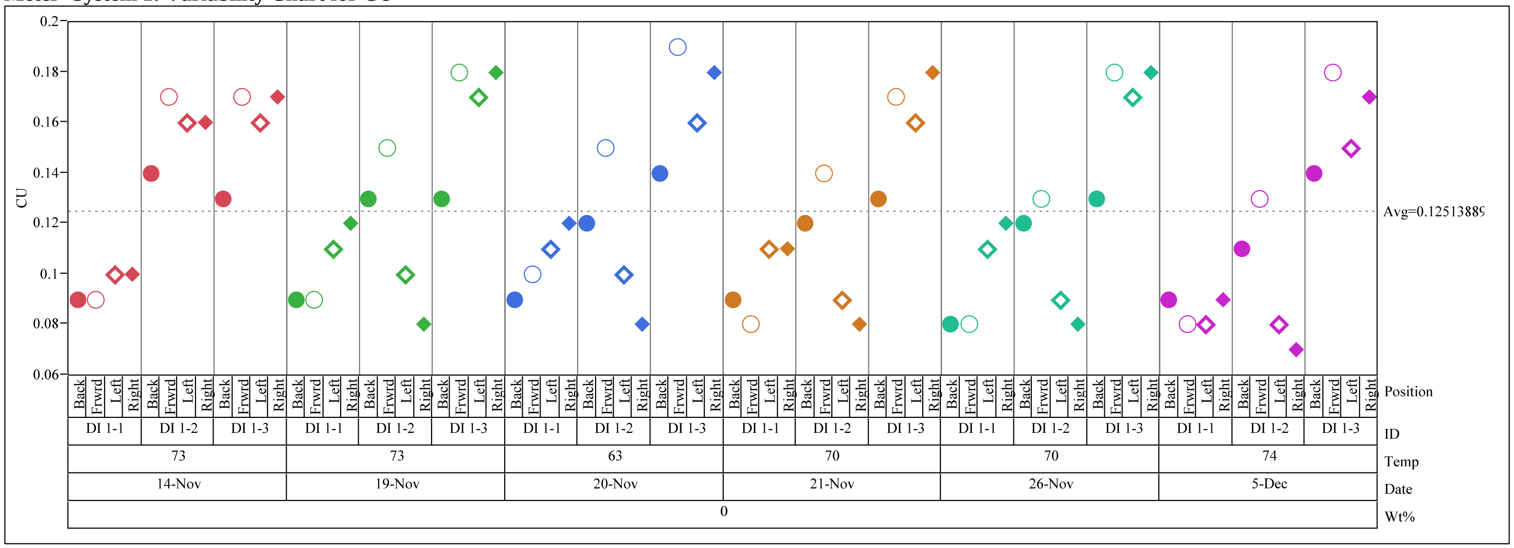
Table A1. Concentration Unit (CU) Measurements

Meter	Peanut Vial ID	Wt%	Bottle	Run	Date	Temp	Concentration Units (CUs)			
							Back	Forward	Left	Right
System 2	0.6	0.6	1	1	4-Dec	70	4.01	3.98	4.01	3.98
System 2	0.7	0.7	1	1	19-Nov	73	4.11	4.16	4.14	4.15
System 2	0.7	0.7	1	1	20-Nov	63	4.13	4.18	4.15	4.16
System 2	0.7	0.7	1	1	21-Nov	70	4.13	4.17	4.15	4.16
System 2	0.7	0.7	1	1	26-Nov	70	4.14	4.18	4.16	4.17
System 2	0.7	0.7	1	1	27-Nov	73	4.16	4.22	4.2	4.2
System 2	0.7	0.7	1	1	3-Dec	73	4.17	4.22	4.21	4.21
System 2	0.7	0.7	1	1	4-Dec	70	4.17	4.22	4.21	4.21
System 2	0.8	0.8	1	1	19-Nov	73	4.34	4.35	4.34	4.36
System 2	0.8	0.8	1	1	20-Nov	63	4.35	4.35	4.35	4.38
System 2	0.8	0.8	1	1	21-Nov	70	4.36	4.37	4.35	4.38
System 2	0.8	0.8	1	1	26-Nov	70	4.37	4.37	4.35	4.37
System 2	0.8	0.8	1	1	27-Nov	73	4.39	4.4	4.39	4.41
System 2	0.8	0.8	1	1	3-Dec	73	4.41	4.41	4.4	4.43
System 2	0.8	0.8	1	1	4-Dec	70	4.41	4.4	4.38	4.42
System 2	1.2	1.2	1	1	19-Nov	73	4.7	4.73	4.68	4.75
System 2	1.2	1.2	1	1	20-Nov	63	4.72	4.75	4.71	4.77
System 2	1.2	1.2	1	1	21-Nov	70	4.73	4.75	4.7	4.8
System 2	1.2	1.2	1	1	26-Nov	70	4.73	4.76	4.71	4.78
System 2	1.2	1.2	1	1	27-Nov	73	4.76	4.78	4.75	4.82
System 2	1.2	1.2	1	1	3-Dec	73	4.77	4.78	4.75	4.81
System 2	1.2	1.2	1	1	4-Dec	70	4.76	4.78	4.75	4.8

Exhibit A1. Concentration Unit (CU) Measurements by Meter for Deionized Water Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 1: Variability Chart for CU



Meter=System 2: Variability Chart for CU

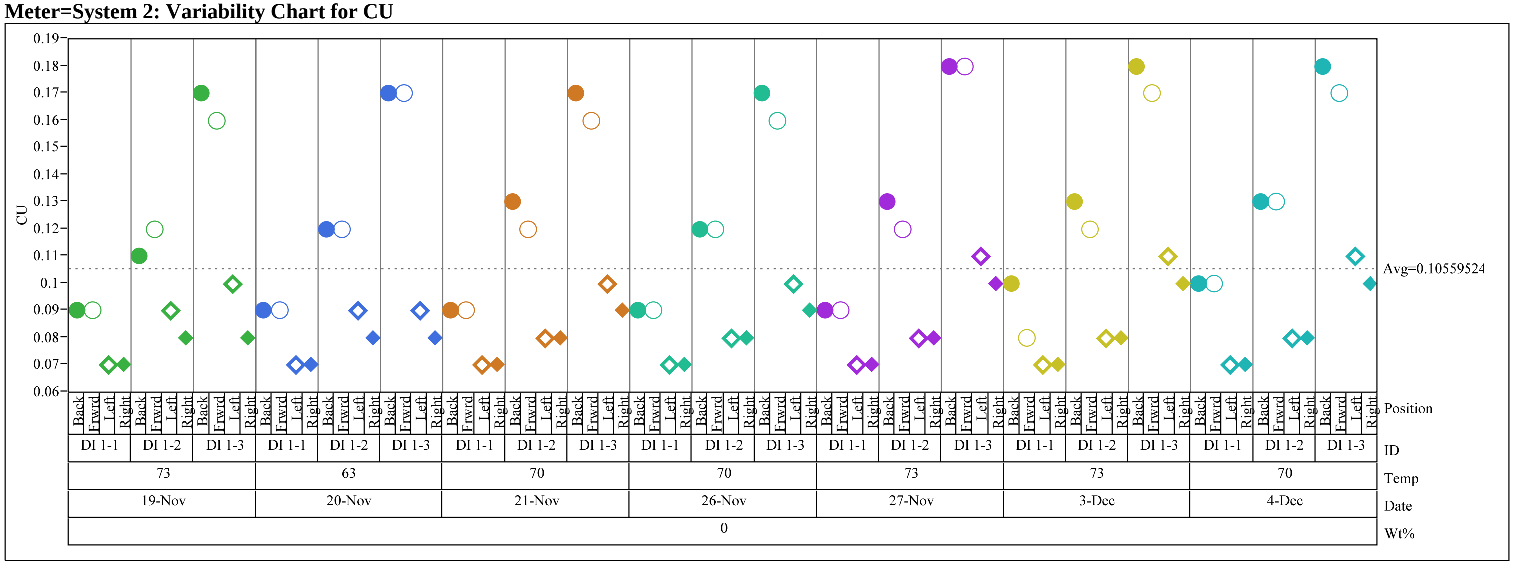
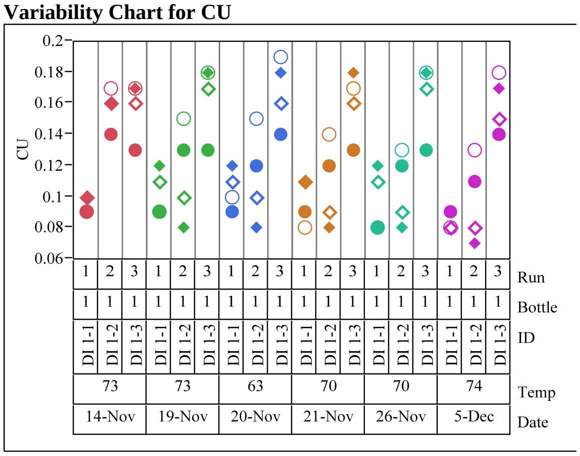


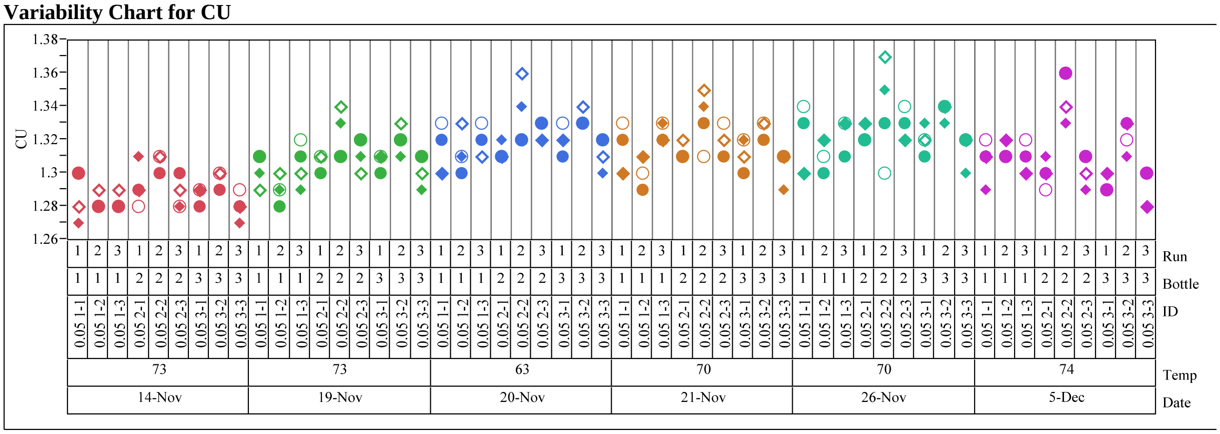
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 1, Wt%=0
Variability Chart for CU



Meter=System 1, Wt%=0.05
Variability Chart for CU



Meter=System 1, Wt%=0.075
Variability Chart for CU

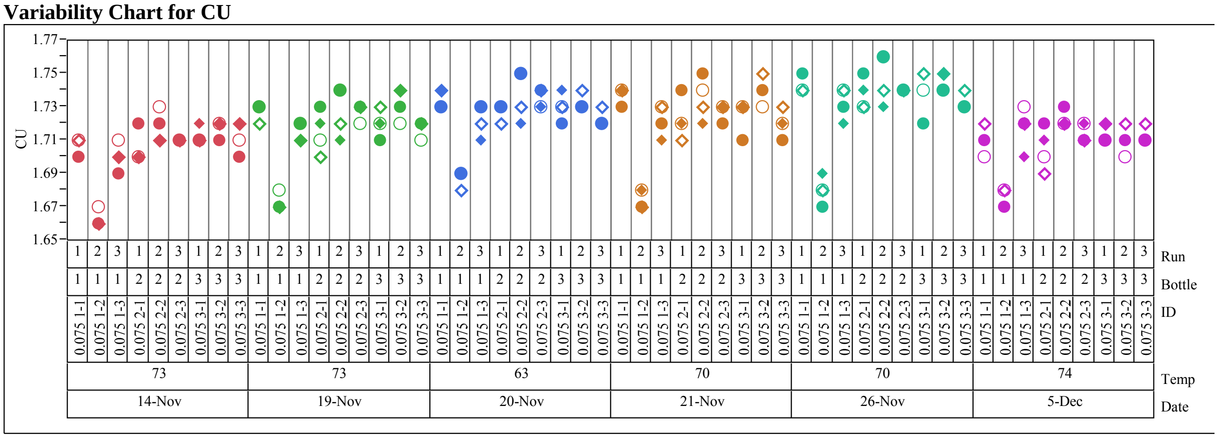
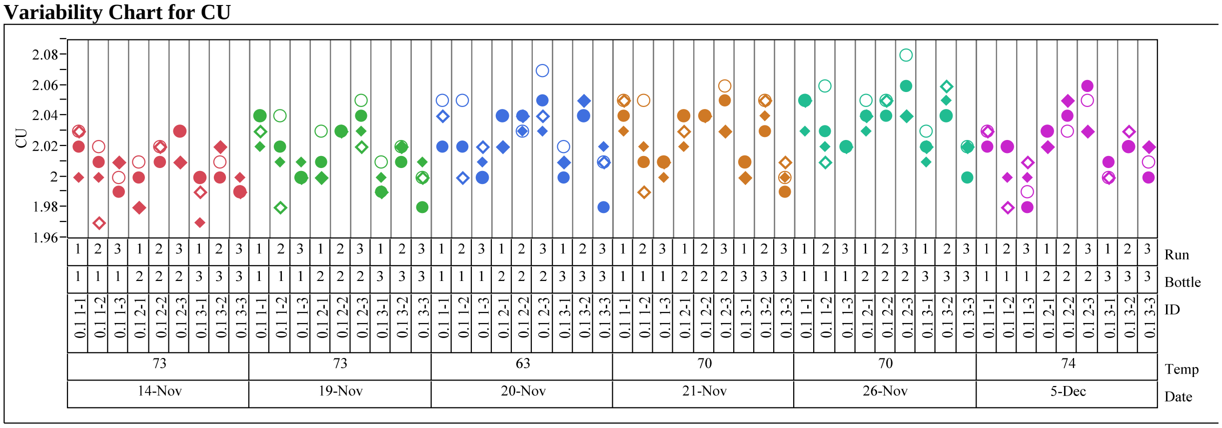


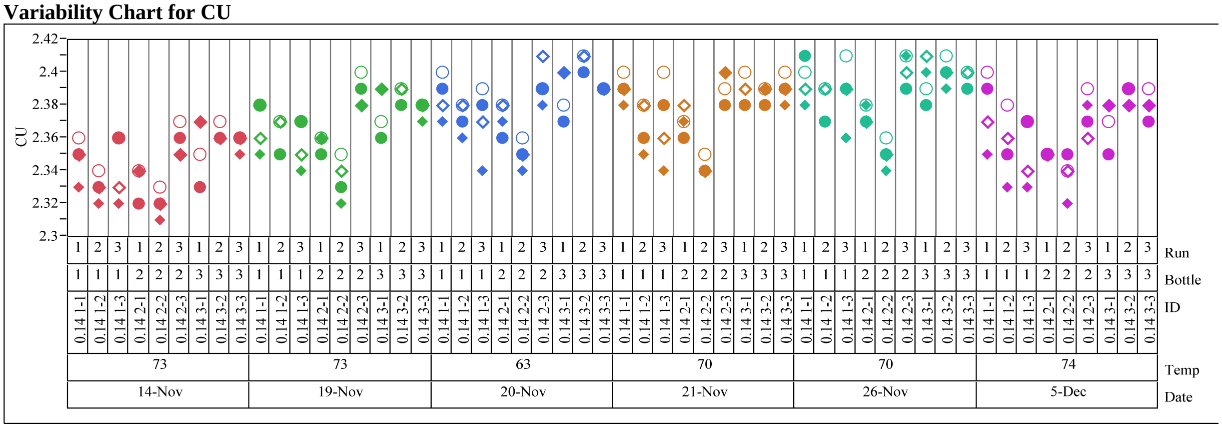
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 1, Wt%=0.1
Variability Chart for CU



Meter=System 1, Wt%=0.14
Variability Chart for CU



Meter=System 1, Wt%=0.15
Variability Chart for CU

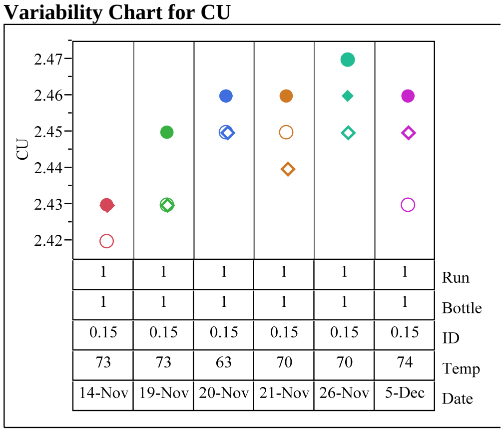
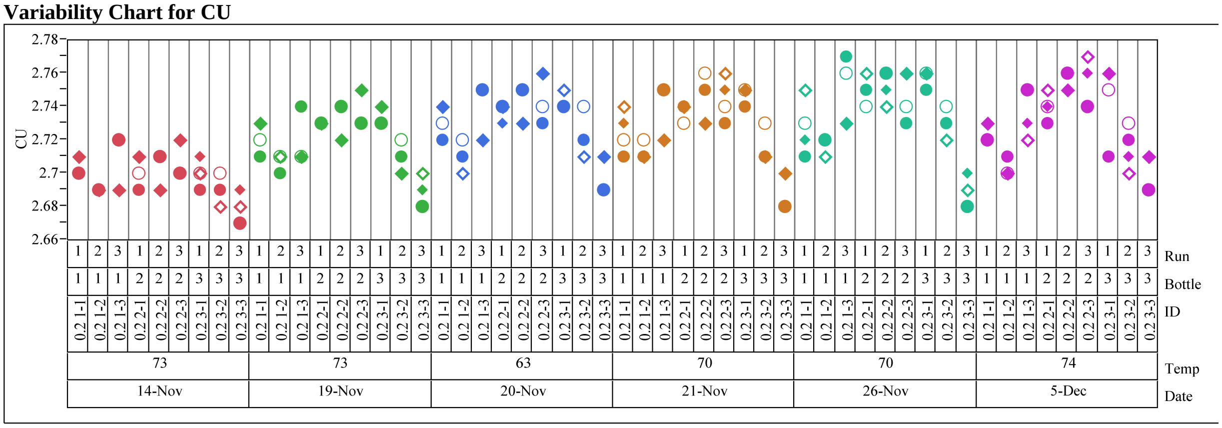


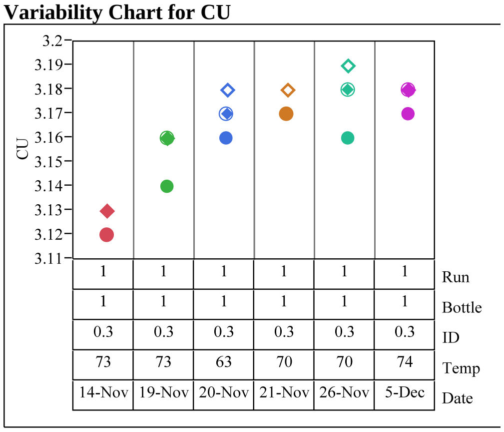
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 1, Wt%=0.2
Variability Chart for CU



Meter=System 1, Wt%=0.3
Variability Chart for CU



Meter=System 1, Wt%=0.4
Variability Chart for CU

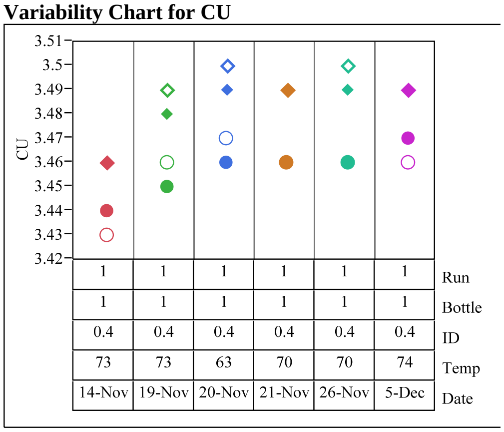
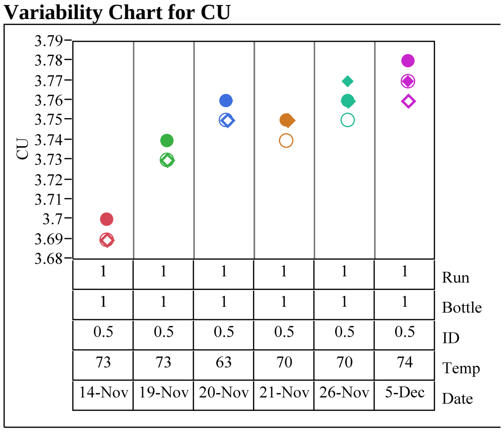


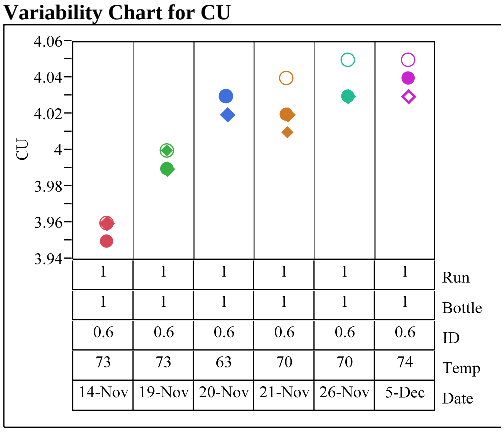
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 1, Wt%=0.5
Variability Chart for CU



Meter=System 1, Wt%=0.6
Variability Chart for CU



Meter=System 1, Wt%=0.7
Variability Chart for CU

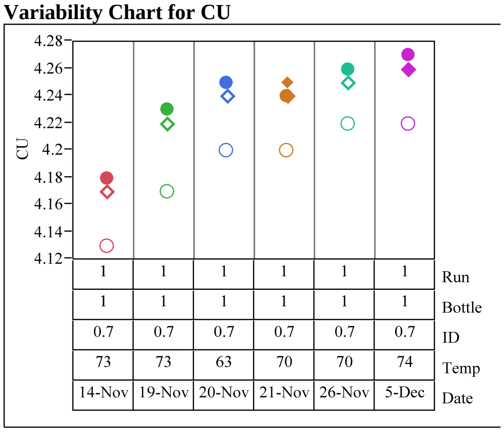
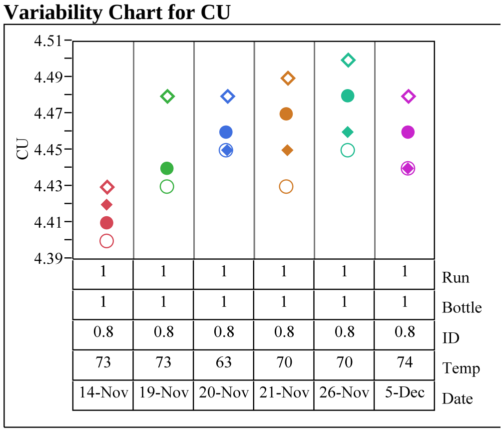


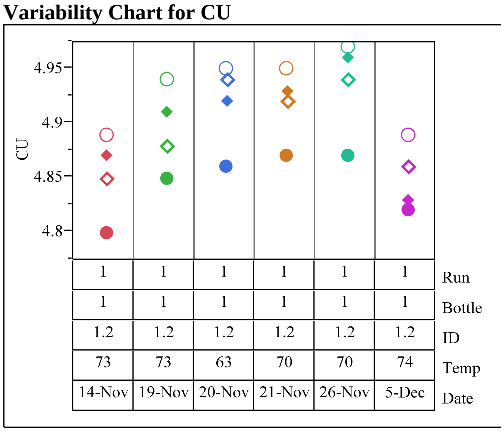
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 1, Wt%=0.8
Variability Chart for CU



Meter=System 1, Wt%=1.2
Variability Chart for CU



Meter=System 2, Wt%=0
Variability Chart for CU

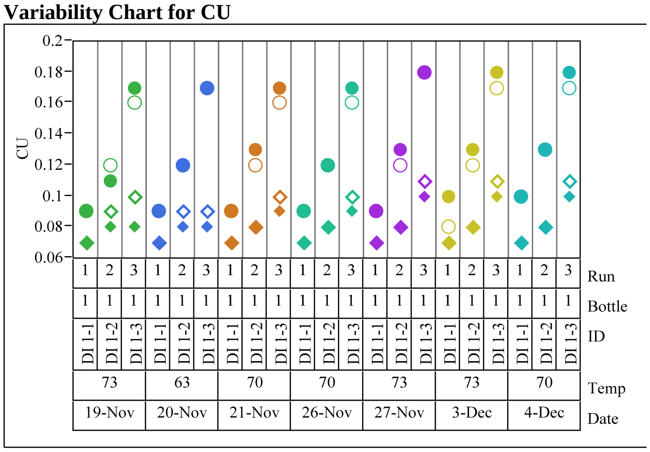
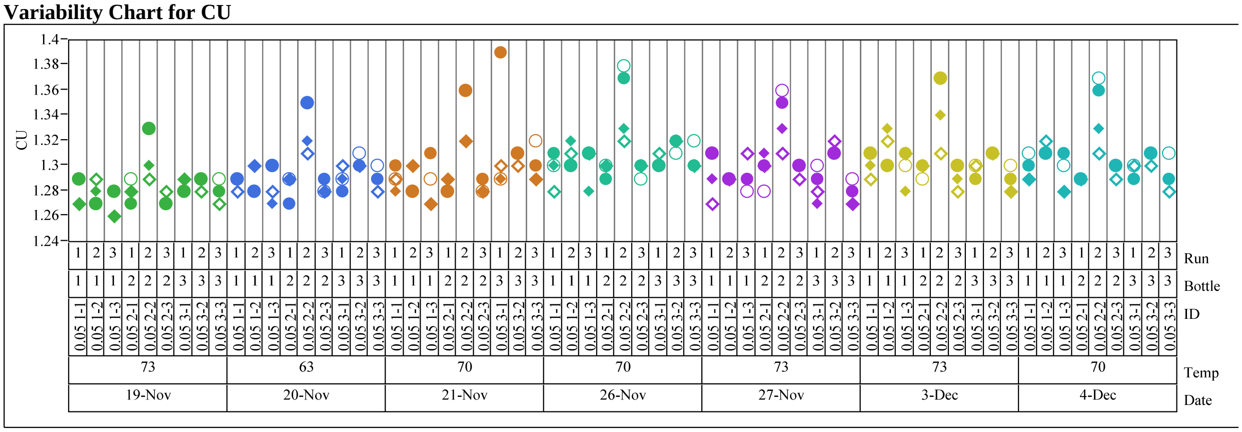


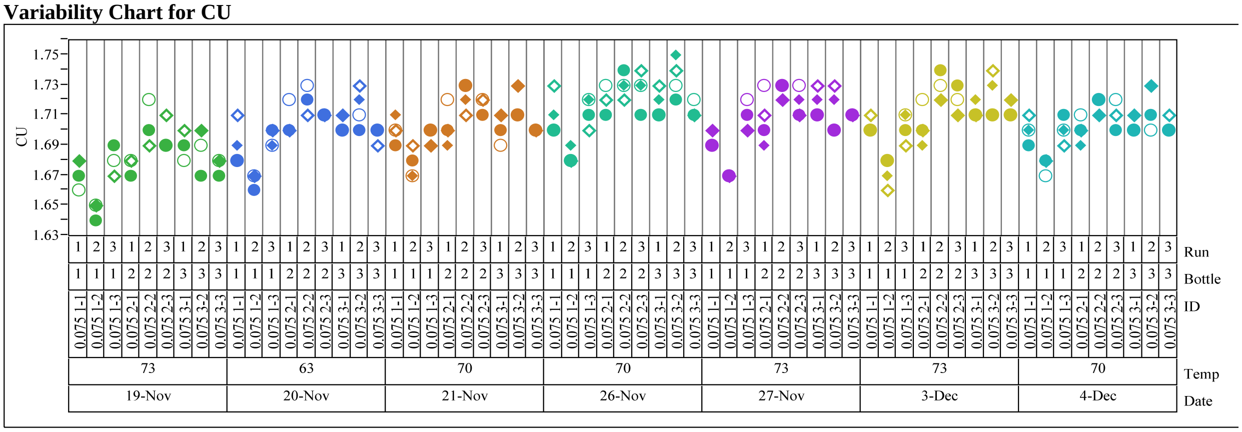
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 2, Wt%=0.05
Variability Chart for CU



Meter=System 2, Wt%=0.075
Variability Chart for CU



Meter=System 2, Wt%=0.1
Variability Chart for CU

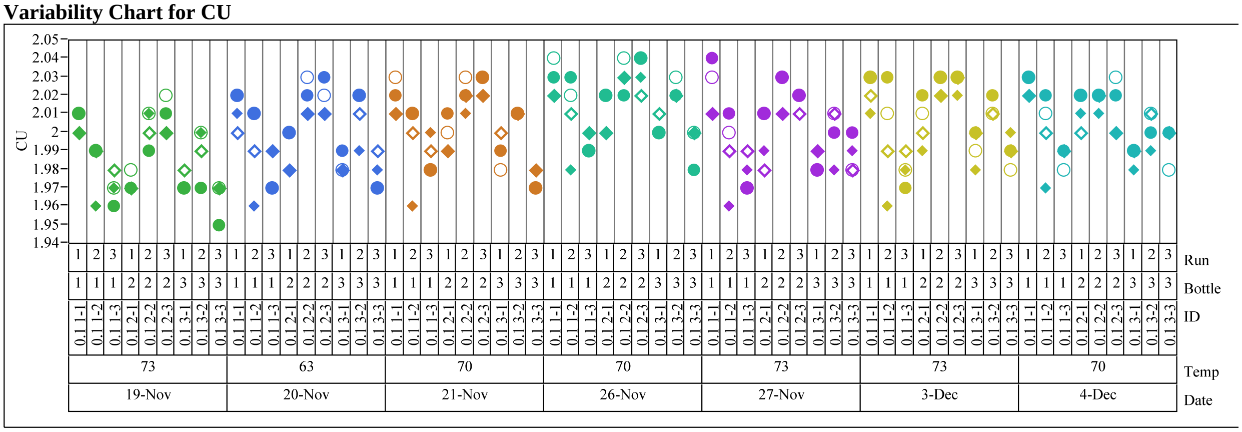
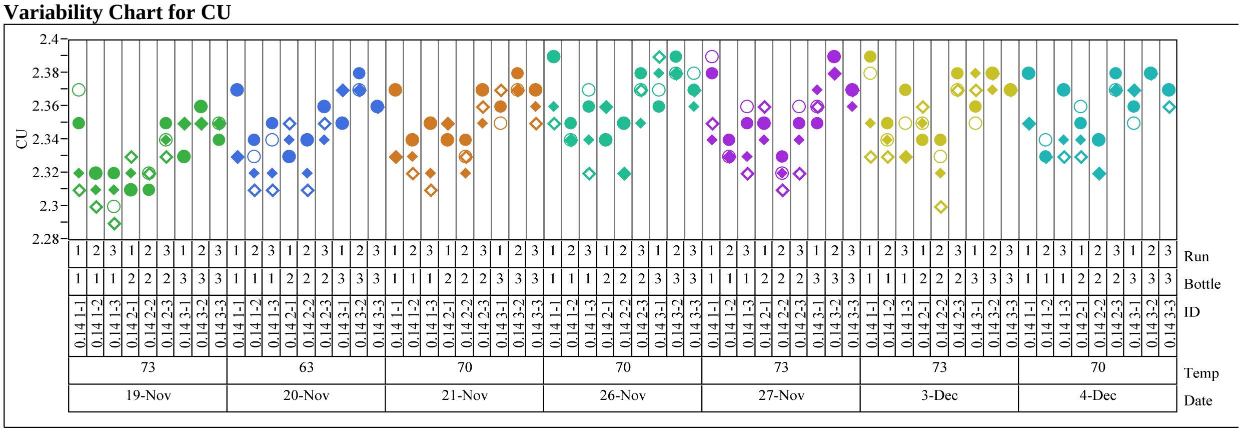


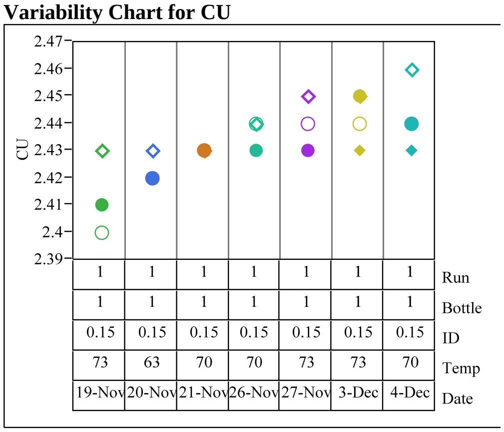
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 2, Wt%=0.14
Variability Chart for CU



Meter=System 2, Wt%=0.15
Variability Chart for CU



Meter=System 2, Wt%=0.2
Variability Chart for CU

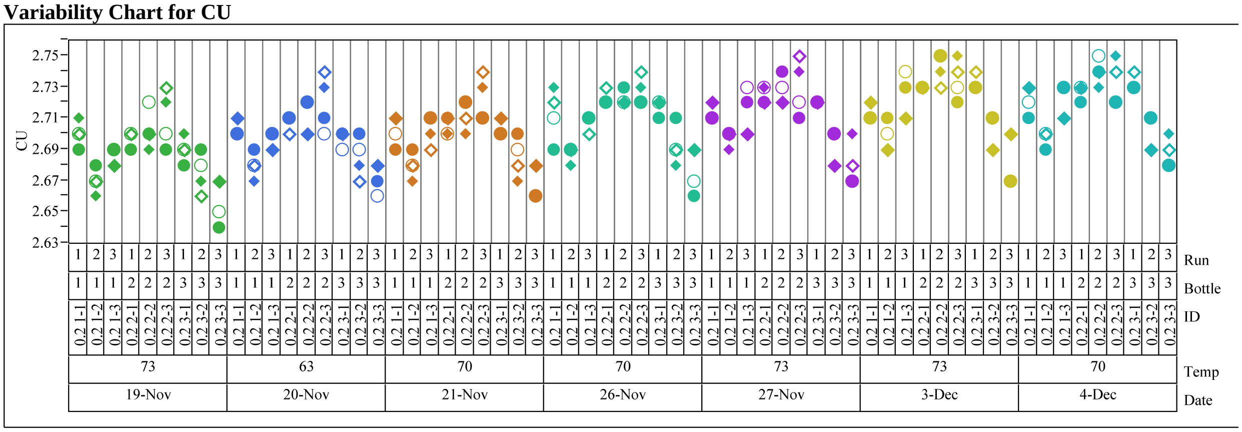
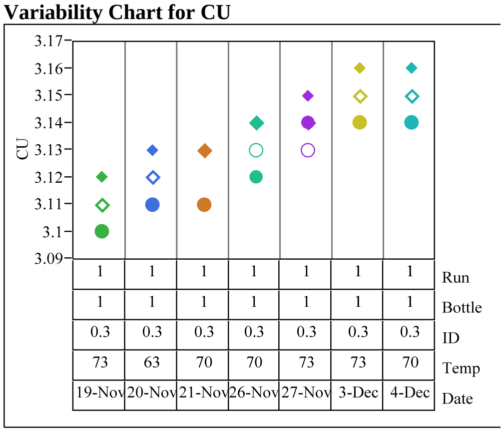


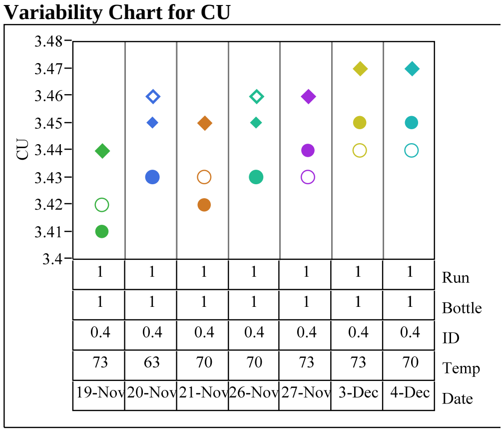
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 2, Wt%=0.3
Variability Chart for CU



Meter=System 2, Wt%=0.4
Variability Chart for CU



Meter=System 2, Wt%=0.5
Variability Chart for CU

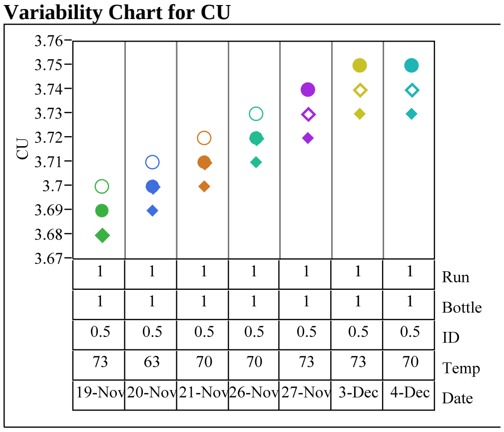
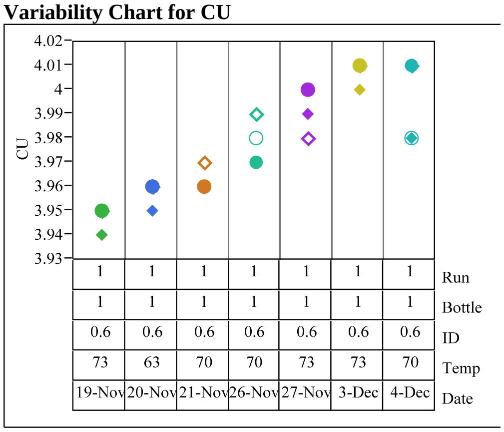


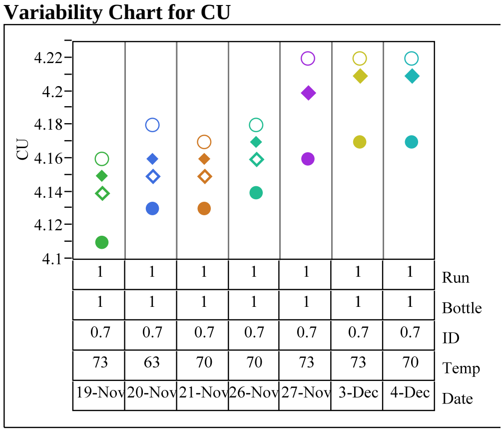
Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 2, Wt%=0.6
Variability Chart for CU



Meter=System 2, Wt%=0.7
Variability Chart for CU



Meter=System 2, Wt%=0.8
Variability Chart for CU

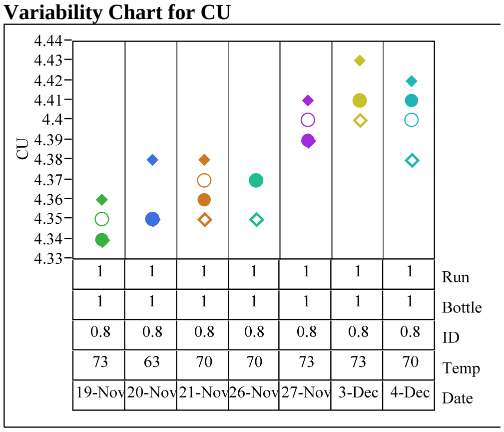


Exhibit A2. Concentration Unit (CU) Measurements by Meter for Deionized Water and Sludge Simulant Standards

○ – forward, ● – backward, ◊ – left, and ♦ – right

Meter=System 2, Wt%=1.2
Variability Chart for CU

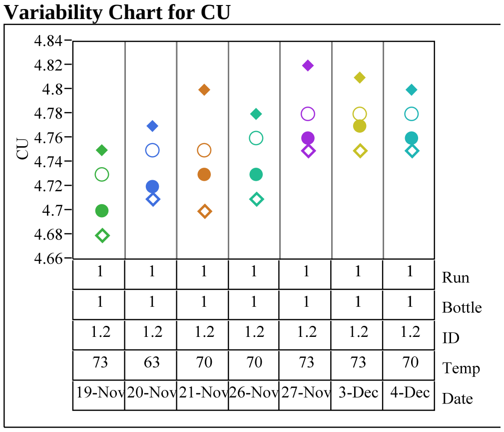
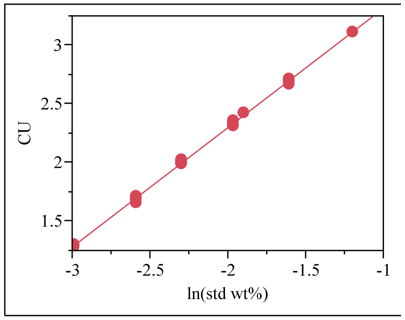


Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=14-Nov, Position=Back



Linear Fit

Linear Fit
CU = 4.3416961 + 1.0179849*ln(std wt%)

Summary of Fit

RSquare	0.999108
RSquare Adj	0.999088
Root Mean Square Error	0.015509
Mean of Response	2.039787
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00173532	0.000347	1.5274
Pure Error	40	0.00908889	0.000227	**Prob > F**
Total Error	45	0.01082421		0.2031
				Max RSq
				0.9993

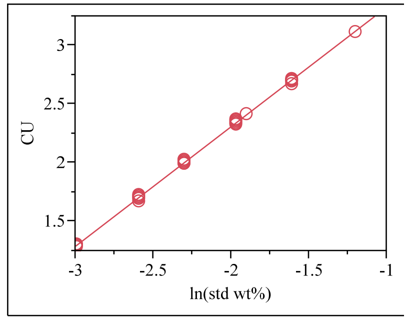
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.127674	12.1277	50418.96
Error	45	0.010824	0.000241	**Prob > F**
C. Total	46	12.138498		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3416961	0.010498	413.56	<.0001*
ln(std wt%)	1.0179849	0.004534	224.54	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=14-Nov, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.3497194 + 1.019369*ln(std wt%)

Summary of Fit

RSquare	0.999138
RSquare Adj	0.999118
Root Mean Square Error	0.015273
Mean of Response	2.044681
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00269657	0.000539	2.7657
Pure Error	40	0.00780000	0.000195	**Prob > F**
Total Error	45	0.01049657		0.0308*
				Max RSq
				0.9994

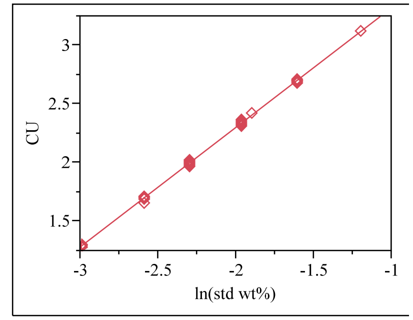
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.160674	12.1607	52134.18
Error	45	0.010497	0.000233	**Prob > F**
C. Total	46	12.171170		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3497194	0.010338	420.75	<.0001*
ln(std wt%)	1.019369	0.004464	228.33	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=14-Nov, Position=Left



Linear Fit

Linear Fit
CU = 4.3433325 + 1.0182381*ln(std wt%)

Summary of Fit

RSquare	0.999024
RSquare Adj	0.999002
Root Mean Square Error	0.016233
Mean of Response	2.040851
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00136960	0.000274	1.0446
Pure Error	40	0.01048889	0.000262	**Prob > F**
Total Error	45	0.01185849		0.4051
				Max RSq
				0.9991

Analysis of Variance

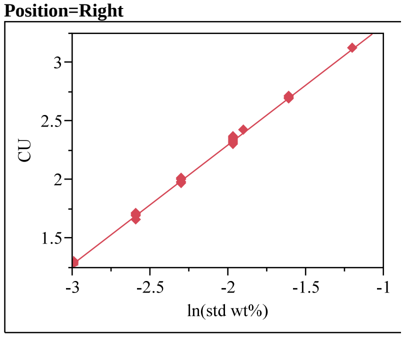
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.133707	12.1337	46044.38
Error	45	0.011858	0.000264	**Prob > F**
C. Total	46	12.145566		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3433325	0.010988	395.27	<.0001*
ln(std wt%)	1.0182381	0.004745	214.58	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=14-Nov, Position=Right



Linear Fit

Linear Fit
CU = 4.3488173 + 1.0216046*ln(std wt%)

Summary of Fit

RSquare	0.999047
RSquare Adj	0.999026
Root Mean Square Error	0.01609
Mean of Response	2.038723
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00091712	0.000183	0.6836
Pure Error	40	0.01073333	0.000268	**Prob > F**
Total Error	45	0.01165045		0.6386
				Max RSq
				0.9991

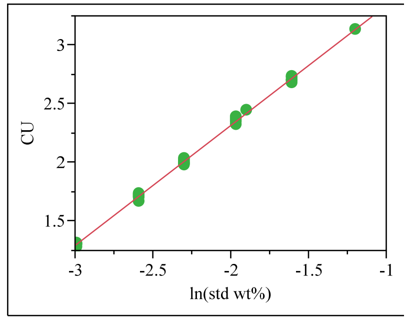
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.214073	12.2141	47177.00
Error	45	0.011650	0.000259	**Prob > F**
C. Total	46	12.225723		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3488173	0.010892	399.28	<.0001*
ln(std wt%)	1.0216046	0.004703	217.20	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=19-Nov, Position=Back



Linear Fit

Linear Fit
CU = 4.3694757 + 1.0223663*ln(std wt%)

Summary of Fit

RSquare	0.99873
RSquare Adj	0.998702
Root Mean Square Error	0.018589
Mean of Response	2.05766
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00103900	0.000208	0.5728
Pure Error	40	0.01451111	0.000363	**Prob > F**
Total Error	45	0.01555011		0.7204
				Max RSq
				0.9988

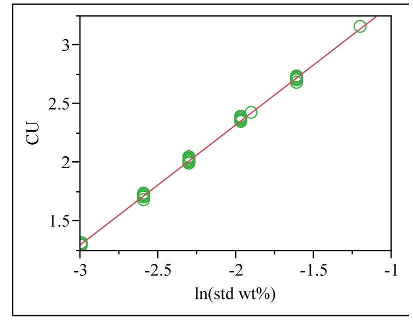
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.232292	12.2323	35398.67
Error	45	0.015550	0.000346	**Prob > F**
C. Total	46	12.247843		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3694757	0.012583	347.25	<.0001*
ln(std wt%)	1.0223663	0.005434	188.15	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=19-Nov, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.3761905 + 1.023548*ln(std wt%)

Summary of Fit

RSquare	0.998951
RSquare Adj	0.998928
Root Mean Square Error	0.016916
Mean of Response	2.061702
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00305447	0.000611	2.4878
Pure Error	40	0.00982222	0.000246	**Prob > F**
Total Error	45	0.01287669		0.0471*
				Max RSq
				0.9992

Analysis of Variance

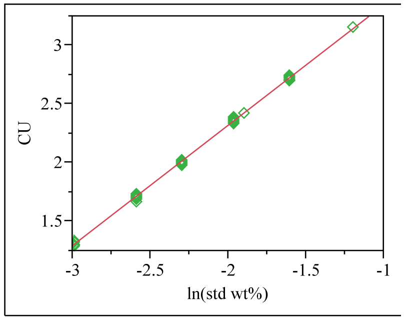
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.260587	12.2606	42846.91
Error	45	0.012877	0.000286	**Prob > F**
C. Total	46	12.273464		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3761905	0.01145	382.19	<.0001*
ln(std wt%)	1.023548	0.004945	206.99	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=19-Nov, Position=Left



Linear Fit

Linear Fit
CU = 4.3760624 + 1.0254673*ln(std wt%)

Summary of Fit

RSquare	0.998772
RSquare Adj	0.998745
Root Mean Square Error	0.018336
Mean of Response	2.057234
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00208503	0.000417	1.2787
Pure Error	40	0.01304444	0.000326	**Prob > F**
Total Error	45	0.01512947		0.2921
				Max RSq
				0.9989

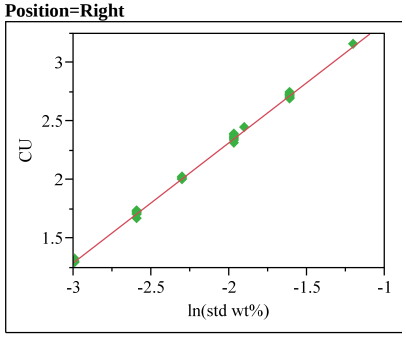
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.306611	12.3066	36603.89
Error	45	0.015129	0.000336	**Prob > F**
C. Total	46	12.321740		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3760624	0.012412	352.58	<.0001*
ln(std wt%)	1.0254673	0.00536	191.32	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=19-Nov, Position=Right



Linear Fit

Linear Fit
CU = 4.375093 + 1.0256032*ln(std wt%)

Summary of Fit

RSquare	0.998859
RSquare Adj	0.998834
Root Mean Square Error	0.017676
Mean of Response	2.055957
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00114909	0.000230	0.7120
Pure Error	40	0.01291111	0.000323	**Prob > F**
Total Error	45	0.01406020		0.6180
				Max RSq
				0.9990

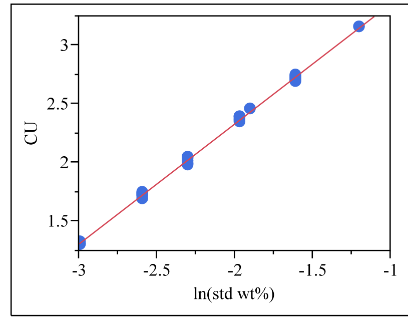
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.309872	12.3099	39398.03
Error	45	0.014060	0.000312	**Prob > F**
C. Total	46	12.323932		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.375093	0.011965	365.66	<.0001*
ln(std wt%)	1.0256032	0.005167	198.49	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=20-Nov, Position=Back



Linear Fit

Linear Fit
CU = 4.381622 + 1.0235036*ln(std wt%)

Summary of Fit

RSquare	0.998809
RSquare Adj	0.998783
Root Mean Square Error	0.018023
Mean of Response	2.067234
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00186195	0.000372	1.1678
Pure Error	40	0.01275556	0.000319	**Prob > F**
Total Error	45	0.01461750		0.3419
				Max RSq
				0.9990

Analysis of Variance

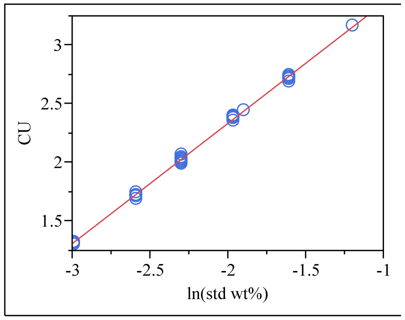
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.259523	12.2595	37740.96
Error	45	0.014618	0.000325	**Prob > F**
C. Total	46	12.274140		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.381622	0.0122	359.15	<.0001*
ln(std wt%)	1.0235036	0.005268	194.27	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=20-Nov, Position=Frwrd



Linear Fit

Linear Fit

CU = 4.3921487 + 1.0253361*ln(std wt%)

Summary of Fit

RSquare	0.998894
RSquare Adj	0.998869
Root Mean Square Error	0.017399
Mean of Response	2.073617
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00280071	0.000560	2.0703
Pure Error	40	0.01082222	0.000271	**Prob > F**
Total Error	45	0.01362294		0.0894
				Max RSq
				0.9991

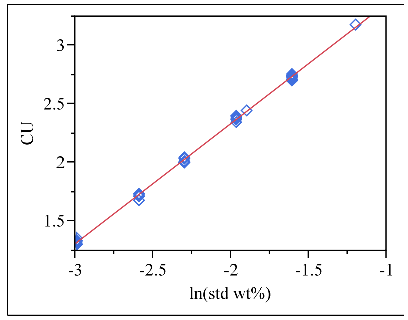
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.303462	12.3035	40641.44
Error	45	0.013623	0.000303	**Prob > F**
C. Total	46	12.317085		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3921487	0.011778	372.93	<.0001*
ln(std wt%)	1.0253361	0.005086	201.60	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=20-Nov, Position=Left



Linear Fit

Linear Fit

CU = 4.388299 + 1.0249509*ln(std wt%)

Summary of Fit

RSquare	0.998533
RSquare Adj	0.9985
Root Mean Square Error	0.020034
Mean of Response	2.070638
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00375021	0.000750	2.0964
Pure Error	40	0.01431111	0.000358	**Prob > F**
Total Error	45	0.01806132		0.0859
				Max RSq
				0.9988

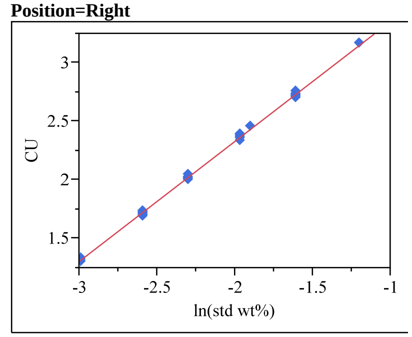
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.294220	12.2942	30631.20
Error	45	0.018061	0.000401	**Prob > F**
C. Total	46	12.312281		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.388299	0.013561	323.60	<.0001*
ln(std wt%)	1.0249509	0.005856	175.02	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=20-Nov, Position=Right



Linear Fit

Linear Fit

CU = 4.3829694 + 1.0244758*ln(std wt%)

Summary of Fit

RSquare	0.998987
RSquare Adj	0.998964
Root Mean Square Error	0.01664
Mean of Response	2.066383
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00165982	0.000332	1.2295
Pure Error	40	0.01080000	0.000270	**Prob > F**
Total Error	45	0.01245982		0.3133
				Max RSq
				0.9991

Analysis of Variance

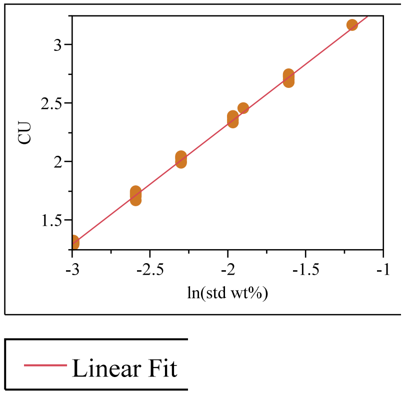
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.282825	12.2828	44360.77
Error	45	0.012460	0.000277	**Prob > F**
C. Total	46	12.295285		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3829694	0.011264	389.13	<.0001*
ln(std wt%)	1.0244758	0.004864	210.62	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=21-Nov, Position=Back



Linear Fit
CU = 4.3848746 + 1.0261652*ln(std wt%)

Summary of Fit

RSquare	0.998558
RSquare Adj	0.998526
Root Mean Square Error	0.019885
Mean of Response	2.064468
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00230464	0.000461	1.1903
Pure Error	40	0.01548889	0.000387	**Prob > F**
Total Error	45	0.01779353		0.3312
				Max RSq
				0.9987

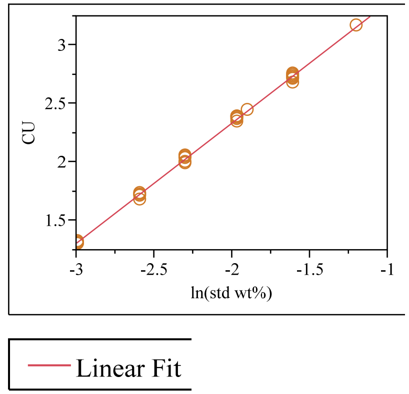
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.323368	12.3234	31165.92
Error	45	0.017794	0.000395	**Prob > F**
C. Total	46	12.341162		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3848746	0.01346	325.77	<.0001*
ln(std wt%)	1.0261652	0.005813	176.54	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=21-Nov, Position=Frwrd



Linear Fit
CU = 4.394876 + 1.027295*ln(std wt%)

Summary of Fit

RSquare	0.99856
RSquare Adj	0.998528
Root Mean Square Error	0.019895
Mean of Response	2.071915
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00338846	0.000678	1.8796
Pure Error	40	0.01442222	0.000361	**Prob > F**
Total Error	45	0.01781069		0.1196
				Max RSq
				0.9988

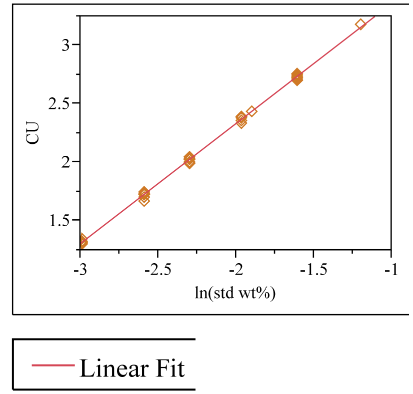
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.350517	12.3505	31204.48
Error	45	0.017811	0.000396	**Prob > F**
C. Total	46	12.368328		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.394876	0.013467	326.35	<.0001*
ln(std wt%)	1.027295	0.005815	176.65	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=21-Nov, Position=Left



Linear Fit
CU = 4.3872441 + 1.0256135*ln(std wt%)

Summary of Fit

RSquare	0.998507
RSquare Adj	0.998474
Root Mean Square Error	0.020225
Mean of Response	2.068085
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00260742	0.000521	1.3202
Pure Error	40	0.01580000	0.000395	**Prob > F**
Total Error	45	0.01840742		0.2752
				Max RSq
				0.9987

Analysis of Variance

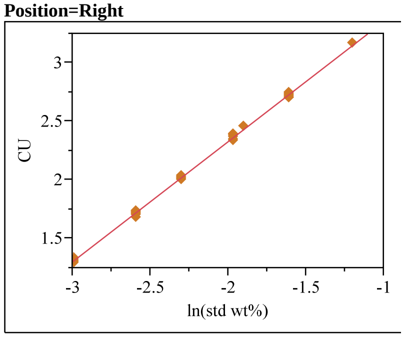
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.310120	12.3101	30094.14
Error	45	0.018407	0.000409	**Prob > F**
C. Total	46	12.328528		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3872441	0.01369	320.46	<.0001*
ln(std wt%)	1.0256135	0.005912	173.48	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=21-Nov, Position=Right



Linear Fit

Linear Fit
CU = 4.3825256 + 1.0254087*ln(std wt%)

Summary of Fit

RSquare	0.99879
RSquare Adj	0.998763
Root Mean Square Error	0.018201
Mean of Response	2.06383
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00179564	0.000359	1.0956
Pure Error	40	0.01311111	0.000328	**Prob > F**
Total Error	45	0.01490676		0.3779
				Max RSq
				0.9989

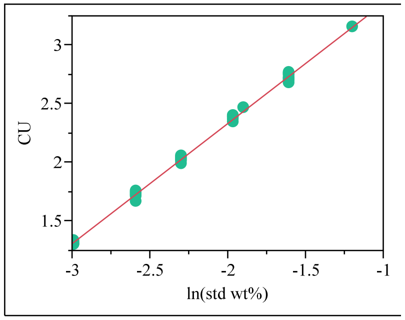
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.305204	12.3052	37146.52
Error	45	0.014907	0.000331	**Prob > F**
C. Total	46	12.320111		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3825256	0.01232	355.73	<.0001*
ln(std wt%)	1.0254087	0.00532	192.73	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=26-Nov, Position=Back



Linear Fit

Linear Fit
CU = 4.3895418 + 1.0241832*ln(std wt%)

Summary of Fit

RSquare	0.998367
RSquare Adj	0.998331
Root Mean Square Error	0.021122
Mean of Response	2.073617
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00183091	0.000366	0.8028
Pure Error	40	0.01824444	0.000456	**Prob > F**
Total Error	45	0.02007535		0.5544
				Max RSq
				0.9985

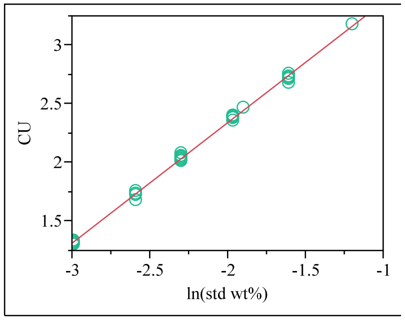
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.275810	12.2758	27516.90
Error	45	0.020075	0.000446	**Prob > F**
C. Total	46	12.295885		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3895418	0.014297	307.02	<.0001*
ln(std wt%)	1.0241832	0.006174	165.88	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=26-Nov, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.4035862 + 1.0276655*ln(std wt%)

Summary of Fit

RSquare	0.998379
RSquare Adj	0.998343
Root Mean Square Error	0.021119
Mean of Response	2.079787
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00420295	0.000841	2.1191
Pure Error	40	0.01586667	0.000397	**Prob > F**
Total Error	45	0.02006962		0.0829
				Max RSq
				0.9987

Analysis of Variance

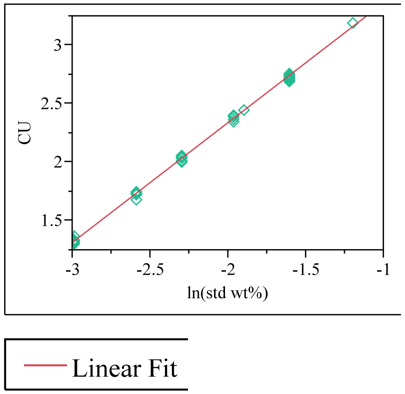
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.359428	12.3594	27712.25
Error	45	0.020070	0.000446	**Prob > F**
C. Total	46	12.379498		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.4035862	0.014295	308.05	<.0001*
ln(std wt%)	1.0276655	0.006173	166.47	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=26-Nov, Position=Left



Linear Fit
CU = 4.3933838 + 1.0242827*ln(std wt%)

Summary of Fit

RSquare	0.998411
RSquare Adj	0.998375
Root Mean Square Error	0.020841
Mean of Response	2.077234
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00283393	0.000567	1.3567
Pure Error	40	0.01671111	0.000418	**Prob > F**
Total Error	45	0.01954504		0.2610
				Max RSq
				0.9986

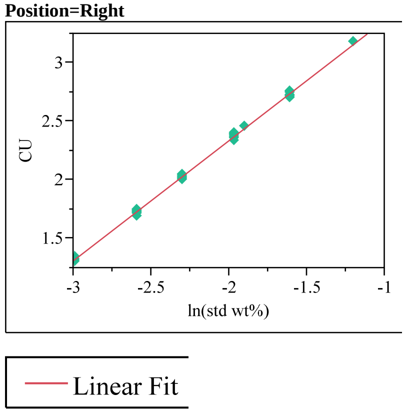
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.278195	12.2782	28269.00
Error	45	0.019545	0.000434	**Prob > F**
C. Total	46	12.297740		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3933838	0.014107	311.43	<.0001*
ln(std wt%)	1.0242827	0.006092	168.13	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=26-Nov, Position=Right



Linear Fit
CU = 4.3916336 + 1.0254847*ln(std wt%)

Summary of Fit

RSquare	0.998806
RSquare Adj	0.998779
Root Mean Square Error	0.018082
Mean of Response	2.072766
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00160138	0.000320	0.9771
Pure Error	40	0.01311111	0.000328	**Prob > F**
Total Error	45	0.01471250		0.4435
				Max RSq
				0.9989

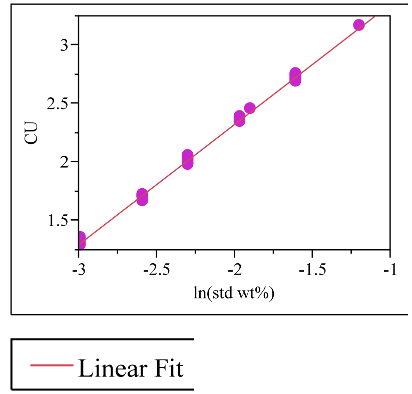
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.307028	12.3070	37642.58
Error	45	0.014712	0.000327	**Prob > F**
C. Total	46	12.321740		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3916336	0.012239	358.81	<.0001*
ln(std wt%)	1.0254847	0.005286	194.02	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=5-Dec, Position=Back



Linear Fit
CU = 4.3833576 + 1.0272821*ln(std wt%)

Summary of Fit

RSquare	0.998449
RSquare Adj	0.998415
Root Mean Square Error	0.020647
Mean of Response	2.060426
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00333909	0.000668	1.6859
Pure Error	40	0.01584444	0.000396	**Prob > F**
Total Error	45	0.01918353		0.1603
				Max RSq
				0.9987

Analysis of Variance

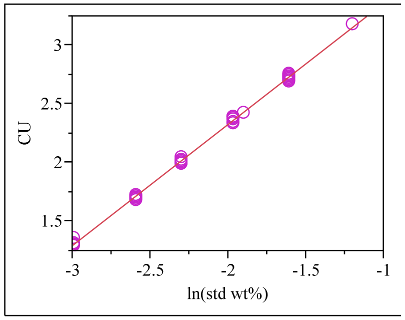
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.350208	12.3502	28970.65
Error	45	0.019184	0.000426	**Prob > F**
C. Total	46	12.369391		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3833576	0.013976	313.63	<.0001*
ln(std wt%)	1.0272821	0.006035	170.21	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=5-Dec, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.3981182 + 1.0328688*ln(std wt%)

Summary of Fit

RSquare	0.998401
RSquare Adj	0.998366
Root Mean Square Error	0.021077
Mean of Response	2.062553
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00432380	0.000865	2.2079
Pure Error	40	0.01566667	0.000392	**Prob > F**
Total Error	45	0.01999047		0.0724
				Max RSq
				0.9987

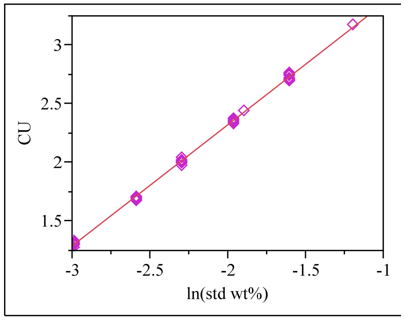
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.484903	12.4849	28104.43
Error	45	0.019990	0.000444	**Prob > F**
C. Total	46	12.504894		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3981182	0.014267	308.27	<.0001*
ln(std wt%)	1.0328688	0.006161	167.64	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=5-Dec, Position=Left



Linear Fit

Linear Fit
CU = 4.3954507 + 1.0327242*ln(std wt%)

Summary of Fit

RSquare	0.998569
RSquare Adj	0.998537
Root Mean Square Error	0.019939
Mean of Response	2.060213
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00231313	0.000463	1.1879
Pure Error	40	0.01557778	0.000389	**Prob > F**
Total Error	45	0.01789090		0.3323
				Max RSq
				0.9988

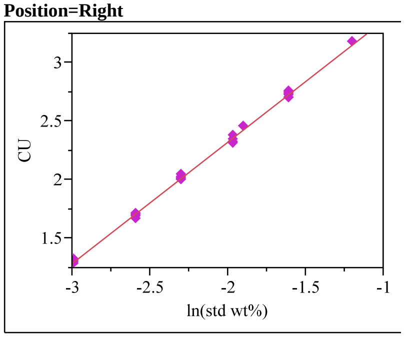
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.481407	12.4814	31393.79
Error	45	0.017891	0.000398	**Prob > F**
C. Total	46	12.499298		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3954507	0.013497	325.66	<.0001*
ln(std wt%)	1.0327242	0.005829	177.18	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 1, Date=5-Dec, Position=Right



Linear Fit

Linear Fit
CU = 4.39897 + 1.0355038*ln(std wt%)

Summary of Fit

RSquare	0.998567
RSquare Adj	0.998535
Root Mean Square Error	0.020005
Mean of Response	2.057447
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00318721	0.000637	1.7202
Pure Error	40	0.01482222	0.000371	**Prob > F**
Total Error	45	0.01800943		0.1522
				Max RSq
				0.9988

Analysis of Variance

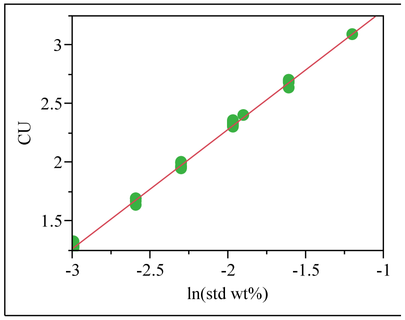
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.548684	12.5487	31355.28
Error	45	0.018009	0.0004	**Prob > F**
C. Total	46	12.566694		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.39897	0.013542	324.85	<.0001*
ln(std wt%)	1.0355038	0.005848	177.07	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=19-Nov, Position=Back



Linear Fit

Linear Fit

CU = 4.3228261 + 1.0166969*ln(std wt%)

Summary of Fit

RSquare	0.998588
RSquare Adj	0.998556
Root Mean Square Error	0.019498
Mean of Response	2.02383
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00292971	0.000586	1.6531
Pure Error	40	0.01417778	0.000354	**Prob > F**
Total Error	45	0.01710749		0.1684
				Max RSq
				0.9988

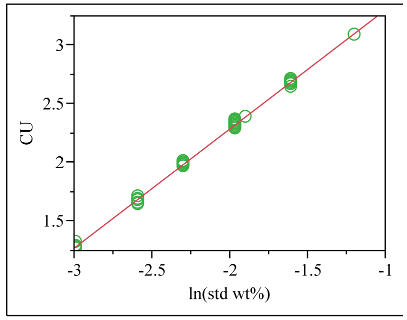
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.097003	12.0970	31820.28
Error	45	0.017107	0.00038	**Prob > F**
C. Total	46	12.114111		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3228261	0.013198	327.53	<.0001*
ln(std wt%)	1.0166969	0.0057	178.38	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=19-Nov, Position=Frwrd



Linear Fit

Linear Fit

CU = 4.3260713 + 1.016062*ln(std wt%)

Summary of Fit

RSquare	0.998455
RSquare Adj	0.998421
Root Mean Square Error	0.020383
Mean of Response	2.028511
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00227387	0.000455	1.1077
Pure Error	40	0.01642222	0.000411	**Prob > F**
Total Error	45	0.01869609		0.3716
				Max RSq
				0.9986

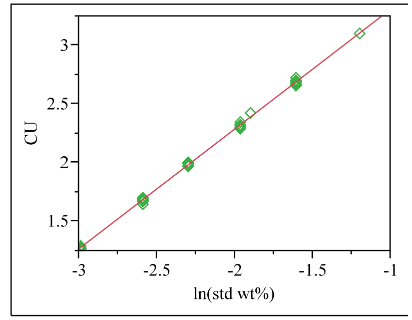
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.081900	12.0819	29080.17
Error	45	0.018696	0.000415	**Prob > F**
C. Total	46	12.100596		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3260713	0.013797	313.55	<.0001*
ln(std wt%)	1.016062	0.005958	170.53	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=19-Nov, Position=Left



Linear Fit

Linear Fit

CU = 4.3334457 + 1.0204523*ln(std wt%)

Summary of Fit

RSquare	0.998853
RSquare Adj	0.998827
Root Mean Square Error	0.017636
Mean of Response	2.025957
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00157461	0.000315	1.0141
Pure Error	40	0.01242222	0.000311	**Prob > F**
Total Error	45	0.01399684		0.4222
				Max RSq
				0.9990

Analysis of Variance

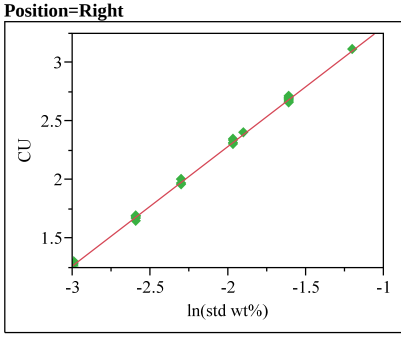
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.186535	12.1865	39179.86
Error	45	0.013997	0.000311	**Prob > F**
C. Total	46	12.200532		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3334457	0.011938	362.99	<.0001*
ln(std wt%)	1.0204523	0.005155	197.94	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=19-Nov, Position=Right



Linear Fit

Linear Fit
CU = 4.3335634 + 1.0206926*ln(std wt%)

Summary of Fit

RSquare	0.998944
RSquare Adj	0.998921
Root Mean Square Error	0.016923
Mean of Response	2.025532
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00104298	0.000209	0.7045
Pure Error	40	0.01184444	0.000296	**Prob > F**
Total Error	45	0.01288743		0.6234
				Max RSq
				0.9990

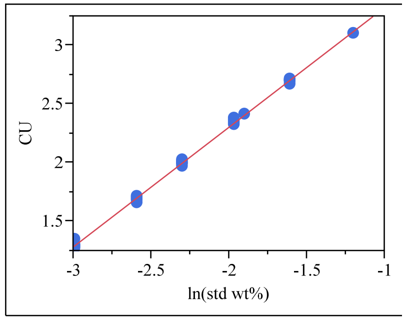
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.192274	12.1923	42572.68
Error	45	0.012887	0.000286	**Prob > F**
C. Total	46	12.205162		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3335634	0.011455	378.31	<.0001*
ln(std wt%)	1.0206926	0.004947	206.33	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=20-Nov, Position=Back



Linear Fit

Linear Fit
CU = 4.347277 + 1.0196061*ln(std wt%)

Summary of Fit

RSquare	0.998627
RSquare Adj	0.998596
Root Mean Square Error	0.019282
Mean of Response	2.041702
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00250800	0.000502	1.4107
Pure Error	40	0.01422222	0.000356	**Prob > F**
Total Error	45	0.01673022		0.2412
				Max RSq
				0.9988

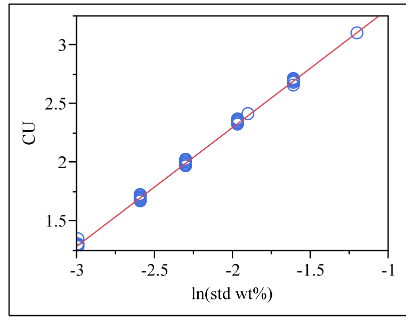
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.166334	12.1663	32724.32
Error	45	0.016730	0.000372	**Prob > F**
C. Total	46	12.183064		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.347277	0.013052	333.08	<.0001*
ln(std wt%)	1.0196061	0.005636	180.90	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=20-Nov, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.3309166 + 1.0124651*ln(std wt%)

Summary of Fit

RSquare	0.998561
RSquare Adj	0.998529
Root Mean Square Error	0.019599
Mean of Response	2.041489
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00192932	0.000386	1.0051
Pure Error	40	0.01535556	0.000384	**Prob > F**
Total Error	45	0.01728487		0.4273
				Max RSq
				0.9987

Analysis of Variance

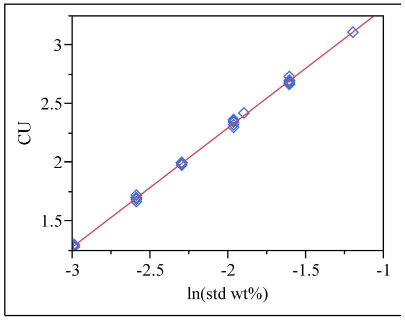
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	11.996511	11.9965	31232.11
Error	45	0.017285	0.000384	**Prob > F**
C. Total	46	12.013796		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3309166	0.013266	326.46	<.0001*
ln(std wt%)	1.0124651	0.005729	176.73	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=20-Nov, Position=Left



Linear Fit

Linear Fit
CU = 4.3367875 + 1.0165669*ln(std wt%)

Summary of Fit

RSquare	0.998859
RSquare Adj	0.998833
Root Mean Square Error	0.017523
Mean of Response	2.038085
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00070608	0.000141	0.4308
Pure Error	40	0.01311111	0.000328	**Prob > F**
Total Error	45	0.01381719		0.8244
				Max RSq
				0.9989

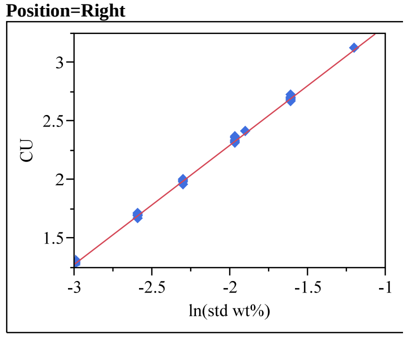
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.093910	12.0939	39387.61
Error	45	0.013817	0.000307	**Prob > F**
C. Total	46	12.107728		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3367875	0.011861	365.63	<.0001*
ln(std wt%)	1.0165669	0.005122	198.46	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=20-Nov, Position=Right



Linear Fit

Linear Fit
CU = 4.3378849 + 1.0175227*ln(std wt%)

Summary of Fit

RSquare	0.998902
RSquare Adj	0.998877
Root Mean Square Error	0.017205
Mean of Response	2.037021
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00098669	0.000197	0.6400
Pure Error	40	0.01233333	0.000308	**Prob > F**
Total Error	45	0.01332002		0.6705
				Max RSq
				0.9990

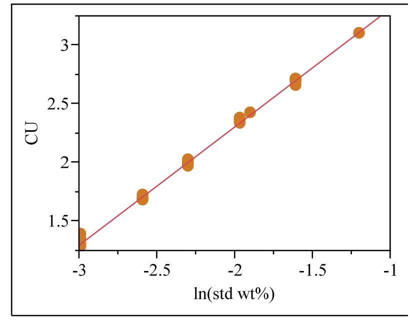
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.116663	12.1167	40934.61
Error	45	0.013320	0.000296	**Prob > F**
C. Total	46	12.129983		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3378849	0.011646	372.48	<.0001*
ln(std wt%)	1.0175227	0.005029	202.32	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=21-Nov, Position=Back



Linear Fit

Linear Fit
CU = 4.3273621 + 1.0082586*ln(std wt%)

Summary of Fit

RSquare	0.997948
RSquare Adj	0.997903
Root Mean Square Error	0.023315
Mean of Response	2.047447
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00403833	0.000808	1.5819
Pure Error	40	0.02042222	0.000511	**Prob > F**
Total Error	45	0.02446055		0.1873
				Max RSq
				0.9983

Analysis of Variance

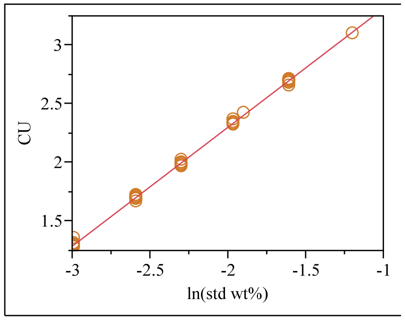
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	11.897033	11.8970	21886.93
Error	45	0.024461	0.000544	**Prob > F**
C. Total	46	11.921494		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3273621	0.015782	274.20	<.0001*
ln(std wt%)	1.0082586	0.006815	147.94	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=21-Nov, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.3356997 + 1.0133572*ln(std wt%)

Summary of Fit

RSquare	0.998364
RSquare Adj	0.998328
Root Mean Square Error	0.020917
Mean of Response	2.044255
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00242227	0.000484	1.1223
Pure Error	40	0.01726667	0.000432	**Prob > F**
Total Error	45	0.01968894		0.3642
				Max RSq
				0.9986

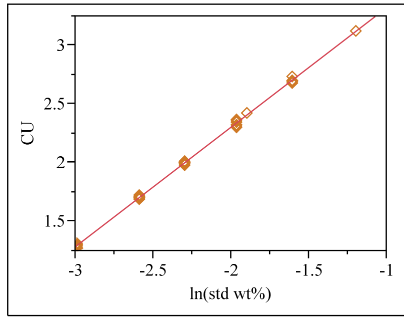
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.017660	12.0177	27466.93
Error	45	0.019689	0.000438	**Prob > F**
C. Total	46	12.037349		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3356997	0.014159	306.22	<.0001*
ln(std wt%)	1.0133572	0.006114	165.73	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=21-Nov, Position=Left



Linear Fit

Linear Fit
CU = 4.3448193 + 1.0184252*ln(std wt%)

Summary of Fit

RSquare	0.998983
RSquare Adj	0.99896
Root Mean Square Error	0.016574
Mean of Response	2.041915
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00069434	0.000139	0.4761
Pure Error	40	0.01166667	0.000292	**Prob > F**
Total Error	45	0.01236101		0.7918
				Max RSq
				0.9990

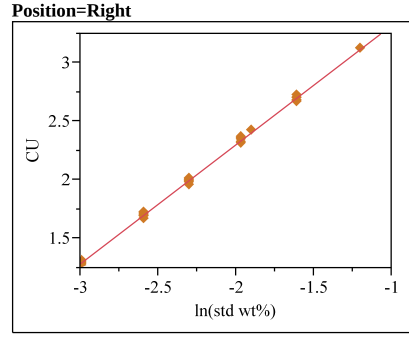
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.138167	12.1382	44188.75
Error	45	0.012361	0.000275	**Prob > F**
C. Total	46	12.150528		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3448193	0.011219	387.28	<.0001*
ln(std wt%)	1.0184252	0.004845	210.21	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=21-Nov, Position=Right



Linear Fit

Linear Fit
CU = 4.3403186 + 1.0175639*ln(std wt%)

Summary of Fit

RSquare	0.99881
RSquare Adj	0.998784
Root Mean Square Error	0.017911
Mean of Response	2.039362
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00108028	0.000216	0.6471
Pure Error	40	0.01335556	0.000334	**Prob > F**
Total Error	45	0.01443583		0.6653
				Max RSq
				0.9989

Analysis of Variance

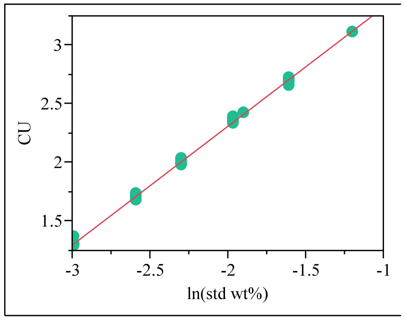
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.117645	12.1176	37773.65
Error	45	0.014436	0.000321	**Prob > F**
C. Total	46	12.132081		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3403186	0.012124	358.00	<.0001*
ln(std wt%)	1.0175639	0.005236	194.35	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=26-Nov, Position=Back



Linear Fit

Linear Fit
CU = 4.3431076 + 1.0126813*ln(std wt%)

Summary of Fit

RSquare	0.998387
RSquare Adj	0.998351
Root Mean Square Error	0.020756
Mean of Response	2.053191
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00343136	0.000686	1.7205
Pure Error	40	0.01595556	0.000399	**Prob > F**
Total Error	45	0.01938692		0.1522
				Max RSq
				0.9987

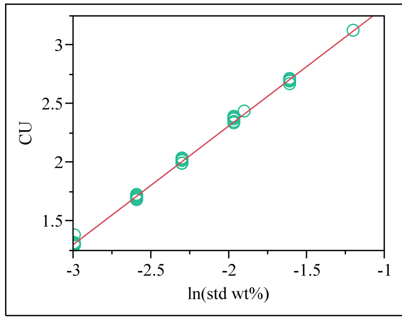
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.001634	12.0016	27857.63
Error	45	0.019387	0.000431	**Prob > F**
C. Total	46	12.021021		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3431076	0.01405	309.12	<.0001*
ln(std wt%)	1.0126813	0.006067	166.91	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=26-Nov, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.3446718 + 1.0119616*ln(std wt%)

Summary of Fit

RSquare	0.998392
RSquare Adj	0.998356
Root Mean Square Error	0.020711
Mean of Response	2.056383
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00290192	0.000580	1.4156
Pure Error	40	0.01640000	0.000410	**Prob > F**
Total Error	45	0.01930192		0.2395
				Max RSq
				0.9986

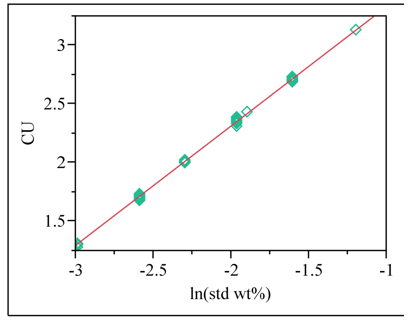
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	11.984583	11.9846	27940.55
Error	45	0.019302	0.000429	**Prob > F**
C. Total	46	12.003885		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3446718	0.014019	309.91	<.0001*
ln(std wt%)	1.0119616	0.006054	167.15	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=26-Nov, Position=Left



Linear Fit

Linear Fit
CU = 4.3527036 + 1.0168309*ln(std wt%)

Summary of Fit

RSquare	0.998856
RSquare Adj	0.99883
Root Mean Square Error	0.017552
Mean of Response	2.053404
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00068484	0.000137	0.4158
Pure Error	40	0.01317778	0.000329	**Prob > F**
Total Error	45	0.01386262		0.8350
				Max RSq
				0.9989

Analysis of Variance

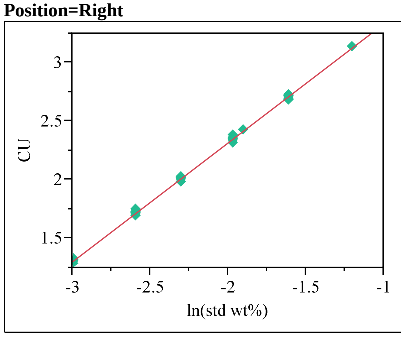
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.100193	12.1002	39278.91
Error	45	0.013863	0.000308	**Prob > F**
C. Total	46	12.114055		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3527036	0.011881	366.37	<.0001*
ln(std wt%)	1.0168309	0.005131	198.19	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=26-Nov, Position=Right



Linear Fit

Linear Fit
CU = 4.3476613 + 1.0152596*ln(std wt%)

Summary of Fit

RSquare	0.998899
RSquare Adj	0.998874
Root Mean Square Error	0.017193
Mean of Response	2.051915
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00059035	0.000118	0.3715
Pure Error	40	0.01271111	0.000318	**Prob > F**
Total Error	45	0.01330146		0.8651
				Max RSq
				0.9989

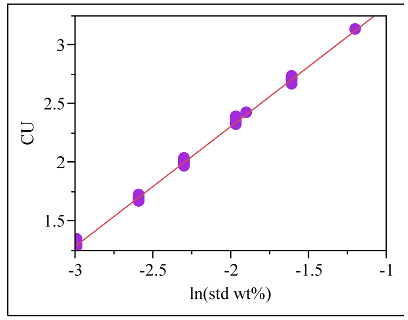
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.062826	12.0628	40809.59
Error	45	0.013301	0.000296	**Prob > F**
C. Total	46	12.076128		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3476613	0.011638	373.58	<.0001*
ln(std wt%)	1.0152596	0.005026	202.01	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=27-Nov, Position=Back



Linear Fit

Linear Fit
CU = 4.3599747 + 1.0222105*ln(std wt%)

Summary of Fit

RSquare	0.998593
RSquare Adj	0.998562
Root Mean Square Error	0.019567
Mean of Response	2.048511
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00167408	0.000335	0.8610
Pure Error	40	0.01555556	0.000389	**Prob > F**
Total Error	45	0.01722963		0.5156
				Max RSq
				0.9987

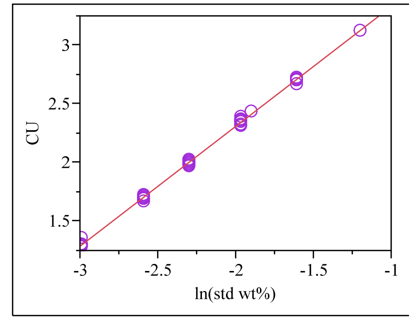
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.228566	12.2286	31938.31
Error	45	0.017230	0.000383	**Prob > F**
C. Total	46	12.245796		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3599747	0.013245	329.18	<.0001*
ln(std wt%)	1.0222105	0.00572	178.71	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=27-Nov, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.3602092 + 1.0216556*ln(std wt%)

Summary of Fit

RSquare	0.998275
RSquare Adj	0.998237
Root Mean Square Error	0.021657
Mean of Response	2.05
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00130700	0.000261	0.5281
Pure Error	40	0.01980000	0.000495	**Prob > F**
Total Error	45	0.02110700		0.7536
				Max RSq
				0.9984

Analysis of Variance

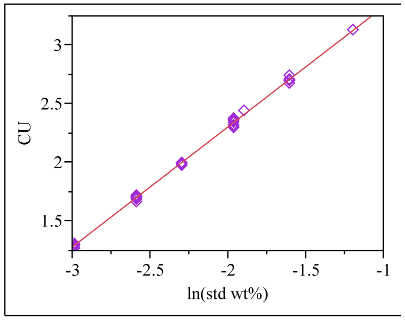
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.215293	12.2153	26042.93
Error	45	0.021107	0.000469	**Prob > F**
C. Total	46	12.236400		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3602092	0.01466	297.42	<.0001*
ln(std wt%)	1.0216556	0.006331	161.38	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=27-Nov, Position=Left



Linear Fit

Linear Fit
CU = 4.3595347 + 1.0239919*ln(std wt%)

Summary of Fit

RSquare	0.998592
RSquare Adj	0.99856
Root Mean Square Error	0.019612
Mean of Response	2.044043
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00159677	0.000319	0.8131
Pure Error	40	0.01571111	0.000393	**Prob > F**
Total Error	45	0.01730789		0.5474
				Max RSq
				0.9987

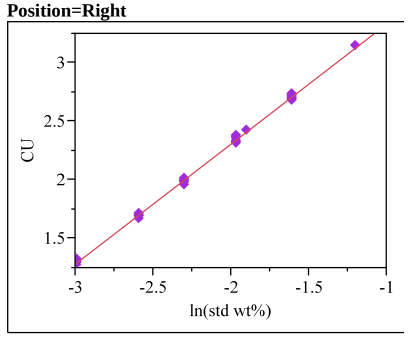
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.271224	12.2712	31904.83
Error	45	0.017308	0.000385	**Prob > F**
C. Total	46	12.288532		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3595347	0.013275	328.40	<.0001*
ln(std wt%)	1.0239919	0.005733	178.62	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=27-Nov, Position=Right



Linear Fit

Linear Fit
CU = 4.3605374 + 1.0248117*ln(std wt%)

Summary of Fit

RSquare	0.998689
RSquare Adj	0.998659
Root Mean Square Error	0.018939
Mean of Response	2.043191
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00162928	0.000326	0.8982
Pure Error	40	0.01451111	0.000363	**Prob > F**
Total Error	45	0.01614039		0.4917
				Max RSq
				0.9988

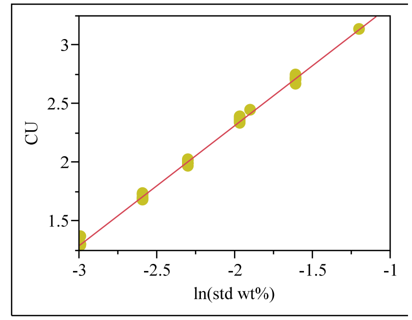
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.290881	12.2909	34267.43
Error	45	0.016140	0.000359	**Prob > F**
C. Total	46	12.307021		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3605374	0.01282	340.15	<.0001*
ln(std wt%)	1.0248117	0.005536	185.11	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=3-Dec, Position=Back



Linear Fit

Linear Fit
CU = 4.3690375 + 1.0231134*ln(std wt%)

Summary of Fit

RSquare	0.998388
RSquare Adj	0.998352
Root Mean Square Error	0.020968
Mean of Response	2.055532
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00222902	0.000446	1.0158
Pure Error	40	0.01755556	0.000439	**Prob > F**
Total Error	45	0.01978458		0.4212
				Max RSq
				0.9986

Analysis of Variance

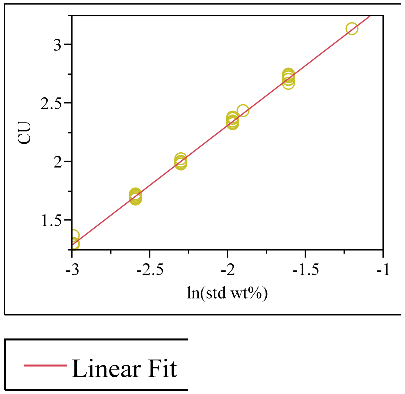
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.250177	12.2502	27863.02
Error	45	0.019785	0.00044	**Prob > F**
C. Total	46	12.269962		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3690375	0.014193	307.83	<.0001*
ln(std wt%)	1.0231134	0.006129	166.92	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=3-Dec, Position=Frwrd



Linear Fit
CU = 4.3638079 + 1.0217416*ln(std wt%)

Summary of Fit

RSquare	0.998537
RSquare Adj	0.998504
Root Mean Square Error	0.019948
Mean of Response	2.053404
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00121718	0.000243	0.5835
Pure Error	40	0.01668889	0.000417	**Prob > F**
Total Error	45	0.01790607		0.7124
				Max RSq
				0.9986

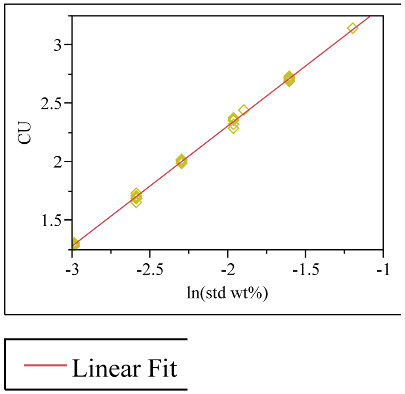
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.217349	12.2173	30703.59
Error	45	0.017906	0.000398	**Prob > F**
C. Total	46	12.235255		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3638079	0.013503	323.18	<.0001*
ln(std wt%)	1.0217416	0.005831	175.22	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=3-Dec, Position=Left



Linear Fit
CU = 4.3684259 + 1.0257598*ln(std wt%)

Summary of Fit

RSquare	0.998539
RSquare Adj	0.998507
Root Mean Square Error	0.020008
Mean of Response	2.048936
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00150347	0.000301	0.7285
Pure Error	40	0.01651111	0.000413	**Prob > F**
Total Error	45	0.01801458		0.6062
				Max RSq
				0.9987

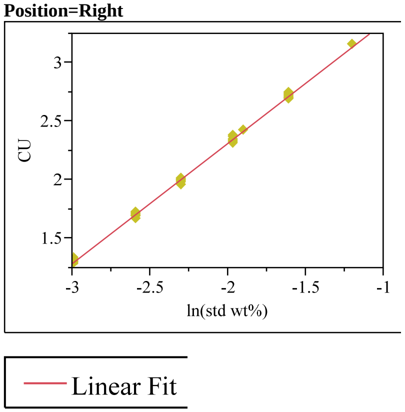
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.313632	12.3136	30759.16
Error	45	0.018015	0.0004	**Prob > F**
C. Total	46	12.331647		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3684259	0.013543	322.55	<.0001*
ln(std wt%)	1.0257598	0.005849	175.38	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=3-Dec, Position=Right



Linear Fit
CU = 4.3704702 + 1.0265697*ln(std wt%)

Summary of Fit

RSquare	0.998407
RSquare Adj	0.998371
Root Mean Square Error	0.020913
Mean of Response	2.049149
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00203588	0.000407	0.9231
Pure Error	40	0.01764444	0.000441	**Prob > F**
Total Error	45	0.01968032		0.4762
				Max RSq
				0.9986

Analysis of Variance

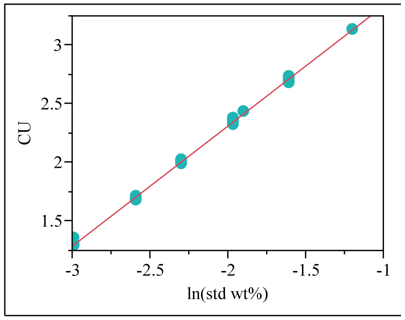
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.333086	12.3331	28200.19
Error	45	0.019680	0.000437	**Prob > F**
C. Total	46	12.352766		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3704702	0.014156	308.74	<.0001*
ln(std wt%)	1.0265697	0.006113	167.93	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=4-Dec, Position=Back



Linear Fit

Linear Fit
CU = 4.3671137 + 1.0239563*ln(std wt%)

Summary of Fit

RSquare	0.998723
RSquare Adj	0.998694
Root Mean Square Error	0.018675
Mean of Response	2.051702
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00322738	0.000645	2.0710
Pure Error	40	0.01246667	0.000312	**Prob > F**
Total Error	45	0.01569405		0.0893
				Max RSq
				0.9990

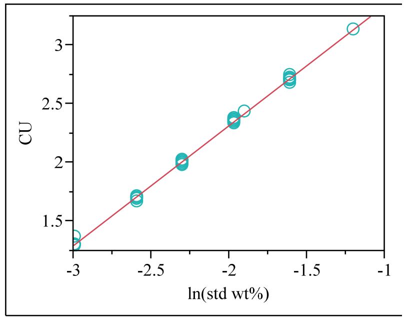
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.270370	12.2704	35183.19
Error	45	0.015694	0.000349	**Prob > F**
C. Total	46	12.286064		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3671137	0.012641	345.47	<.0001*
ln(std wt%)	1.0239563	0.005459	187.57	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=4-Dec, Position=Frwrd



Linear Fit

Linear Fit
CU = 4.367488 + 1.0234632*ln(std wt%)

Summary of Fit

RSquare	0.998545
RSquare Adj	0.998512
Root Mean Square Error	0.019926
Mean of Response	2.053191
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00342257	0.000685	1.8956
Pure Error	40	0.01444444	0.000361	**Prob > F**
Total Error	45	0.01786701		0.1167
				Max RSq
				0.9988

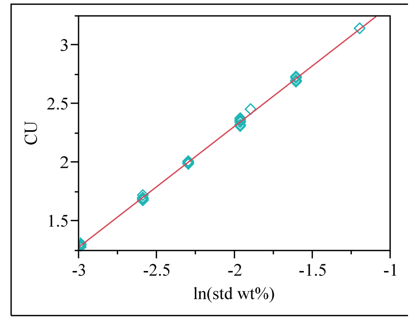
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.258554	12.2586	30874.50
Error	45	0.017867	0.000397	**Prob > F**
C. Total	46	12.276421		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.367488	0.013488	323.81	<.0001*
ln(std wt%)	1.0234632	0.005825	175.71	<.0001*

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=4-Dec, Position=Left



Linear Fit

Linear Fit
CU = 4.3772695 + 1.0300471*ln(std wt%)

Summary of Fit

RSquare	0.99891
RSquare Adj	0.998886
Root Mean Square Error	0.017351
Mean of Response	2.048085
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00192499	0.000385	1.3250
Pure Error	40	0.01162222	0.000291	**Prob > F**
Total Error	45	0.01354721		0.2733
				Max RSq
				0.9991

Analysis of Variance

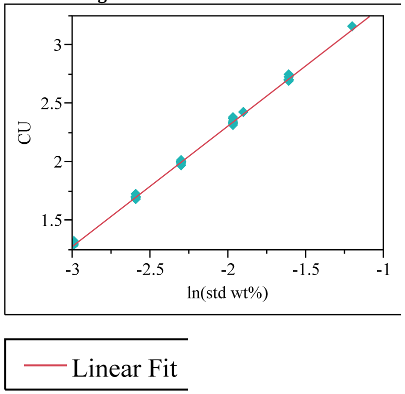
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.416780	12.4168	41245.03
Error	45	0.013547	0.000301	**Prob > F**
C. Total	46	12.430328		<.0001*

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3772695	0.011745	372.70	<.0001*
ln(std wt%)	1.0300471	0.005072	203.09	<.0001*

Exhibit A3. Linear Model of CU Values versus Natural Logarithm of Wt% Solids Values

Bivariate Fit of CU By ln(std wt%) Meter=System 2, Date=4-Dec, Position=Right



Linear Fit
CU = 4.3745054 + 1.0293893*ln(std wt%)

Summary of Fit

RSquare	0.998816
RSquare Adj	0.99879
Root Mean Square Error	0.018071
Mean of Response	2.046809
Observations (or Sum Wgts)	47

Lack Of Fit

Source	DF	Sum of Squares	Mean Square	F Ratio
Lack Of Fit	5	0.00213968	0.000428	1.3633
Pure Error	40	0.01255556	0.000314	**Prob > F**
Total Error	45	0.01469524		0.2585
				Max RSq
				0.9990

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	12.400926	12.4009	37974.32
Error	45	0.014695	0.000327	**Prob > F**
C. Total	46	12.415621		<.0001*

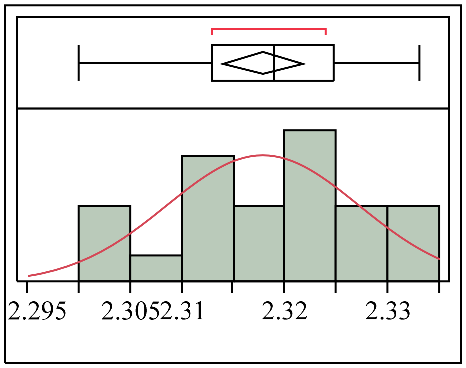
Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	4.3745054	0.012232	357.62	<.0001*
ln(std wt%)	1.0293893	0.005282	194.87	<.0001*

Exhibit A4. Statistical Investigation of LTL Values by Turbidity Meter

Distributions Meter=System 1

95/95 LTL



Normal(2.31779,0.0093)

Quantiles

100.0%	maximum	2.333
99.5%		2.333
97.5%		2.333
90.0%		2.33
75.0%	quartile	2.32475
50.0%	median	2.319
25.0%	quartile	2.313
10.0%		2.301
2.5%		2.3
0.5%		2.3
0.0%	minimum	2.3

Moments

Mean	2.3177917
Std Dev	0.0093016
Std Err Mean	0.0018987
Upper 95% Mean	2.3217194
Lower 95% Mean	2.3138639
N	24

Fitted Normal

Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	2.3177917	2.3138639	2.3217194
Dispersion	σ	0.0093016	0.0072293	0.0130479

-2log(Likelihood) = -157.414209472197

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.952727	0.3101

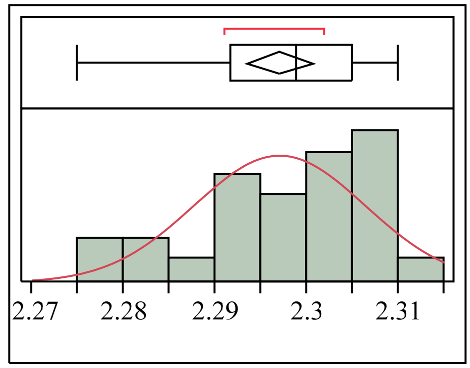
Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

One-sided Tolerance Interval

Proportion	Lower TI	Upper TI	1-Alpha
0.950	2.296312	.	0.950

Distributions Meter=System 2

95/95 LTL



Normal(2.297,0.00933)

Quantiles

100.0%	maximum	2.31
99.5%		2.31
97.5%		2.31
90.0%		2.309
75.0%	quartile	2.305
50.0%	median	2.299
25.0%	quartile	2.29175
10.0%		2.2824
2.5%		2.275
0.5%		2.275
0.0%	minimum	2.275

Moments

Mean	2.297
Std Dev	0.0093294
Std Err Mean	0.0017631
Upper 95% Mean	2.3006175
Lower 95% Mean	2.2933825
N	28

Fitted Normal

Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	2.297	2.2933825	2.3006175
Dispersion	σ	0.0093294	0.007376	0.0126985

-2log(Likelihood) = -183.316393011789

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.937403	0.0949

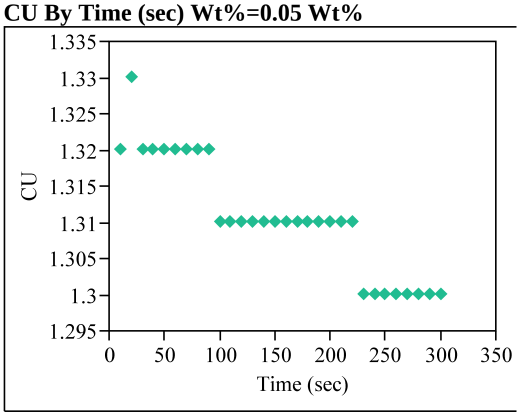
Note: Ho = The data is from the Normal distribution. Small p-values reject Ho.

One-sided Tolerance Interval

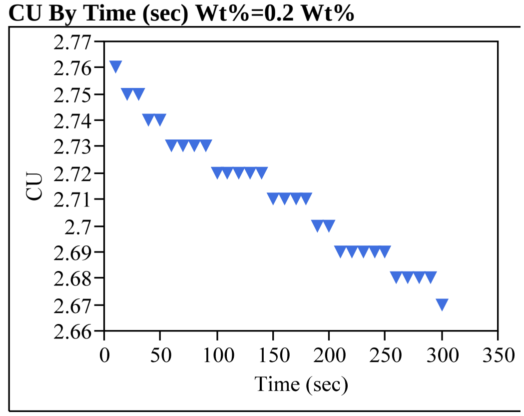
Proportion	Lower TI	Upper TI	1-Alpha
0.950	2.276048	.	0.950

Exhibit A5. Plot of Time Study in Handling Sludge Simulant Standard Samples

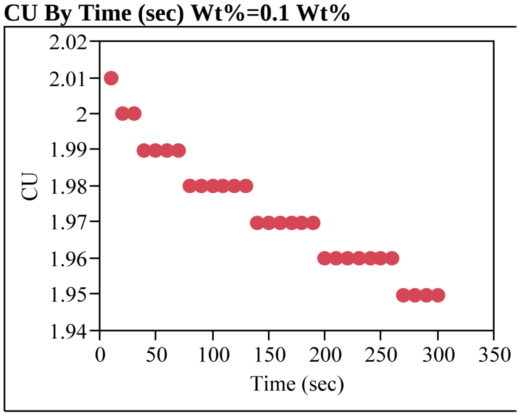
CU By Time (sec) Wt%=0.05 Wt%



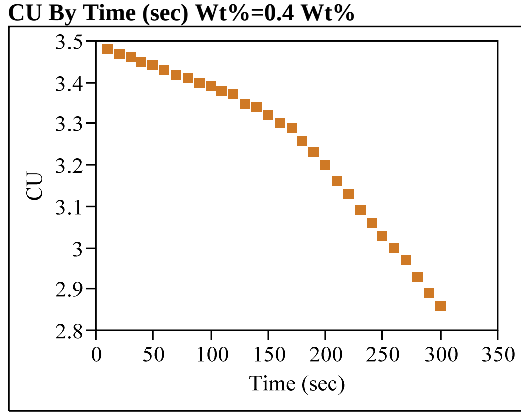
CU By Time (sec) Wt%=0.2 Wt%



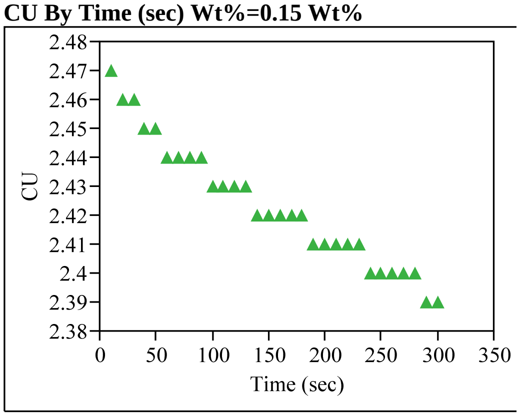
CU By Time (sec) Wt%=0.1 Wt%



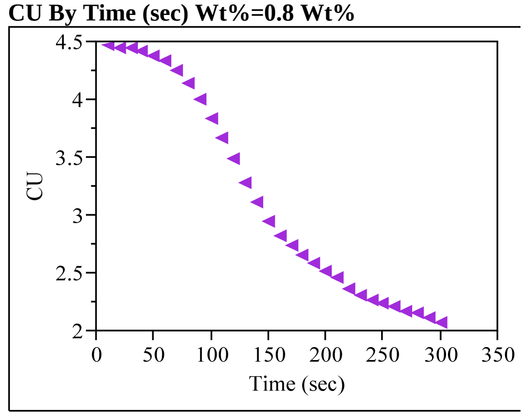
CU By Time (sec) Wt%=0.4 Wt%



CU By Time (sec) Wt%=0.15 Wt%



CU By Time (sec) Wt%=0.8 Wt%



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Electronic Distribution by E-Mail to the Following

Name:	Location:
Sharon Marra	773-A
Connie Herman	999-W
Patricia Lee	703-41A
Gene Shine	703-41A
Michael Stone	999-W
David Peeler	999-W
Tommy Edwards	999-W
Kevin Fox	999-W
Fabienne Johnson	999-W
Eric Freed	704-S
Jonathan Bricker	704-27S
John Iaukea	704-30S
Ryan McNew	704-S
Jeff Ray	704-S
Robert Hinds	704-S
Terri Fellinger	704-26S
Michael J. Hart	210-S
Roger N. Mahannah	704-28S
Michael T. Feller	704-28S
Arthur Whittington	704-28S
Paul Farrow	704-26S
John Gregory	704-S
Amanda Shafer	704-27S
Aria Behrouzi	704-27S
Mason Clark	704-27S
Helen Boyd	704-27S
Hank Elder	704-24S
Bill Holtzscheiter	704-15S
Pat Vaughan	773-41A