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Generation of the LHS Samples for the AP-145 (PABC09) PA Calculations

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Introduction

The Waste Isolation Pilot Plant (WIPP), located in southeastern New Mexico, has been developed by the U.S. Department of Energy (DOE) for the geologic (deep underground) disposal of transuranic (TRU) waste. Containment of TRU waste at the WIPP is regulated by the U.S. Environmental Protection Agency (EPA) according to the regulations set forth in Title 40 of the Code of Federal Regulations (CFR), Part 191 (U.S. EPA 1993). The DOE demonstrates compliance with the containment requirements according to the Certification Criteria in Title 40 CFR Part 194 (U.S. EPA 1996) by means of performance assessment (PA) calculations performed by Sandia National Laboratories (SNL). WIPP PA calculations estimate the probability and consequence of potential radionuclide releases from the repository to the accessible environment for a regulatory period of 10,000 years after facility closure. The models are maintained and updated with new information as part of a recertification process that occurs at five-year intervals after the first waste is received at the site.

PA calculations were included in the 1996 Compliance Certification Application (CCA) (U.S. DOE 1996), and in a subsequent Performance Assessment Verification Test (PAVT) (MacKinnon and Freeze 1997a, 1997b and 1997c). Based in part on the CCA and PAVT PA calculations, the EPA certified that the WIPP met the containment criteria in the regulations and was approved for disposal of transuranic waste in May 1998 (U.S. EPA 1998). PA calculations were also an integral part of the 2004 Compliance Recertification Application (CRA-2004) (U.S. DOE 2004). During their review of the CRA-2004, the EPA requested an additional PA calculation, referred to as the CRA-2004 Performance Assessment Baseline Calculation (PABC) (Leigh et al. 2005), be conducted with modified assumptions and parameter values (Cotsworth 2005).

Since the CRA-2004 PABC, additional PA calculations were completed for and documented in the 2009 Compliance Recertification Application (CRA-2009). The CRA-2009 PA resulted from continued review of the CRA-2004 PABC, including a number of technical changes and corrections, as well as updates to parameters and improvements to the PA computer codes (Clayton et al. 2008). The EPA has requested that additional information, which was received between the commencement of the CRA-2009 PA (December 2007) and the submittal of the CRA-2009 (March 2009), be included in an additional PA calculation (Cotsworth 2009), referred to as the CRA-2009 Performance Assessment Baseline Calculation (PABC-2009). The PABC-2009 analysis is guided by AP-145 (Clayton 2009). This report documents the analysis of the parameters sampled using LHS for the PABC-2009. Results, where different, are compared with the results from the CRA-2009 PA.

The program LHS is used to sample the subjective distributions of parameters using a Latin Hypercube sampling design. PRELHS is run prior to LHS and is used to obtain from the WIPP database the data describing the distributions and to create an input file to LHS based on that data. The user creates an input file for PRELHS that specifies which parameters are to be sampled using their "material" and "property" identifiers. PRELHS performs limited error checking on the data extracted from the database. LHS can reorder

sampled data to induce or restrict correlations among the parameters. However, for one pair of parameters another conditional relationship was specified by the code analysts. This conditional relationship restricted the value for one parameter to be less than the sampled value of the other parameter of the pair. This conditional relationship was enforced using the utility LHS_EDIT Version 1.0 (Appendix VIII) to modify the output file generated by LHS. This report documents the use of PRELHS Version 2.30, LHS Version 2.42 and LHS_EDIT to provide three sets of sampled data for use in the AP-145 Performance Assessment Baseline Calculation (PABC09) (Clayton 2009a). These three sets represent three replicates of one hundred samples for each of 75 variables. For the most part these variables are associated with model parameters. However, there are also 19 "placeholder" variables sampled. These placeholders are included to enable users to add additional parameters and run LHS while preserving the ability to regenerate the values previously sampled for the model parameters.

The execution of LHS was verified by:

1. Checking the LHS input files to ensure that the headers properly document the analysis and that the random number seeds are correct.
2. Verifying that the proper set of parameters is being sampled. This was done by comparing the set to the specifications of the AP for the analysis, although the AP only lists changes from a previous analysis.
3. Checking the EVAL script input files to ensure that any conditional relationships imposed using LHS_EDIT.EXE are properly specified.
4. Examining the LHS log files for any obvious errors or failures.
5. Examining the PRELHS transfer (output) file to verify that the data were properly extracted from the database.
6. Examining the correlation matrices for "significant" values and to verify that non-zero correlations specified in the input file were properly generated.
7. Checking the values generated to ensure that they do not exceed the specified range.
8. Checking that the distributions match those specified in the parameter database.
9. Plotting the empirical Cumulative Distribution Function (CDF) against the expected CDF and looking for anomalies.

Run Control

The script EVAL_LHS.COM was used to execute PRELHS, LHS and LHS_EDIT. This script processes an input file which lists the specific information required to run these codes. The details of run control are documented in Long (2009). The script and its input files are stored in LIBPABC09_EVAL (PACMS2:[CMS_CRA09.PABC09_EVAL]).

PRELHS Input Files

The three input files for PRELHS are listed in appendices I to III. The files for the three replicates are stored in LIBPABC09_LHS (pacms2:[cms_CRA09.CRA09_lhs]) and are named LHS1_CRA09_R1.INP, LHS1_CRA09_R2.INP, and LHS1_CRA09_R3.INP. Except for the title and random seed these three files are identical. Different random seeds are assigned in each input file to cause LHS to generate three unique sets of values.

The corresponding output (transfer) files from PRELHS for the three replicates are listed in appendices IV to VI. The three transfer files are also identical except for titles and the random seed values. These files were inspected to verify that the data used to construct the distributions were properly extracted from the library.

LHS Output files

The LHS output files were examined for errors. These files are stored in LIBPABC09_LHS (pacms2:[cms_CRA09.CRA09_lhs]). The files created by LHS are named LHS2_CRA09_R1.TRN, LHS2_CRA09_R2.TRN, and LHS2_CRA09_R3.TRN. These files are subsequently processed by LHS_EDIT and its output files, used in the analysis, are named LHS2_CRA09_R1_CON.TRN, LHS2_CRA09_R2_CON.TRN , and LHS2_CRA09_R3_CON.TRN. The ranges of the sampled variables were compared to the range specified as input for the distribution. No values were found to exceed the specified ranges of the distributions. The LHS output file lists the correlation coefficients between the sampled variables. No significant ($\alpha = 0.01$) spurious correlations were observed among the uncorrelated variables, although in replicate 2 the correlation between the ranks of the variables CASTILER:PRESSURE (material:property) and WAS_AREA:PROBDEG was -0.234 which is significant at $\alpha = 0.05$. However, WAS_AREA:PROBDEG is a discrete user-specified distribution (delta distribution) having only 2 possible values (Figure 52). This restriction undoubtedly limits the ability of LHS to shuffle the values to enforce a correlation near zero. In addition, the significance test on the correlation coefficient is questionable in any case because the data fails to even come close to meeting the assumptions of normality of the data. The magnitude of this correlation was tested previously using Monte Carlo methods. These results suggest that the percentage of values exceeding the standard test statistics for correlation coefficients can be high (>50%) when LHS samples discrete distributions have few possible values. Thus, this correlation was shown to be non-significant (Kirchner 2008).

The sampled data for those variables for which a correlation matrix was entered showed correlations that were close to those specified (Tables 1 and 2). Variable 53 is S_HALITE:PRMX_LOG and variable 54 is S_HALITE:COMP_RCK. Variable 61 is CASTILER:PRMX_LOG and variable 54 is CASTILER:COMP_RCK (Appendix I).

Table 1. Correlation observed between ranks of variables 53 and 54 in replicate 1. A value of -0.99 was specified.

	49	50	51	52	53
49	1.0000				
50	0.0043	1.0000			
51	0.0045	-0.0198	1.0000		
52	0.0306	0.0024	-0.0414	1.0000	
53	-0.0014	-0.0066	0.0092	-0.0300	1.0000
54	0.0108	0.0111	-0.0109	0.0189	-0.9869

Table 2. Correlation observed between ranks of variables 61 and 62 in replicate 1. A value of -0.75 was specified.

	61	62	63	64
61	1.0000			
62	-0.7281	1.0000		
63	0.0505	-0.0260	1.0000	
64	-0.0379	0.0534	0.0079	1.0000

The sampled distributions were compared to the expected distributions. Cumulative distribution functions for the sampled data were constructed by ordering the data from smallest to largest value and assigning the probability $i/100-0.005$ to the i^{th} ordered value, i.e. the midpoint of the interval containing the value based on order statistics (Figures 1 through 168). With the exception of the variable modified using LHS_EDIT (Figures 53, 109 and 165), the differences between the CDFs of the sampled values and the CDFs of the expected distributions are due to the differences between the estimated probability assigned to the values and the true probability associated with the data.

Most of the distributions used for the AP145 analysis were identical to those used in the CRA-2009. The exceptions were five K_d values (AM+3:MKD_AM, PU+3:MKD_PU, PU+4:MKD_PU, TH+4:MKD_TH, U+4:MKD_U) and two solubility multiplier parameters (SOLMOD3:SOLVAR and SOLVAR4:SOLVAR). The K_d parameters are the equilibrium partitioning coefficients between water and the solid (rock matrix) phases. The minimum values for the ranges of possible values were reduced in response to comment 3-C-25 from EPA (Kelly 2009) to account for concentrations of organic ligands that were higher than assumed in the 1996 PA (Table 3) (Clayton 2009b). The actinide solubility multiplier parameters incorporated the changes specified for the CRA-2009 PABC by the EPA (Cotsworth, 2009), based on its preliminary review of the CRA-2009 (U.S. DOE, 2009). Cotsworth (2009) specified that the solubilities calculated for the CRA-2009 PABC include new estimates of the masses of the organic ligands to be emplaced in the WIPP (Crawford et al., 2009). The changes in the two solubility multiplier parameters resulted in their median values changing from -3.0862E-2 to 0.072 and from 7.50E-2 to -0.520, respectively (Xiong et al., 2009). These two parameters are assigned "cumulative" distributions, i.e. the CDF of the distribution is defined in terms of probability:value pairs (Tables 4 and 5, respectively) as opposed to a parametric descriptions of a distribution function, e.g. the mean and variance of a normal distribution. Note that these tables were constructed by binning the data and have repeated values of probabilities. Such repetition occurs when the distribution has two or more modes. The repeated values define intervals in which no observations occur. The algorithm in LHS for the "cumulative" distribution will select the upper bound of the interval if the sampled probability equals a repeated value.

Table 3. Changes in the minimum values of K_ds from the CRA-2009 to the PABC-2009 analysis.

Material	Property	CRA-2009	PABC-2009
U+4	MKD_U	0.7	0.0005
PU+3	MKD_PU	0.02	0.005
PU+4	MKD_PU	0.7	0.0005

TH+4	MKD_TH	0.7	0.0005
AM+3	MKD_AM	0.02	0.005

A conditional relationship had prior to the CRA-2009 been enforced between WAS_AREA:GRATMICH and WAS_AREA:GRATMICI using ALGEBRA prior to running the BRAGFLO code (Nemer and Stein 2005). This relationship was implemented by setting WAS_AREA:GRATMICH to the value of WAS_AREA:GRATMICI if WAS_AREA:GRATMICH exceeded WAS_AREA:GRATMICI in any particular vector. Changing these values in this way introduced a small error into the sensitivity analysis for WAS_AREA:GRATMICH because the regression analysis was based on the sampled values rather than the conditional values used in the code. LHS_EDIT was used to enforce a conditional relationship between WAS_AREA:GRATMICH and WAS_AREA:GRATMICI in the LHS transfer file, thus making the conditioned values available for use in the sensitivity analysis. However, for the PABC-09 PA, as in the CRA-2009 PA, it was assumed that WAS_AREA:GRATMICH was uniformly distributed between 0 and the minimum of either 1.02717E-9 (the upper level of the uniform distribution specified in the parameter data base for the variable) and the value selected for WAS_AREA:GRATMICI. LHS_EDIT rescaled the sampled value of WAS_AREA:GRATMICH from the range 0 to 1.02717E-9 to the new range using the equation

$$v_i' = \frac{v_i - U_{V,lower}}{U_{V,upper} - U_{V,lower}} \times \left(Min(x_i, U_{V,upper}) - U_{V,lower} \right) + U_{V,lower} \quad (1)$$

Table 4. Changes in distribution of SOLMOD3:SOLVAR.

CRA-2009		PABC-2009		CRA-2009		PABC-2009	
Probability	Value	Probability	Value	Probability	Value	Probability	Value
0.00E+00	-3.15E+00	0.00E+00	-4.20E+00	7.28E-01	4.50E-01	2.40E-01	-6.00E-01
0.00E+00	-3.00E+00	2.90E-03	-4.05E+00	7.53E-01	6.00E-01	2.78E-01	-4.50E-01
4.12E-03	-2.85E+00	2.90E-03	-3.90E+00	7.94E-01	7.50E-01	3.38E-01	-3.00E-01
4.12E-03	-2.70E+00	8.70E-03	-3.75E+00	8.27E-01	9.00E-01	3.90E-01	-1.50E-01
4.12E-03	-2.55E+00	2.02E-02	-3.60E+00	8.56E-01	1.05E+00	4.62E-01	0.00E+00
4.12E-03	-2.40E+00	3.47E-02	-3.45E+00	8.85E-01	1.20E+00	5.41E-01	1.50E-01
4.12E-03	-2.25E+00	3.76E-02	-3.30E+00	9.26E-01	1.35E+00	6.19E-01	3.00E-01
4.12E-03	-2.10E+00	4.34E-02	-3.15E+00	9.51E-01	1.50E+00	6.97E-01	4.50E-01
4.12E-03	-1.95E+00	5.20E-02	-3.00E+00	9.59E-01	1.65E+00	7.31E-01	6.00E-01
8.23E-03	-1.80E+00	5.49E-02	-2.85E+00	9.63E-01	1.80E+00	8.15E-01	7.50E-01
2.47E-02	-1.65E+00	5.49E-02	-2.70E+00	9.79E-01	1.95E+00	9.05E-01	9.00E-01
2.88E-02	-1.50E+00	6.07E-02	-2.55E+00	9.79E-01	2.10E+00	9.25E-01	1.05E+00
5.35E-02	-1.35E+00	6.94E-02	-2.40E+00	9.84E-01	2.25E+00	9.39E-01	1.20E+00
8.64E-02	-1.20E+00	7.80E-02	-2.25E+00	9.88E-01	2.40E+00	9.54E-01	1.35E+00
1.19E-01	-1.05E+00	8.38E-02	-2.10E+00	9.96E-01	2.55E+00	9.62E-01	1.50E+00
1.40E-01	-9.00E-01	8.38E-02	-1.95E+00	9.96E-01	2.70E+00	9.65E-01	1.65E+00
1.85E-01	-7.50E-01	8.67E-02	-1.80E+00	1.00E+00	2.85E+00	9.77E-01	1.80E+00
2.35E-01	-6.00E-01	9.25E-02	-1.65E+00	1.00E+00	3.00E+00	9.86E-01	1.95E+00

2.67E-01	-4.50E-01	9.83E-02	-1.50E+00	1.00E+00	3.15E+00	9.91E-01	2.10E+00
3.46E-01	-3.00E-01	1.04E-01	-1.35E+00			9.91E-01	2.25E+00
4.28E-01	-1.50E-01	1.30E-01	-1.20E+00			9.94E-01	2.40E+00
5.19E-01	0.00E+00	1.56E-01	-1.05E+00			9.97E-01	2.55E+00
5.84E-01	1.50E-01	1.85E-01	-9.00E-01			1	2.70E+00
6.50E-01	3.00E-01	2.11E-01	-7.50E-01			1	2.85E+00

Table 5. Changes in distribution of SOLMOD4:SOLVAR.

CRA-2009		PABC-2009		CRA-2009		PABC-2009	
Probability	**Value**	**Probability**	**Value**	**Probability**	**Value**	**Probability**	**Value**
0.00E+00	-2.10E+00	0.00E+00	-2.25E+00	7.78E-01	7.50E-01	8.36E-01	6.00E-01
0.00E+00	-1.95E+00	1.43E-02	-2.10E+00	8.67E-01	9.00E-01	8.79E-01	7.50E-01
0.00E+00	-1.80E+00	2.14E-02	-1.95E+00	9.11E-01	1.05E+00	9.14E-01	9.00E-01
2.22E-02	-1.65E+00	3.57E-02	-1.80E+00	9.11E-01	1.20E+00	9.36E-01	1.05E+00
2.22E-02	-1.50E+00	6.43E-02	-1.65E+00	9.11E-01	1.35E+00	9.36E-01	1.20E+00
2.22E-02	-1.35E+00	9.29E-02	-1.50E+00	9.33E-01	1.50E+00	9.43E-01	1.35E+00
2.22E-02	-1.20E+00	1.43E-01	-1.35E+00	9.33E-01	1.65E+00	9.57E-01	1.50E+00
2.22E-02	-1.05E+00	2.21E-01	-1.20E+00	9.56E-01	1.80E+00	9.64E-01	1.65E+00
4.44E-02	-9.00E-01	2.64E-01	-1.05E+00	9.56E-01	1.95E+00	9.71E-01	1.80E+00
8.89E-02	-7.50E-01	3.00E-01	-9.00E-01	9.78E-01	2.10E+00	9.71E-01	1.95E+00
2.00E-01	-6.00E-01	3.57E-01	-7.50E-01	9.78E-01	2.25E+00	9.79E-01	2.10E+00
4.00E-01	-4.50E-01	4.43E-01	-6.00E-01	1.00E+00	2.40E+00	9.79E-01	2.25E+00
4.22E-01	-3.00E-01	5.50E-01	-4.50E-01	1.00E+00	2.55E+00	9.86E-01	2.40E+00
4.22E-01	-1.50E-01	5.71E-01	-3.00E-01	1.00E+00	2.70E+00	9.86E-01	2.55E+00
4.89E-01	0.00E+00	6.07E-01	-1.50E-01			9.86E-01	2.70E+00
5.11E-01	1.50E-01	6.50E-01	0.00E+00			9.86E-01	2.85E+00
6.22E-01	3.00E-01	6.86E-01	1.50E-01			9.86E-01	3.00E+00
6.67E-01	4.50E-01	7.79E-01	3.00E-01			9.86E-01	3.15E+00
6.89E-01	6.00E-01	8.29E-01	4.50E-01			1.00E+00	3.30E+00

Where v_i' is the conditioned value of WAS_AREA:GRATMICH, v_i is the sampled value of WAS_AREA:GRATMICH, x_i is the sampled value of WAS_AREA:GRATMICI, and $U_{V,lower}$ and $U_{V,upper}$ are the bounds of the uniform distribution assigned to WAS_AREA:GRATMICH. This method preserves the probability associated with the value of WAS_AREA:GRATMICH. The CDFs for the sampled values, the CRABC conditioned values and the CRA-2009 conditioned values are shown in Figures 53, 109 and 165 for replicates 1, 2 and 3, respectively. This conditional relationship results in a positive correlation between the two variables. This correlation was computed using data from Replicates 1 through 3 using Excel and found to be 0.74 (Figure 169). The nature of the correlation is fundamentally different than that which LHS could induce between the variables. If instead of limiting the value of WAS_AREA:GRATMICH a correlation of 0.74 had been specified between the variables in the input file to LHS then LHS would

have generated values for WAS_AREA:GRATMICH that exceeded the corresponding value for WAS_AREA:GRATMICI.

Summary and Conclusions

LHS was used to generate one hundred vectors of sampled parameter values for each of three replicates. A unique random number seed was assigned to each of the three replicates. These seed values were identical to those used in the CRA1-PABC and CRA-2009 analyses. The resulting sampled data had the expected correlation structure and the values fell within the expected ranges. The LHS results were subsequently modified to enforce a conditional relationship between WAS_AREA:GRATMICH and WAS_AREA:GRATMICI.

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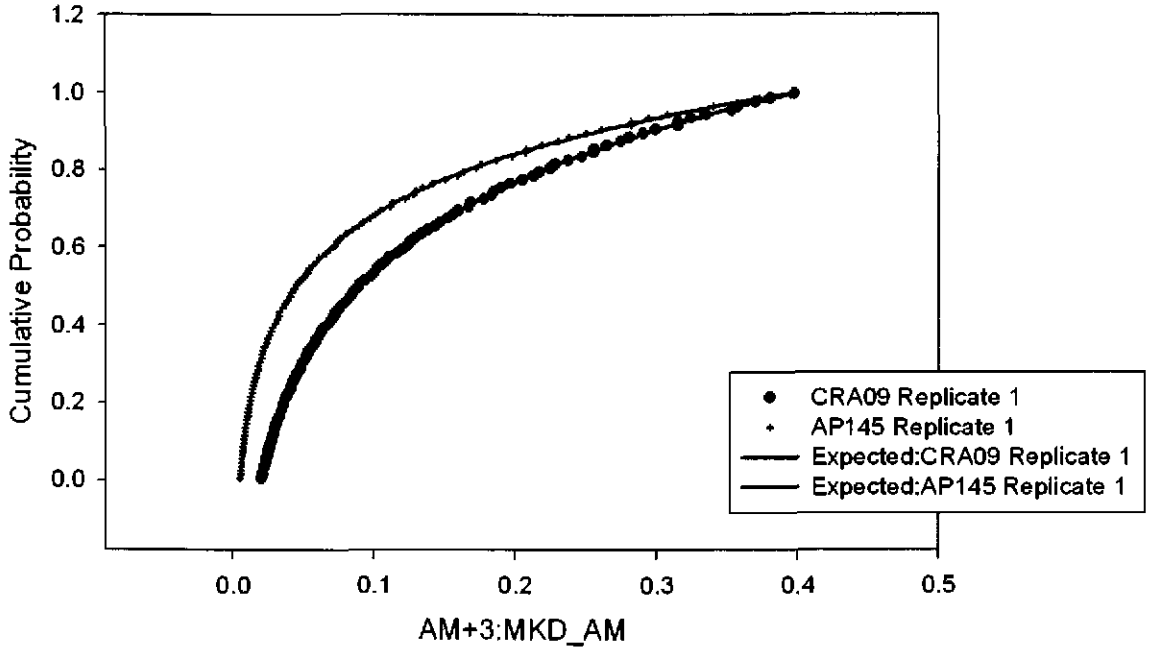

Figure 1. Observed and Expected CDFs for AM+3:MKD_AM (Loguniform Distribution) Rep. 1.

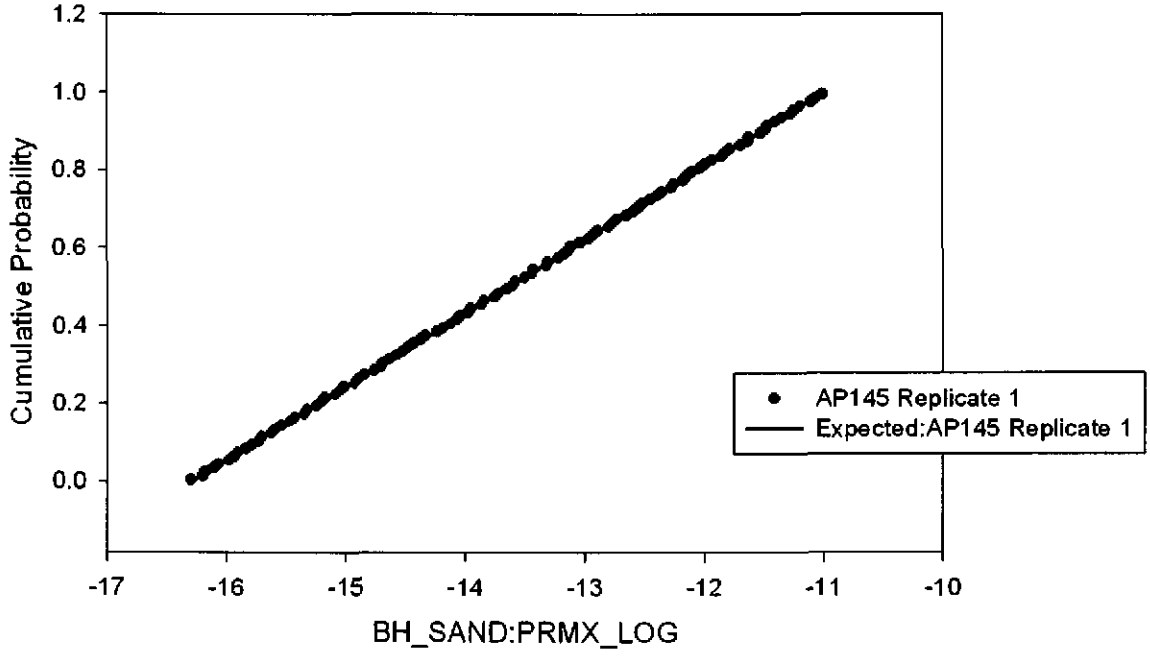

Figure 2. Observed and Expected CDFs for BH_SAND:PRMX_LOG (Uniform Distribution) Rep. 1.

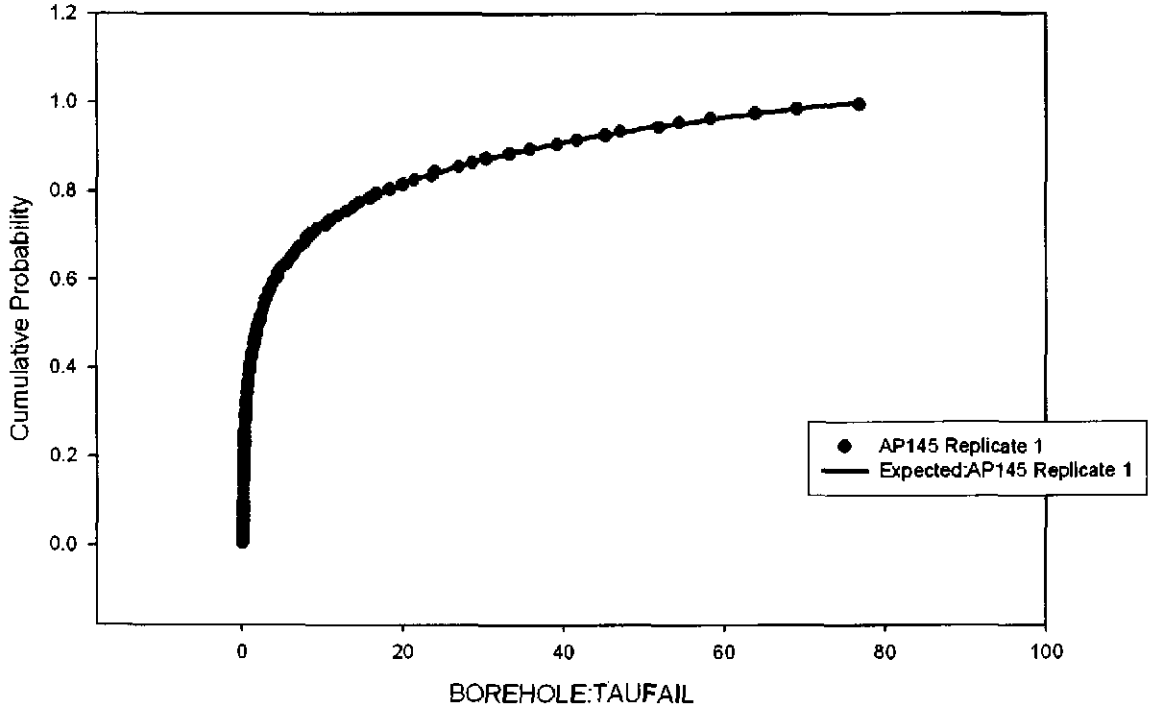

Figure 3. Observed and Expected CDFs for BOREHOLE:TAUFAIL (Loguniform Distribution) Rep. 1.

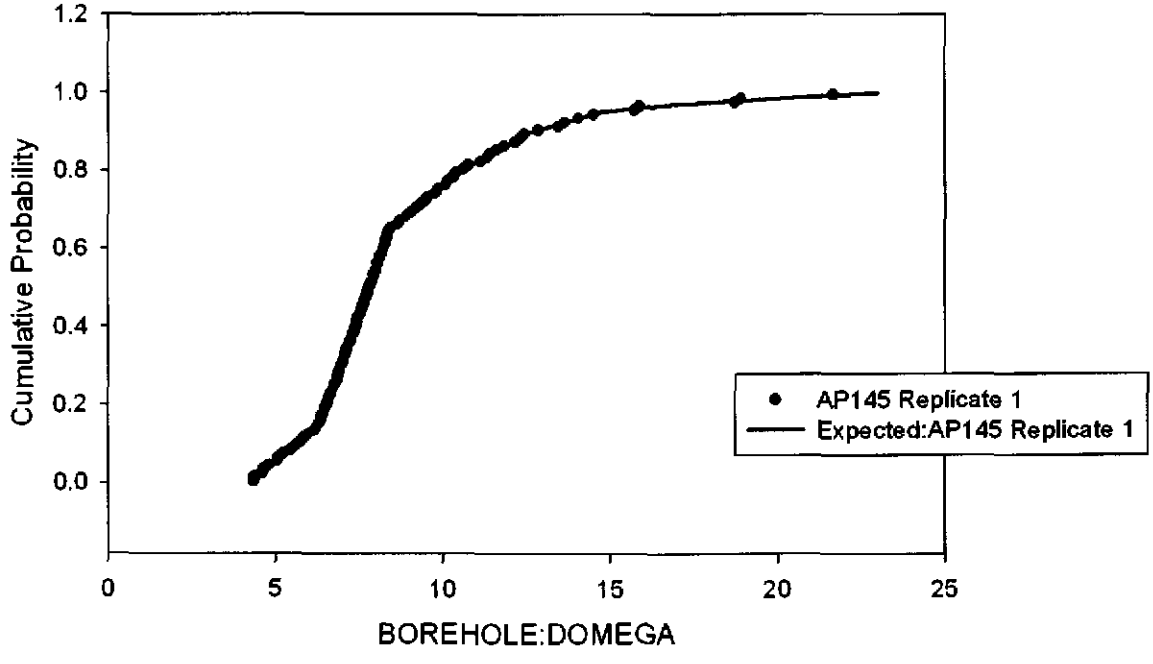

Figure 4. Observed and Expected CDFs for BOREHOLE:DOMEGA (User Continuous Distribution) Rep. 1.

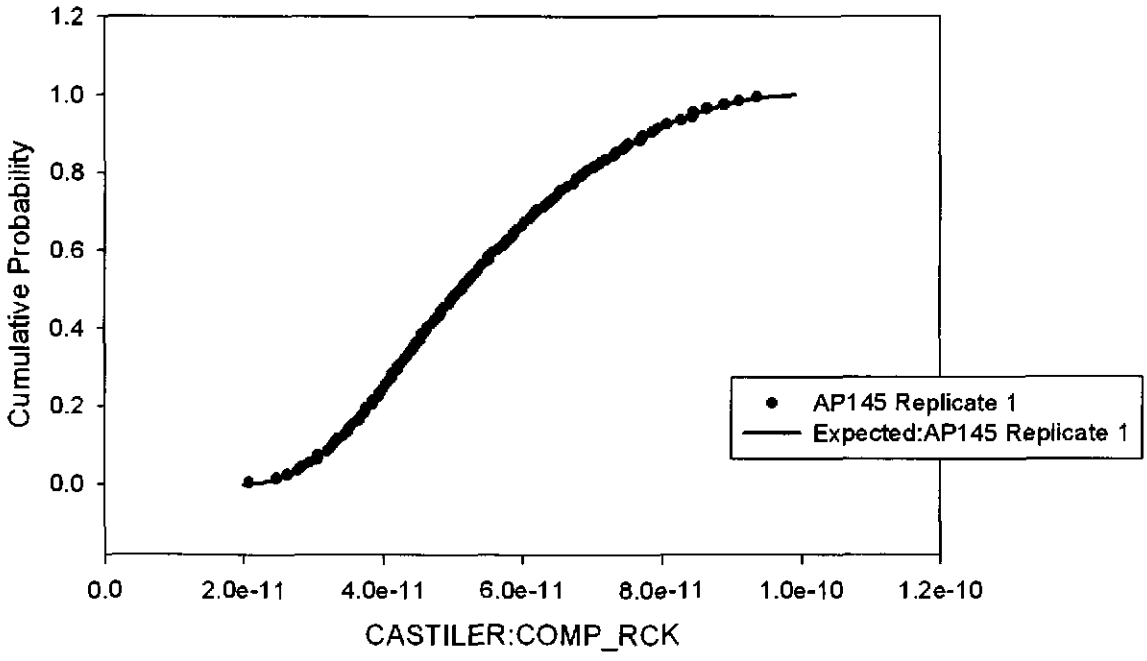

Figure 5. Observed and Expected CDFs for CASTILER:COMP_RCK (Triangular Distribution) Rep. 1.

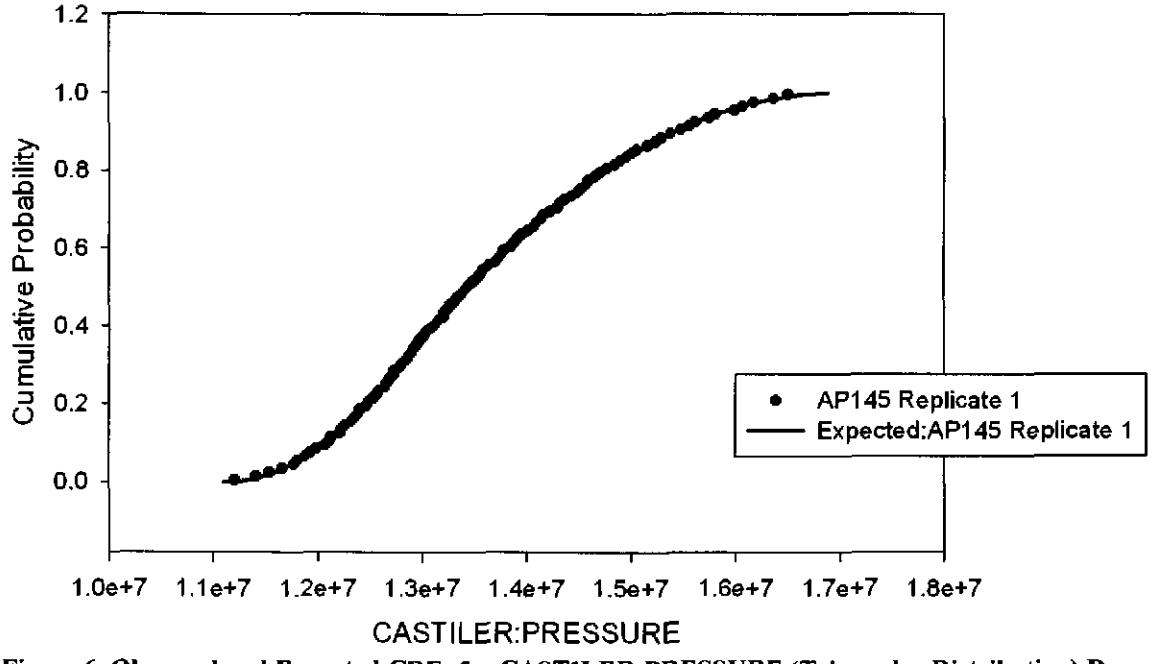

Figure 6. Observed and Expected CDFs for CASTILER:PRESSURE (Triangular Distribution) Rep. 1.

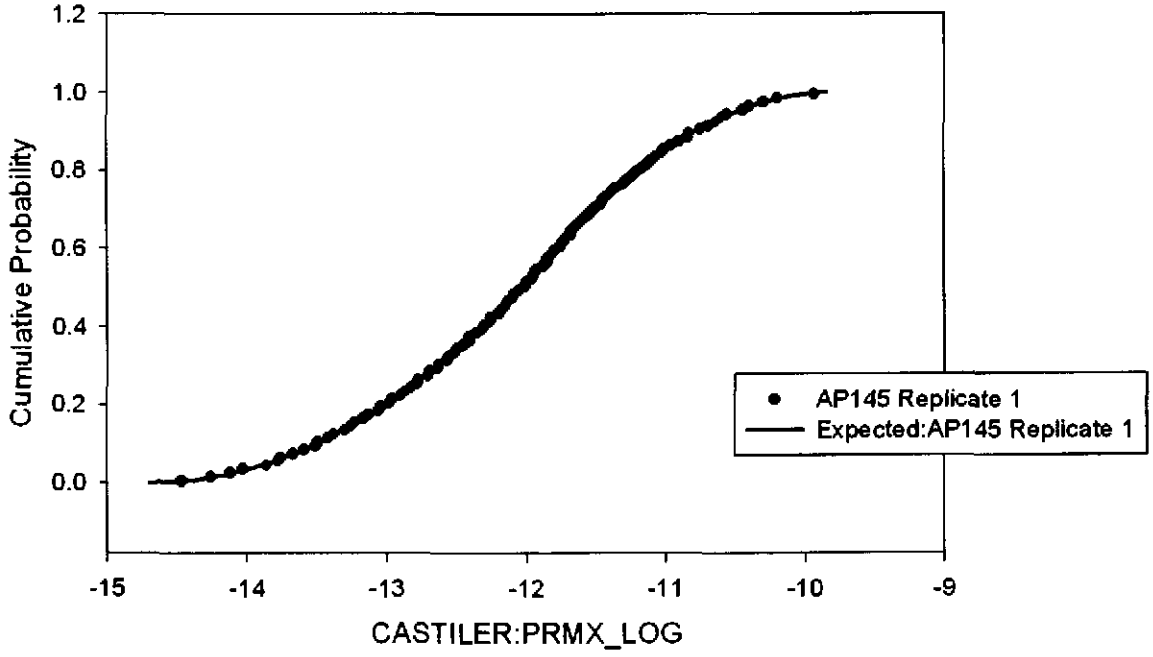

Figure 7. Observed and Expected CDFs for CASTILER:PRMX_LOG (Triangular Distribution) Rep. 1.

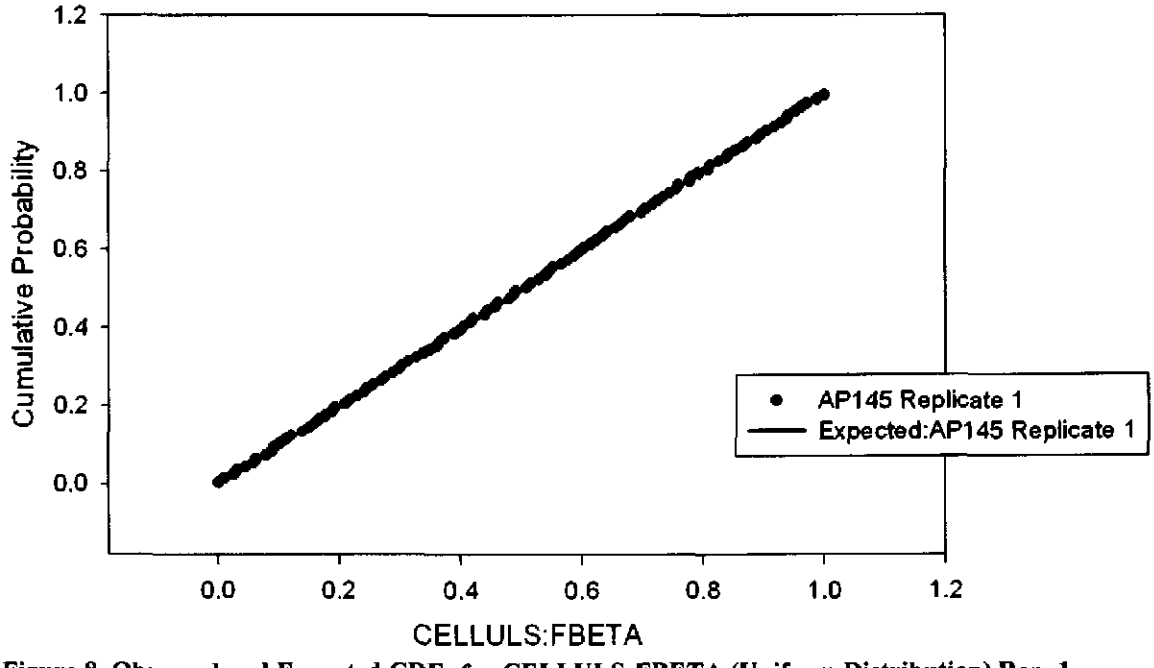

Figure 8. Observed and Expected CDFs for CELLULS:FBETA (Uniform Distribution) Rep. 1.

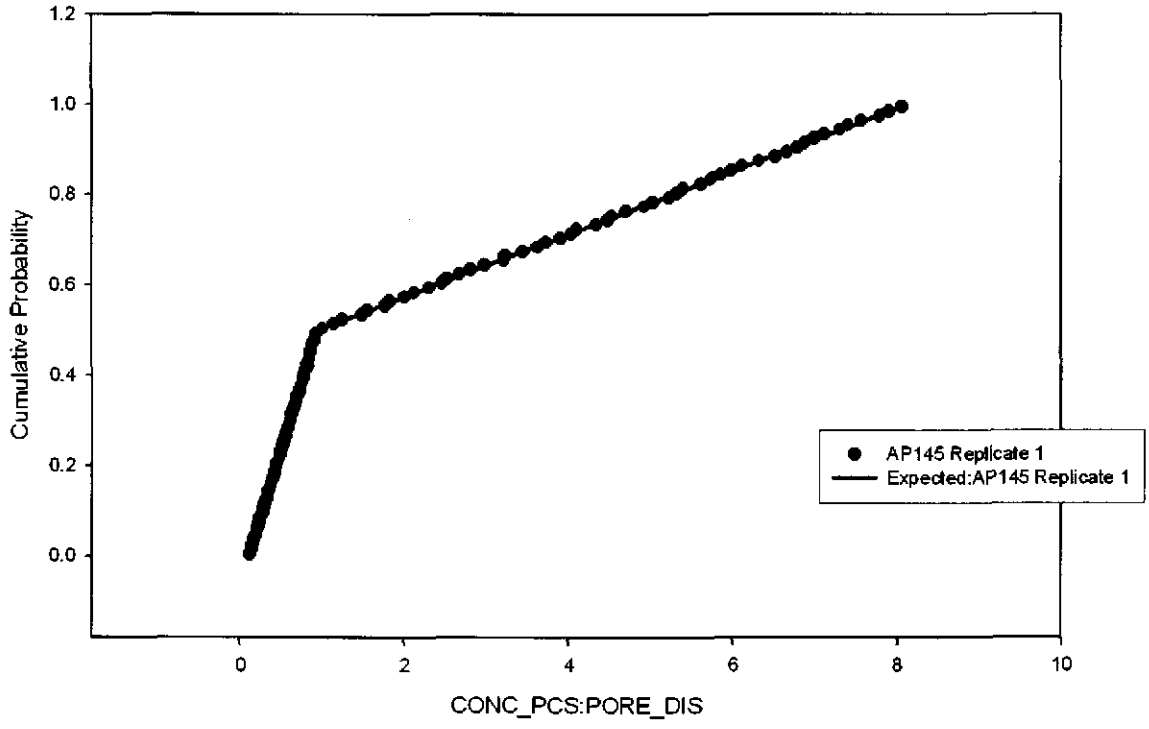

Figure 9. Observed and Expected CDFs for CONC_PCS:PORE_DIS (User Continuous Distribution) Rep. 1.

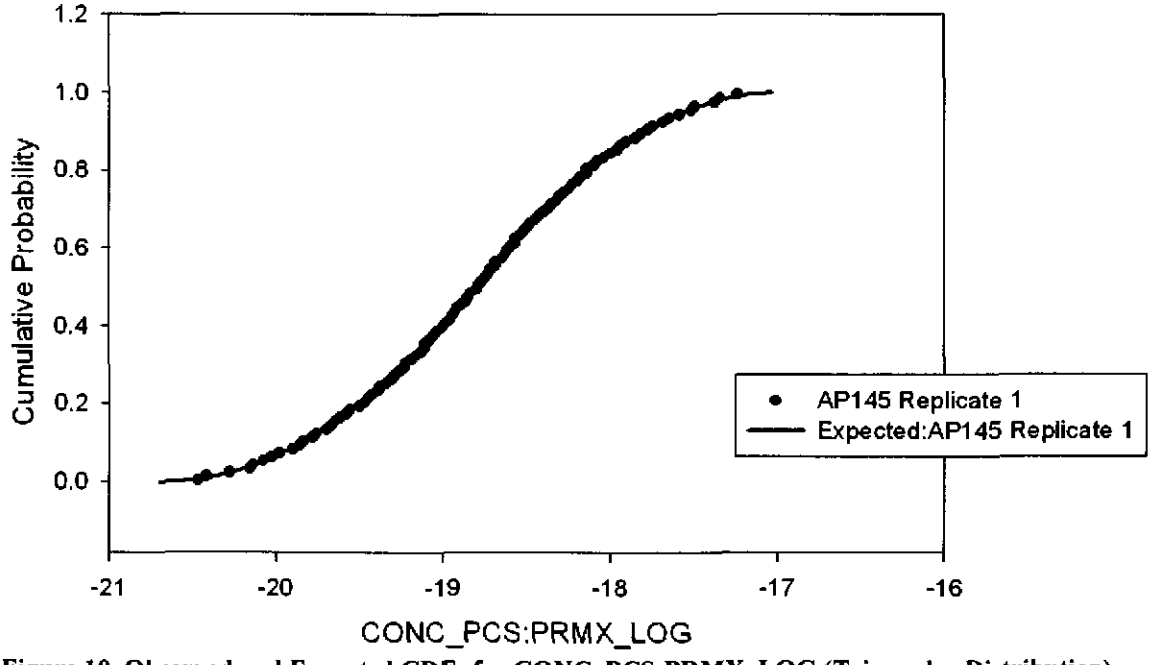

Figure 10. Observed and Expected CDFs for CONC_PCS:PRMX_LOG (Triangular Distribution) Rep. 1.

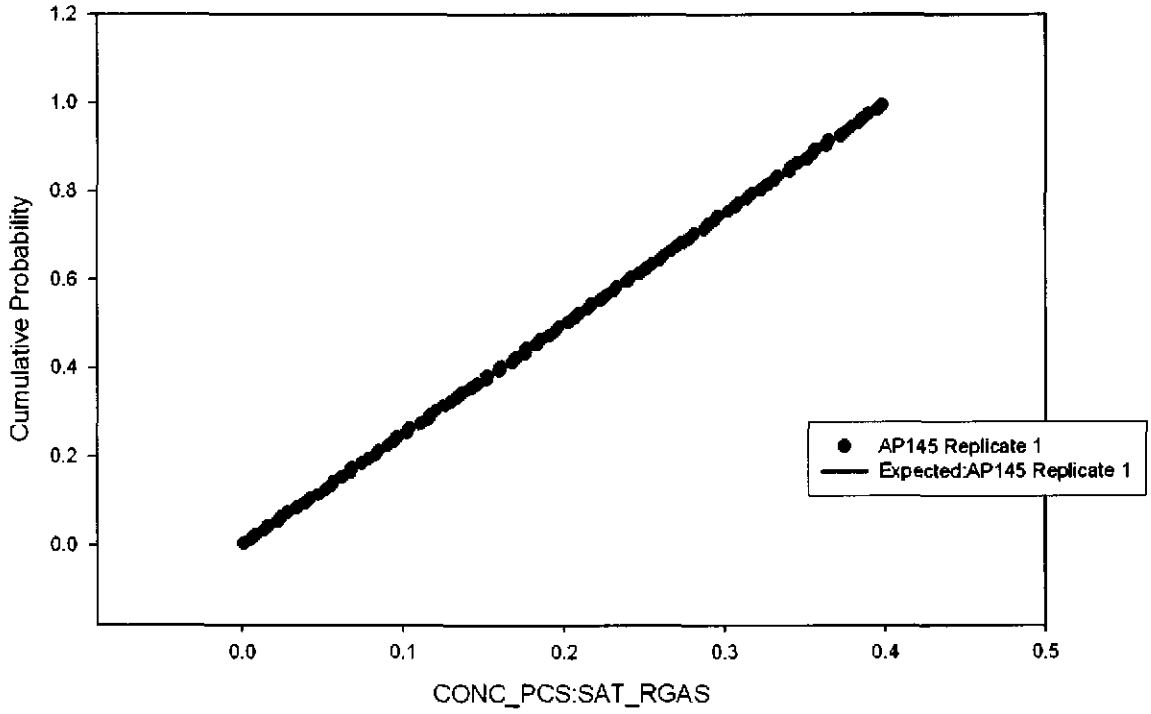

Figure 11. Observed and Expected CDFs for CONC_PCS:SAT_RGAS (Uniform Distribution) Rep. 1.

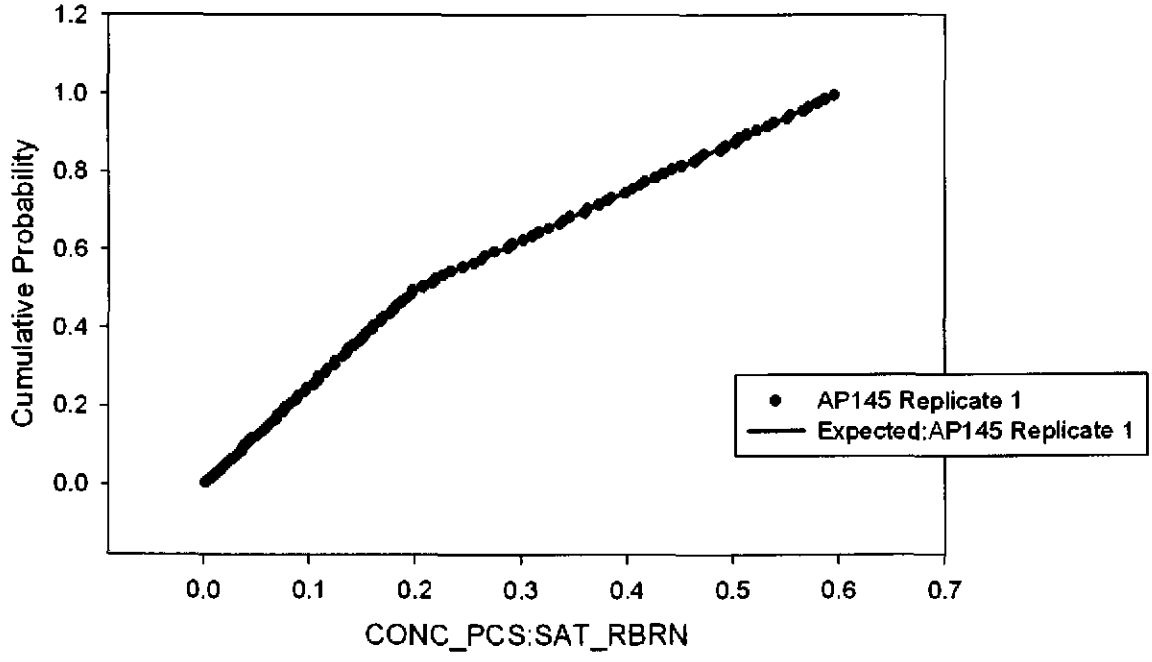

Figure 12. Observed and Expected CDFs for CONC_PCS:SAT_RBRN (User Continuous Distribution) Rep. 1.

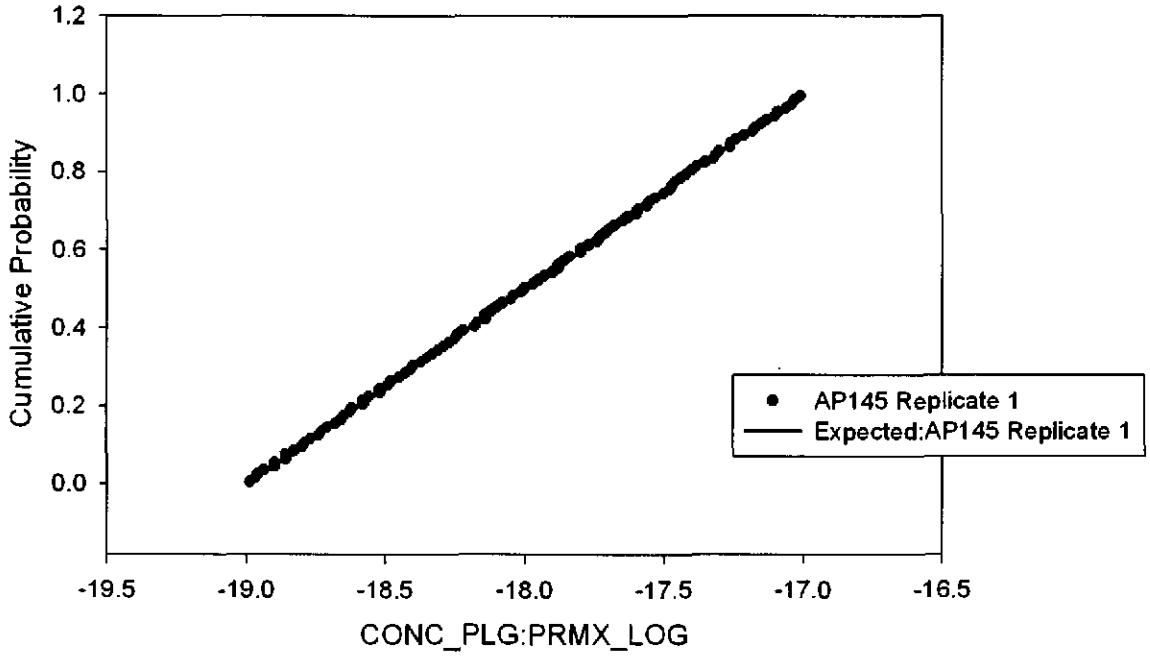

Figure 13. Observed and Expected CDFs for CONC_PLG:PRMX_LOG (Uniform Distribution) Rep. 1.

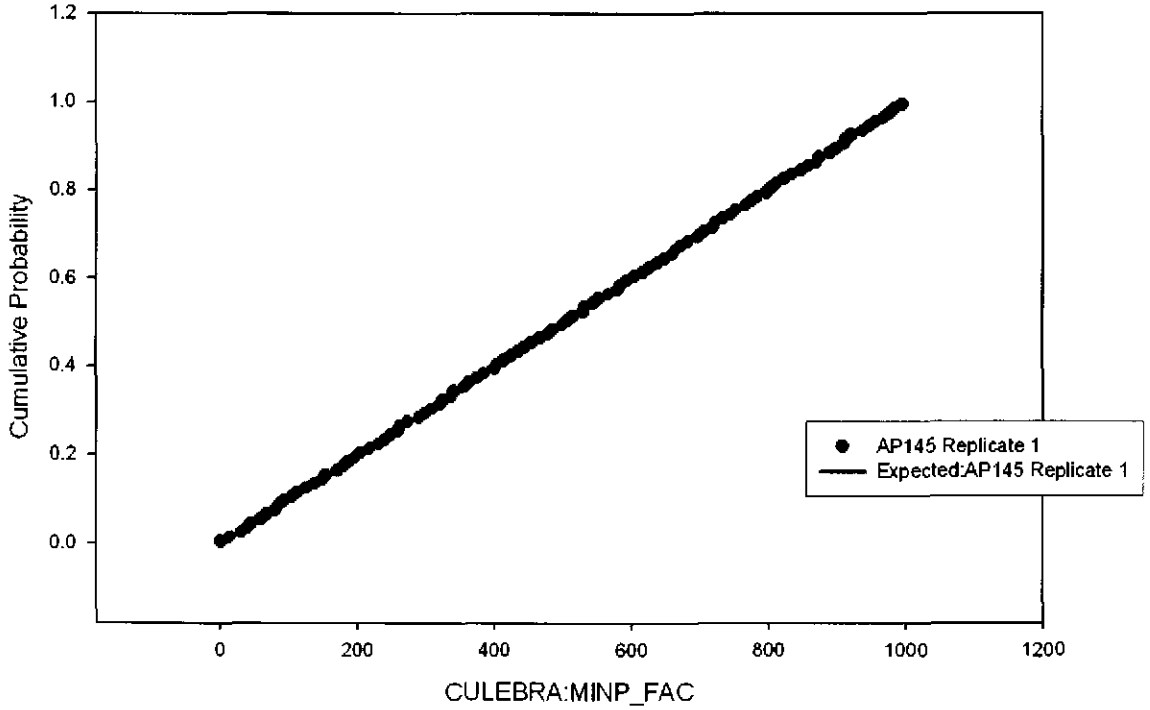

Figure 14. Observed and Expected CDFs for CULEBRA:MINP_FAC (Uniform Distribution) Rep. 1.

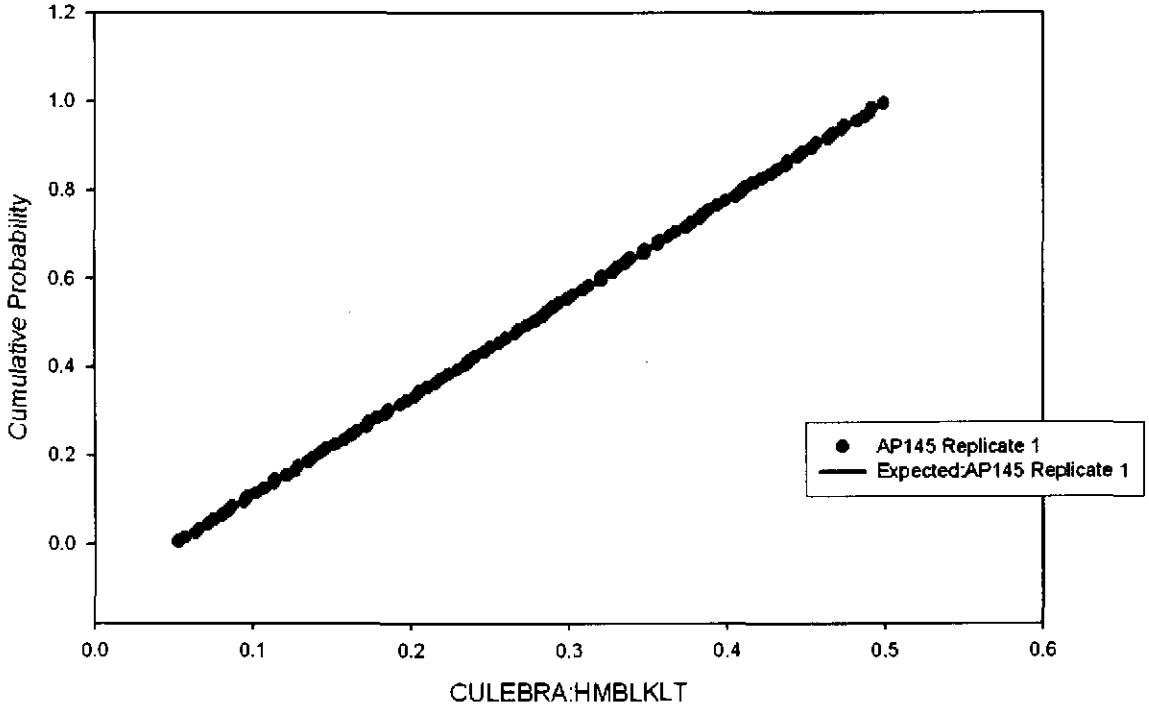

Figure 15. Observed and Expected CDFs for CULEBRA:HMBLKLT (Uniform Distribution) Rep. 1.

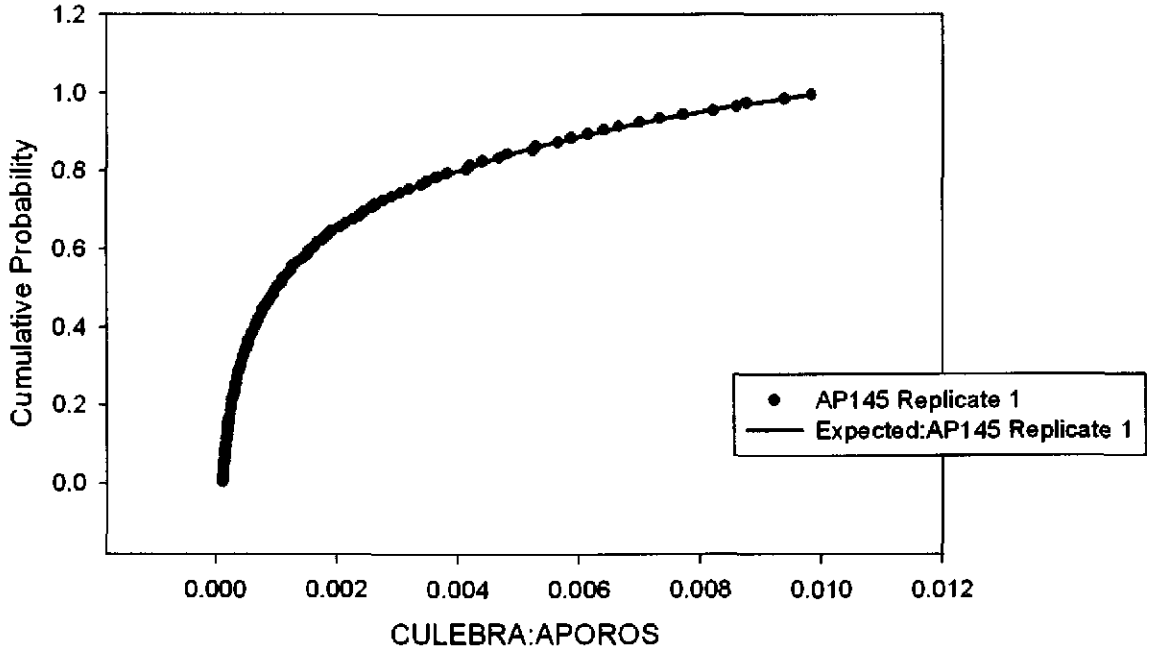

Figure 16. Observed and Expected CDFs for CULEBRA:APOROS (Loguniform Distribution) Rep. 1.

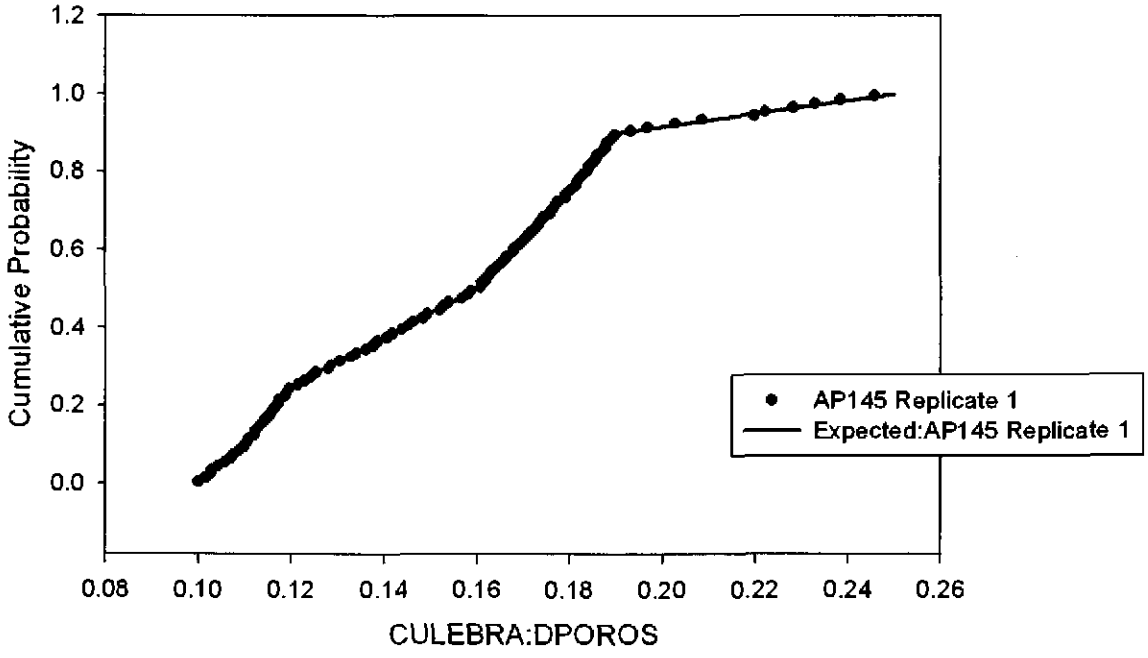

Figure 17. Observed and Expected CDFs for CULEBRA:DPOROS (User Continuous Distribution) Rep. 1.

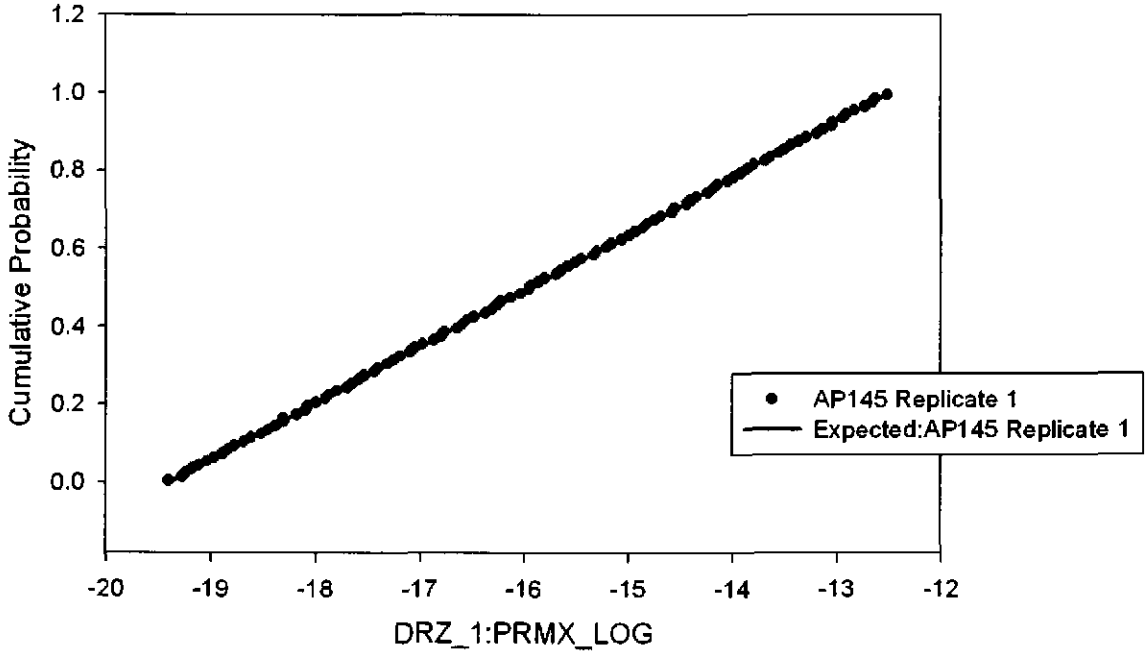

Figure 18. Observed and Expected CDFs for DRZ_1:PRMX_LOG (Uniform Distribution) Rep. 1.

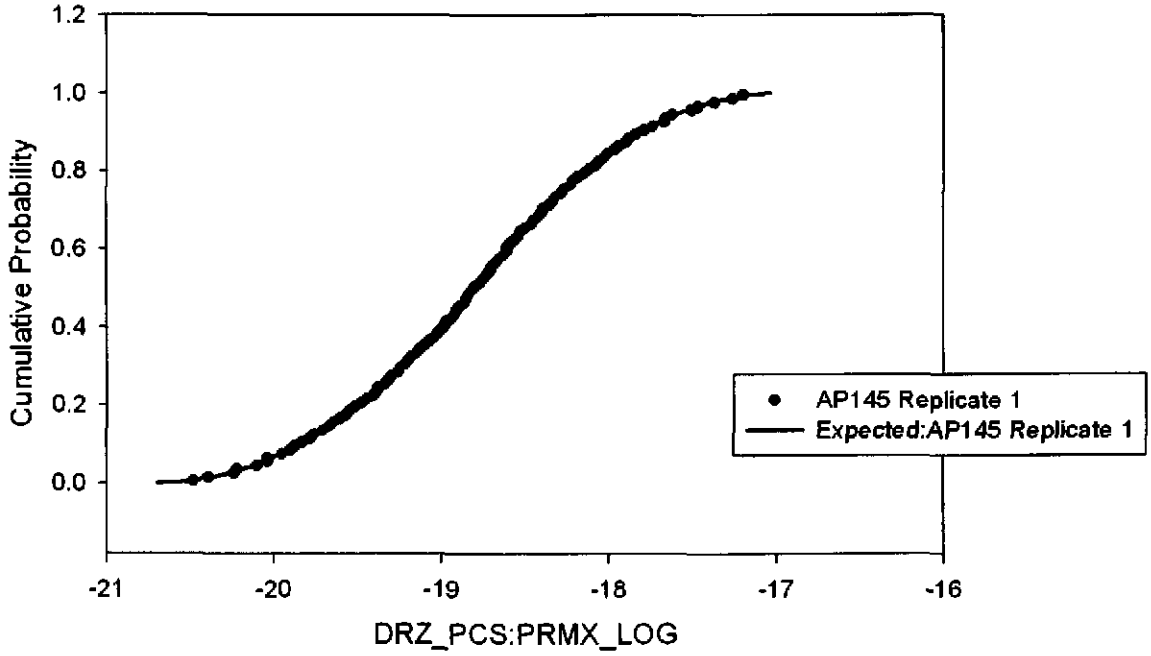

Figure 19. Observed and Expected CDFs for DRZ_PCS:PRMX_LOG (Triangular Distribution) Rep. 1.

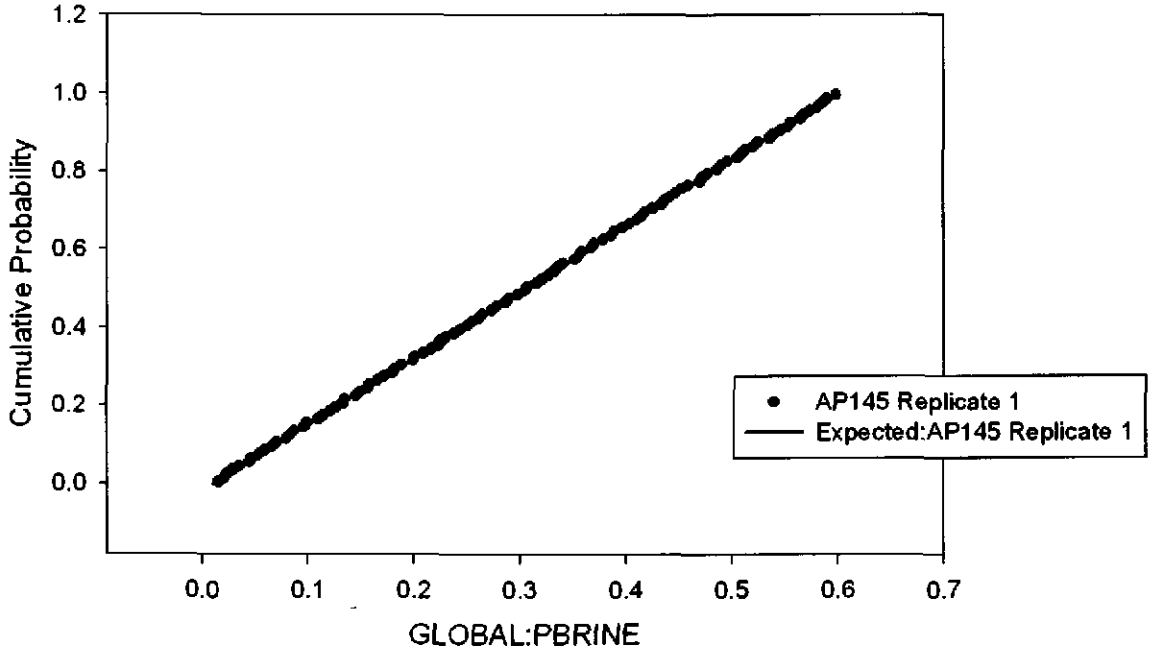

Figure 20. Observed and Expected CDFs for GLOBAL:PBRINE (Uniform Distribution) Rep. 1.

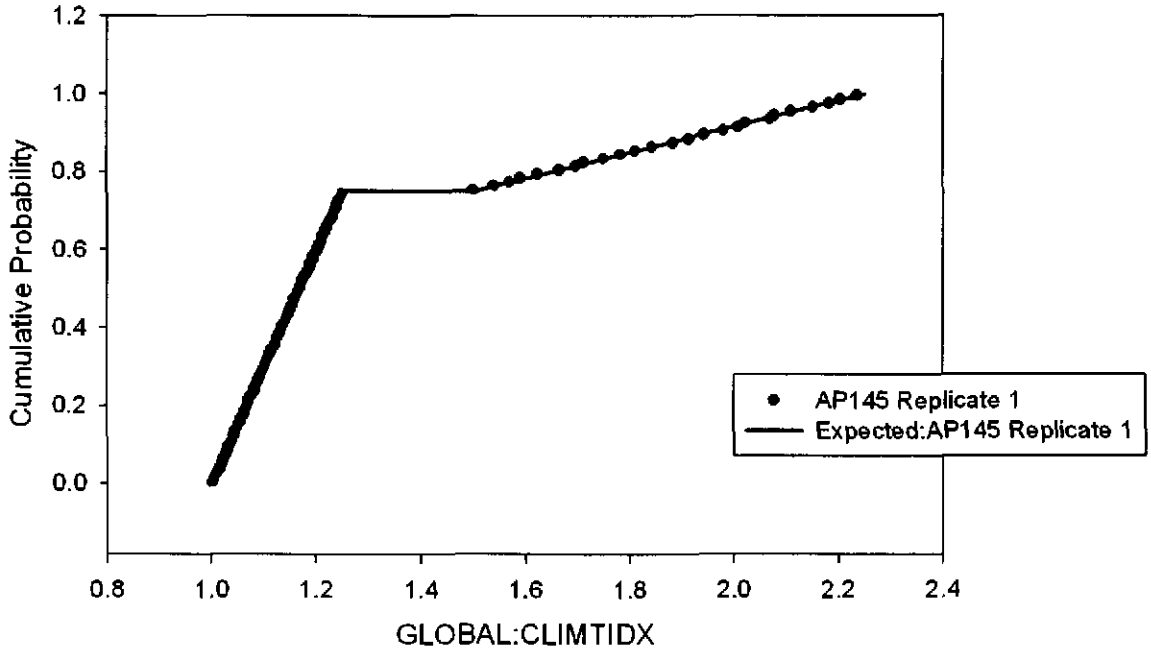

Figure 21. Observed and Expected CDFs for GLOBAL:CLIMTIDX (User Continuous Distribution) Rep. 1.

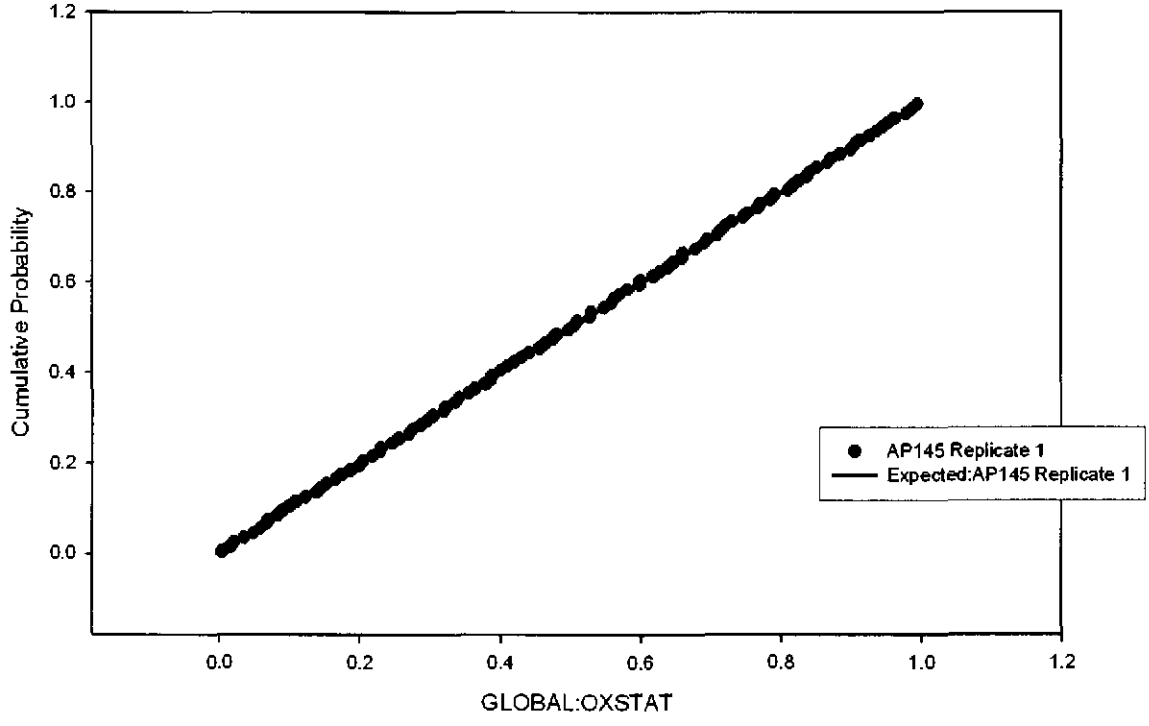

Figure 22. Observed and Expected CDFs for GLOBAL:OXSTAT (Uniform Distribution) Rep. 1.

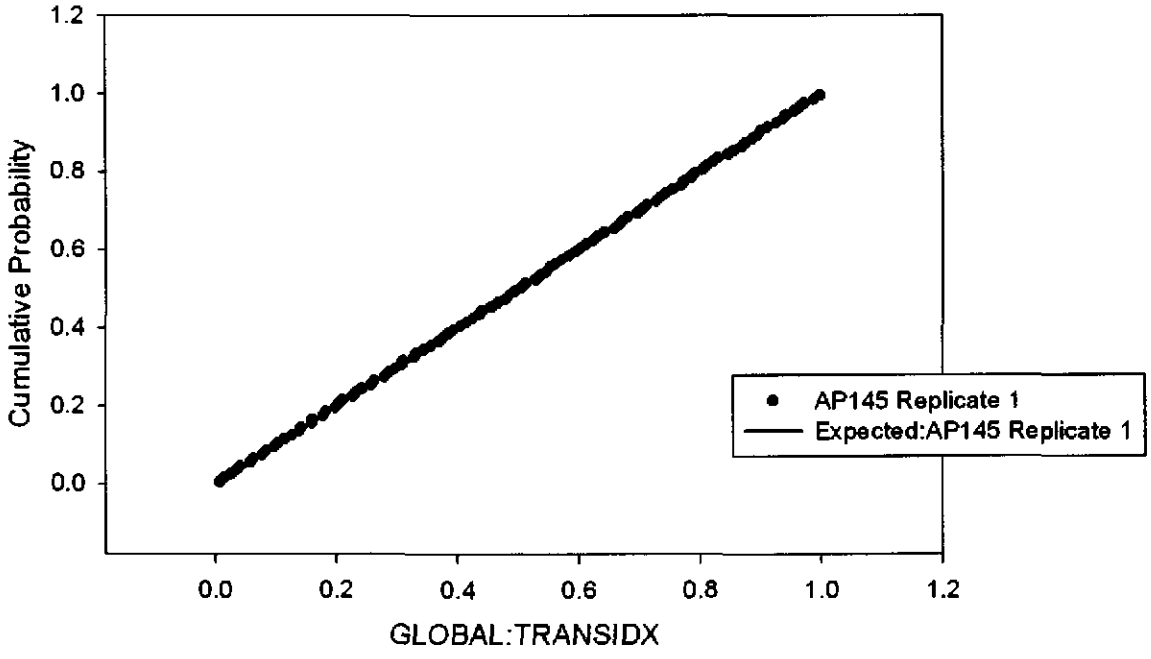

Figure 23. Observed and Expected CDFs for GLOBAL:TRANSIDX (Uniform Distribution) Rep. 1.

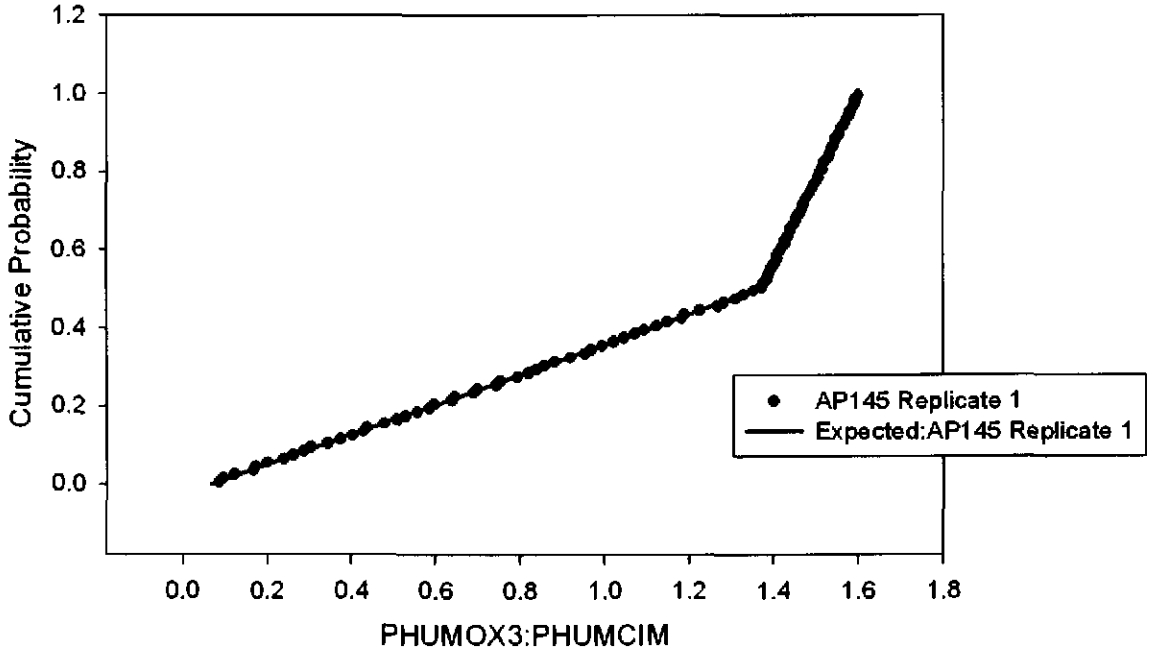

Figure 24. Observed and Expected CDFs for PHUMOX3:PHUMCIM (User Continuous Distribution) Rep. 1.

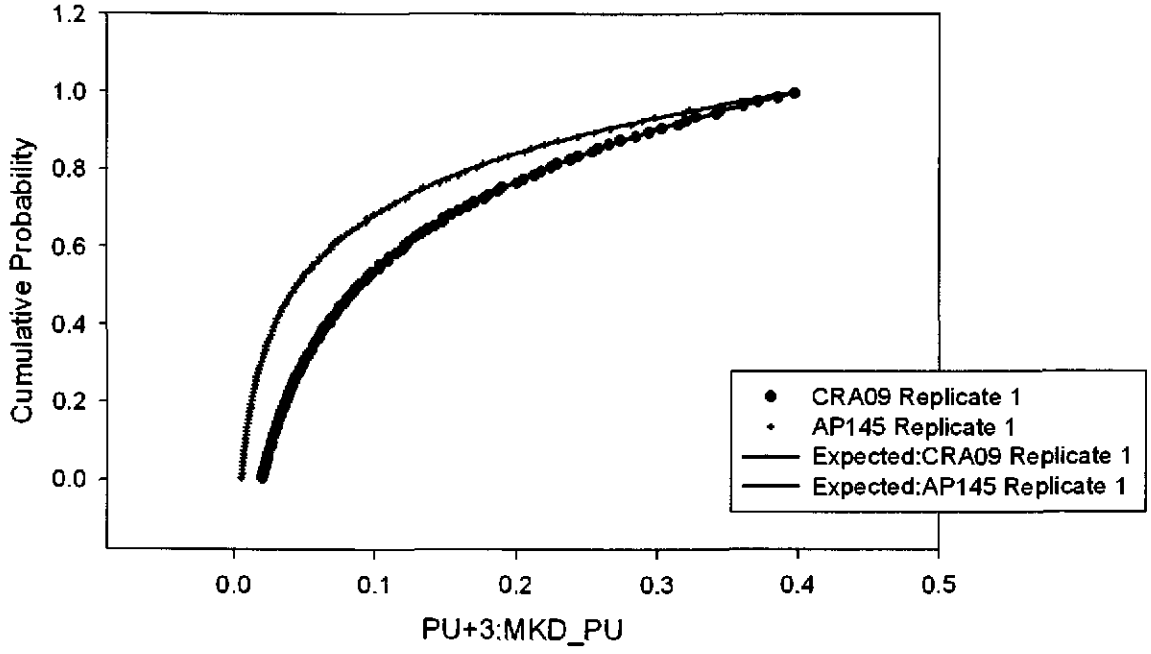

Figure 25. Observed and Expected CDFs for PU+3:MKD_PU (Loguniform Distribution) Rep. 1.

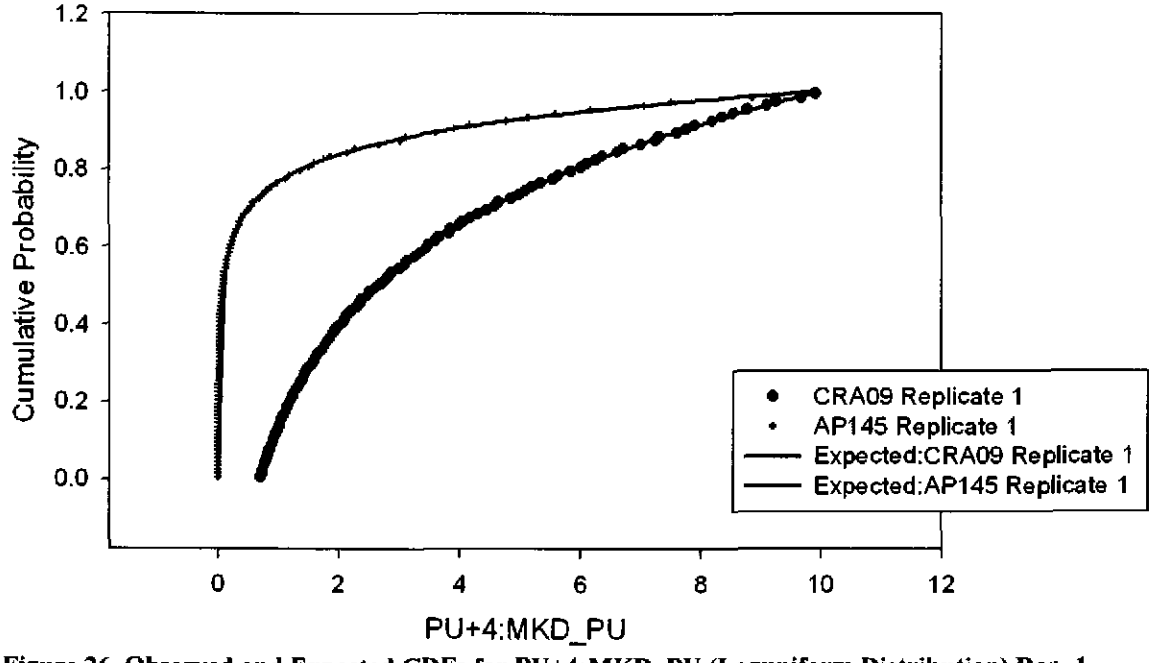

Figure 26. Observed and Expected CDFs for PU+4:MKD_PU (Loguniform Distribution) Rep. 1.

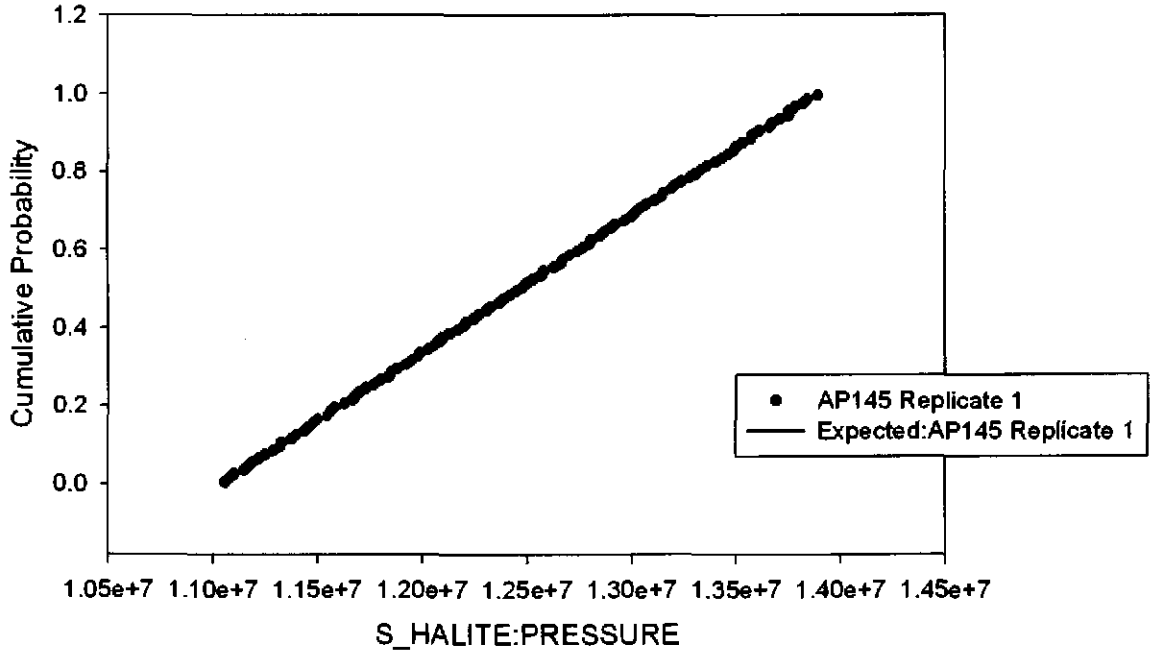

Figure 27. Observed and Expected CDFs for *S_HALITE:PRESSURE (Uniform Distribution)* Rep. 1.

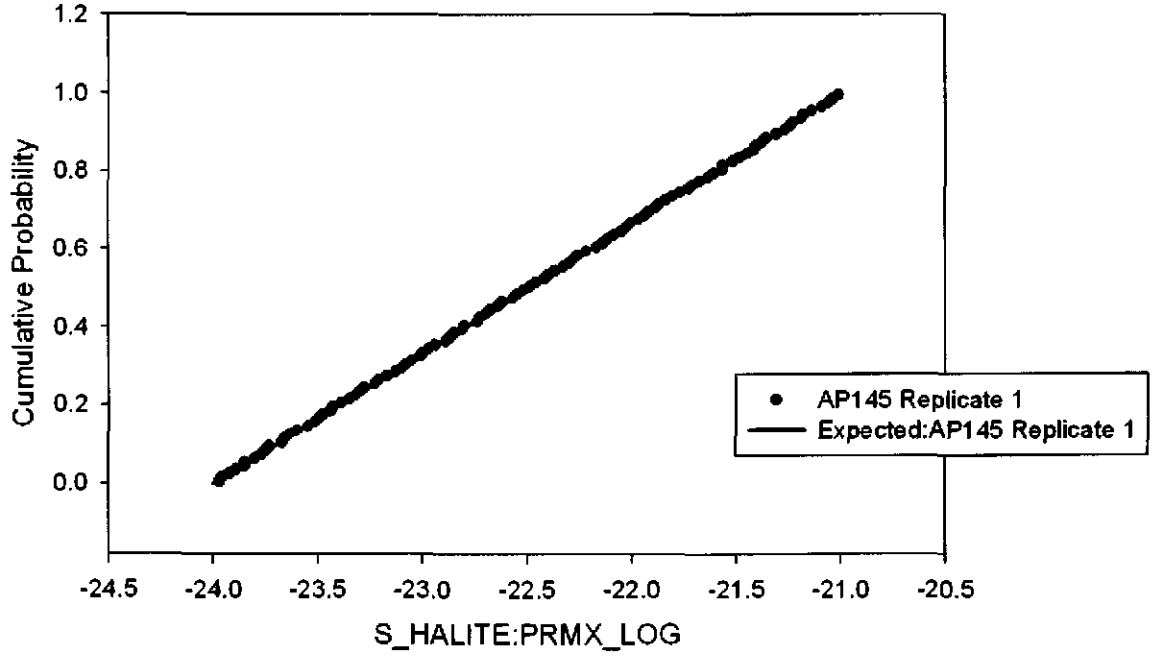

Figure 28. Observed and Expected CDFs for S_HALITE:PRMX_LOG (Uniform Distribution) Rep. 1.

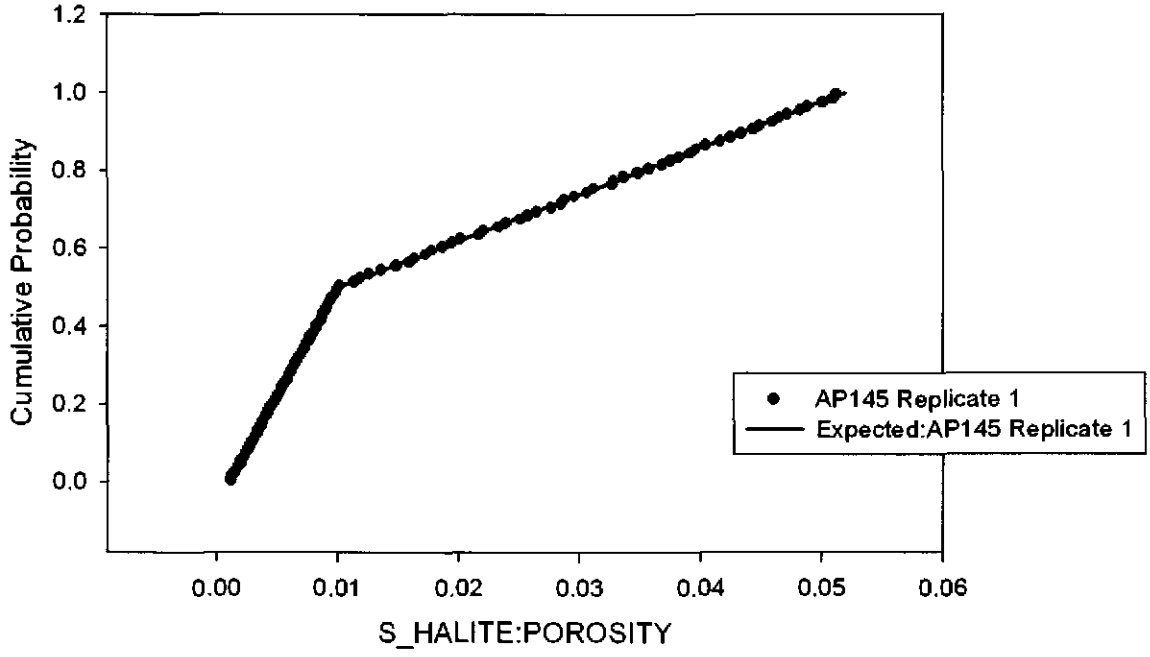

Figure 29. Observed and Expected CDFs for S_HALITE:POROSITY (User Continuous Distribution) Rep. 1.

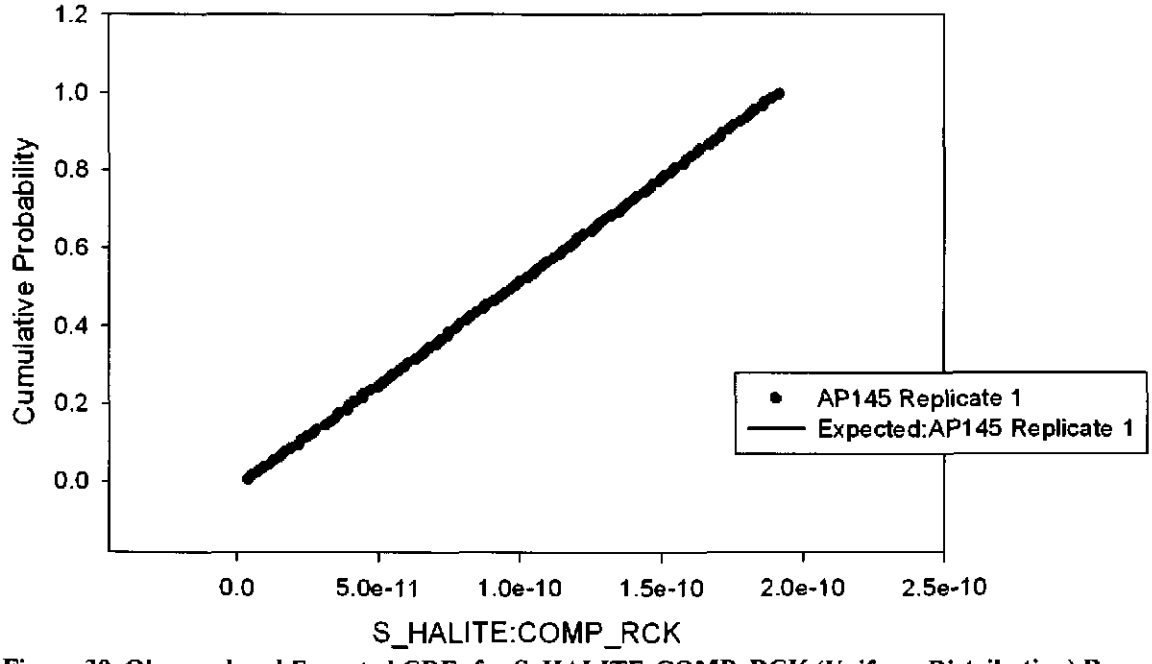

Figure 30. Observed and Expected CDFs for S_HALITE:COMP_RCK (Uniform Distribution) Rep. 1.

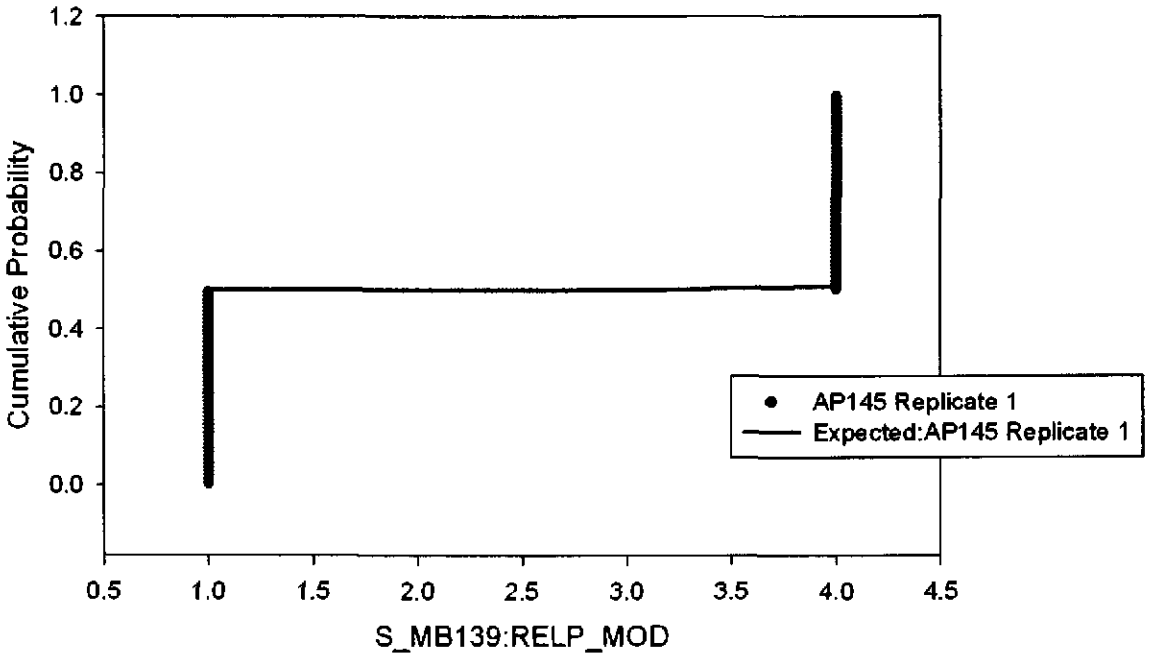

Figure 31. Observed and Expected CDFs for S_MB139:RELP_MOD (User Discrete (Delta) Distribution) Rep. 1.

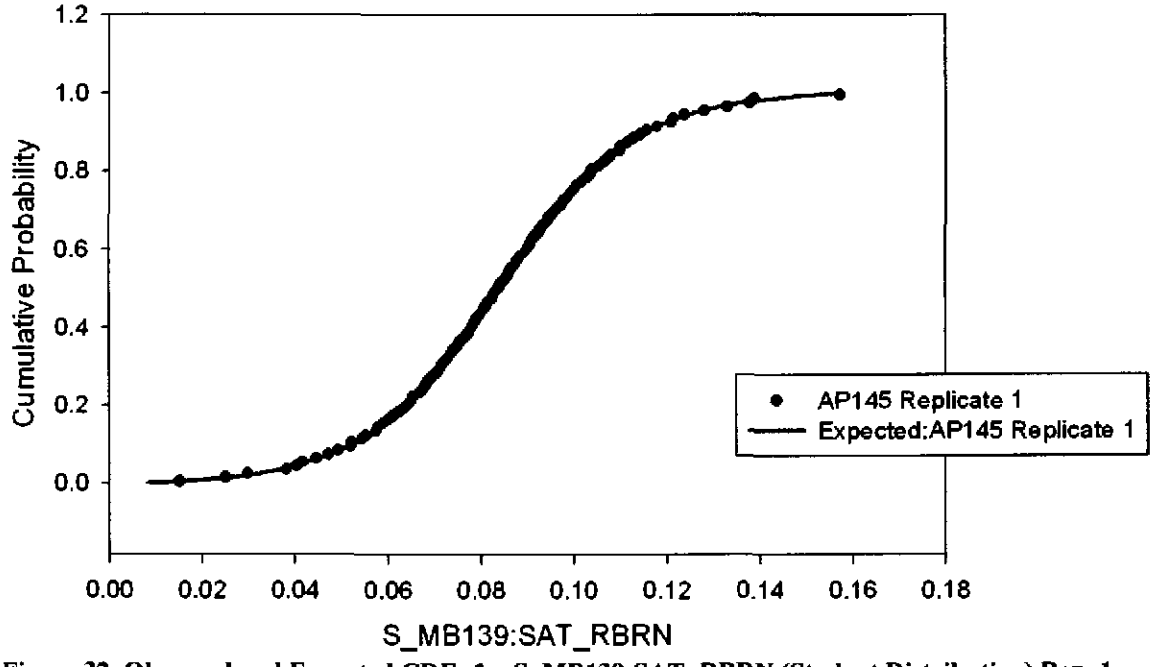

Figure 32. Observed and Expected CDFs for S_MB139:SAT_RBRN (Student Distribution) Rep. 1.

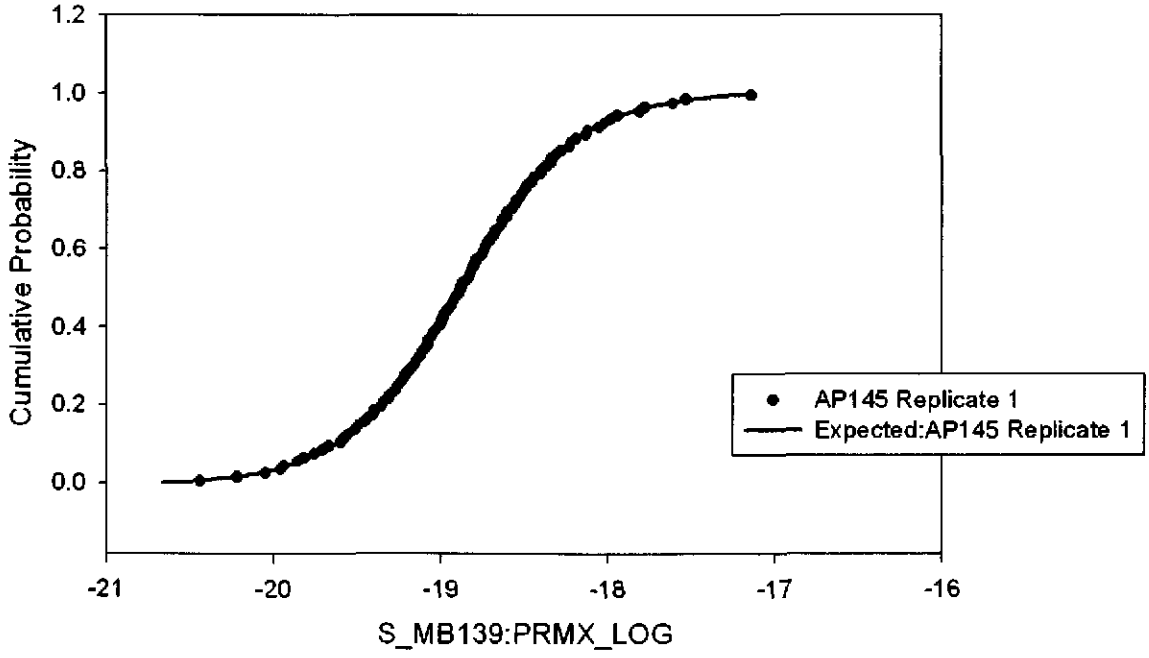

Figure 33. Observed and Expected CDFs for S_MB139:PRMX_LOG (Student Distribution) Rep. 1.

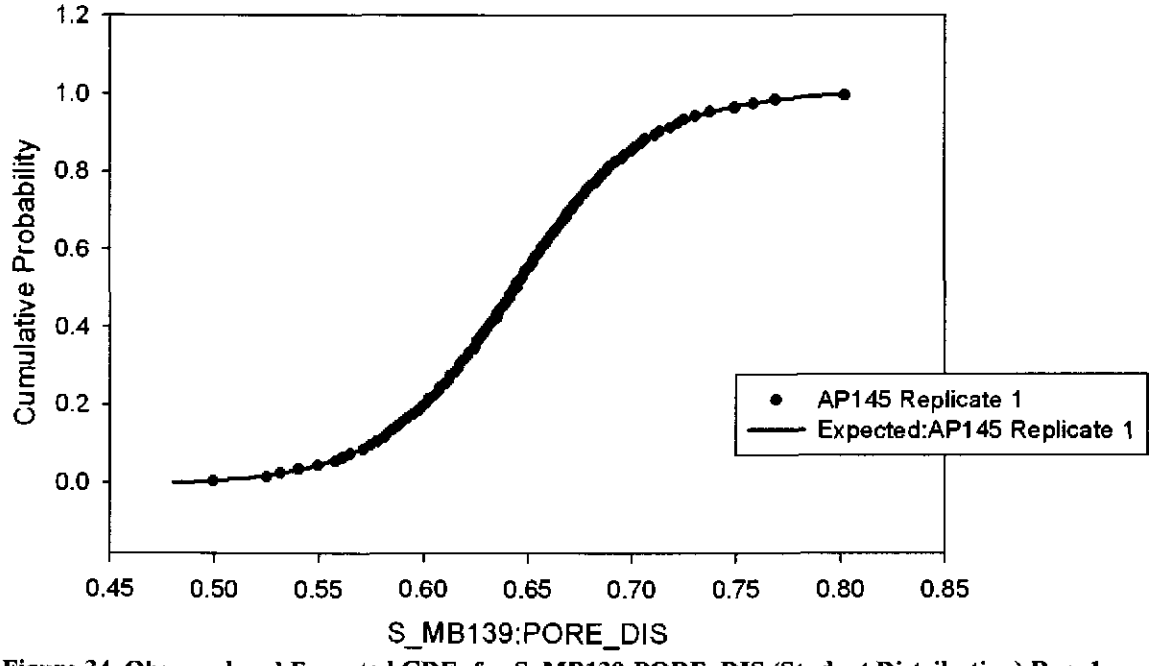

Figure 34. Observed and Expected CDFs for S_MB139:PORE_DIS (Student Distribution) Rep. 1.

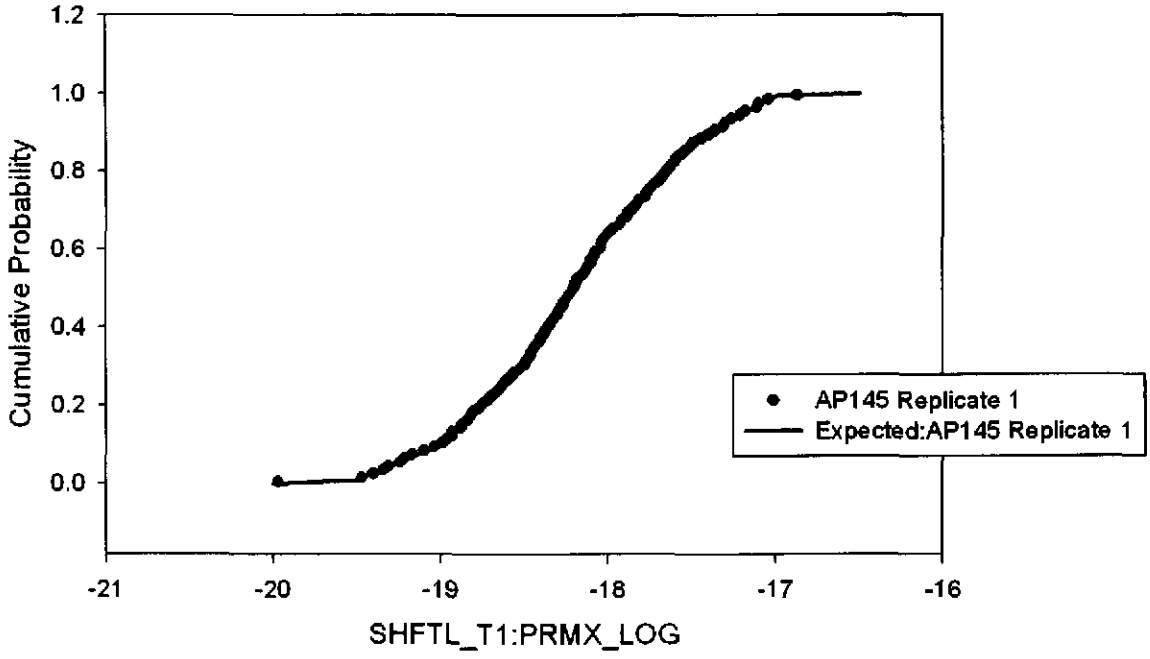

Figure 35. Observed and Expected CDFs for SHFTL_T1:PRMX_LOG (User Continuous Distribution) Rep. 1.

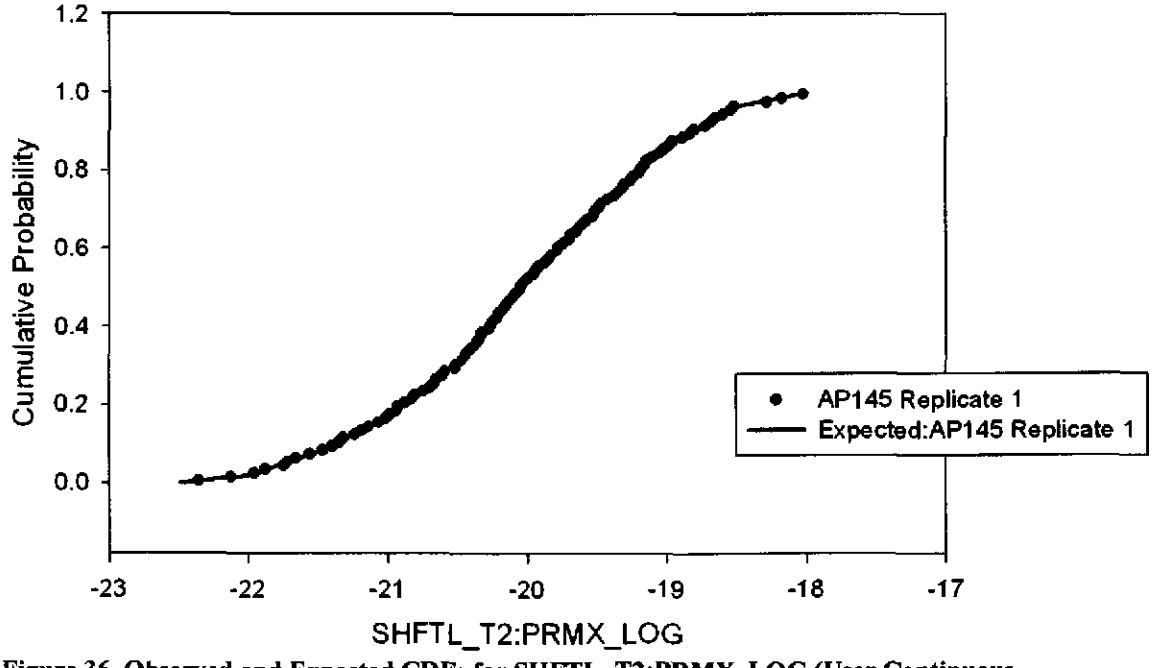

Figure 36. Observed and Expected CDFs for SHFTL_T2:PRMX_LOG (User Continuous Distribution) Rep. 1.

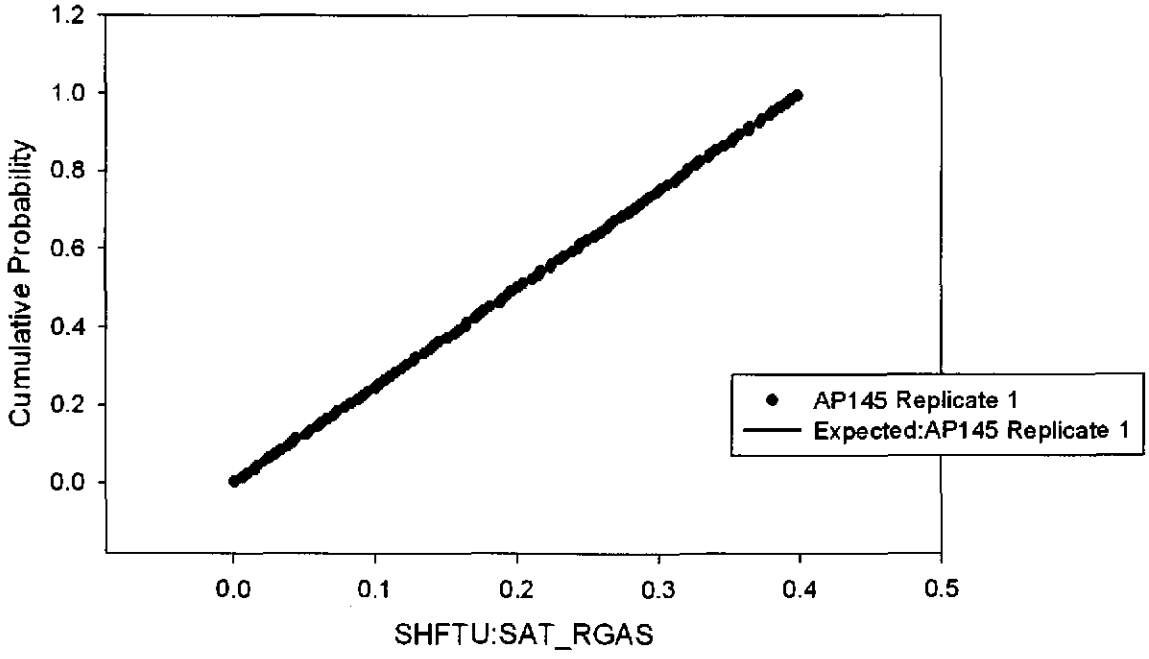

Figure 37. Observed and Expected CDFs for SHFTU:SAT_RGAS (Uniform Distribution) Rep. 1.

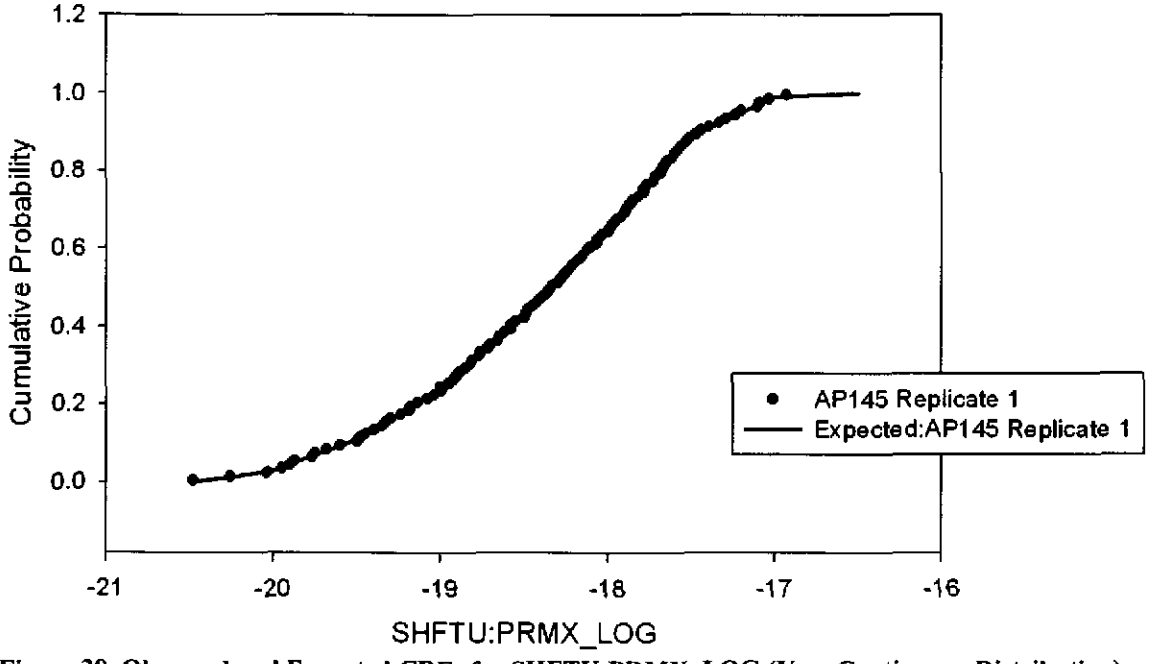

Figure 38. Observed and Expected CDFs for SHFTU:PRMX_LOG (User Continuous Distribution) Rep. 1.

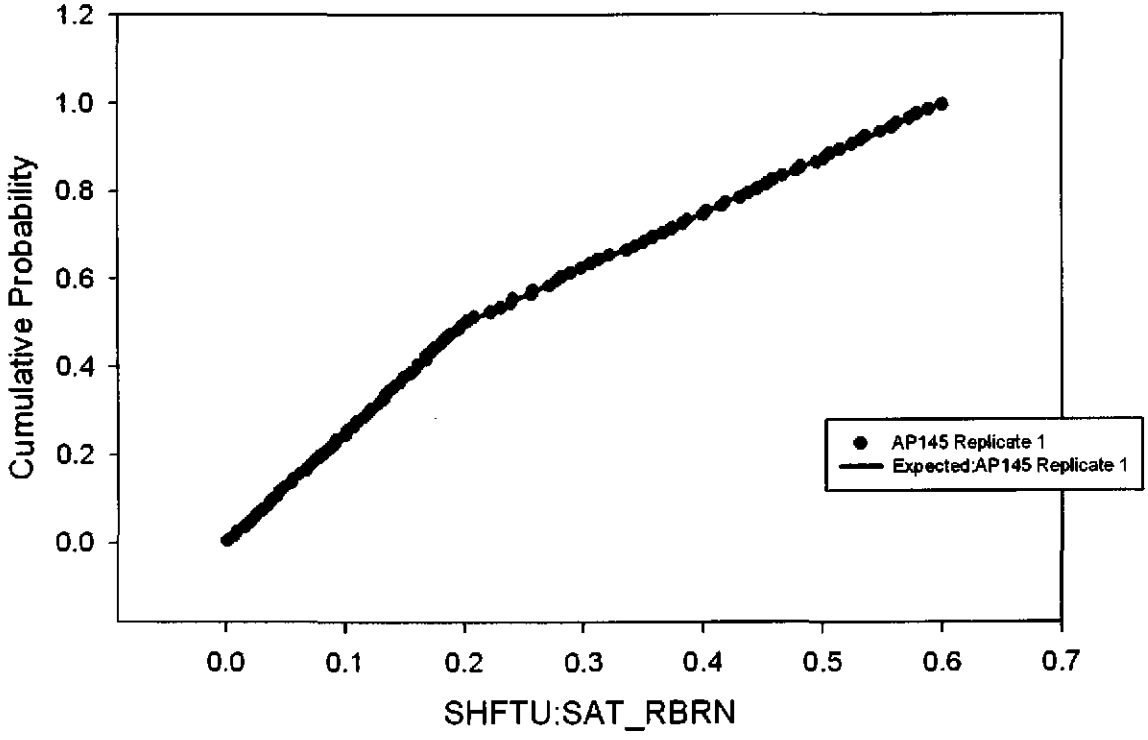

Figure 39. Observed and Expected CDFs for SHFTU:SAT_RBRN (User Continuous Distribution) Rep. 1.

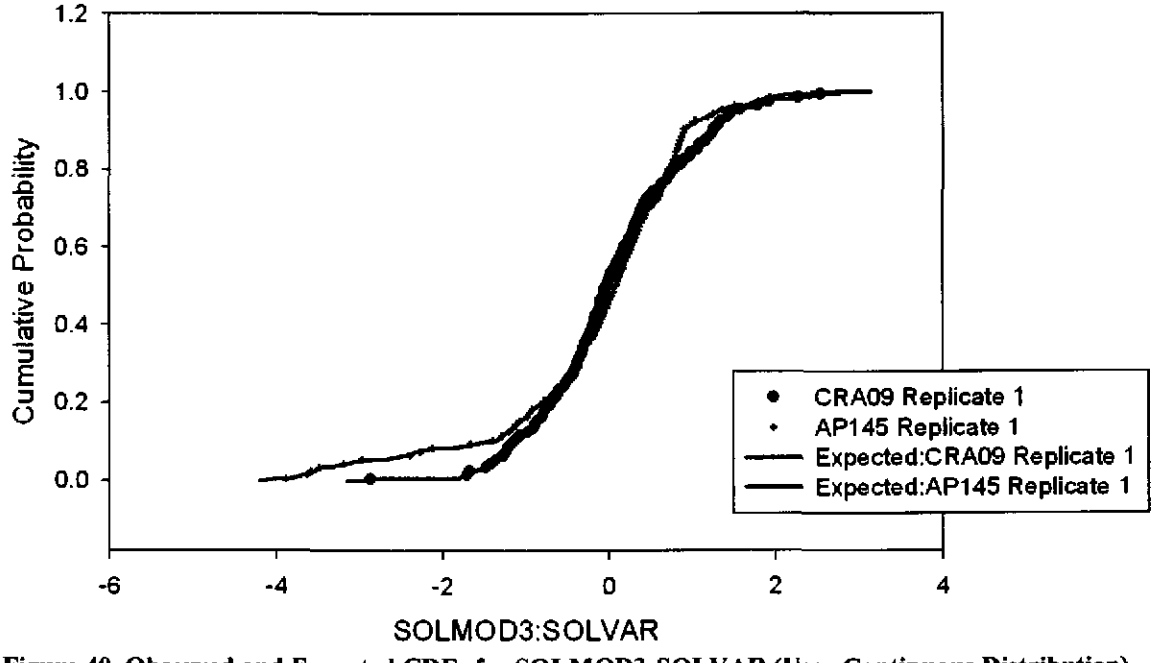

Figure 40. Observed and Expected CDFs for SOLMOD3:SOLVAR (User Continuous Distribution) Rep. 1.

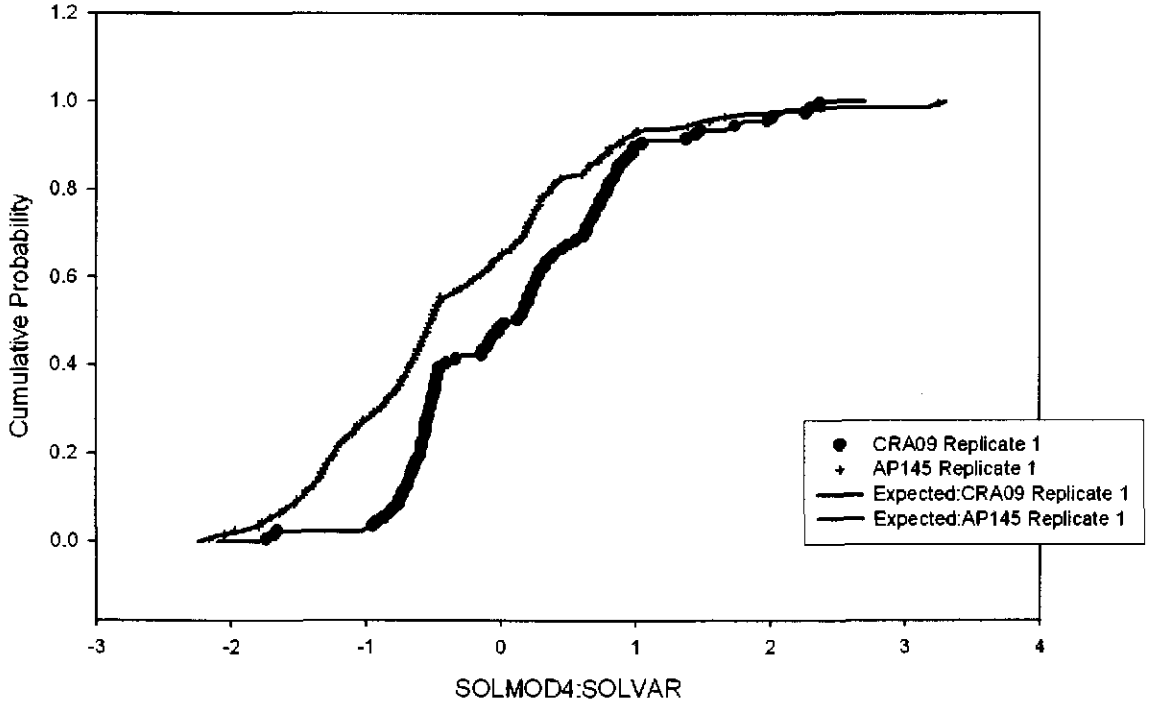

Figure 41. Observed and Expected CDFs for SOLMOD4:SOLVAR (User Continuous Distribution) Rep. 1.

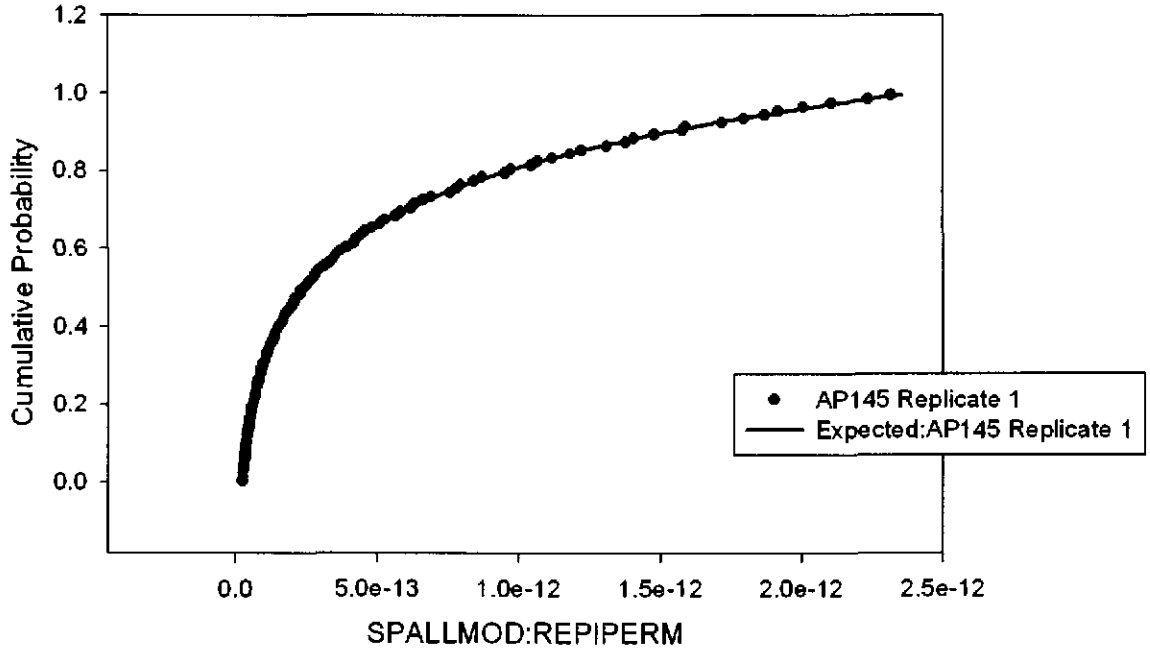

Figure 42. Observed and Expected CDFs for SPALLMOD:REPIPERM (Loguniform Distribution) Rep. 1.

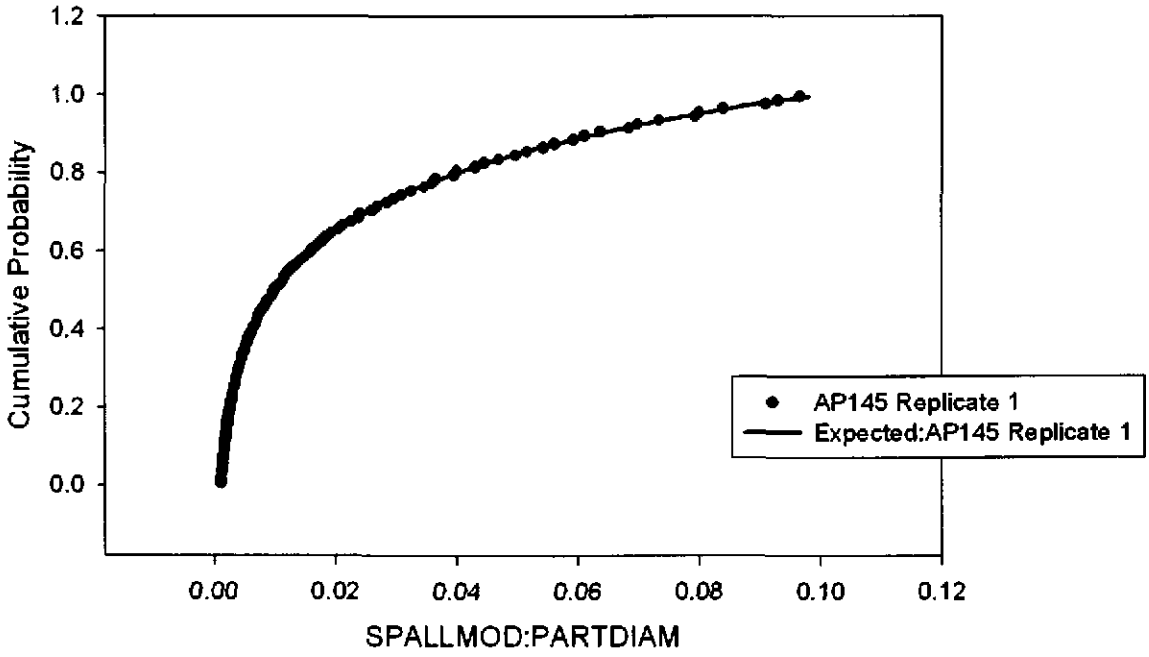

Figure 43. Observed and Expected CDFs for SPALLMOD:PARTDIAM (Loguniform Distribution) Rep. 1.

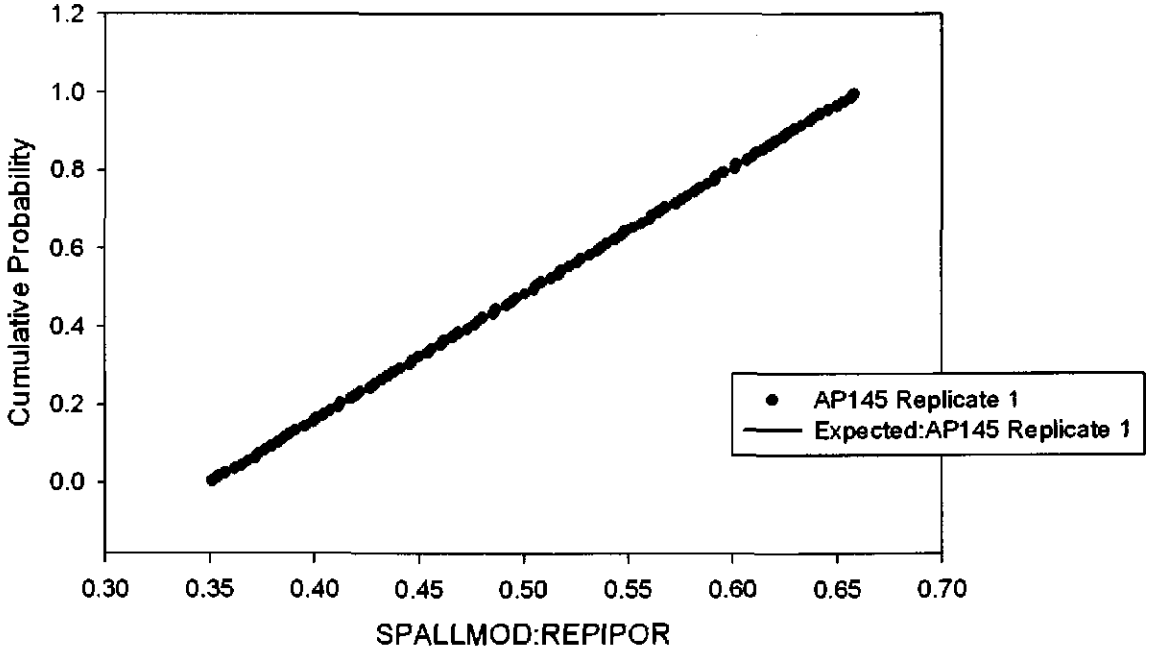

Figure 44. Observed and Expected CDFs for SPALLMOD:REPIPOR (Uniform Distribution) Rep. 1.

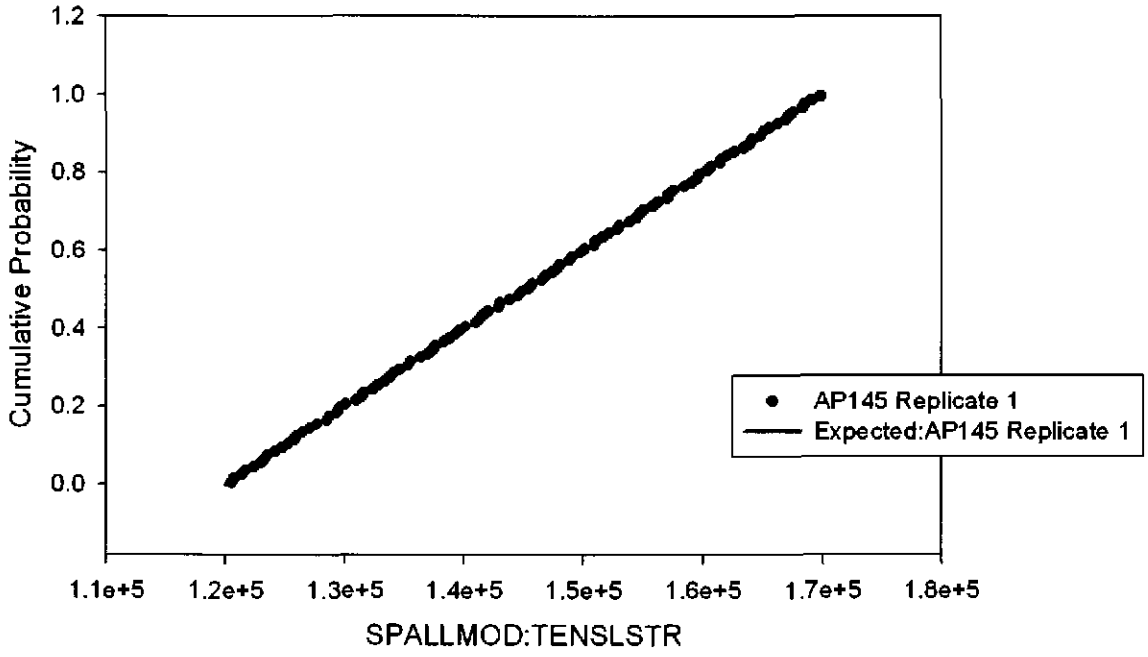

Figure 45. Observed and Expected CDFs for SPALLMOD:TENSLSTR (Uniform Distribution) Rep. 1.

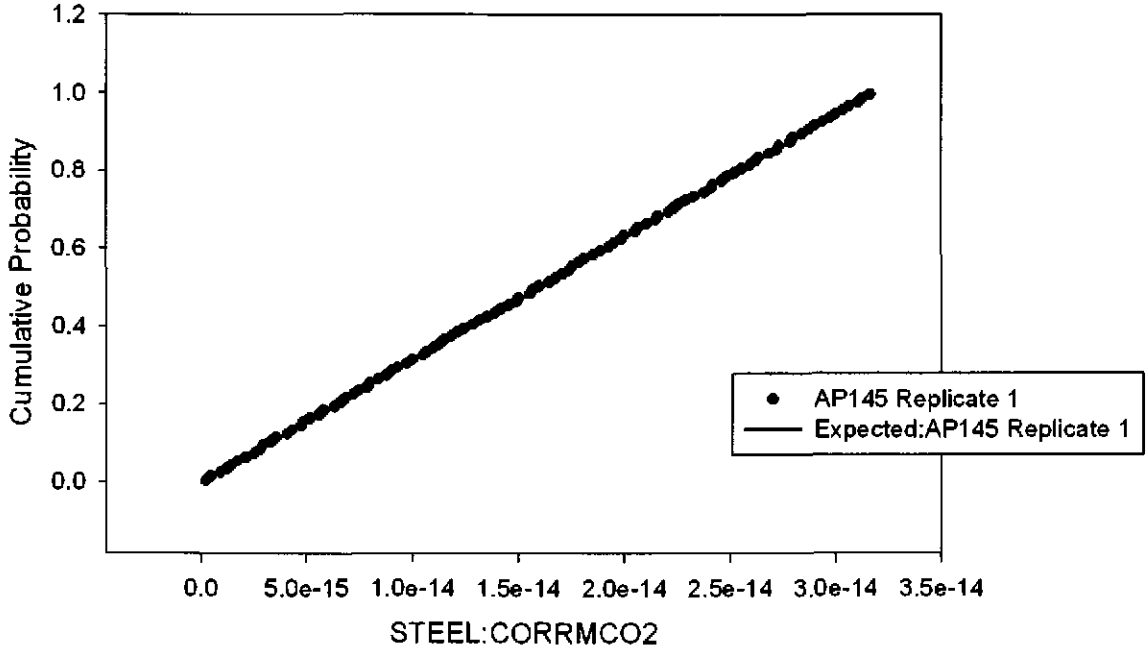

Figure 46. Observed and Expected CDFs for STEEL:CORRMCO2 (Uniform Distribution) Rep. 1.

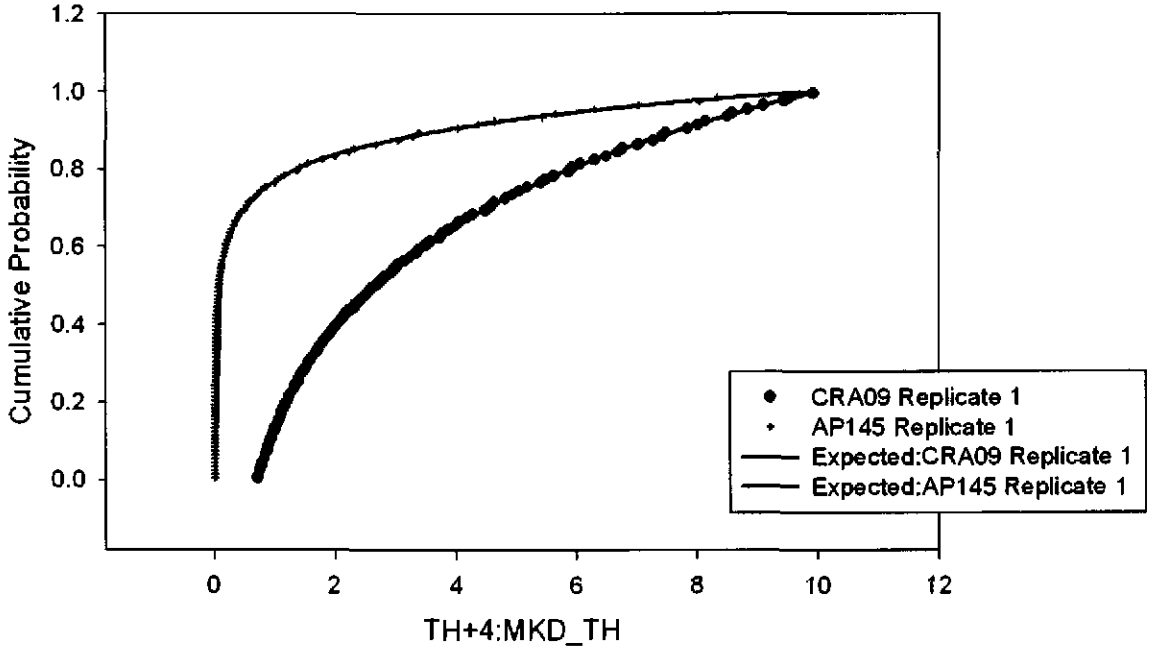

Figure 47. Observed and Expected CDFs for TH+4:MKD_TH (Loguniform Distribution) Rep. 1.

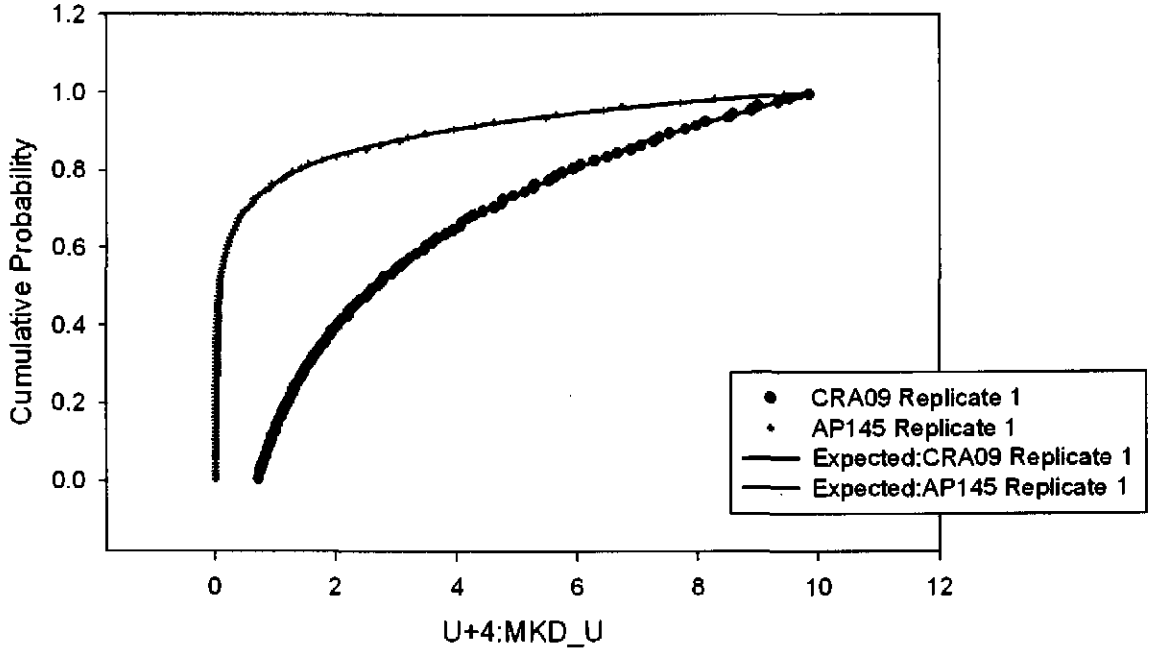

Figure 48. Observed and Expected CDFs for U+4:MKD_U (Loguniform Distribution) Rep. 1.

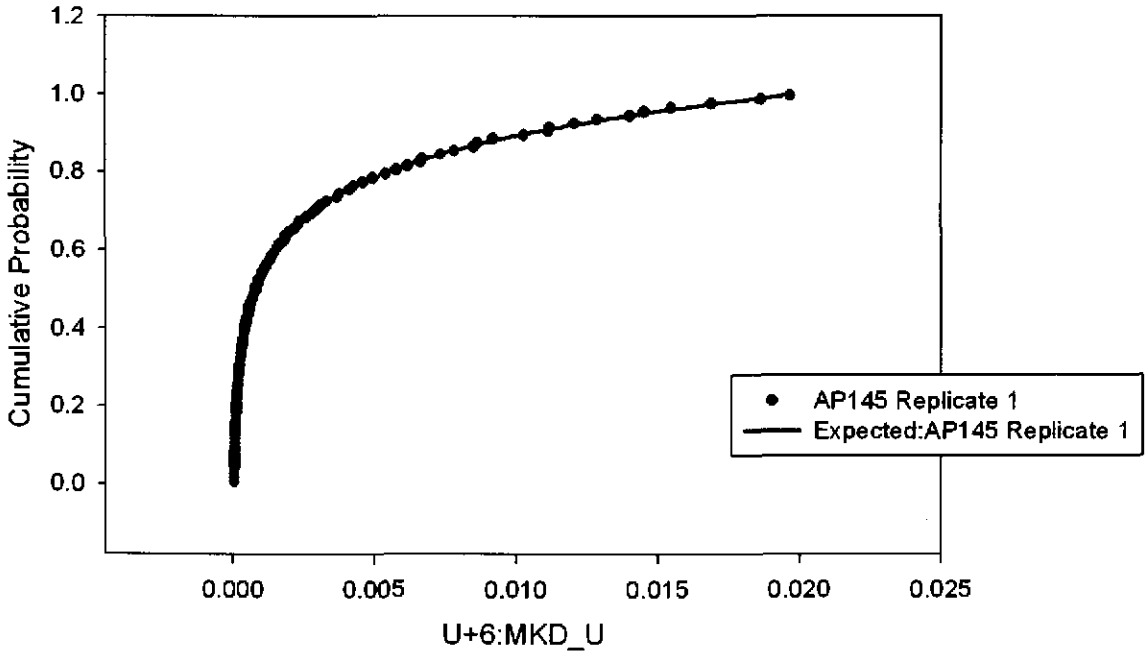

Figure 49. Observed and Expected CDFs for U+6:MKD_U (Loguniform Distribution) Rep. 1.

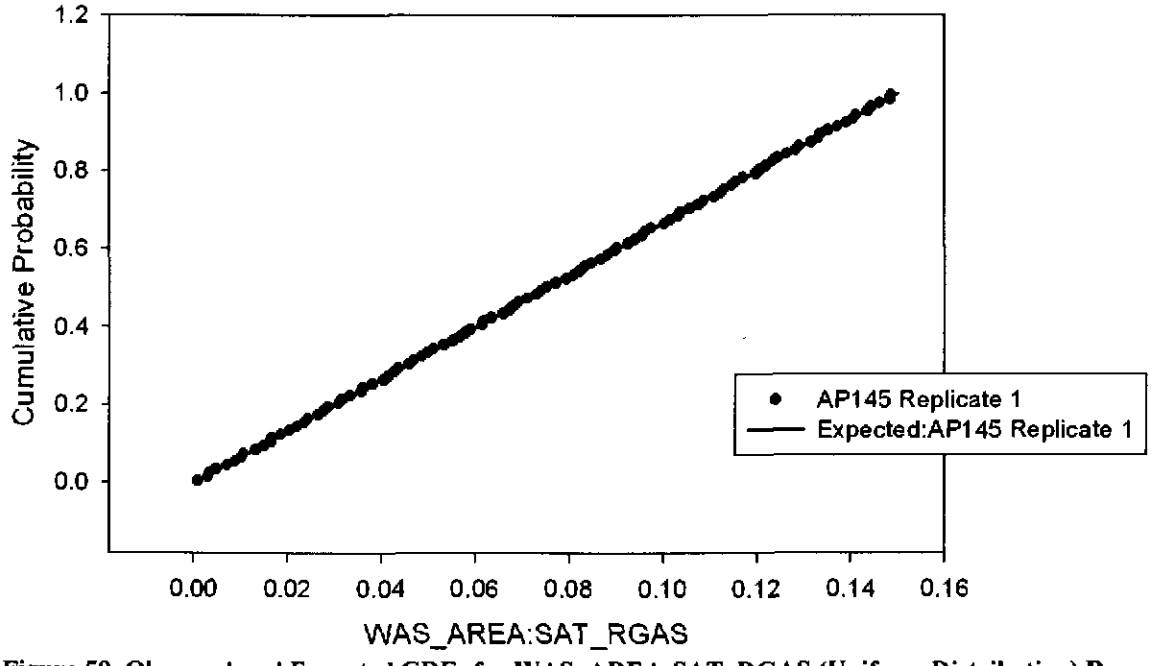

Figure 50. Observed and Expected CDFs for WAS_AREA:SAT_RGAS (Uniform Distribution) Rep. 1.

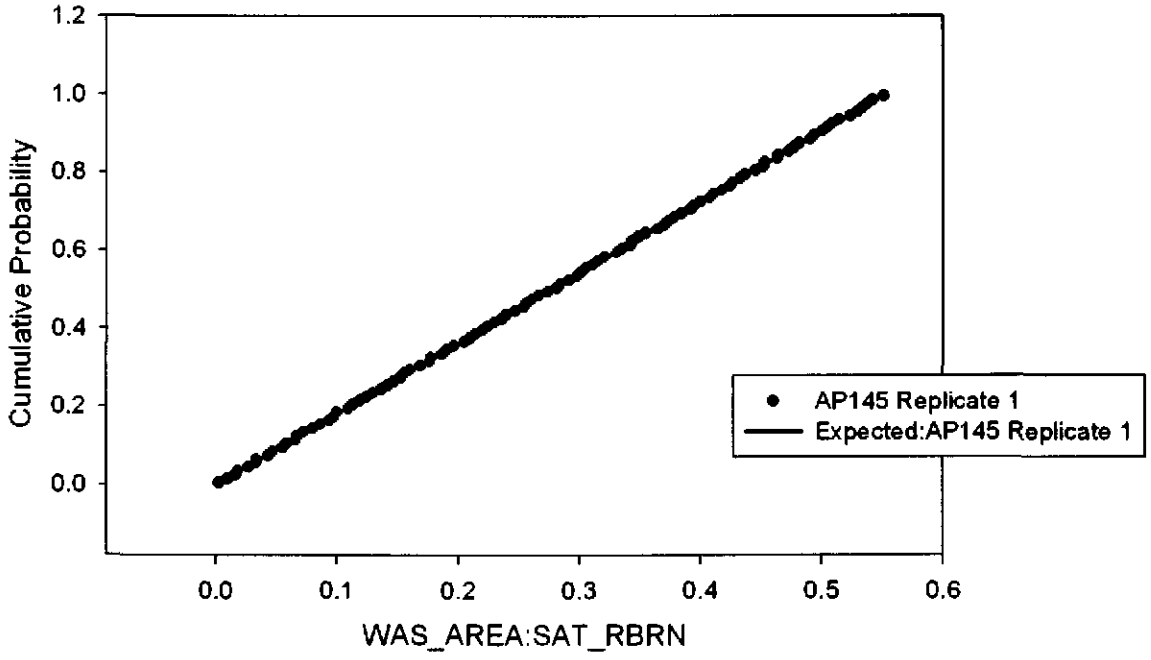

Figure 51. Observed and Expected CDFs for WAS_AREA:SAT_RBRN (Uniform Distribution) Rep. 1.

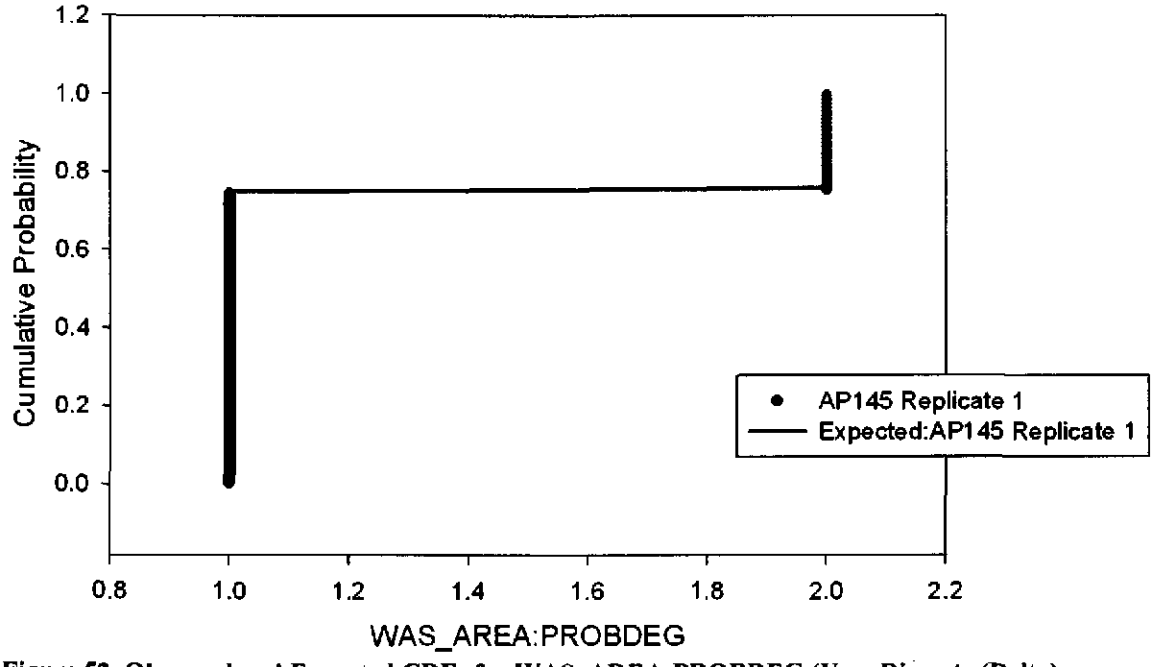

Figure 52. Observed and Expected CDFs for WAS_AREA:PROBDEG (User Discrete (Delta) Distribution) Rep. 1.

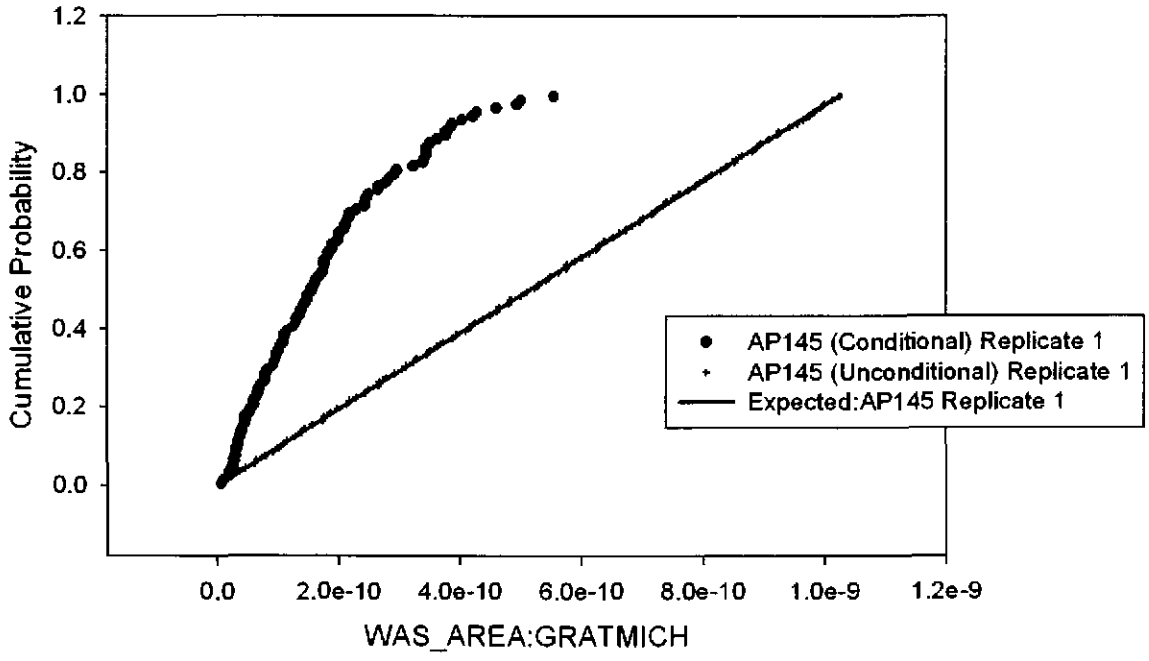

Figure 53. Observed and Expected CDFs for WAS_AREA:GRATMICH (Uniform Distribution) Rep. 1.

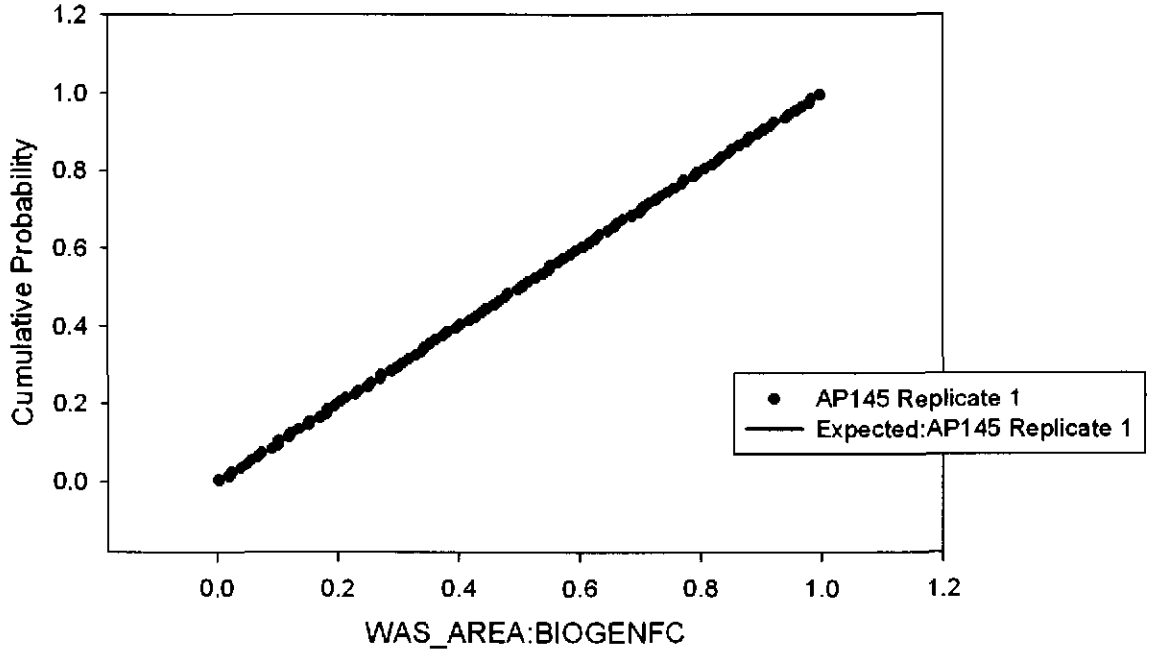

Figure 54. Observed and Expected CDFs for WAS_AREA:BIOGENFC (Uniform Distribution) Rep. 1.

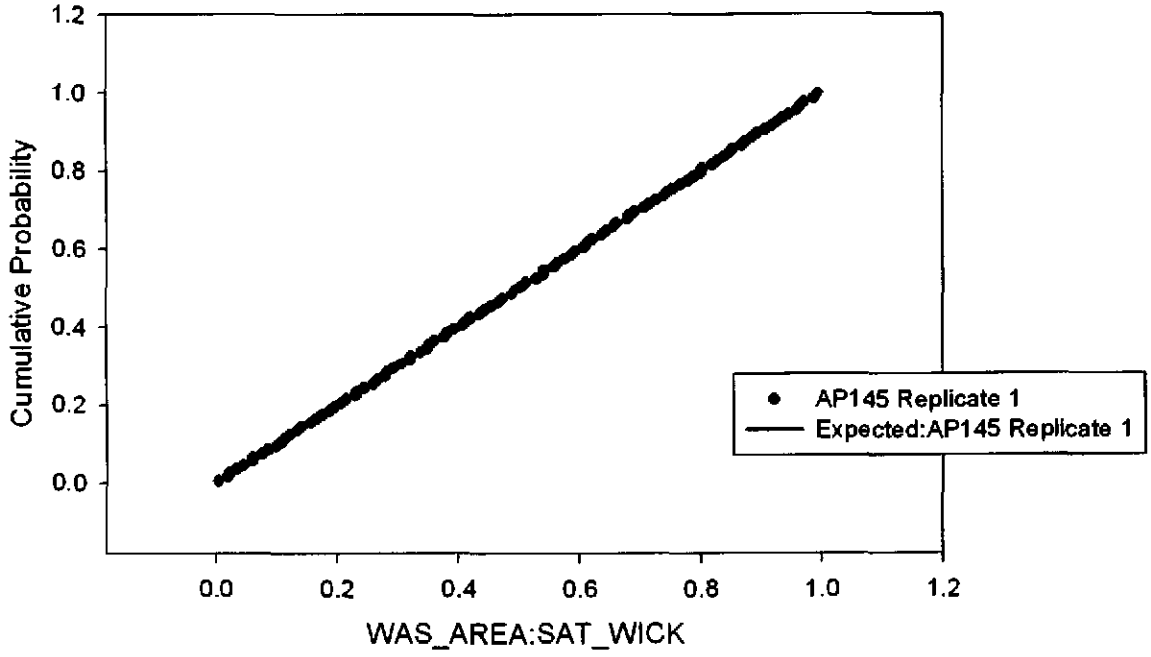

Figure 55. Observed and Expected CDFs for WAS_AREA:SAT_WICK (Uniform Distribution) Rep. 1.

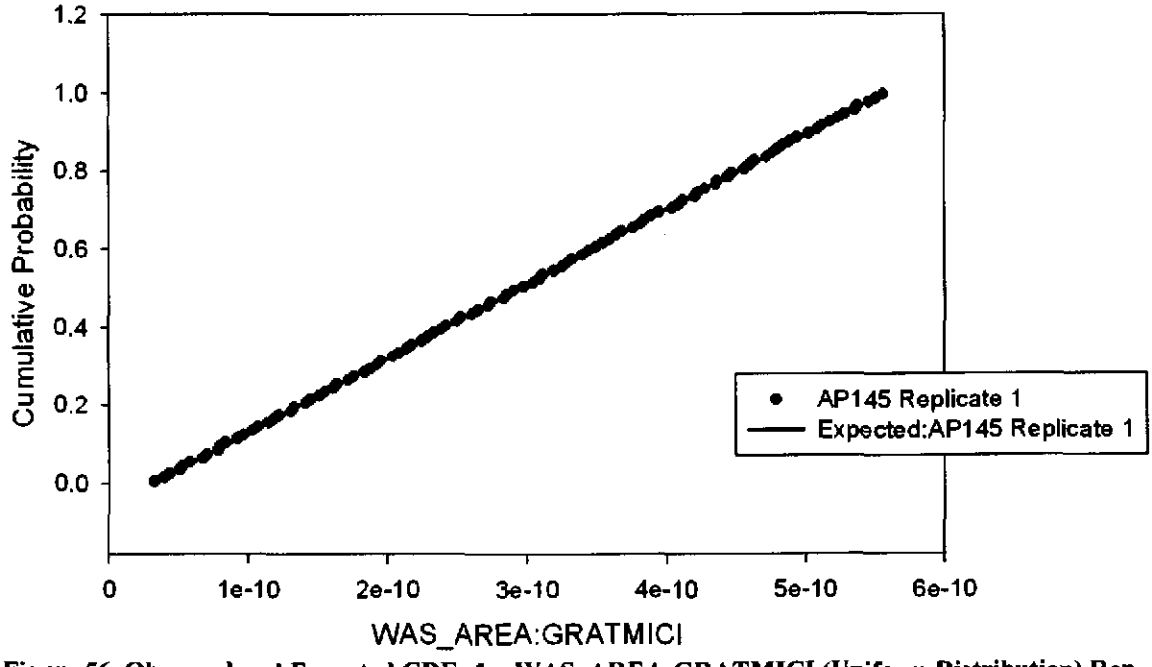

Figure 56. Observed and Expected CDFs for WAS_AREA:GRATMICI (Uniform Distribution) Rep. 1.

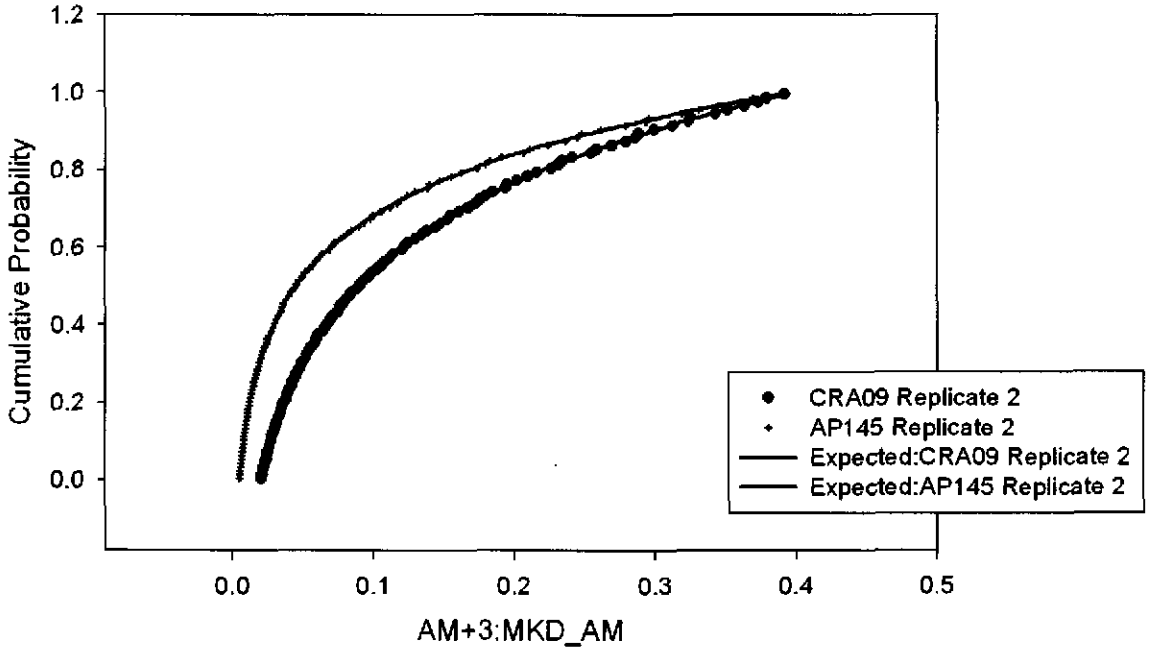

Figure 57. Observed and Expected CDFs for AM+3:MKD_AM (Loguniform Distribution) Rep. 2.

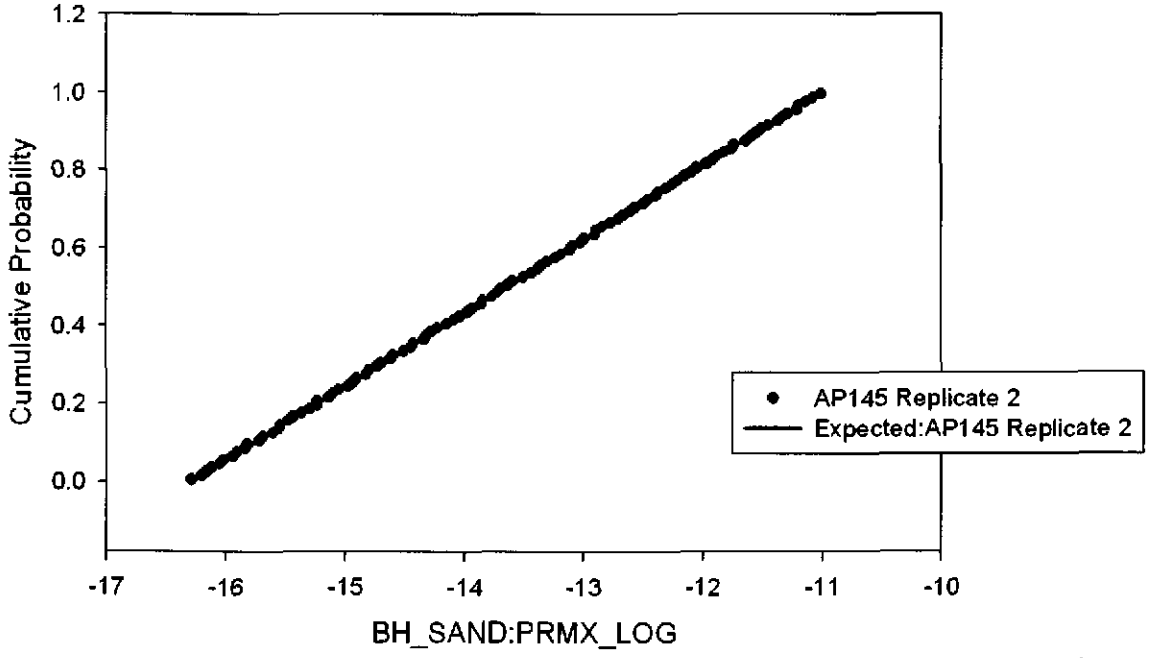

Figure 58. Observed and Expected CDFs for BH_SAND:PRMX_LOG (Uniform Distribution) Rep. 2.

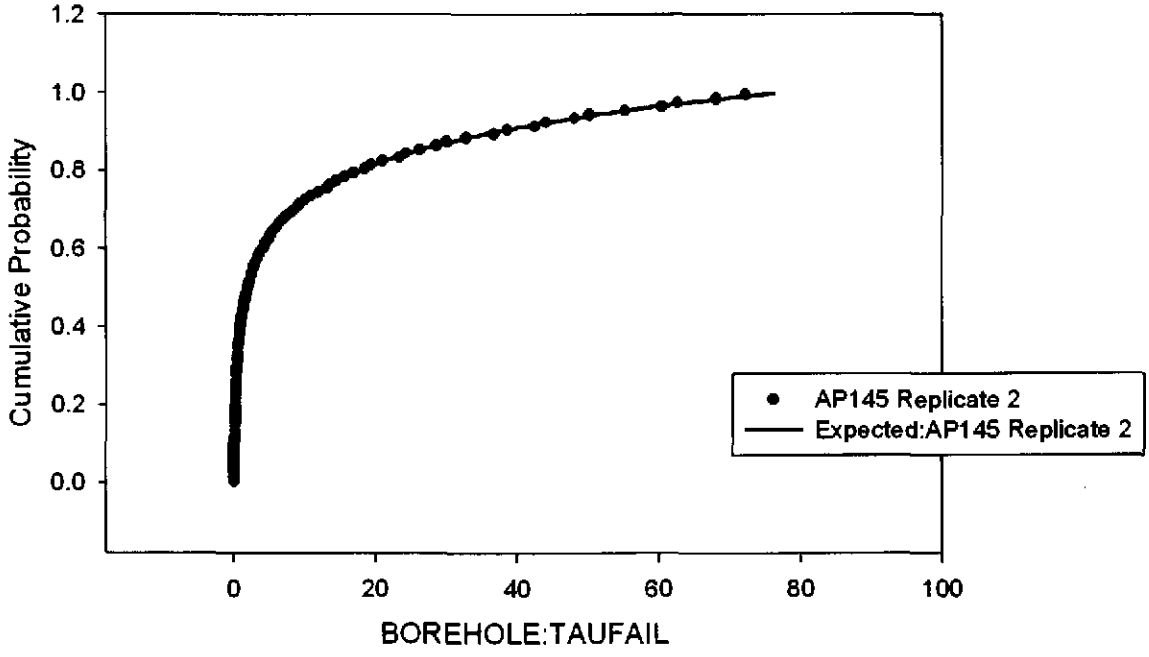

Figure 59. Observed and Expected CDFs for **BOREHOLE:TAUFAIL (Loguniform Distribution) Rep. 2.**

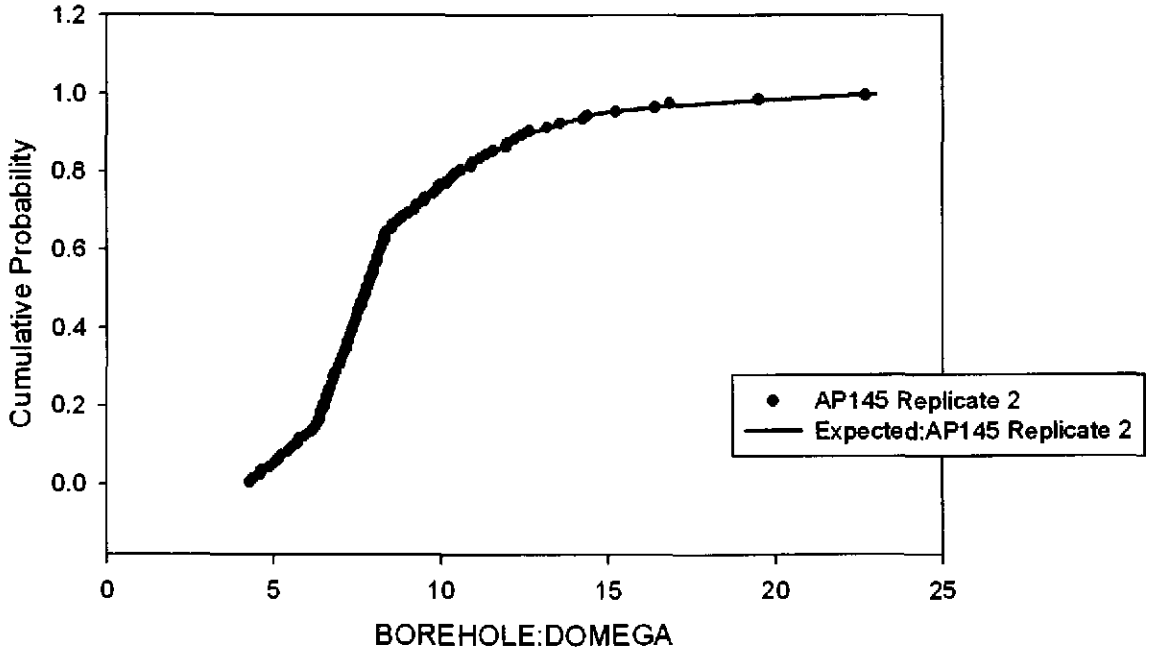

Figure 60. Observed and Expected CDFs for BOREHOLE:DOMEGA (User Continuous Distribution) Rep. 2.

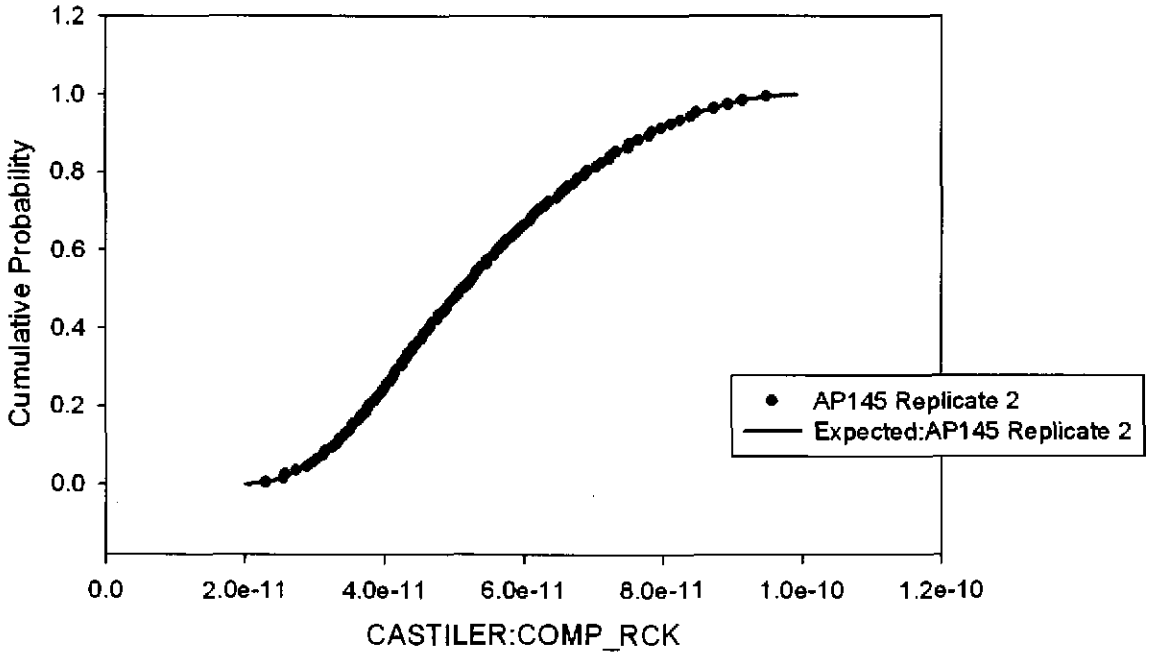

Figure 61. Observed and Expected CDFs for CASTILER:COMP_RCK (Triangular Distribution) Rep. 2.

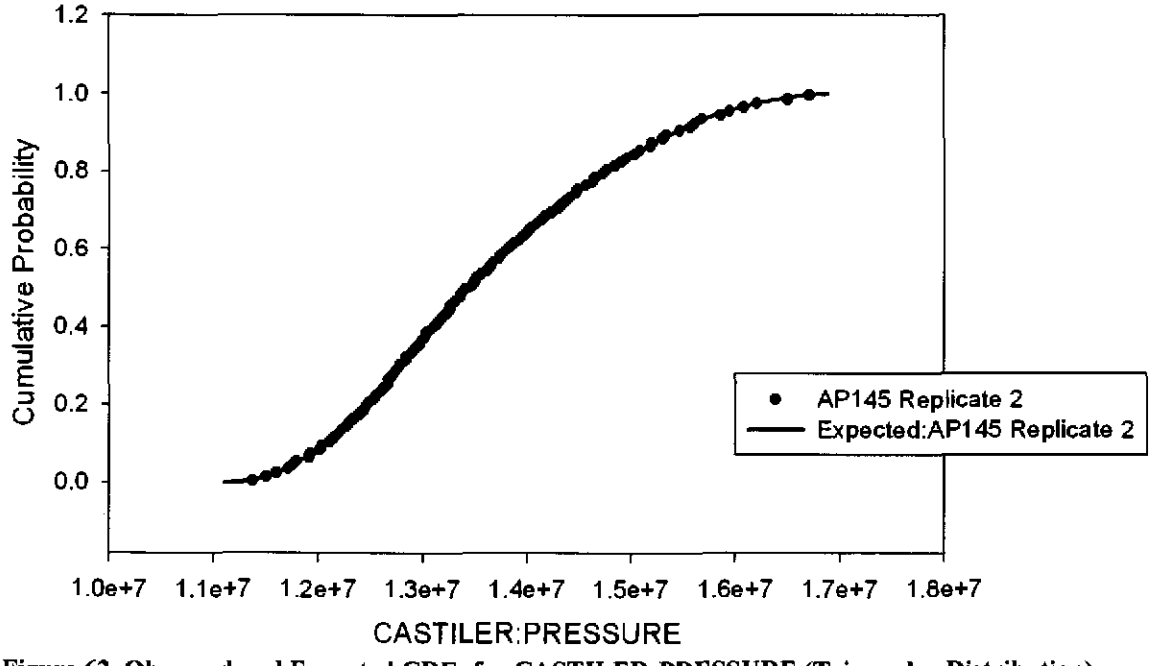

Figure 62. Observed and Expected CDFs for CASTILER:PRESSURE (Triangular Distribution) Rep. 2.

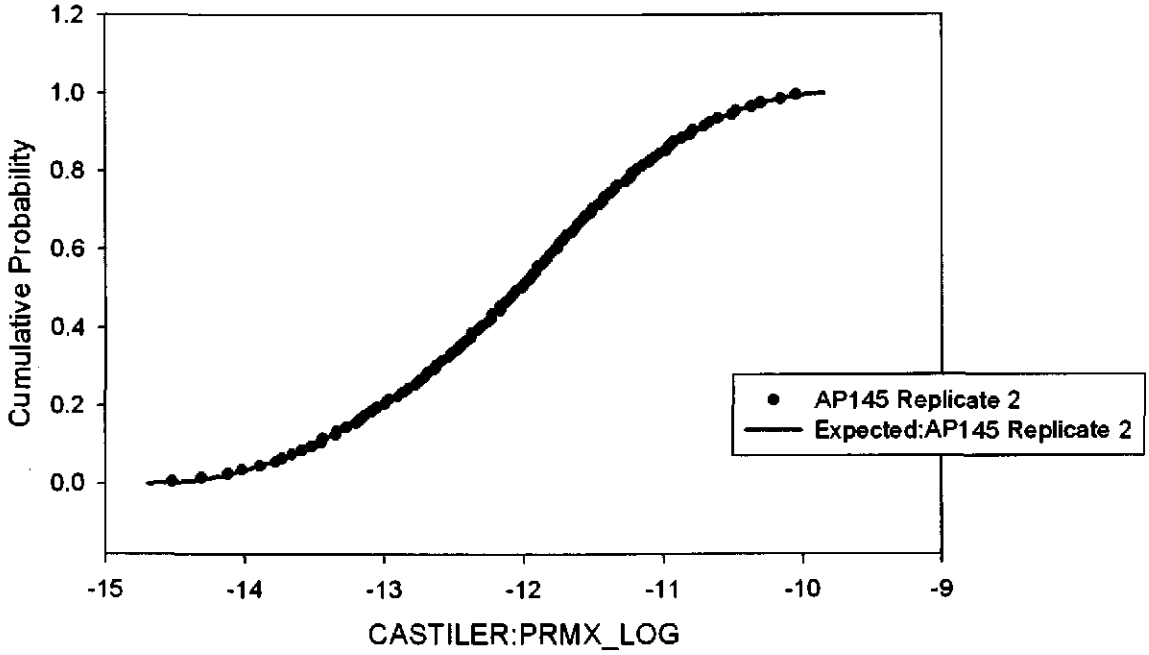

Figure 63. Observed and Expected CDFs for CASTILER:PRMX_LOG (Triangular Distribution) Rep. 2.

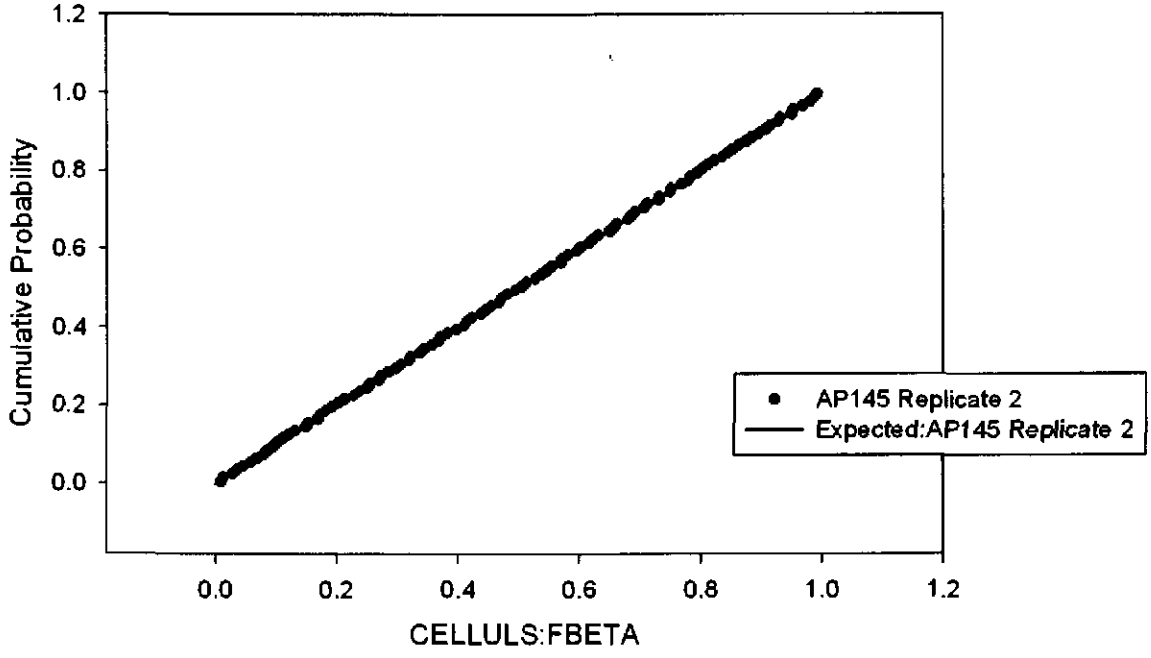

Figure 64. Observed and Expected CDFs for CELLULS:FBETA (Uniform Distribution) Rep. 2.

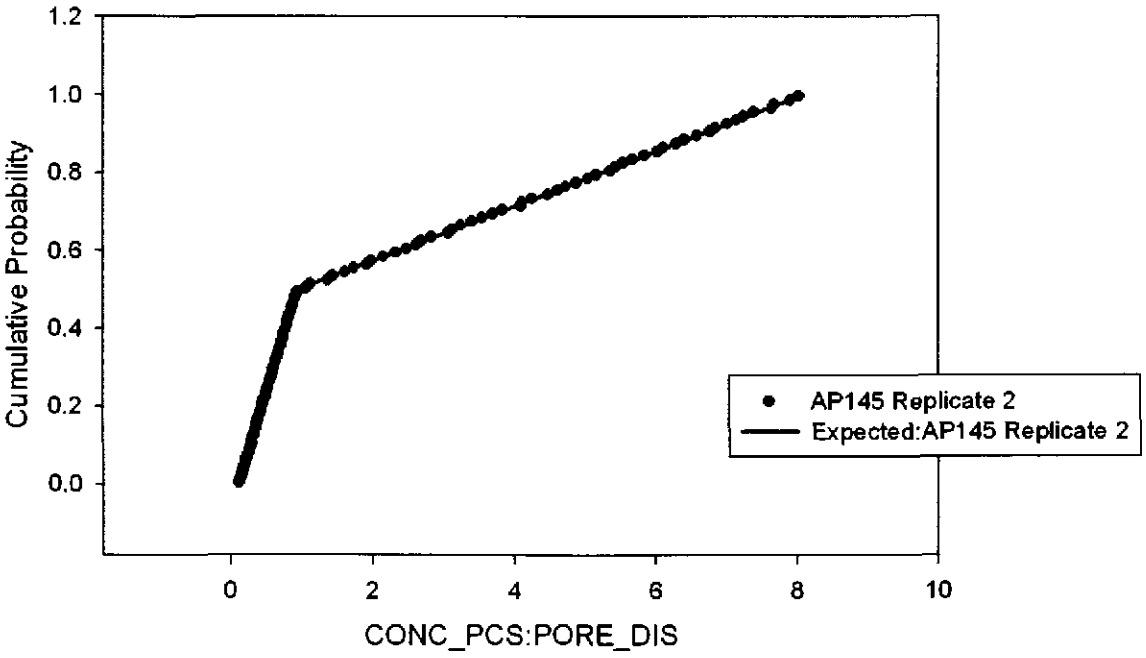

Figure 65. Observed and Expected CDFs for CONC_PCS:PORE_DIS (User Continuous Distribution) Rep. 2.

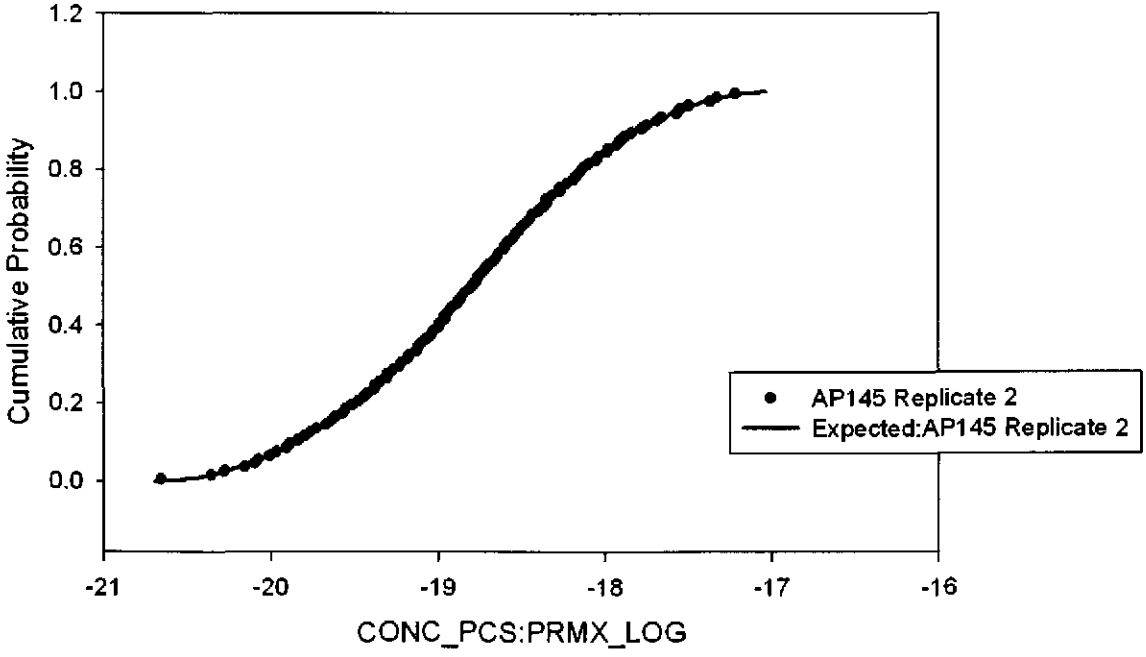

Figure 66. Observed and Expected CDFs for CONC_PCS:PRMX_LOG (Triangular Distribution) Rep. 2.

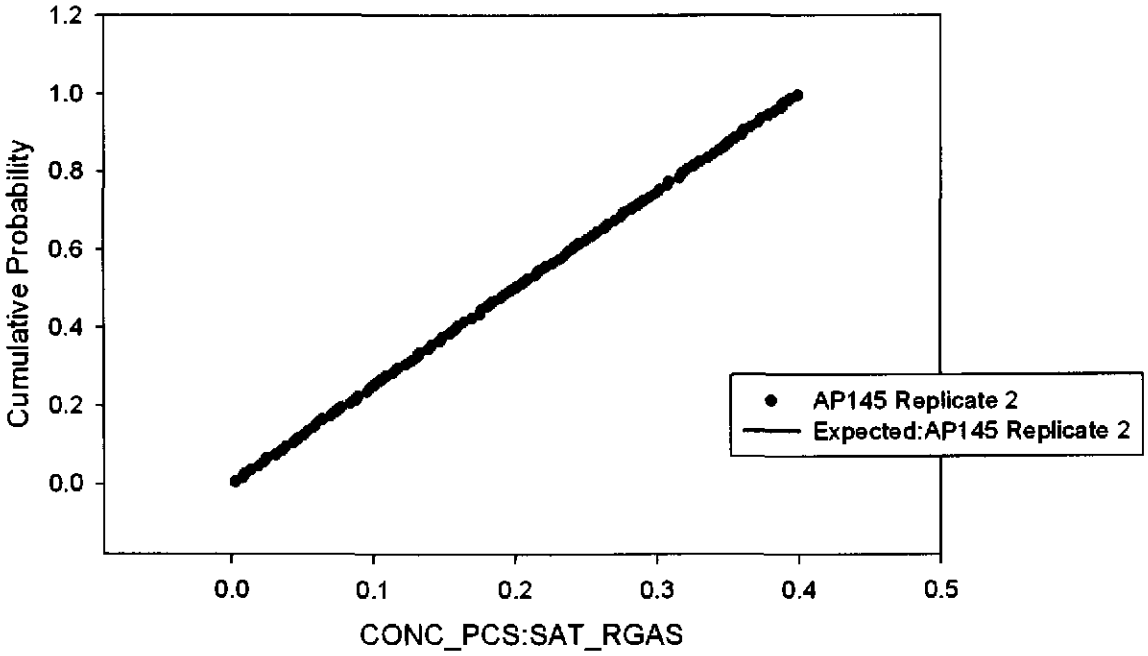

Figure 67. Observed and Expected CDFs for CONC_PCS:SAT_RGAS (Uniform Distribution) Rep. 2.

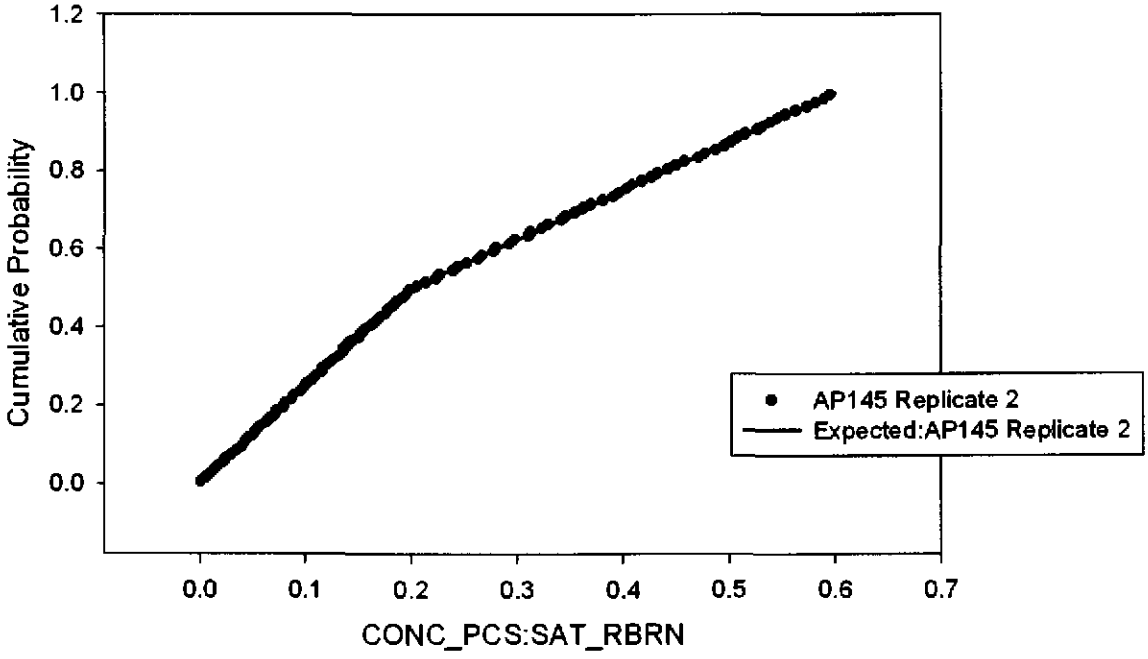

Figure 68. Observed and Expected CDFs for CONC_PCS:SAT_RBRN (User Continuous Distribution) Rep. 2.

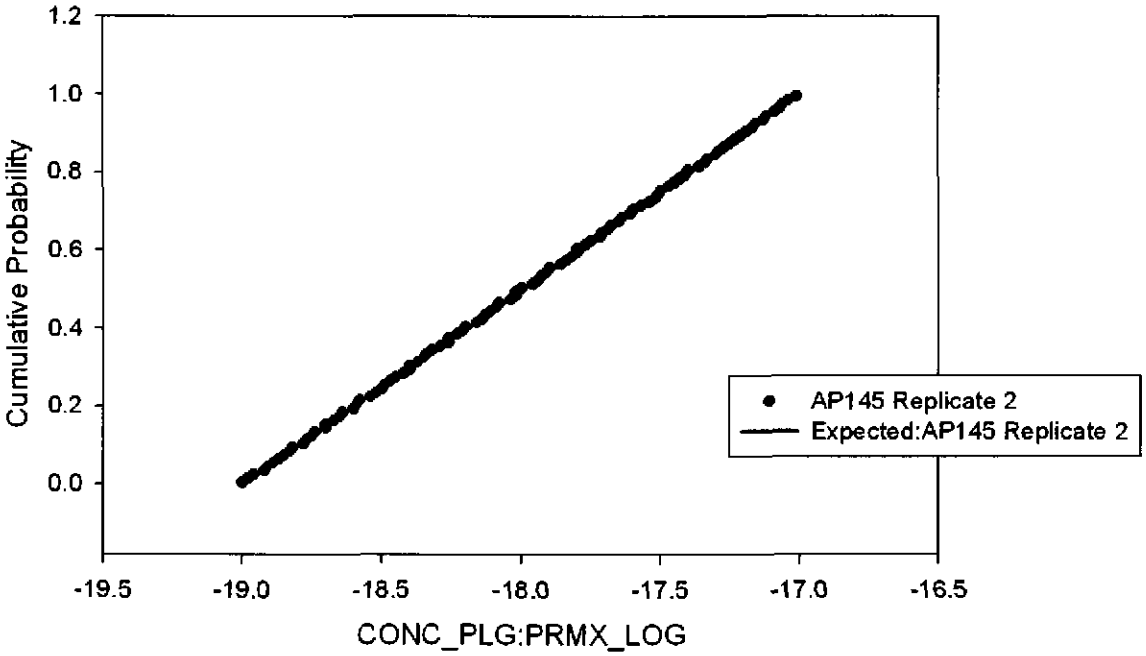

Figure 69. Observed and Expected CDFs for CONC_PLG:PRMX_LOG (Uniform Distribution) Rep. 2.

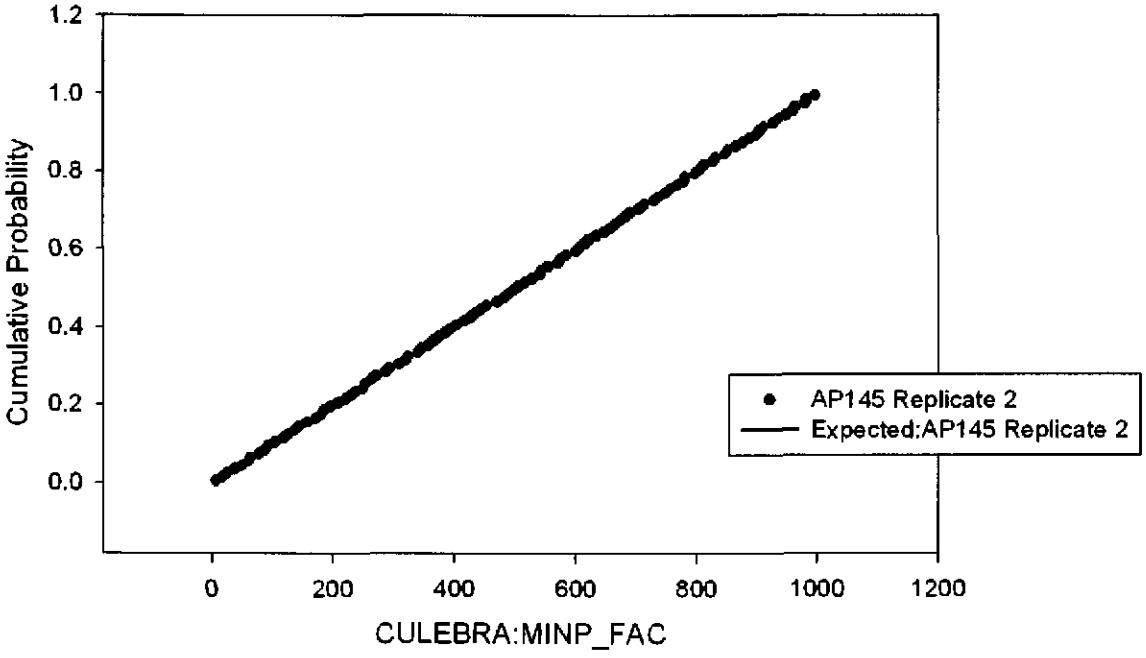

Figure 70. Observed and Expected CDFs for CULEBRA:MINP_FAC (Uniform Distribution) Rep. 2.

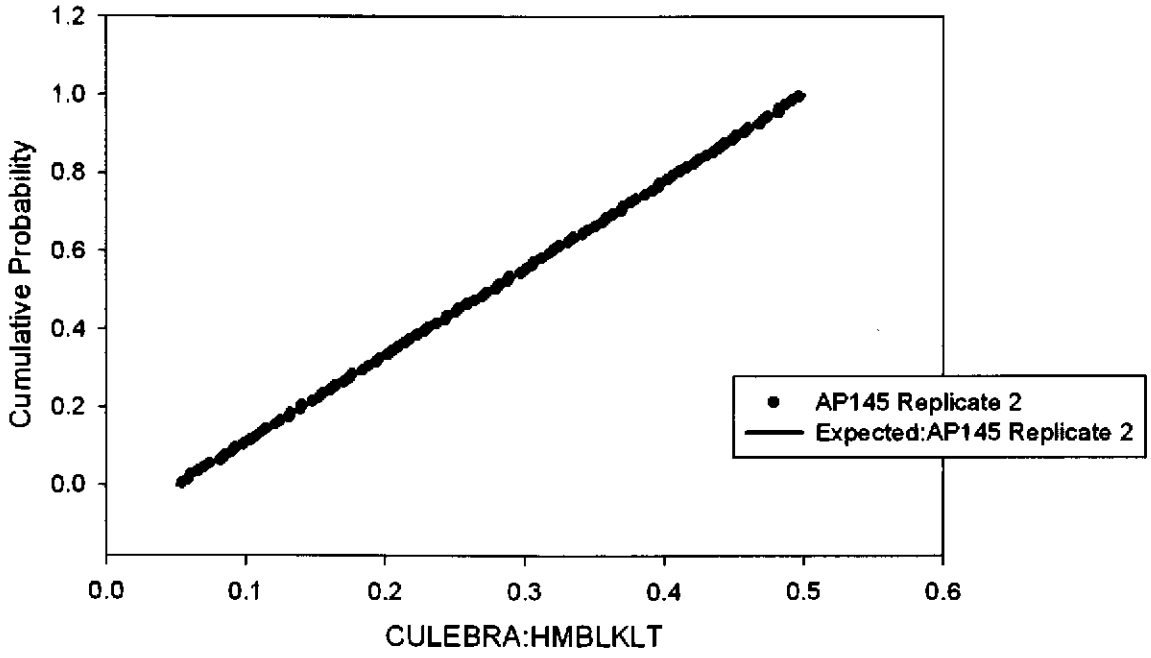

Figure 71. Observed and Expected CDFs for CULEBRA:HMBLKLT (Uniform Distribution) Rep. 2.

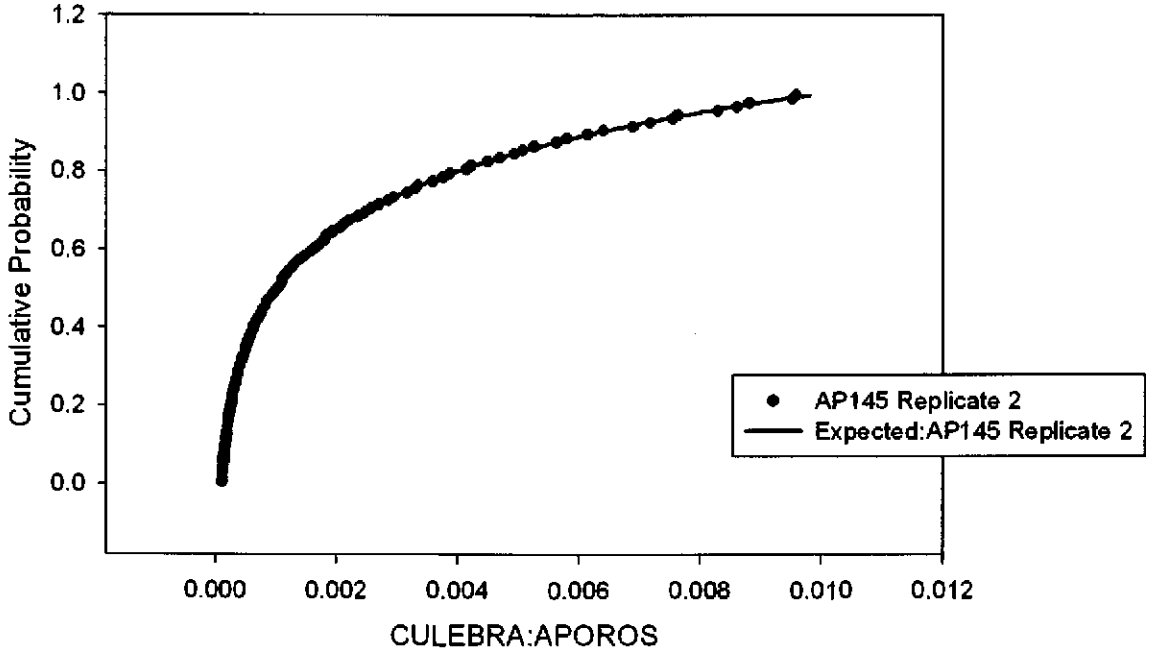

Figure 72. Observed and Expected CDFs for CULEBRA:APOROS (Loguniform Distribution) Rep. 2.

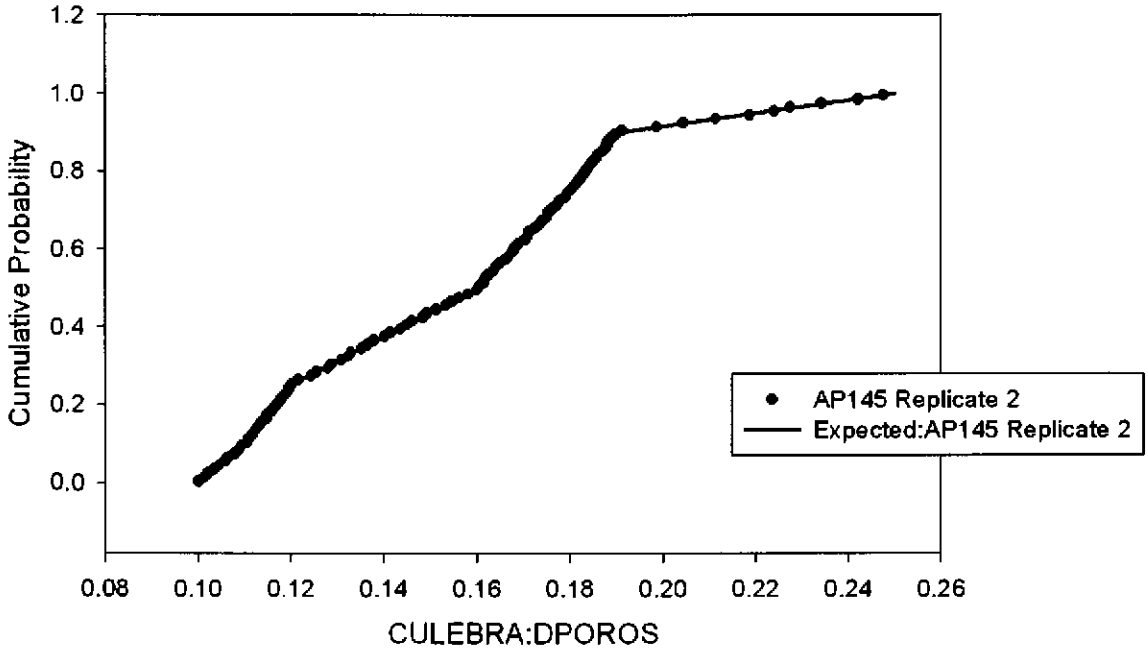

Figure 73. Observed and Expected CDFs for CULEBRA:DPOROS (User Continuous Distribution) Rep. 2.

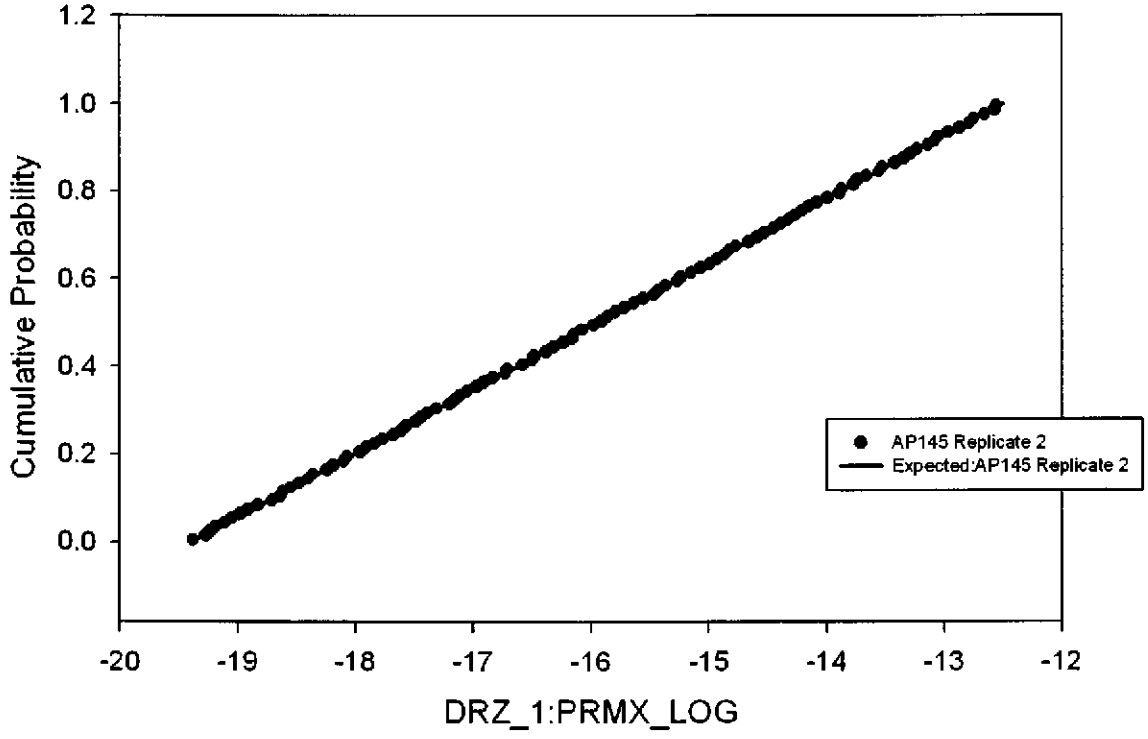

Figure 74. Observed and Expected CDFs for DRZ_1:PRMX_LOG (Uniform Distribution) Rep. 2.

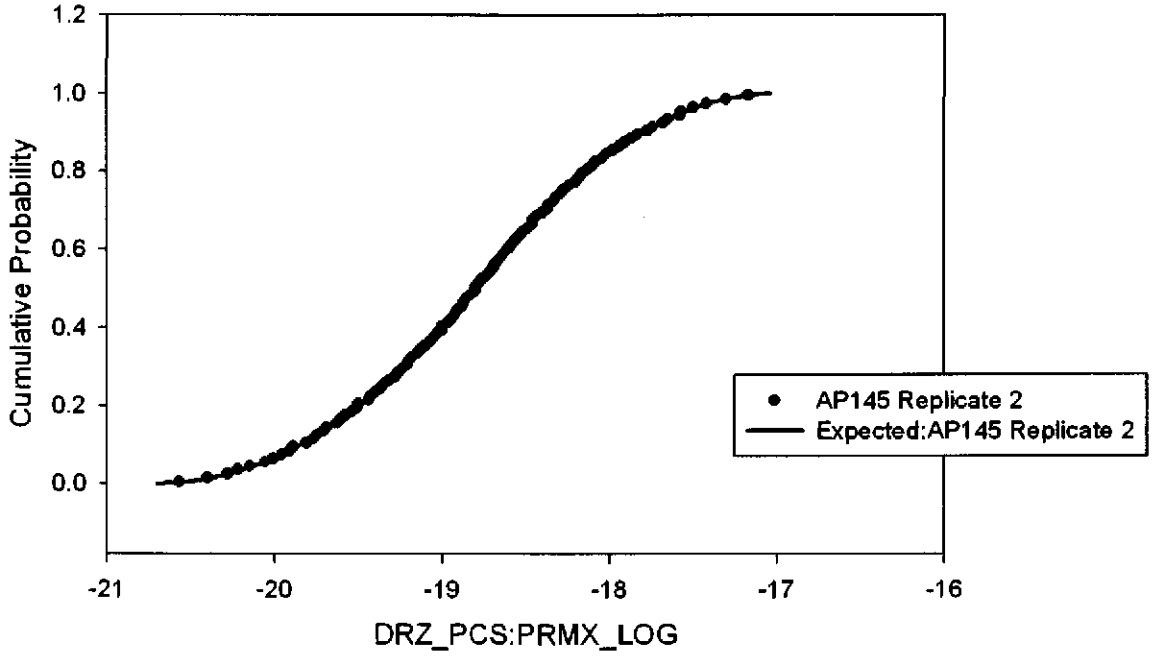

Figure 75. Observed and Expected CDFs for DRZ_PCS:PRMX_LOG (Triangular Distribution) Rep. 2.

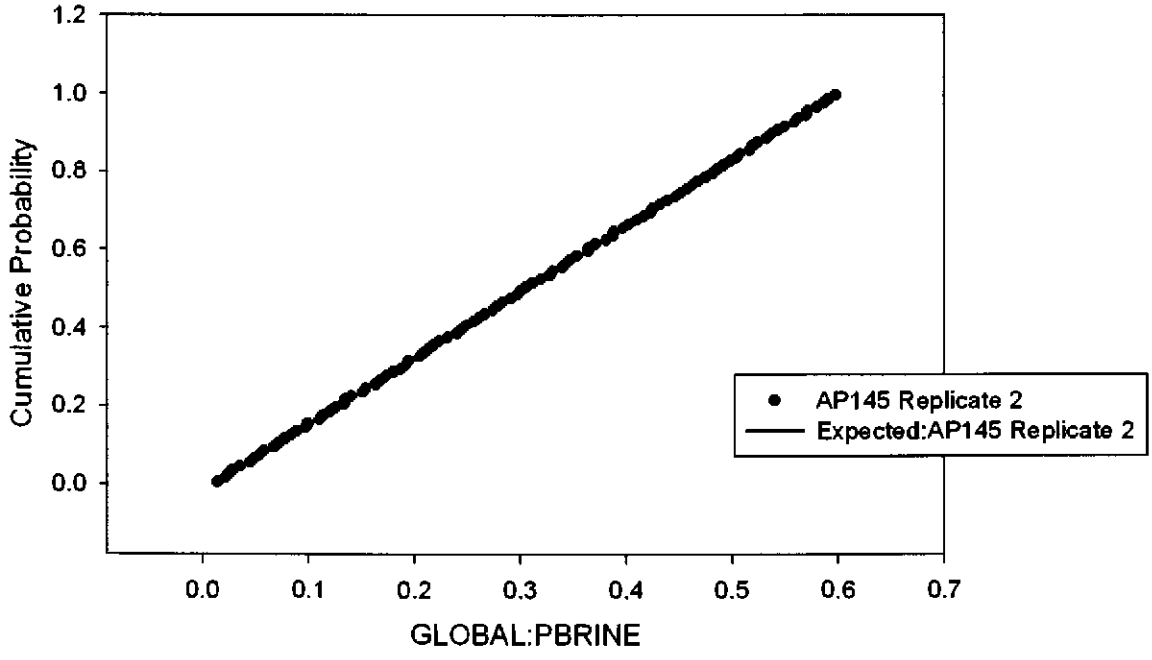

Figure 76. Observed and Expected CDFs for GLOBAL:PBRINE (Uniform Distribution) Rep. 2.

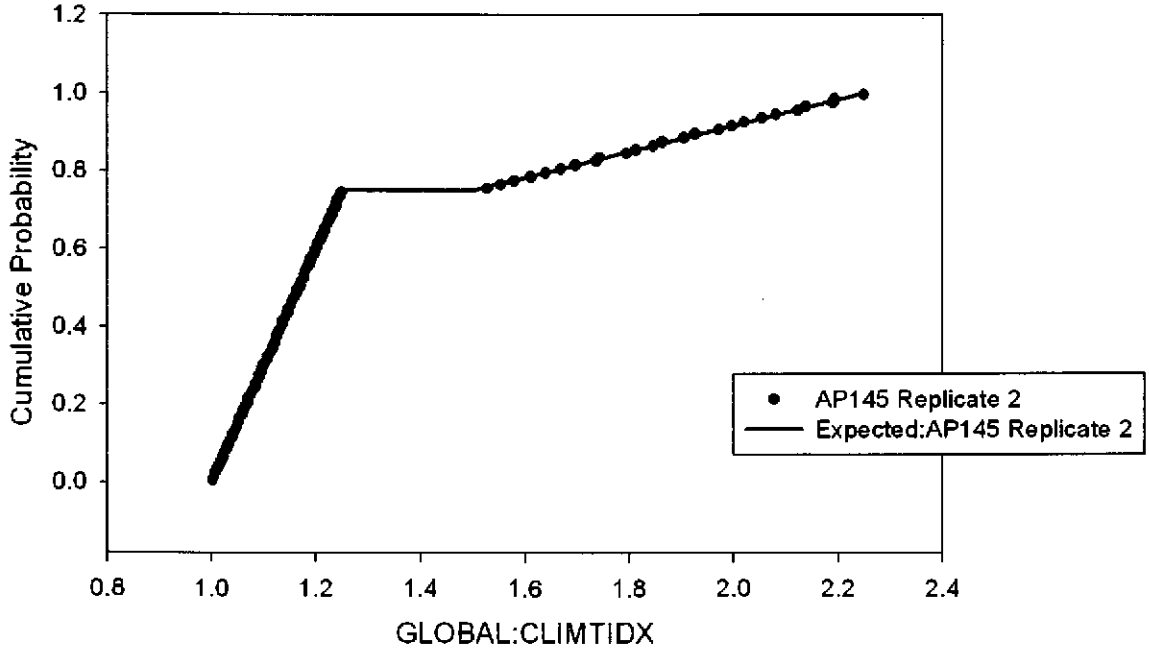

Figure 77. Observed and Expected CDFs for GLOBAL:CLIMTIDX (User Continuous Distribution) Rep. 2.

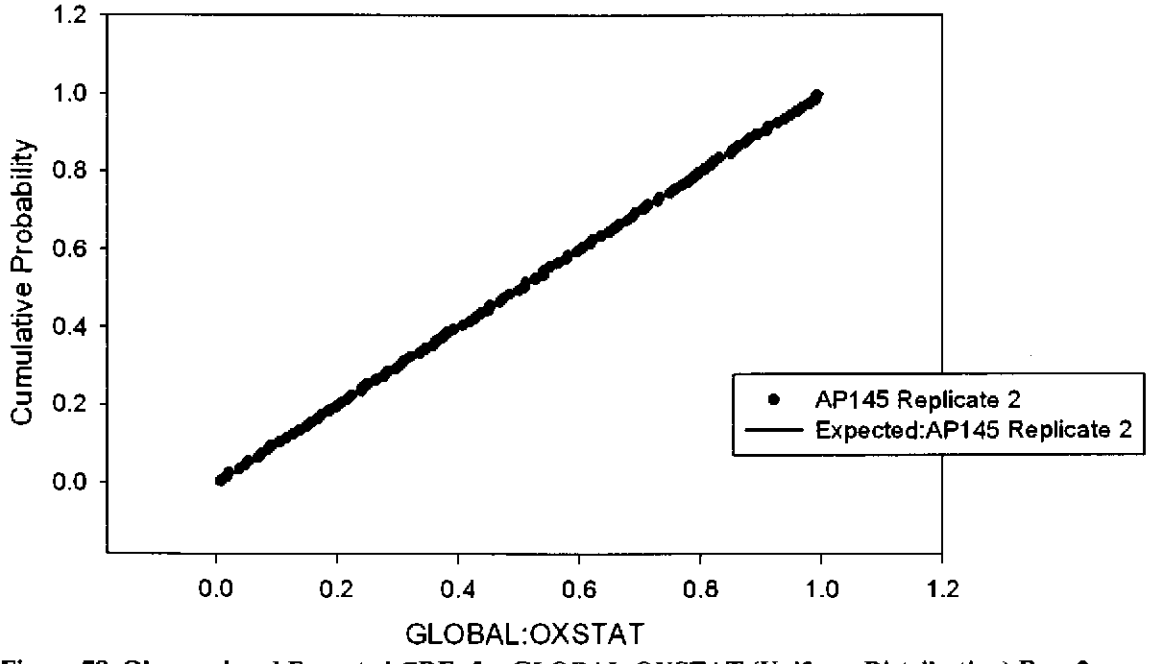

Figure 78. Observed and Expected CDFs for GLOBAL:OXSTAT (Uniform Distribution) Rep. 2.

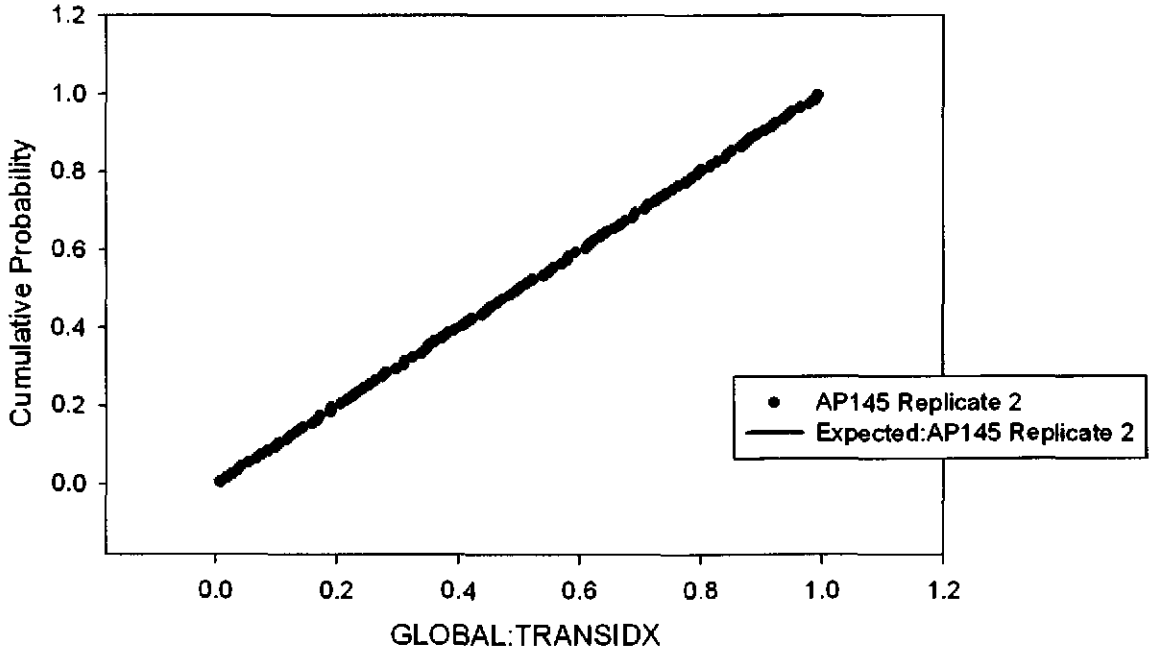

Figure 79. Observed and Expected CDFs for GLOBAL:TRANSIDX (Uniform Distribution) Rep. 2.

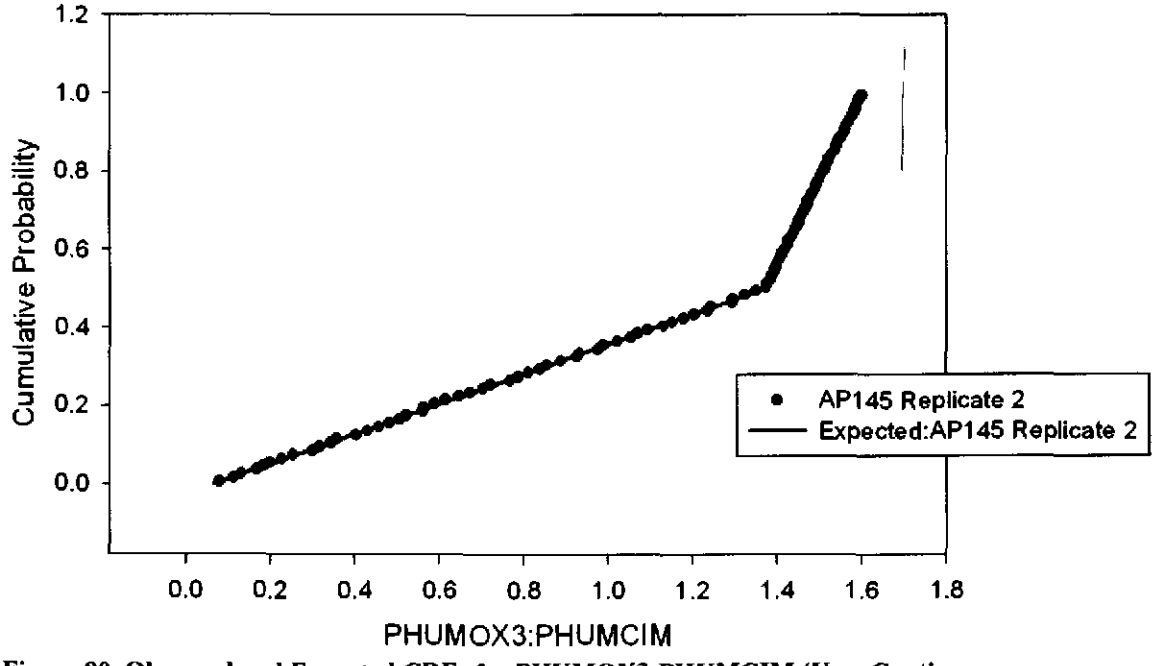

Figure 80. Observed and Expected CDFs for PHUMOX3:PHUMCIM (User Continuous Distribution) Rep. 2.

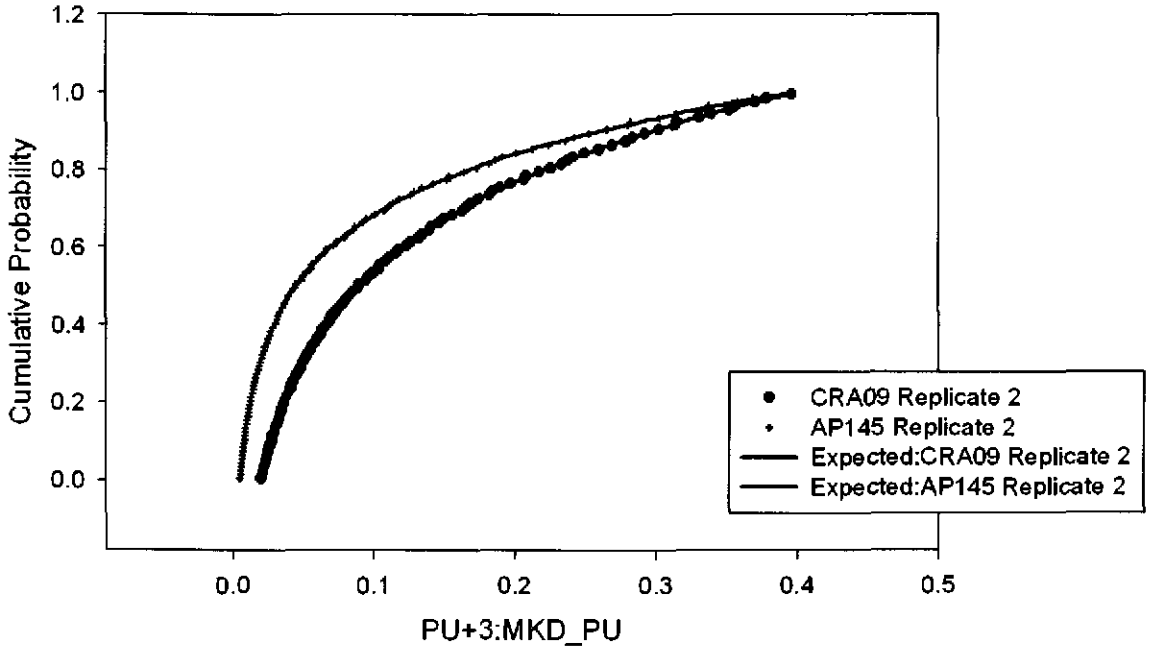

Figure 81. Observed and Expected CDFs for PU+3:MKD_PU (Loguniform Distribution) Rep. 2.

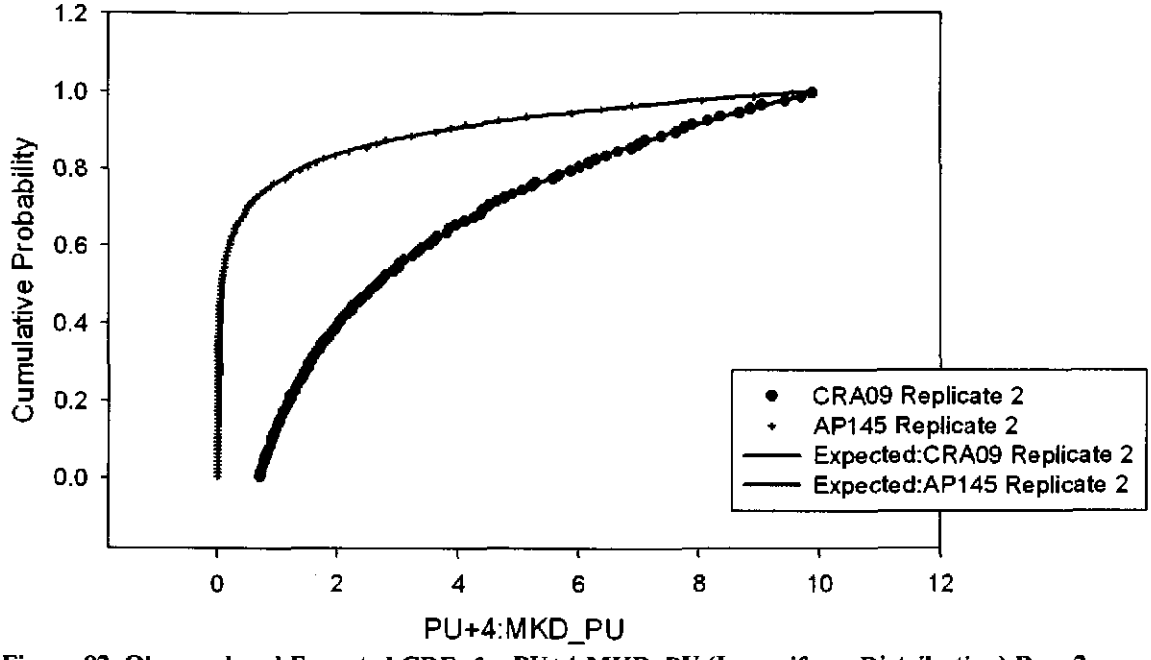

Figure 82. Observed and Expected CDFs for PU+4:MKD_PU (Loguniform Distribution) Rep. 2.

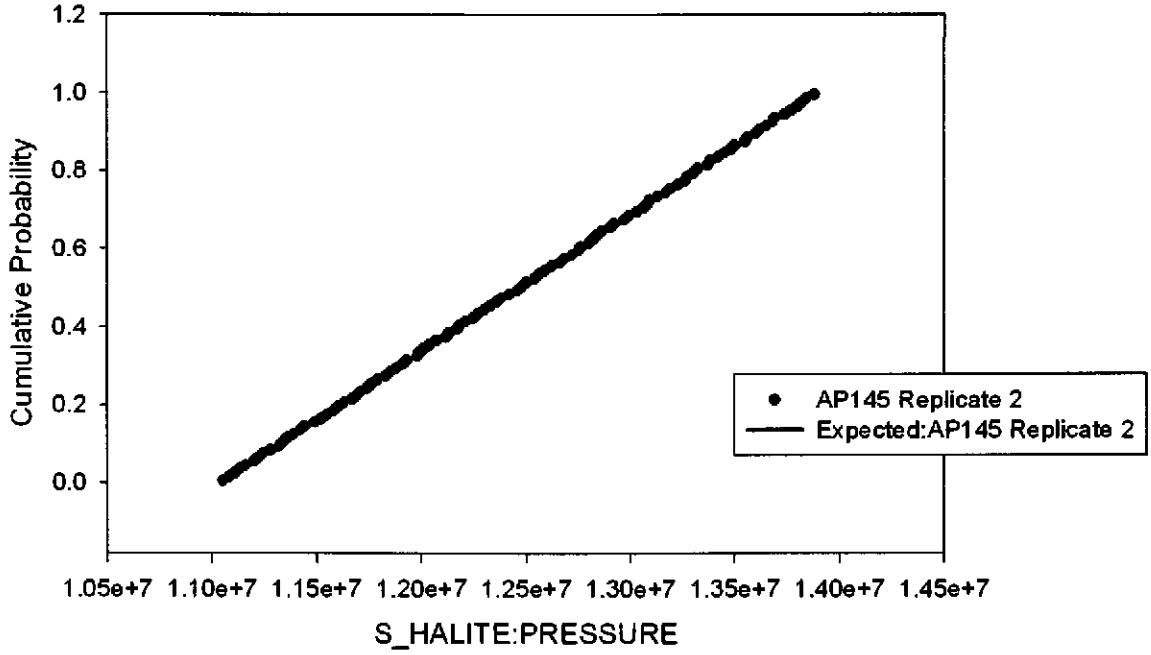

Figure 83. Observed and Expected CDFs for S_HALITE:PRESSURE (Uniform Distribution) Rep. 2.

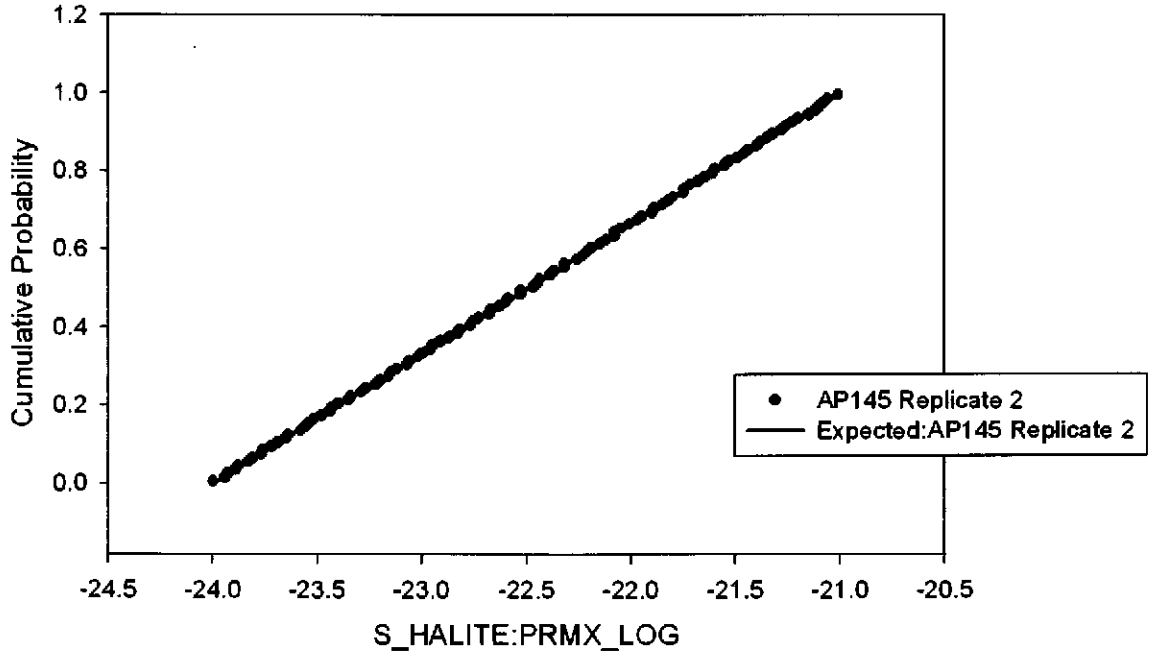

Figure 84. Observed and Expected CDFs for S_HALITE:PRMX_LOG (Uniform Distribution) Rep. 2.

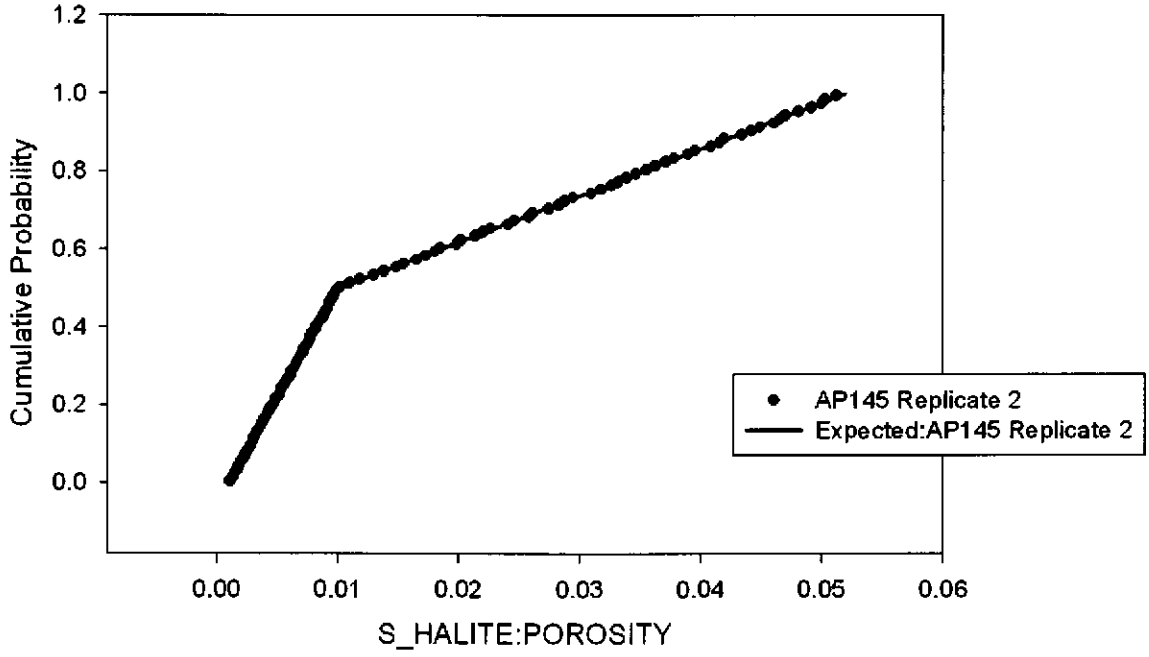

Figure 85. Observed and Expected CDFs for S_HALITE:POROSITY (User Continuous Distribution) Rep. 2.

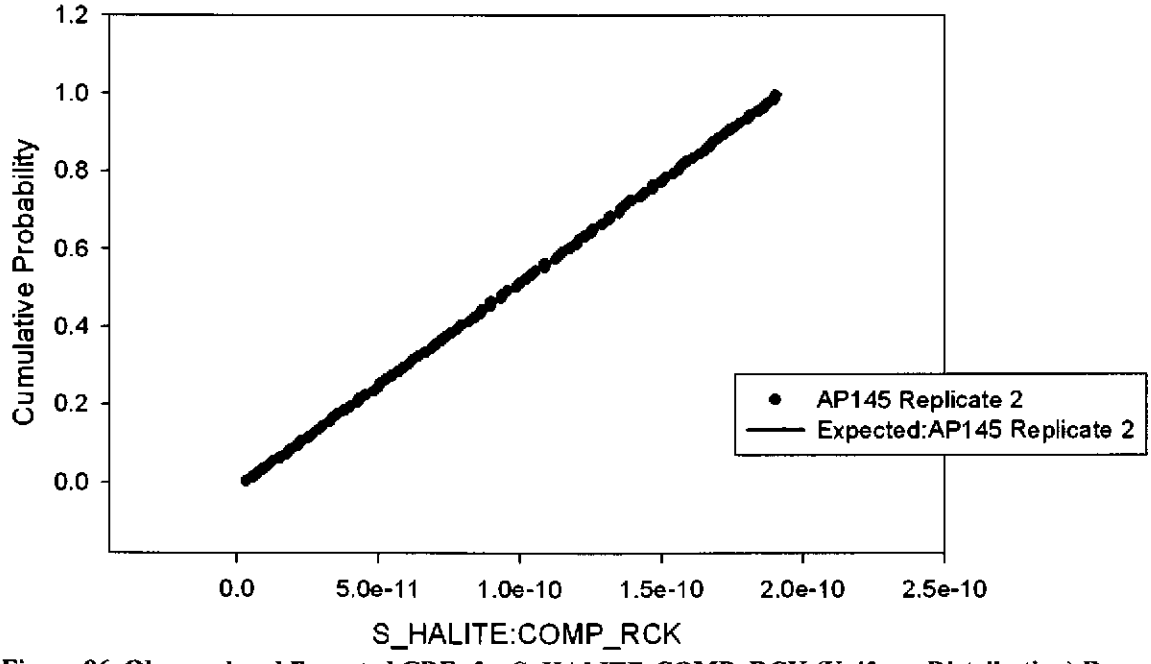

Figure 86. Observed and Expected CDFs for S_HALITE:COMP_RCK (Uniform Distribution) Rep. 2.

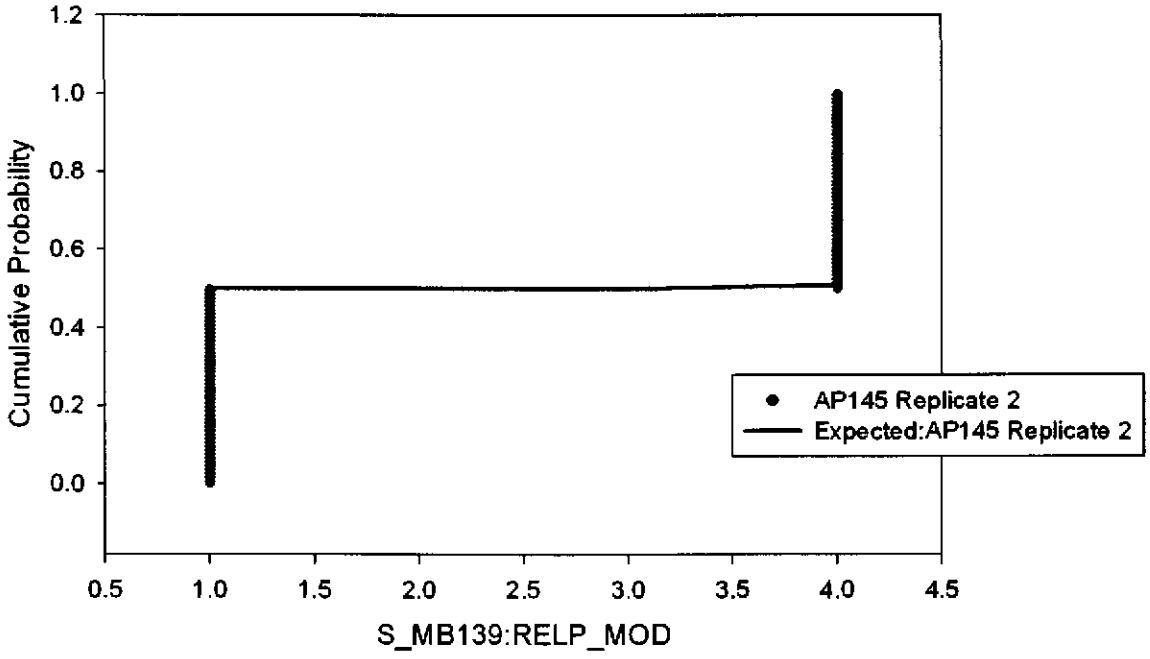

Figure 87. Observed and Expected CDFs for S_MB139:RELP_MOD (User Discrete (Delta) Distribution) Rep. 2.

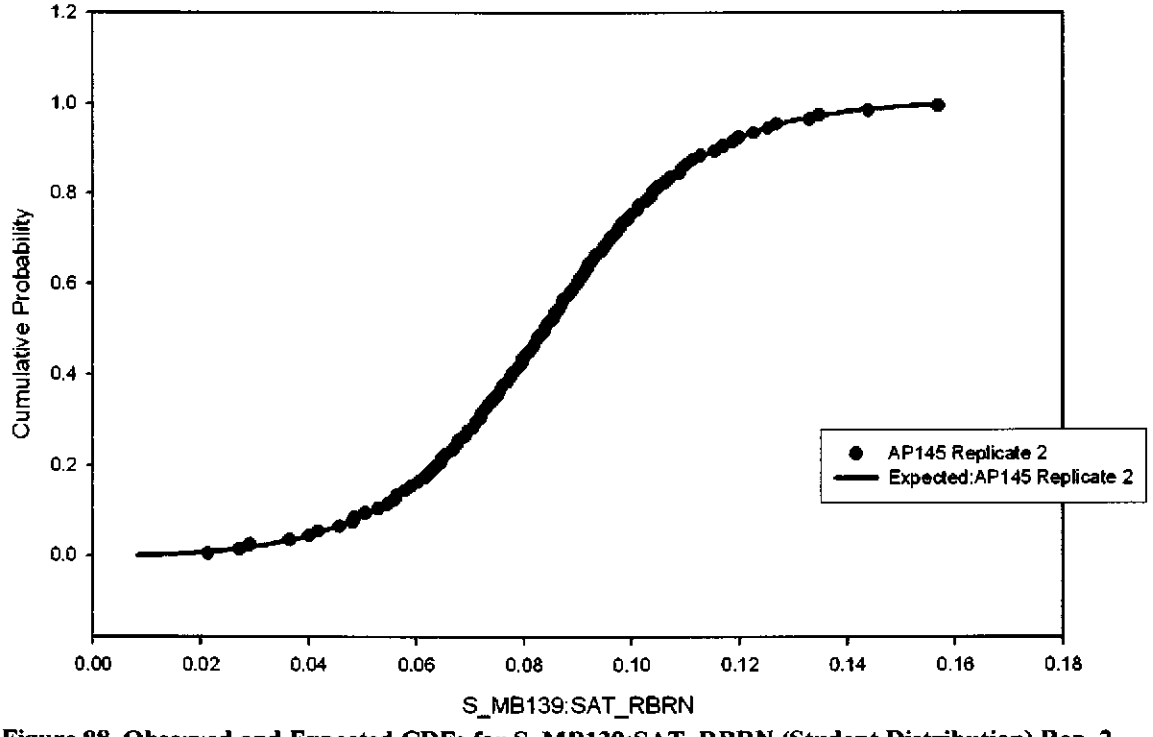

Figure 88. Observed and Expected CDFs for S_MB139:SAT_RBRN (Student Distribution) Rep. 2.

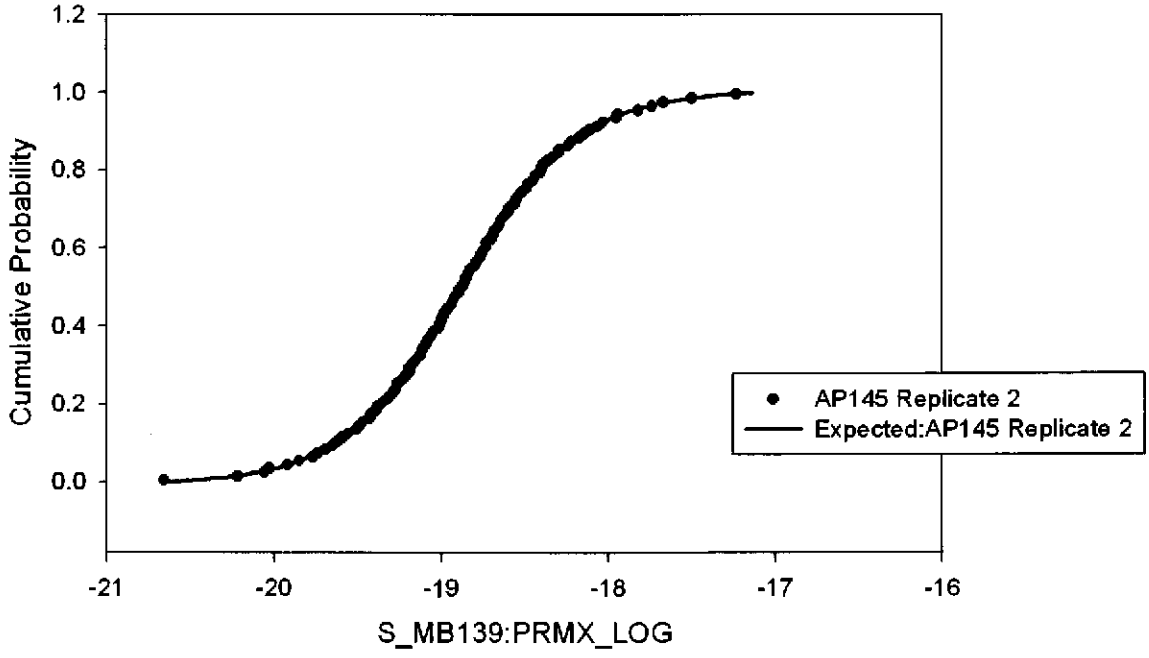

Figure 89. Observed and Expected CDFs for S_MB139:PRMX_LOG (Student Distribution) Rep. 2.

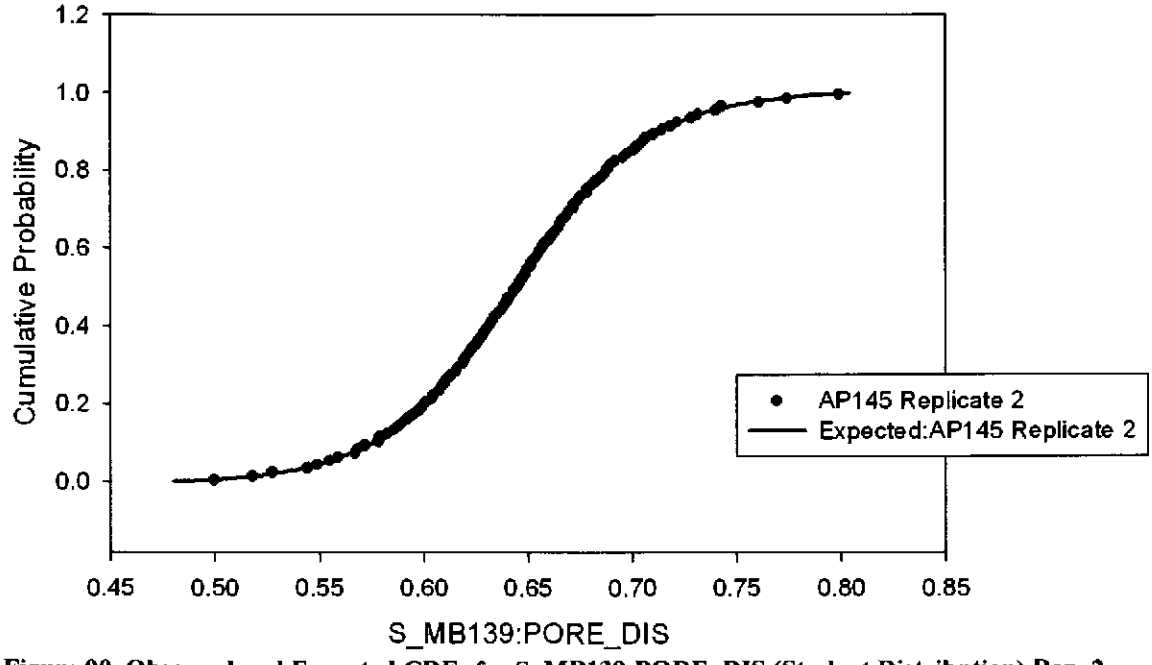

Figure 90. Observed and Expected CDFs for S_MB139:PORE_DIS (Student Distribution) Rep. 2.

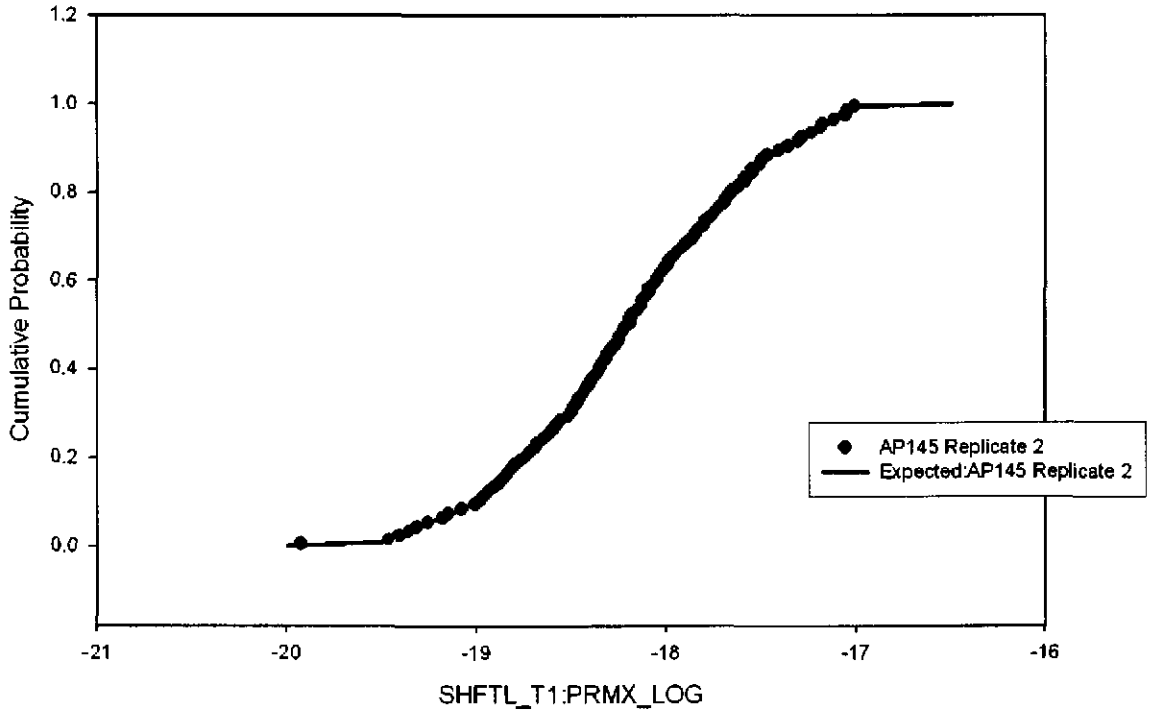

Figure 91. Observed and Expected CDFs for SHFTL_T1:PRMX_LOG (User Continuous Distribution) Rep. 2.

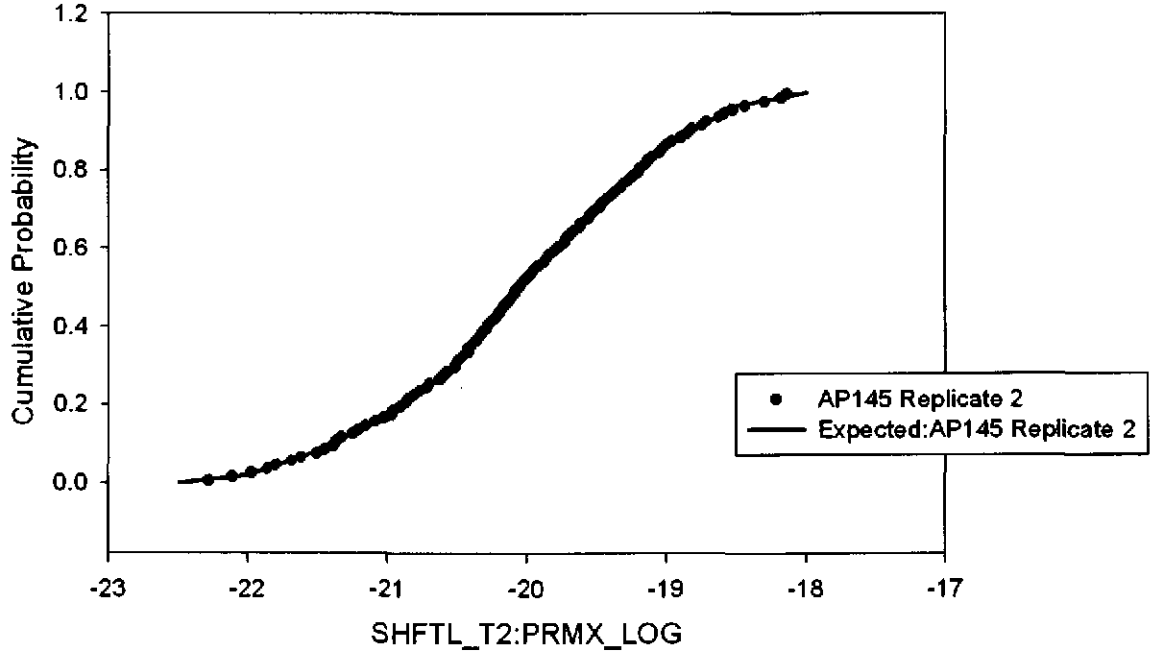

Figure 92. Observed and Expected CDFs for SHFTL_T2:PRMX_LOG (User Continuous Distribution) Rep. 2.

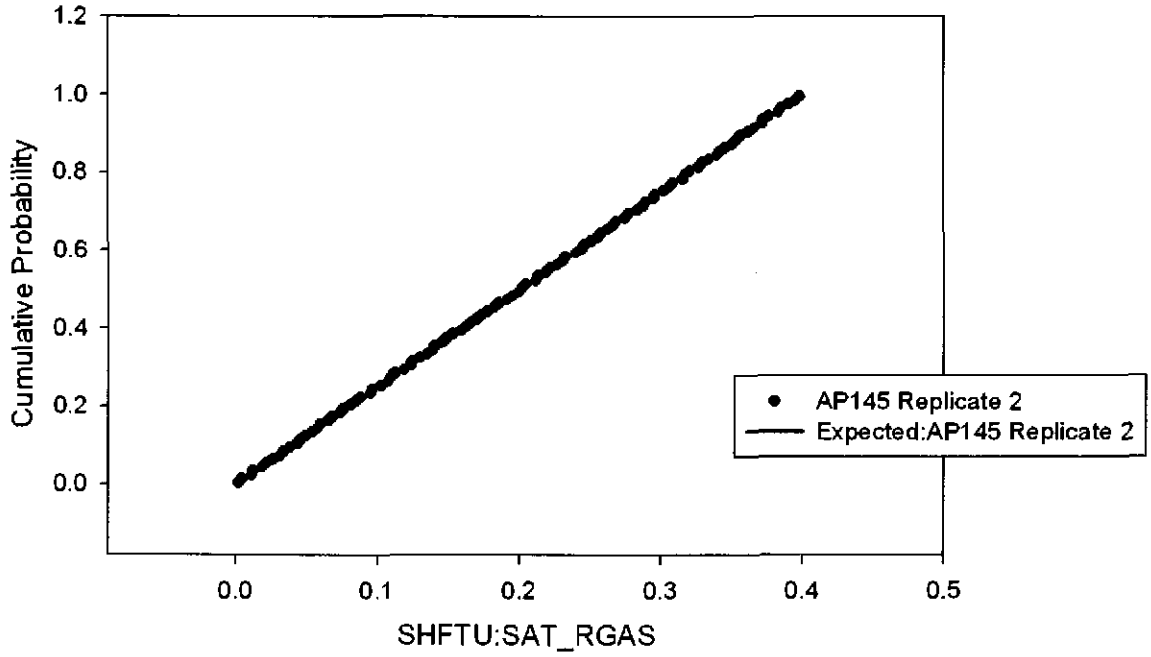

Figure 93. Observed and Expected CDFs for SHFTU:SAT_RGAS (Uniform Distribution) Rep. 2.

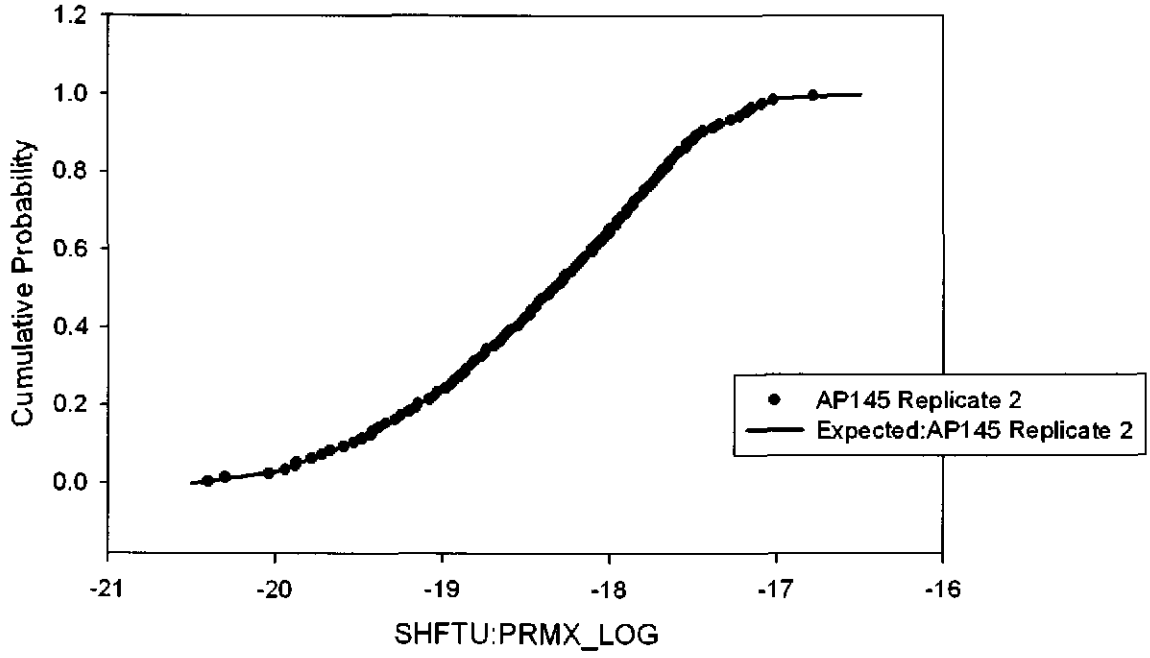

Figure 94. Observed and Expected CDFs for SHFTU:PRMX_LOG (User Continuous Distribution) Rep. 2.

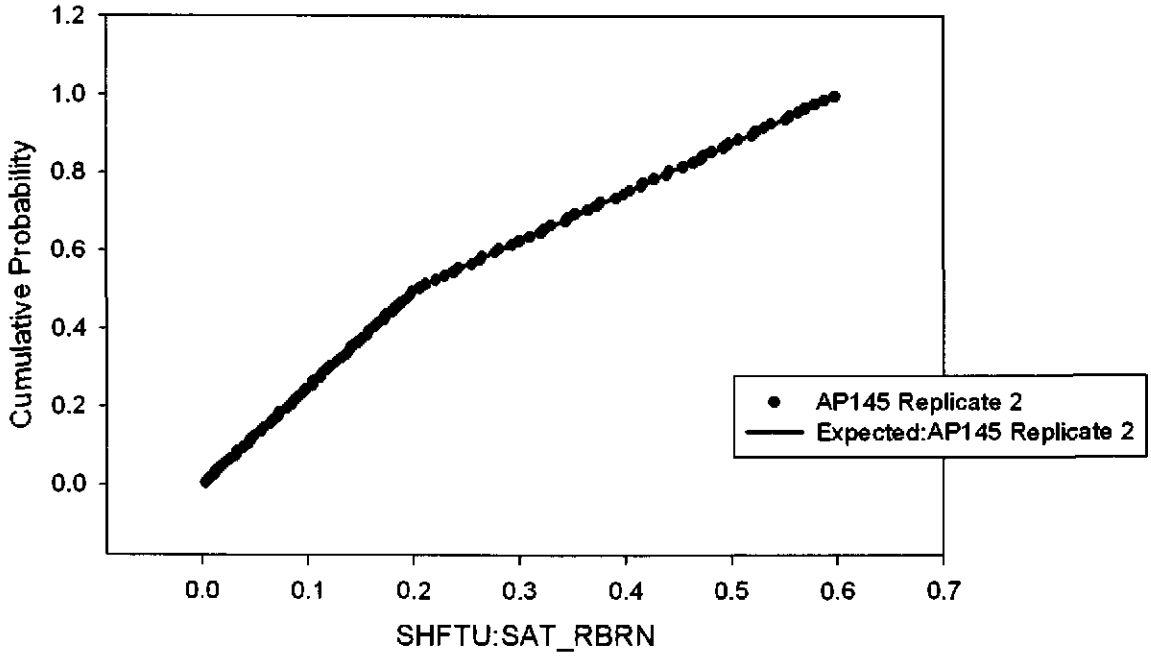

Figure 95. Observed and Expected CDFs for SHFTU:SAT_RBRN (User Continuous Distribution) Rep. 2.

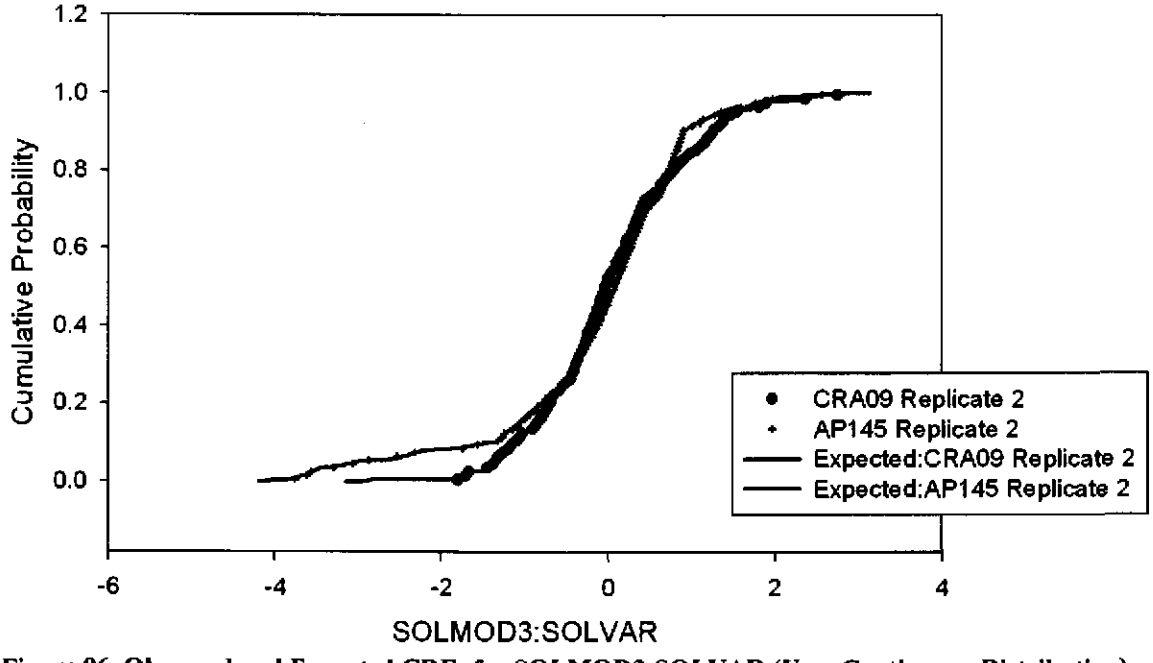

Figure 96. Observed and Expected CDFs for SOLMOD3:SOLVAR (User Continuous Distribution) Rep. 2.

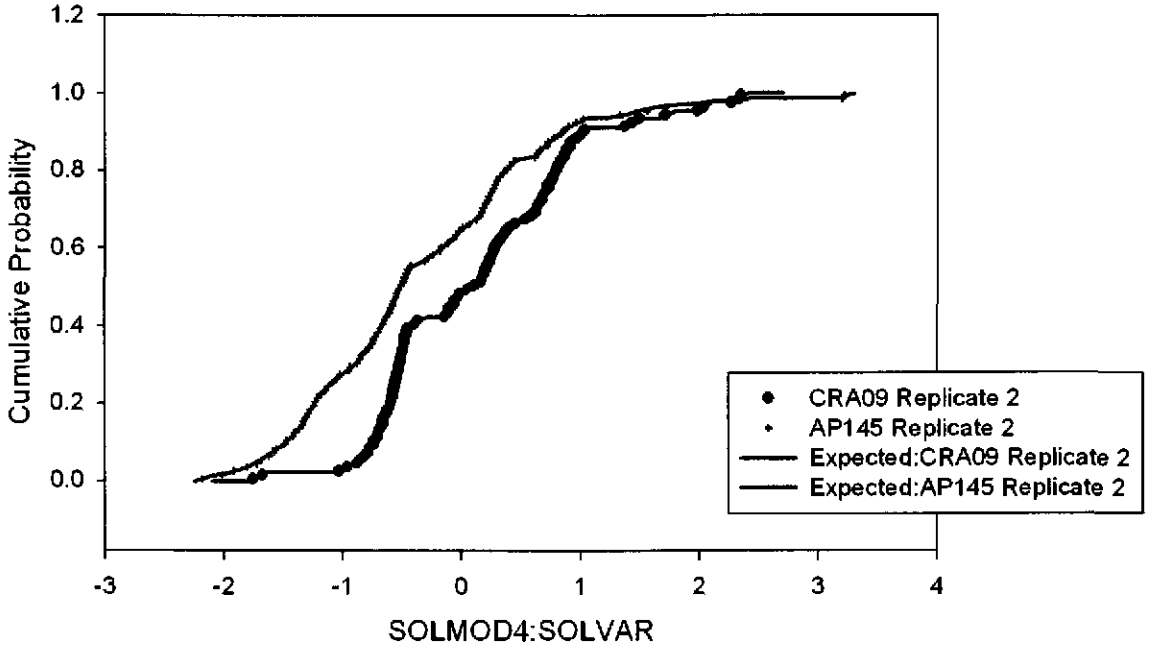

Figure 97. Observed and Expected CDFs for SOLMOD4:SOLVAR (User Continuous Distribution) Rep. 2.

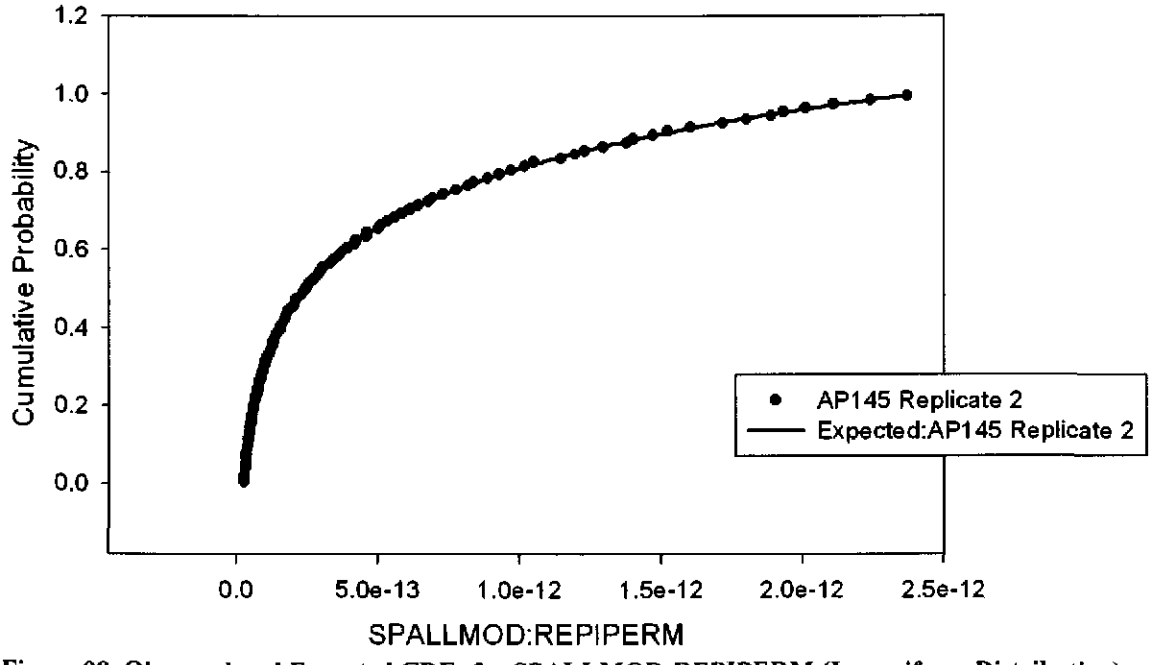

Figure 98. Observed and Expected CDFs for SPALLMOD:REPIPERM (Loguniform Distribution) Rep. 2.

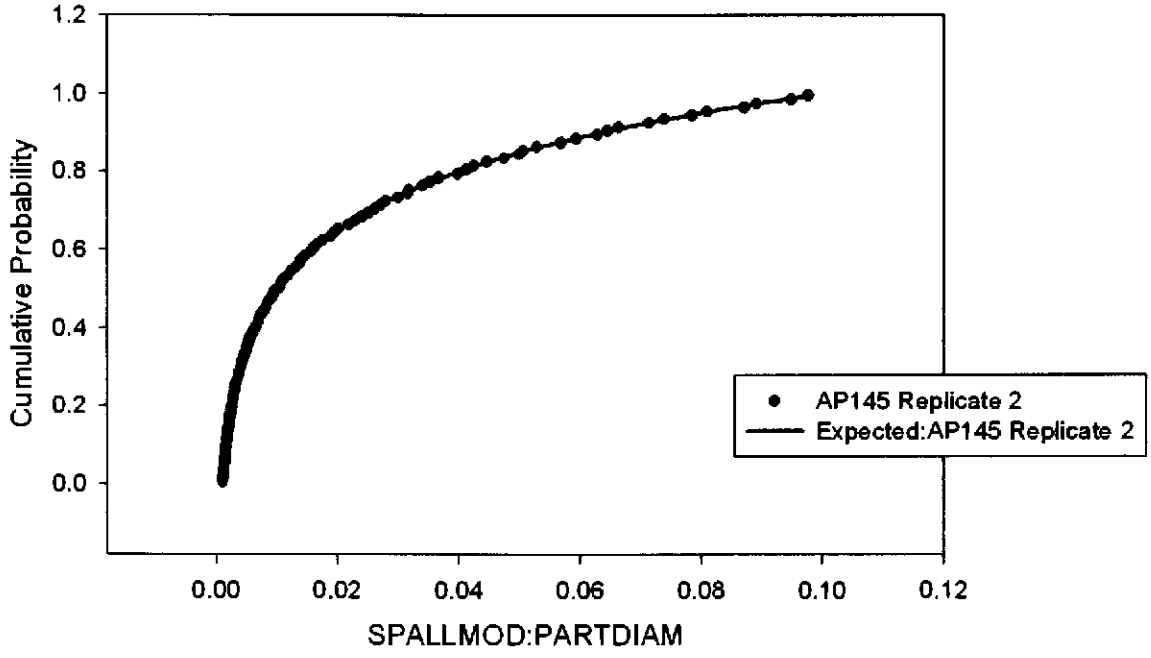

Figure 99. Observed and Expected CDFs for SPALLMOD:PARTDIAM (Loguniform Distribution) Rep. 2.

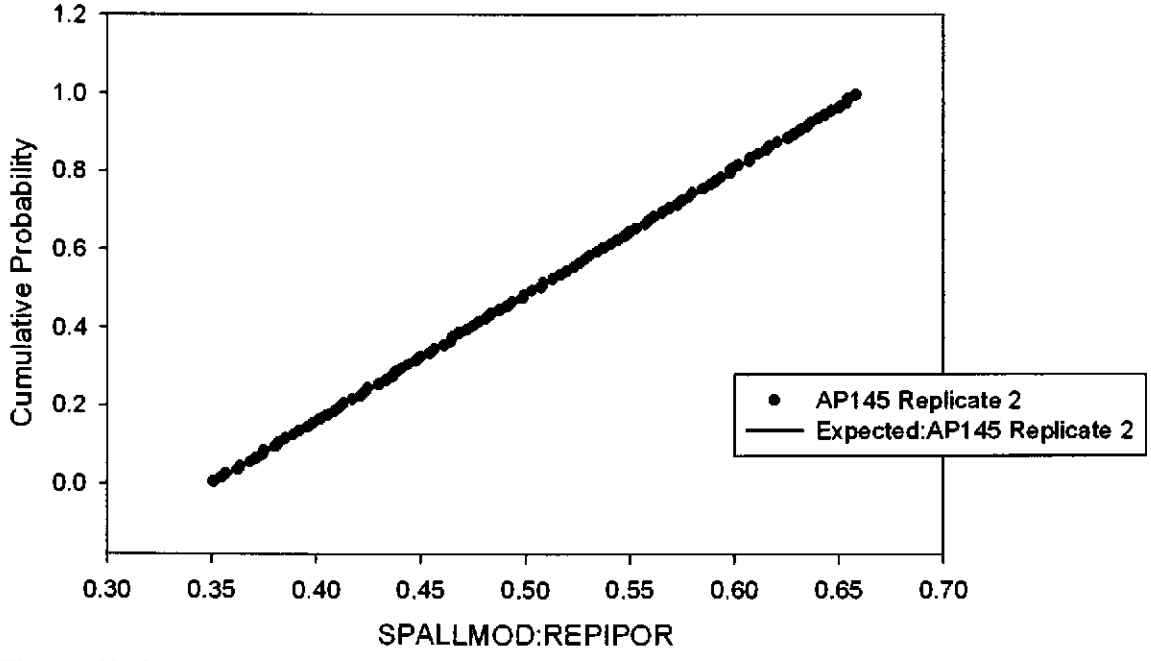

Figure 100. Observed and Expected CDFs for SPALLMOD:REPIPOR (Uniform Distribution) Rep. 2.

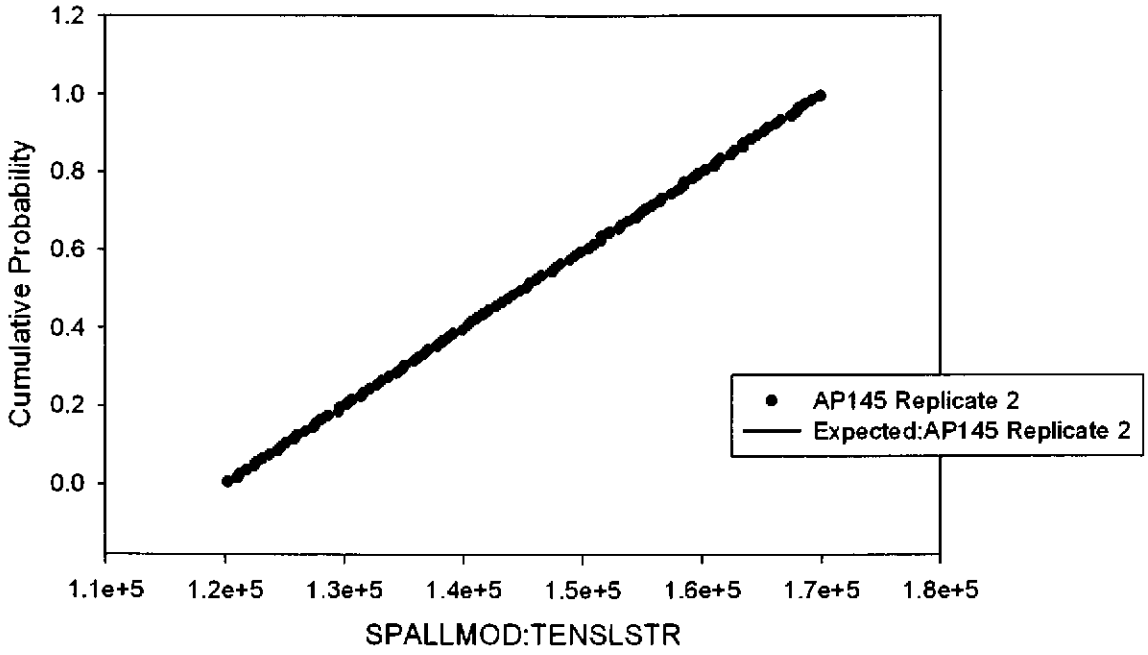

Figure 101. Observed and Expected CDFs for SPALLMOD:TENSLSTR (Uniform Distribution) Rep. 2.

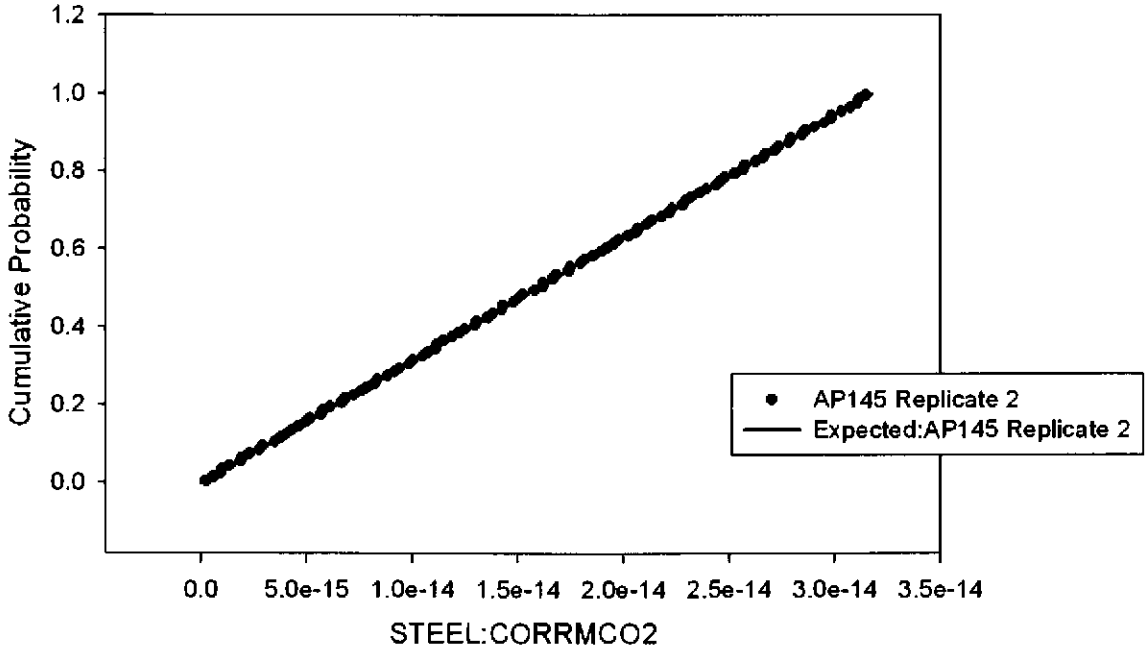

Figure 102. Observed and Expected CDFs for STEEL:CORRMCO2 (Uniform Distribution) Rep. 2.

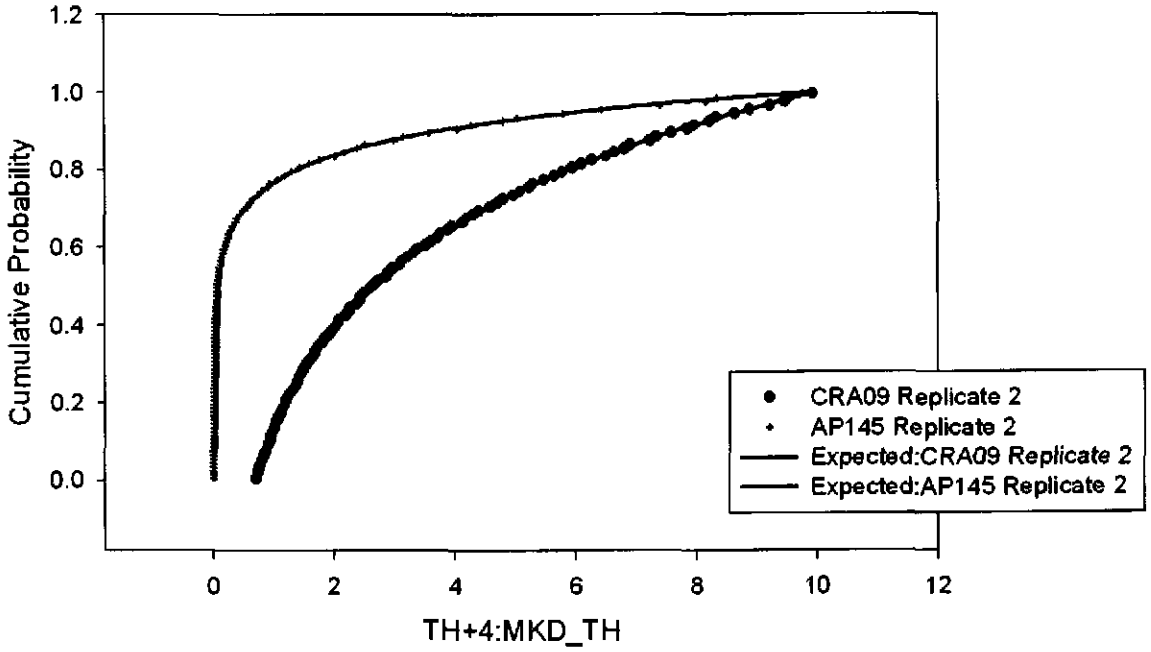

Figure 103. Observed and Expected CDFs for TH+4:MKD_TH (Loguniform Distribution) Rep. 2.

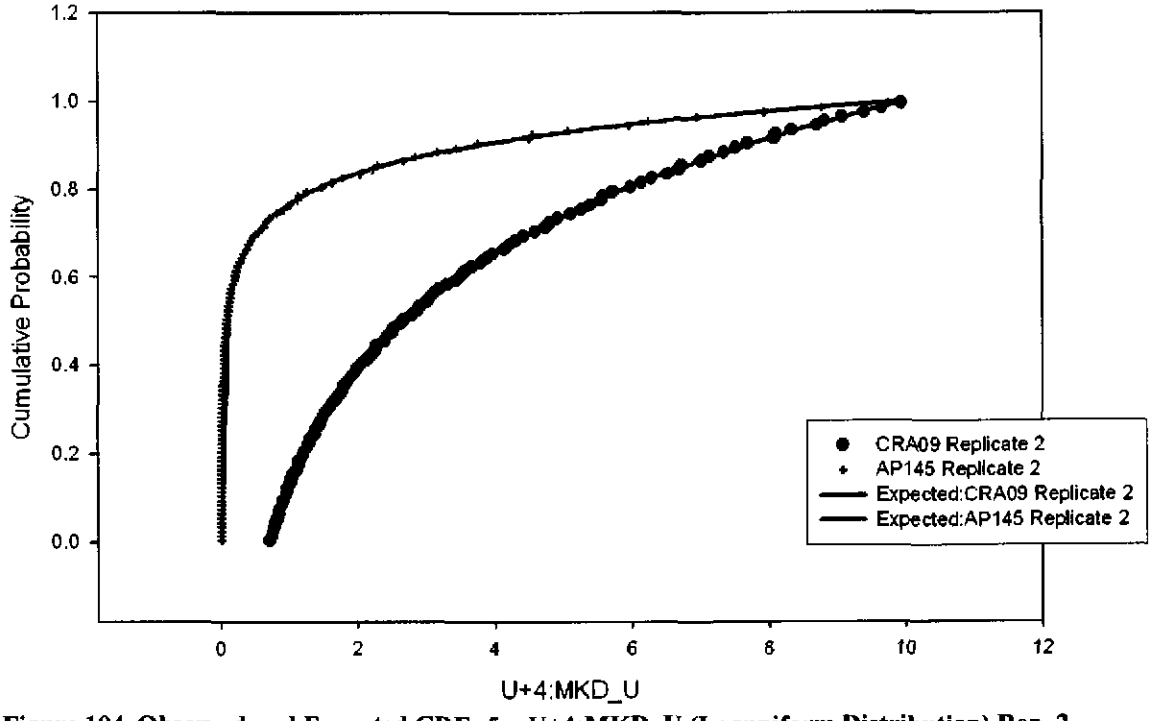

Figure 104. Observed and Expected CDFs for U+4:MKD_U (Loguniform Distribution) Rep. 2.

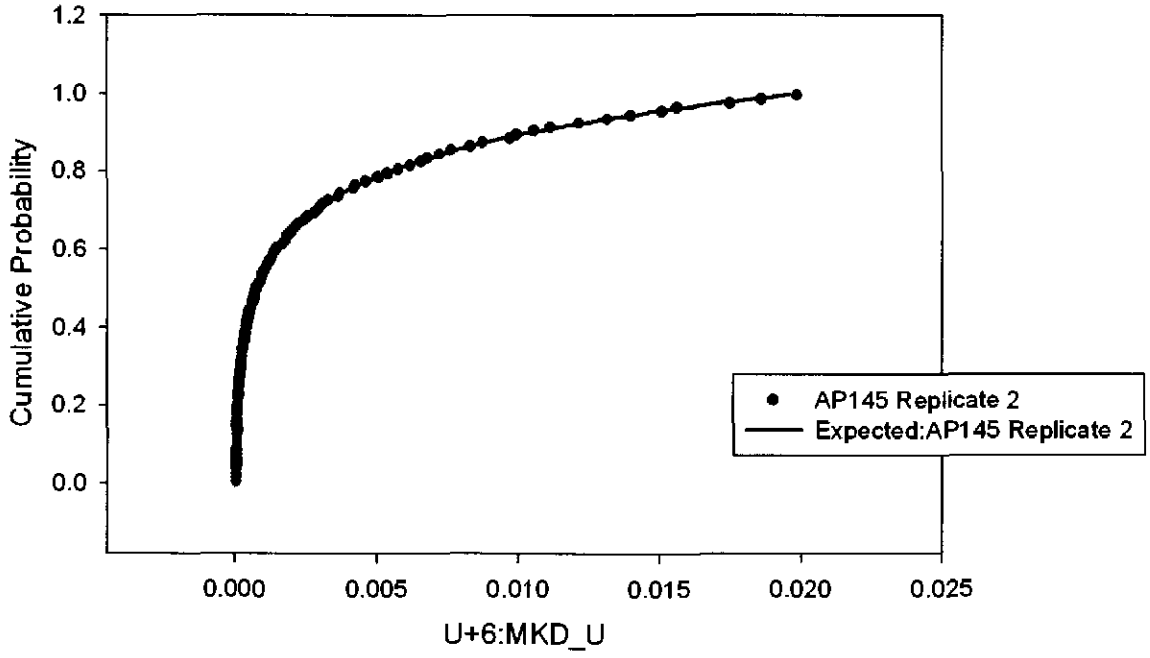

Figure 105. Observed and Expected CDFs for U+6:MKD_U (Loguniform Distribution) Rep. 2.

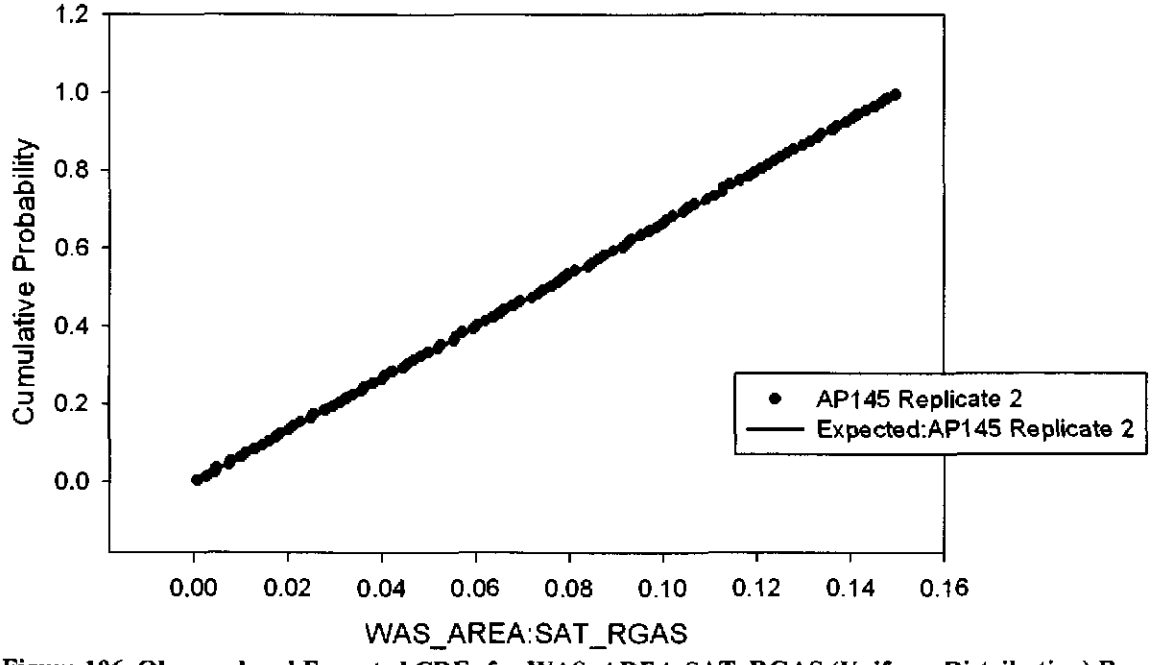

Figure 106. Observed and Expected CDFs for WAS_AREA:SAT_RGAS (Uniform Distribution) Rep. 2.

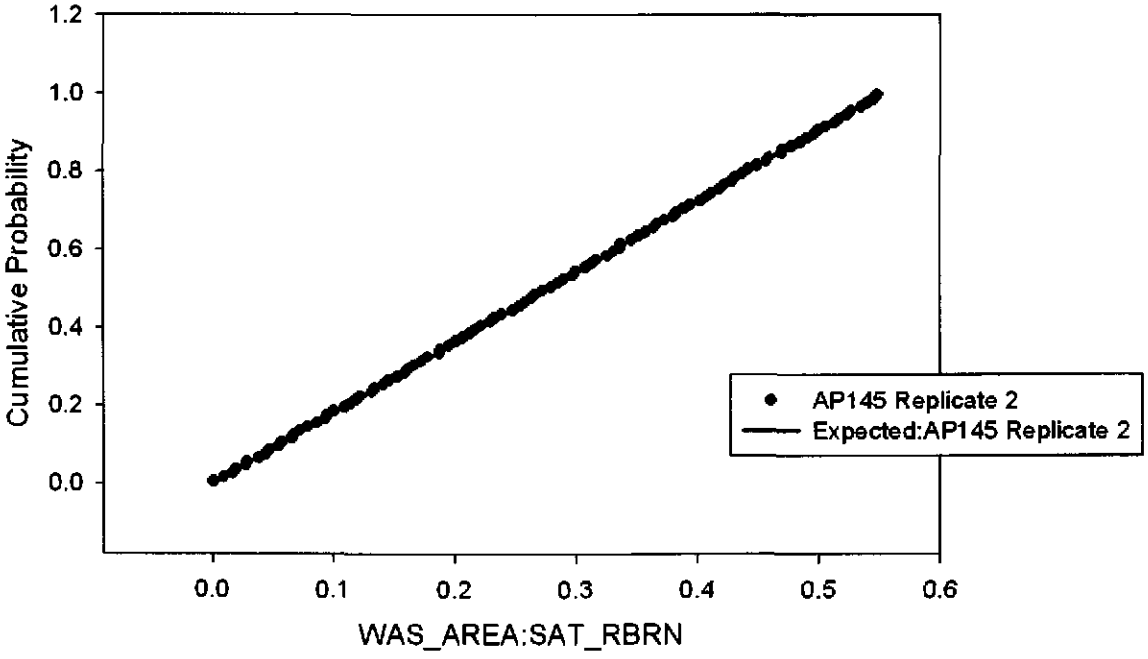

Figure 107. Observed and Expected CDFs for WAS_AREA:SAT_RBRN (Uniform Distribution) Rep. 2.

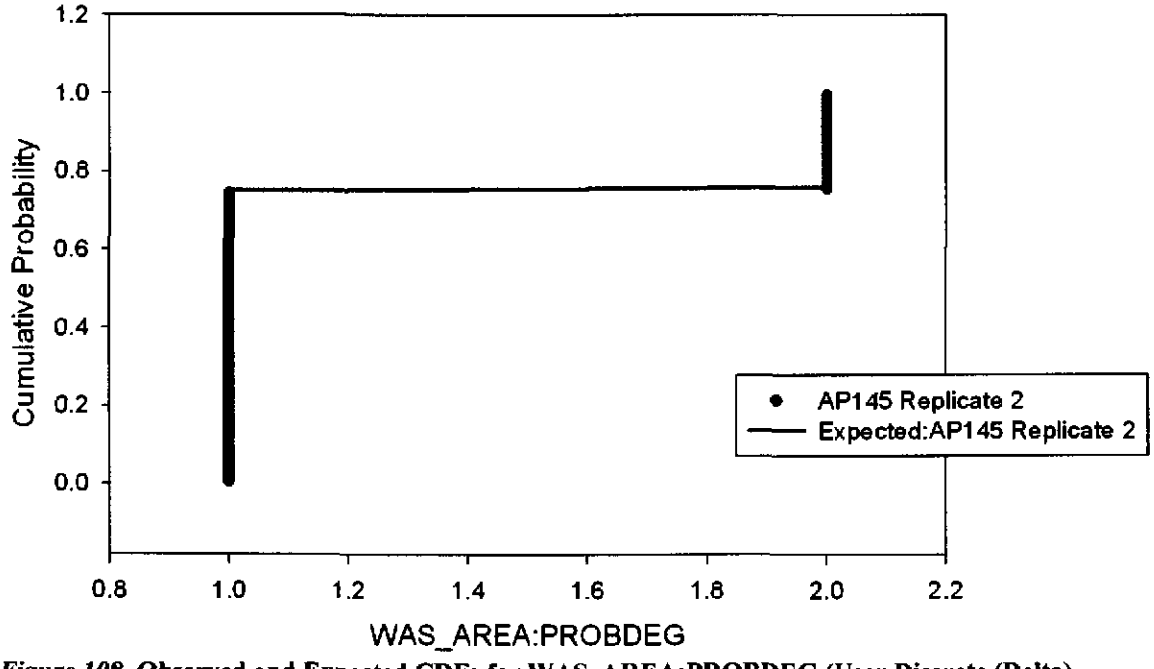

Figure 108. Observed and Expected CDFs for WAS_AREA:PROBDEG (User Discrete (Delta) Distribution) Rep. 2.

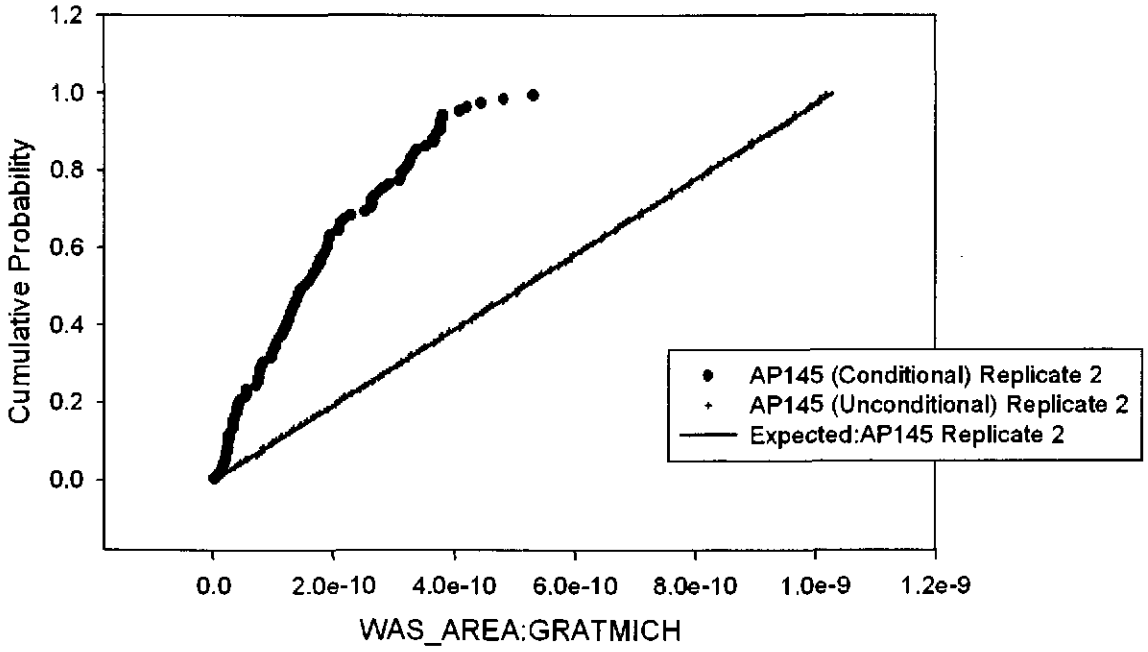

Figure 109. Observed and Expected CDFs for WAS_AREA:GRATMICH (Uniform Distribution) Rep. 2.

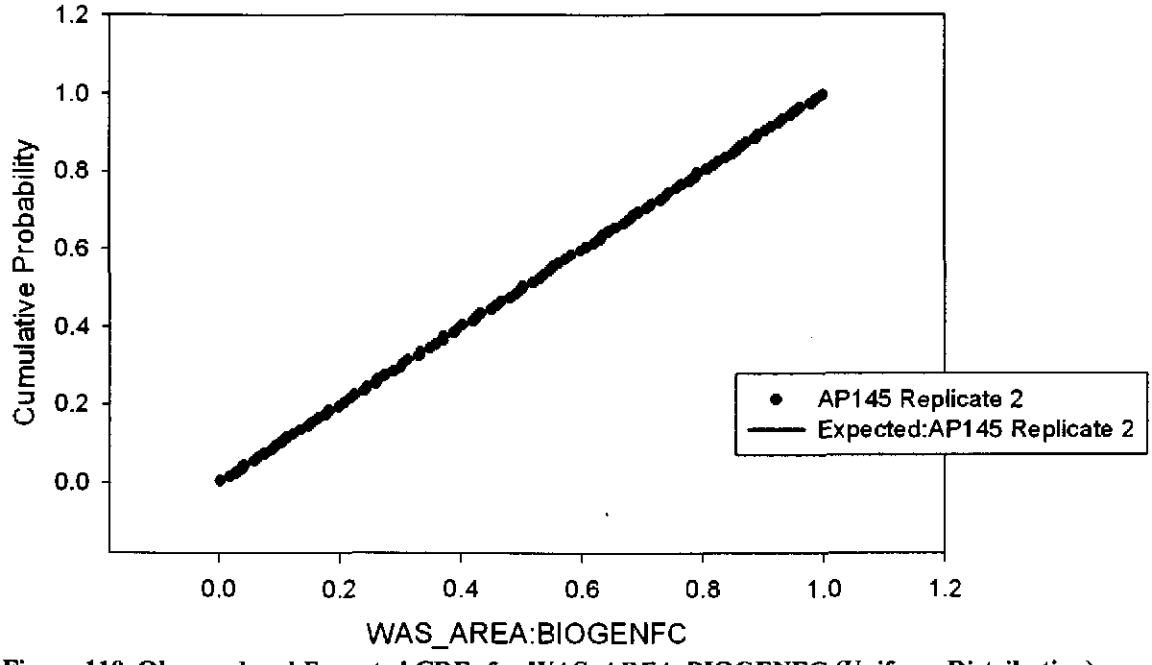

Figure 110. Observed and Expected CDFs for WAS_AREA:BIOGENFC (Uniform Distribution) Rep. 2.

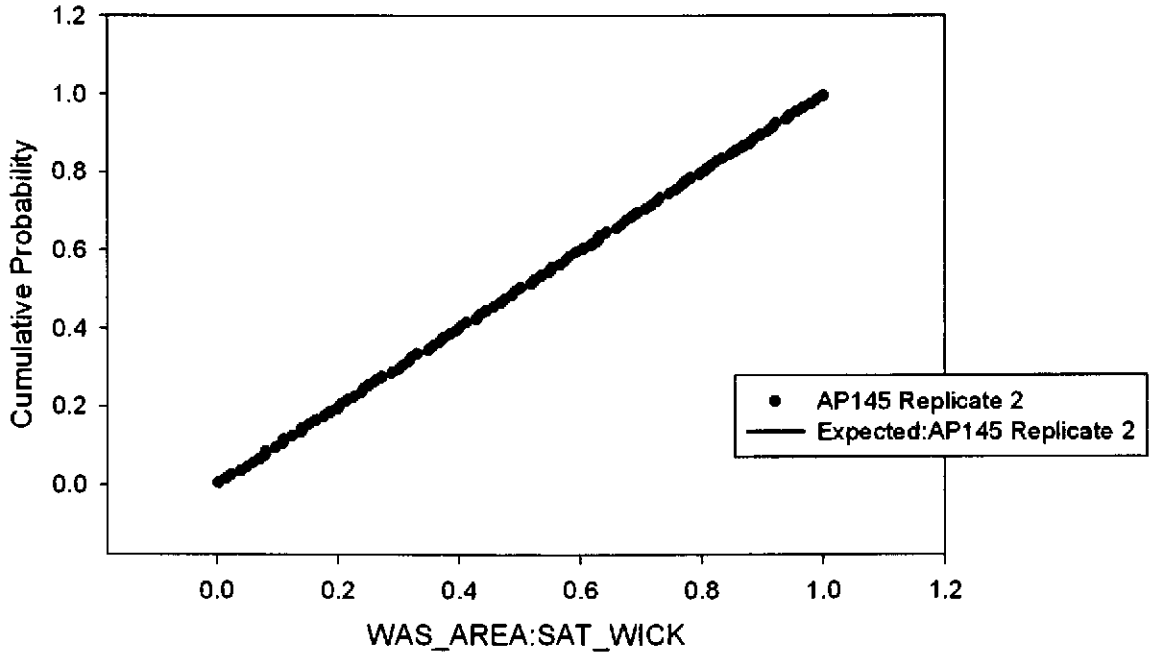

Figure 111. Observed and Expected CDFs for WAS_AREA:SAT_WICK (Uniform Distribution) Rep. 2.

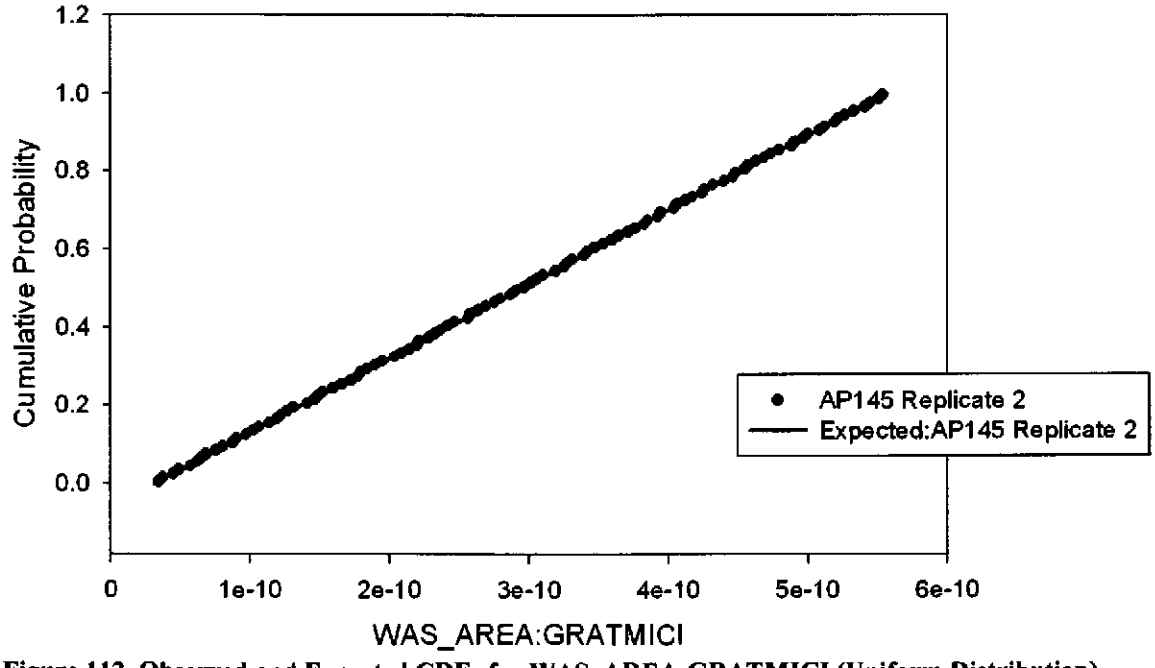

Figure 112. Observed and Expected CDFs for WAS_AREA:GRATMICI (Uniform Distribution) Rep. 2.

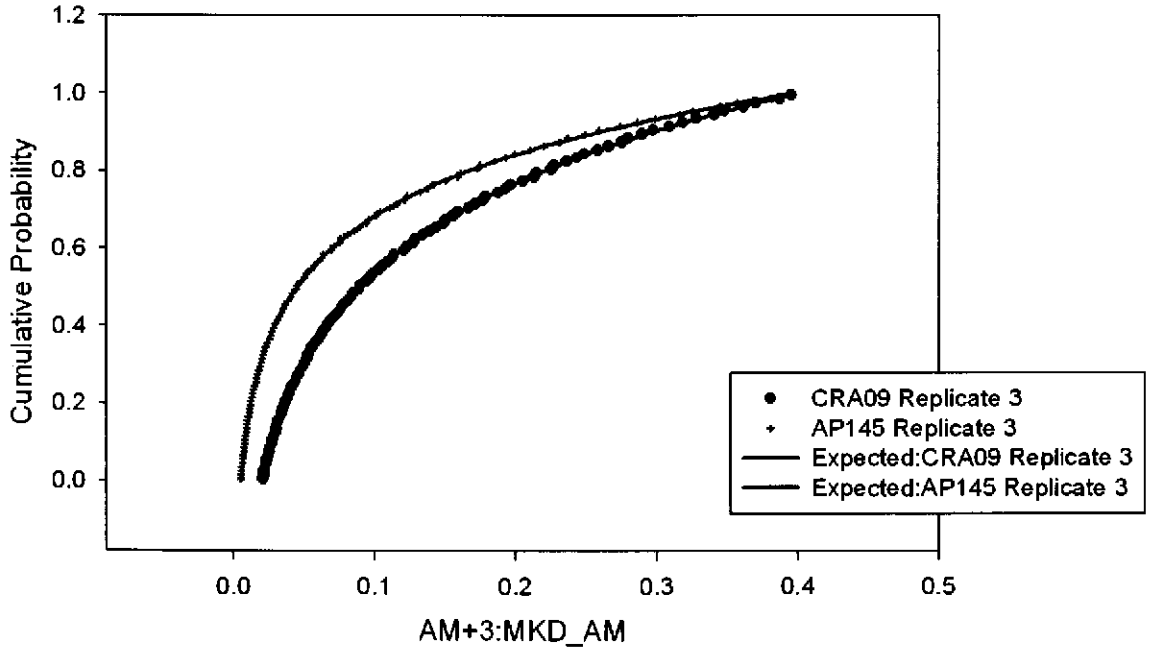

Figure 113. Observed and Expected CDFs for AM+3:MKD_AM (Loguniform Distribution) Rep. 3.

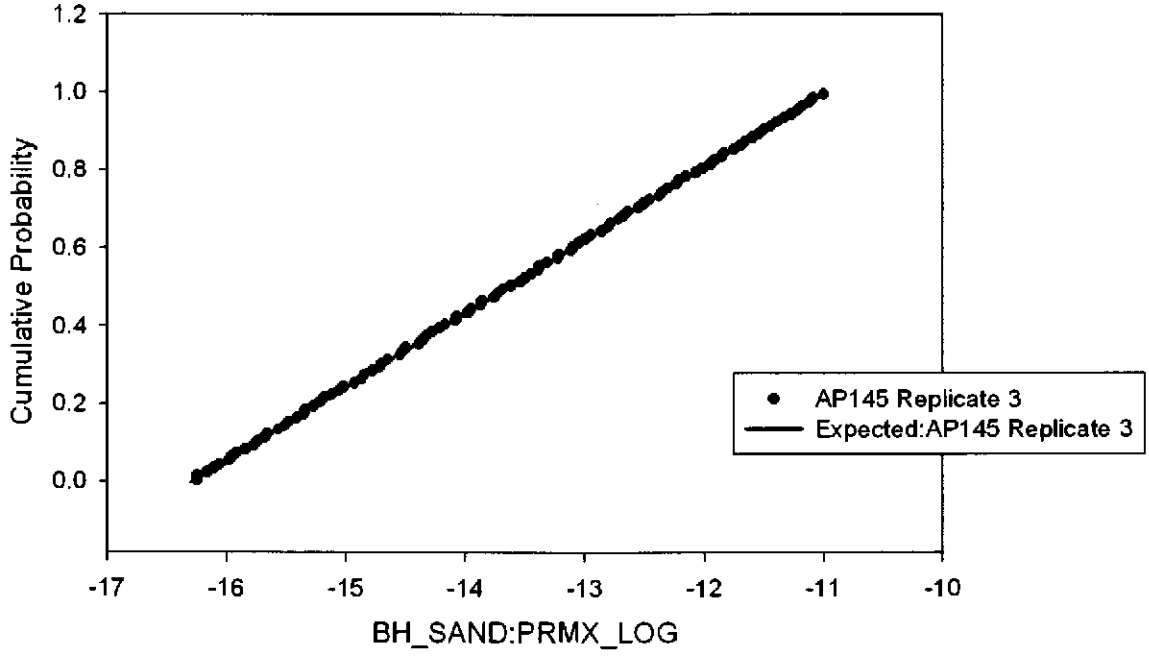

Figure 114. Observed and Expected CDFs for BH_SAND:PRMX_LOG (Uniform Distribution) Rep. 3.

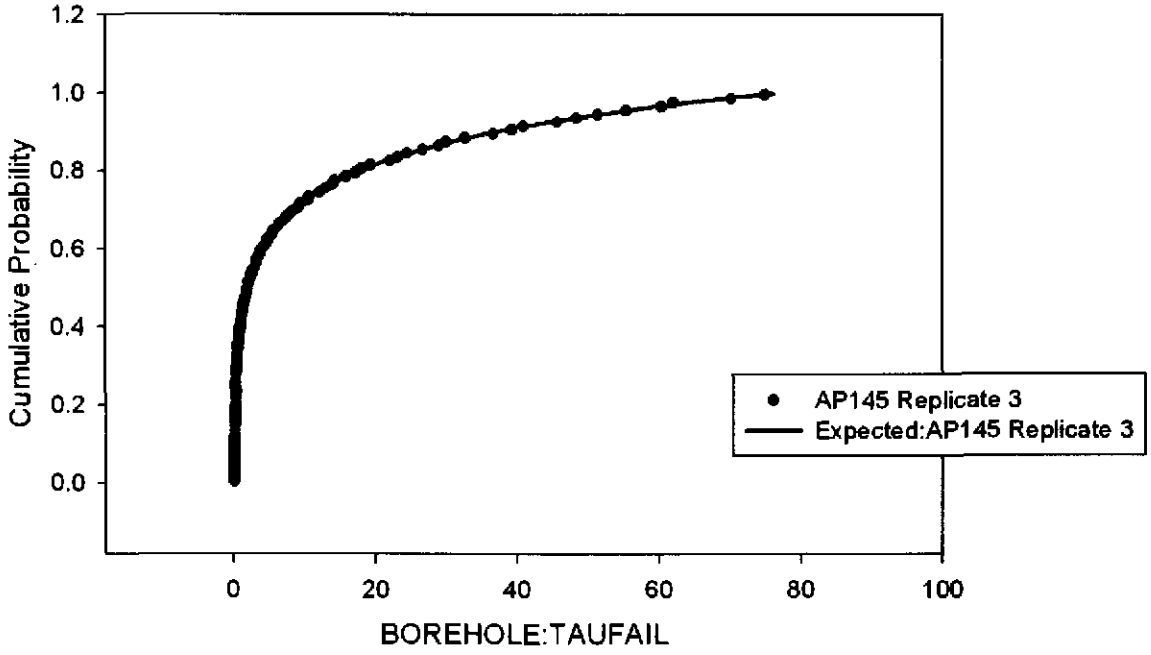

Figure 115. Observed and Expected CDFs for BOREHOLE:TAUFAIL (Loguniform Distribution) Rep. 2.

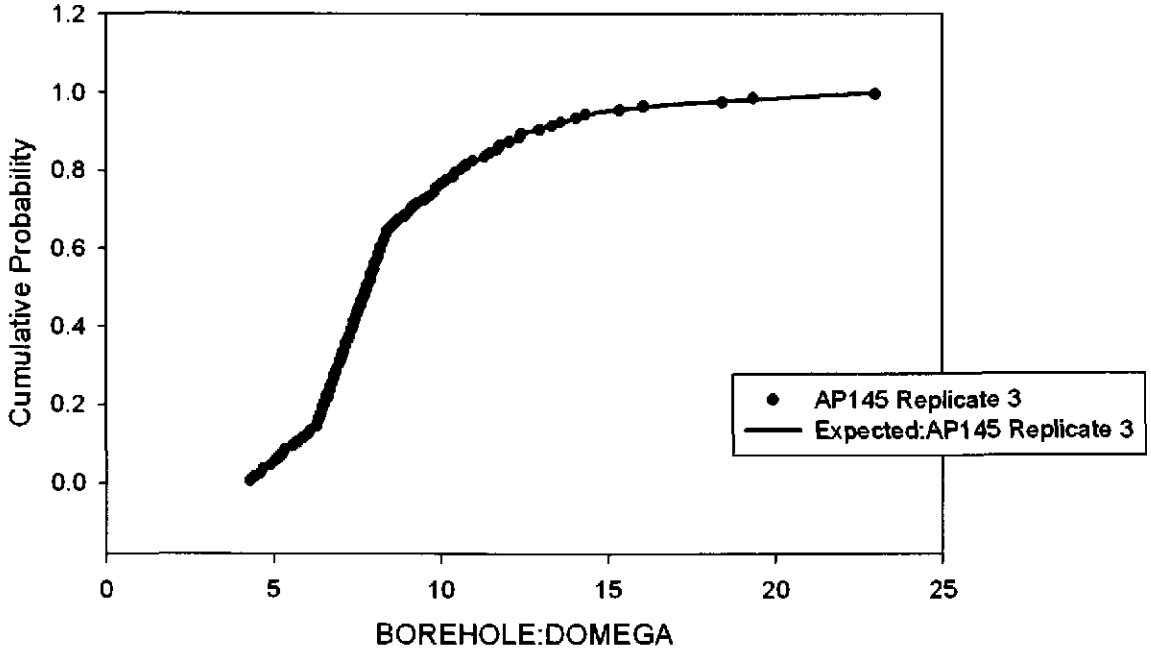

Figure 116. Observed and Expected CDFs for BOREHOLE:DOMEGA (User Continuous Distribution) Rep. 3.

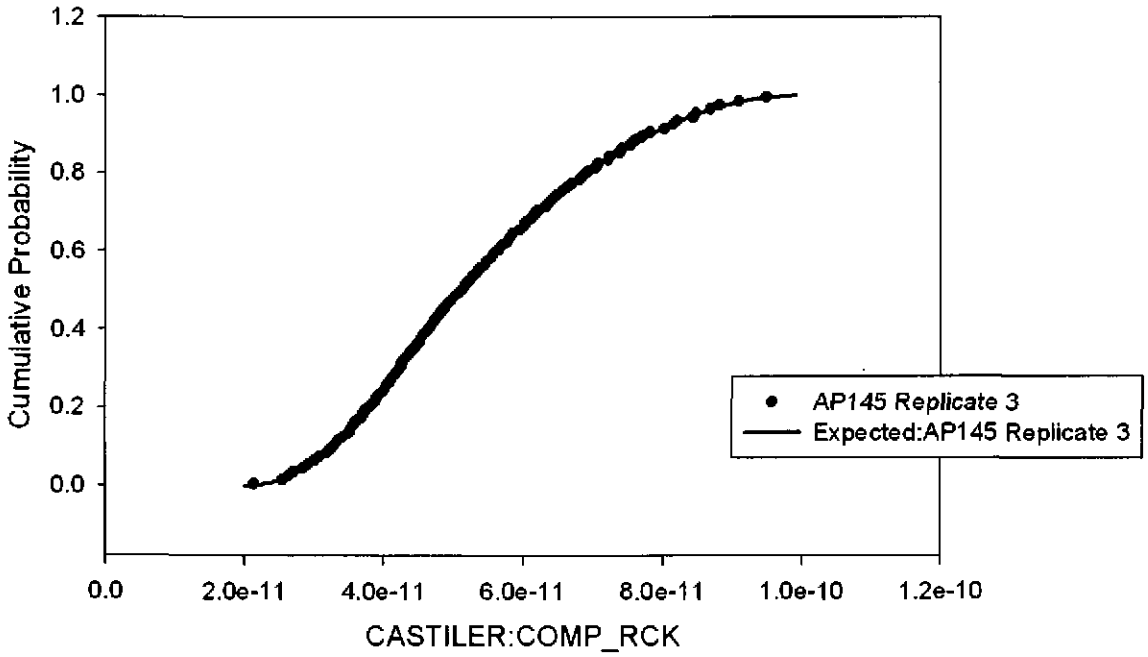

Figure 117. Observed and Expected CDFs for CASTILER:COMP_RCK (Triangular Distribution) Rep. 3.

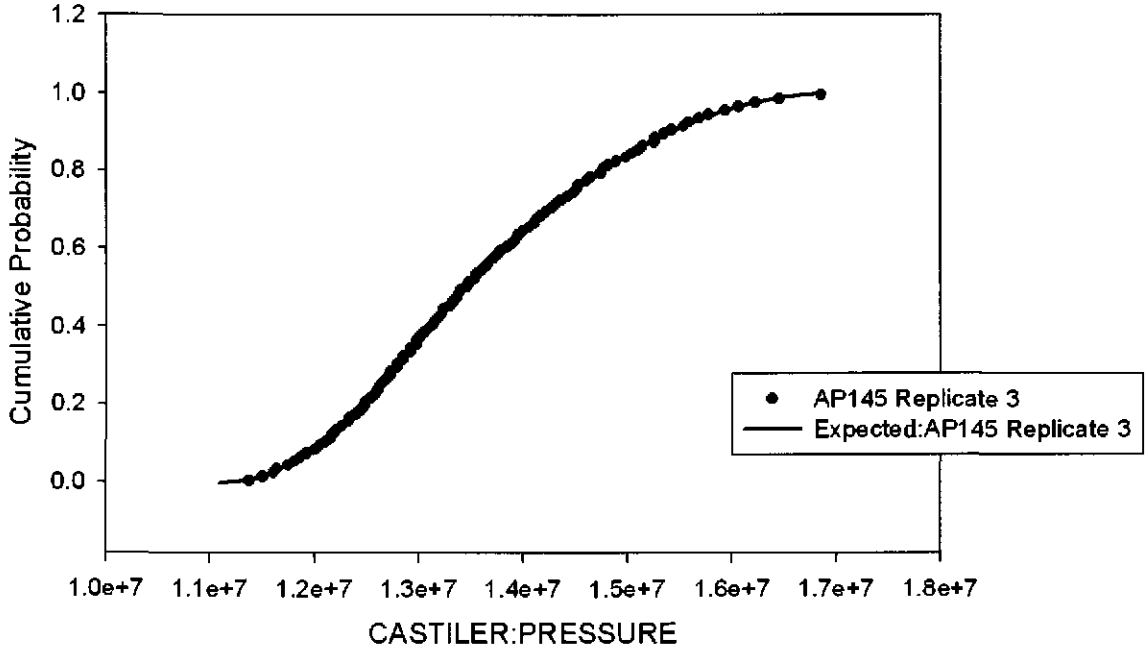

Figure 118. Observed and Expected CDFs for CASTILER:PRESSURE (Triangular Distribution) Rep. 3.

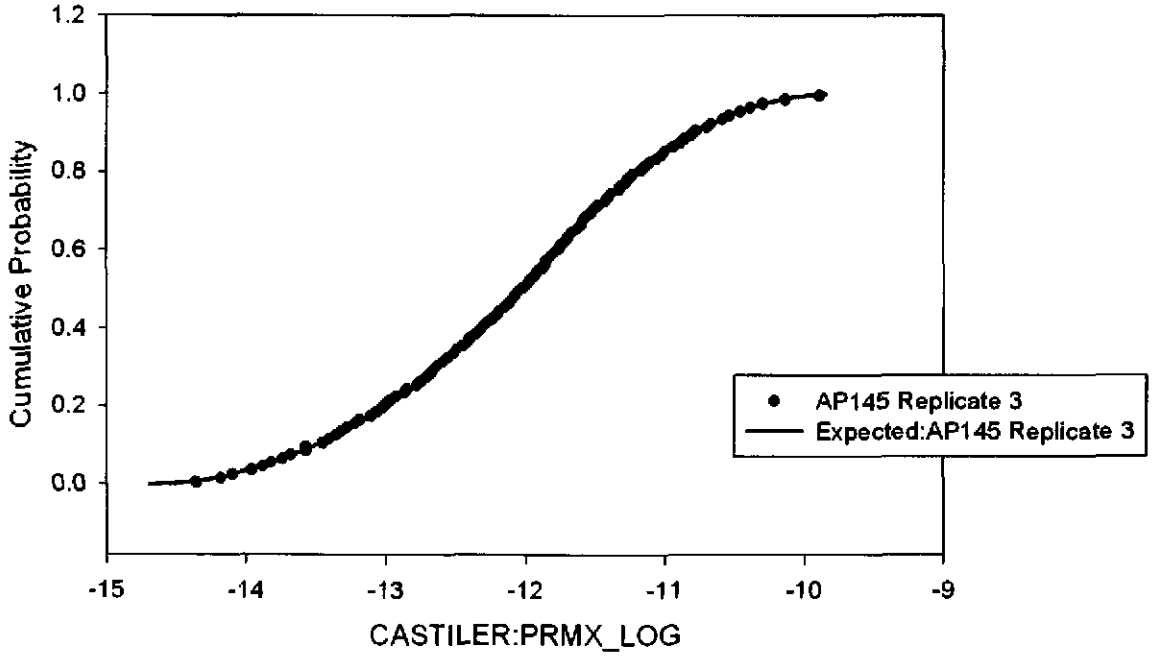

Figure 119. Observed and Expected CDFs for CASTILER:PRMX_LOG (Triangular Distribution) Rep. 3.

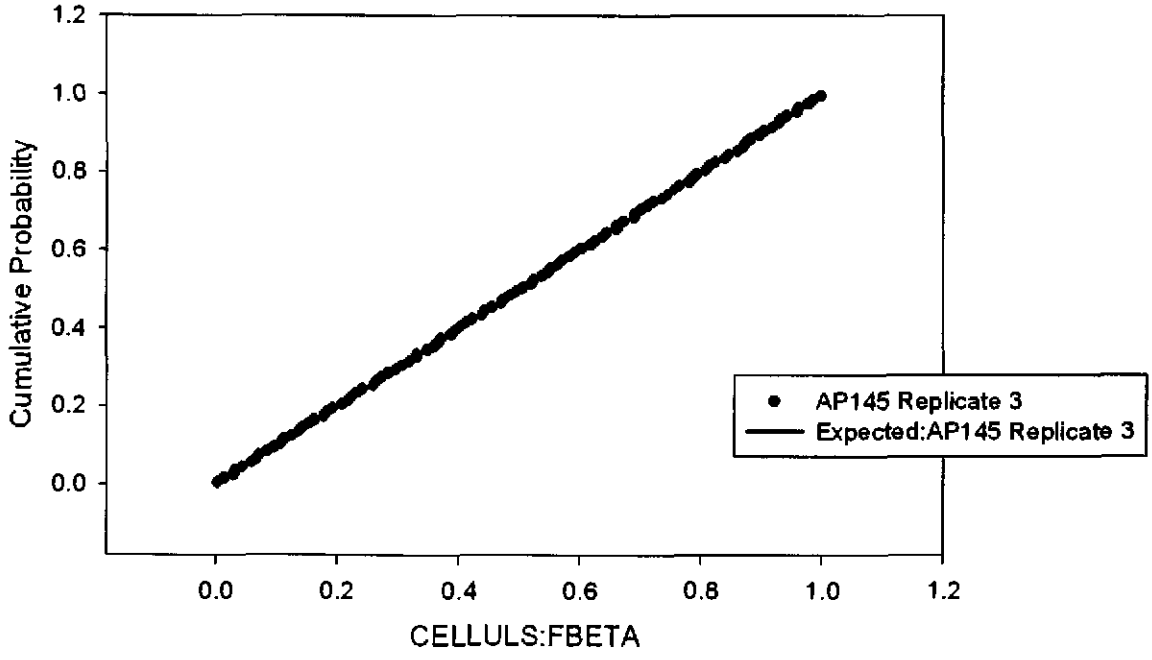

Figure 120. Observed and Expected CDFs for CELLULS:FBETA (Uniform Distribution) Rep. 3.

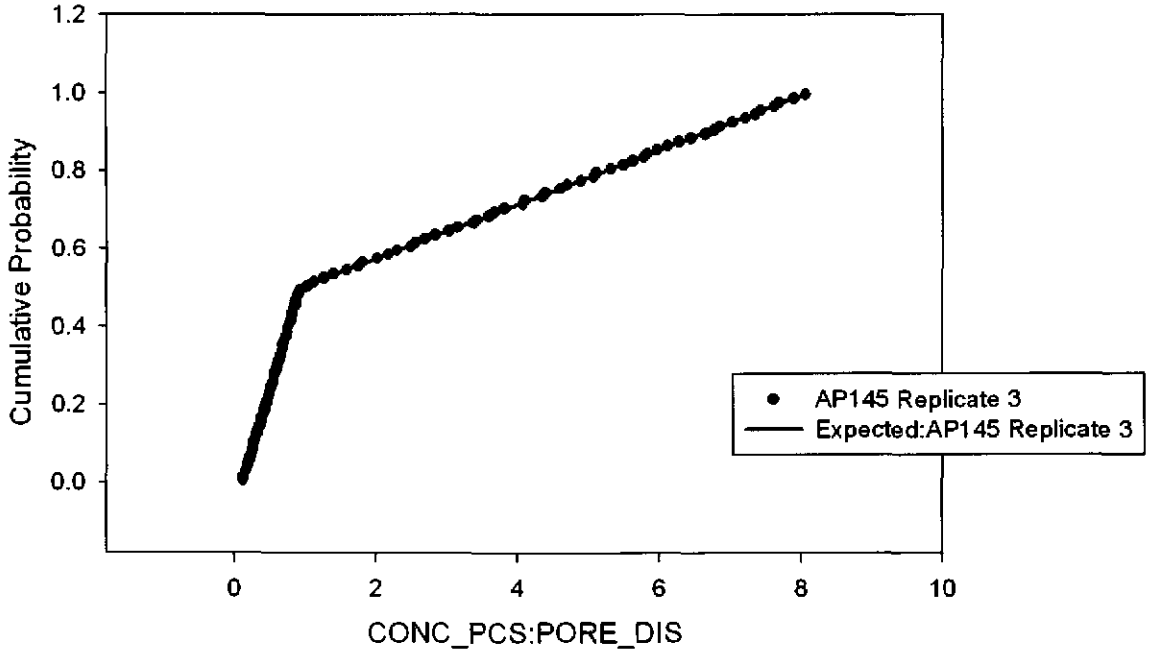

Figure 121. Observed and Expected CDFs for CONC_PCS:PORE_DIS (User Continuous Distribution) Rep. 3.

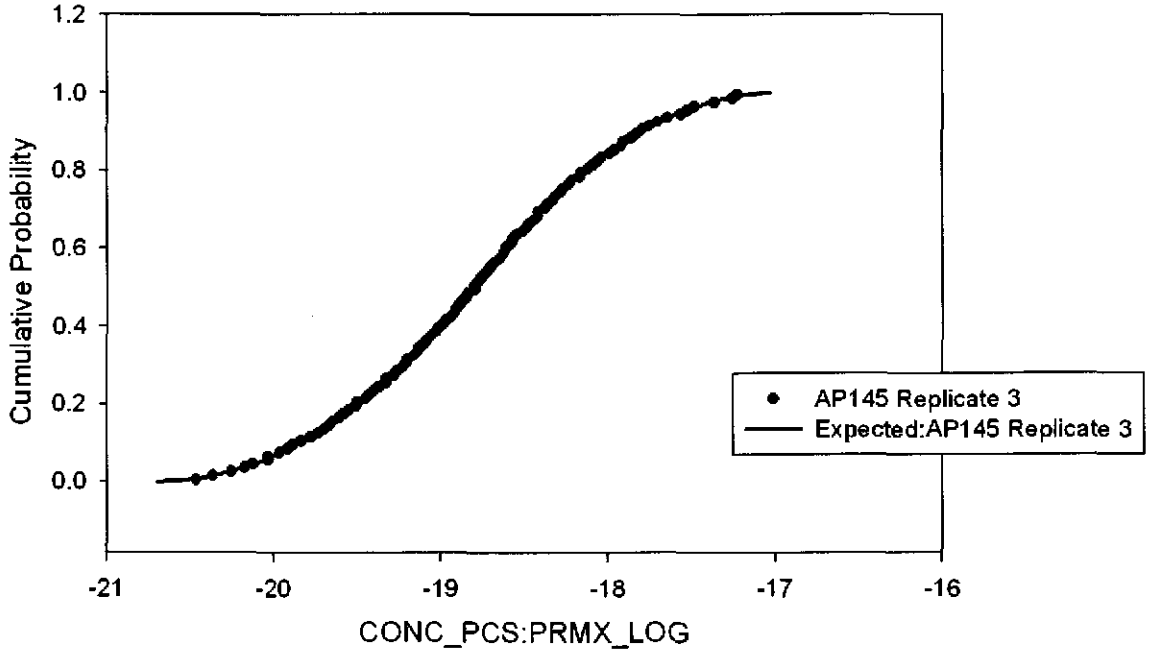

Figure 122. Observed and Expected CDFs for CONC_PCS:PRMX_LOG (Triangular Distribution) Rep. 3.

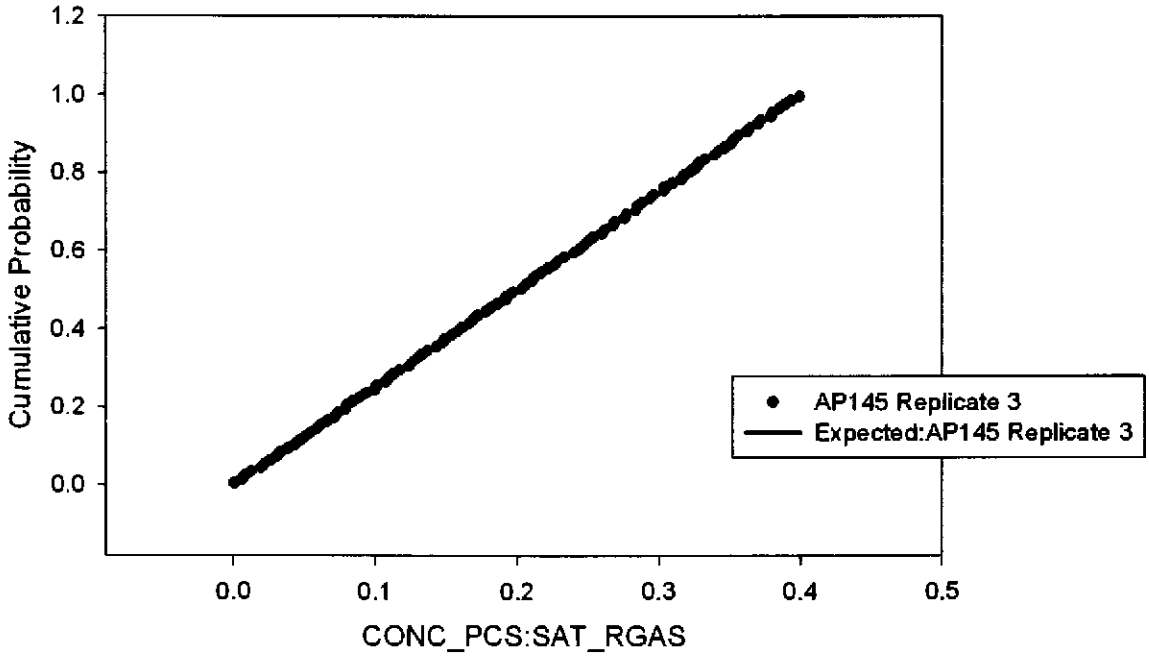

Figure 123. Observed and Expected CDFs for CONC_PCS:SAT_RGAS (Uniform Distribution) Rep. 3.

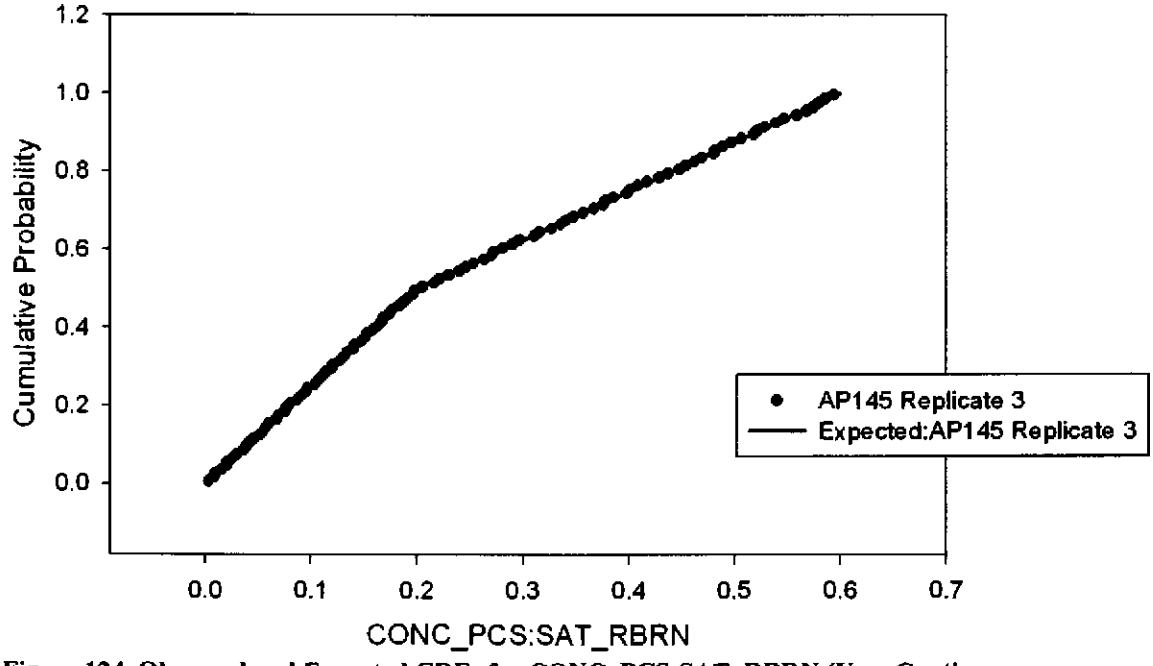

Figure 124. Observed and Expected CDFs for CONC_PCS:SAT_RBRN (User Continuous Distribution) Rep. 3.

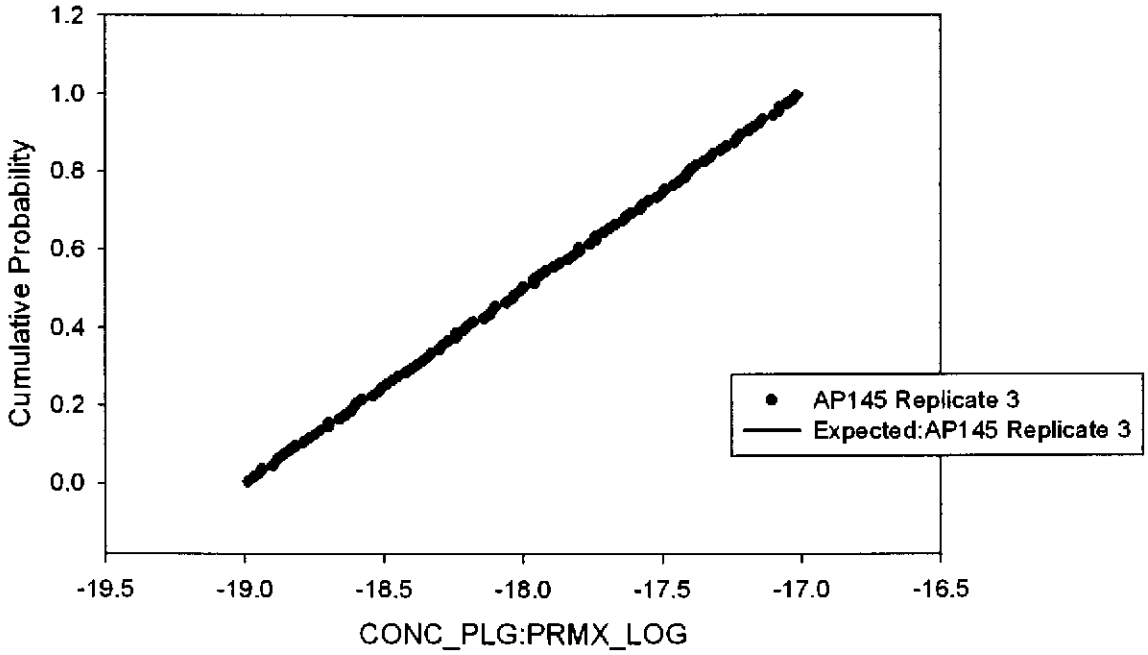

Figure 125. Observed and Expected CDFs for CONC_PLG:PRMX_LOG (Uniform Distribution) Rep. 3.

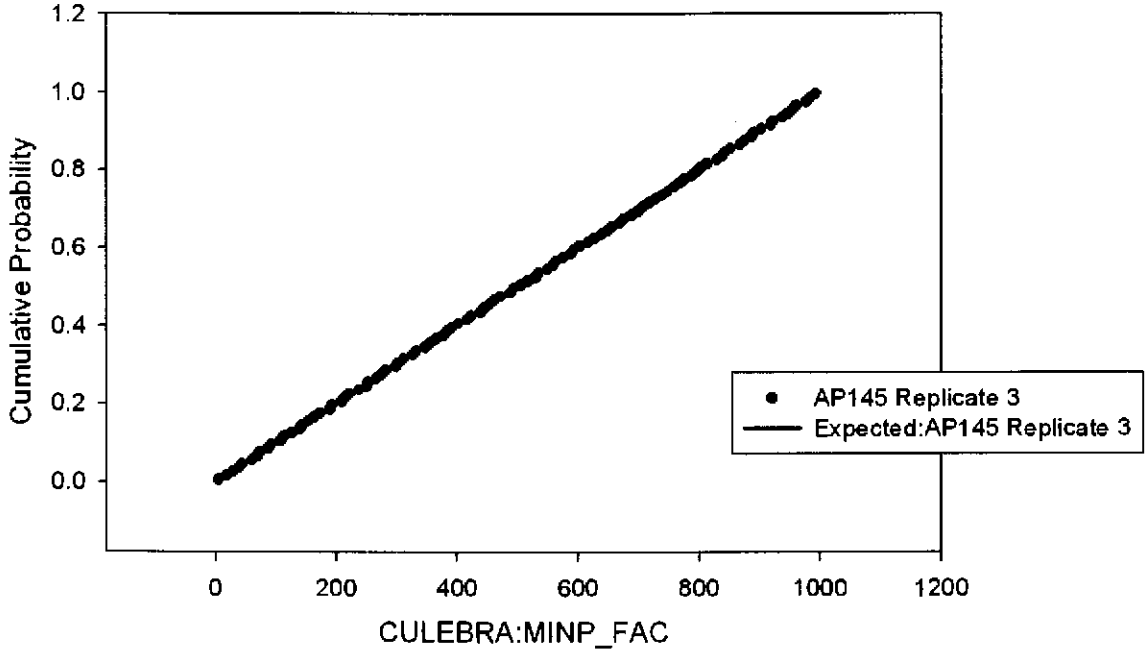

Figure 126. Observed and Expected CDFs for CULEBRA:MINP_FAC (Uniform Distribution) Rep. 3.

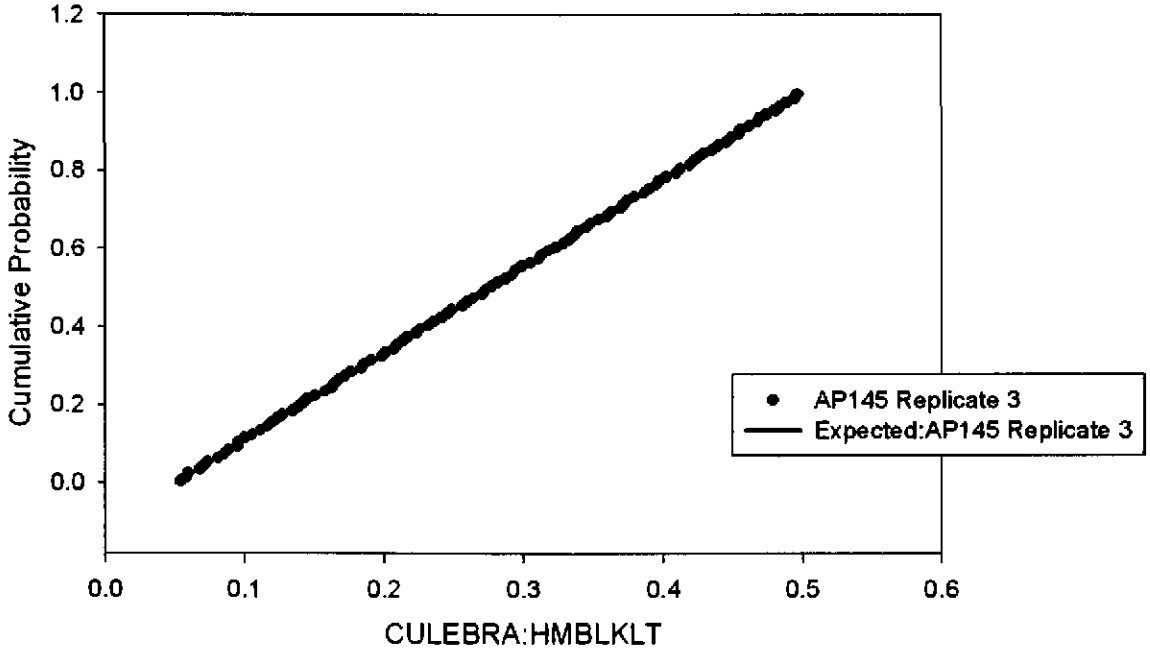

Figure 127. Observed and Expected CDFs for CULEBRA:HMBLKLT (Uniform Distribution) Rep. 3.

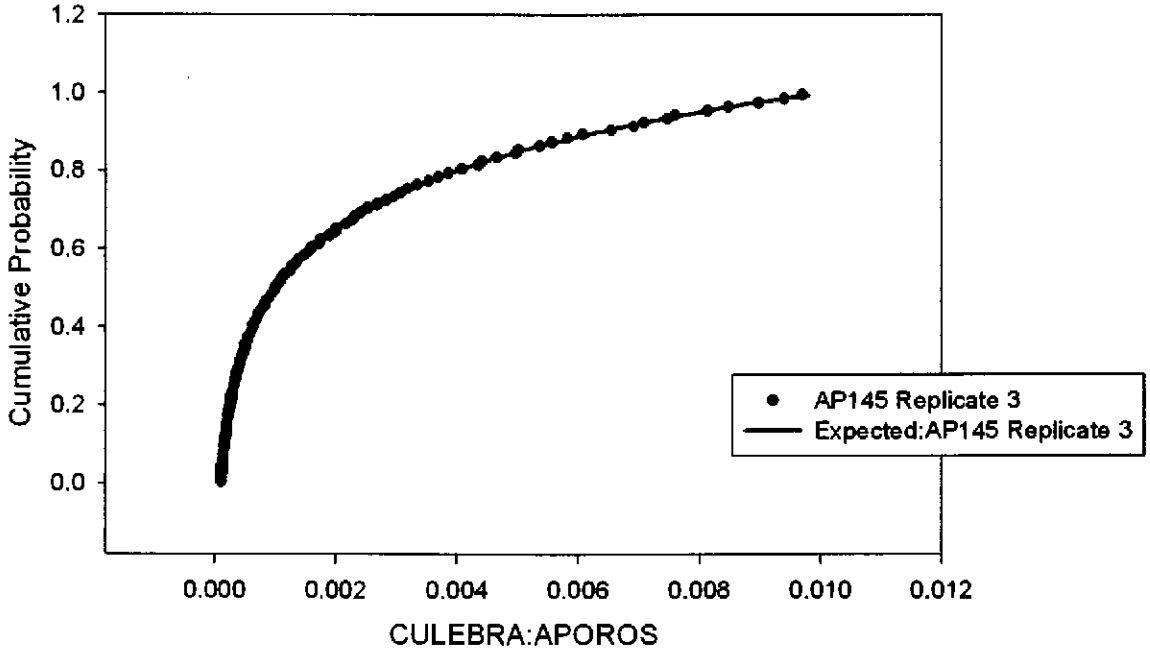

Figure 128. Observed and Expected CDFs for CULEBRA:APOROS (Loguniform Distribution) Rep. 3.

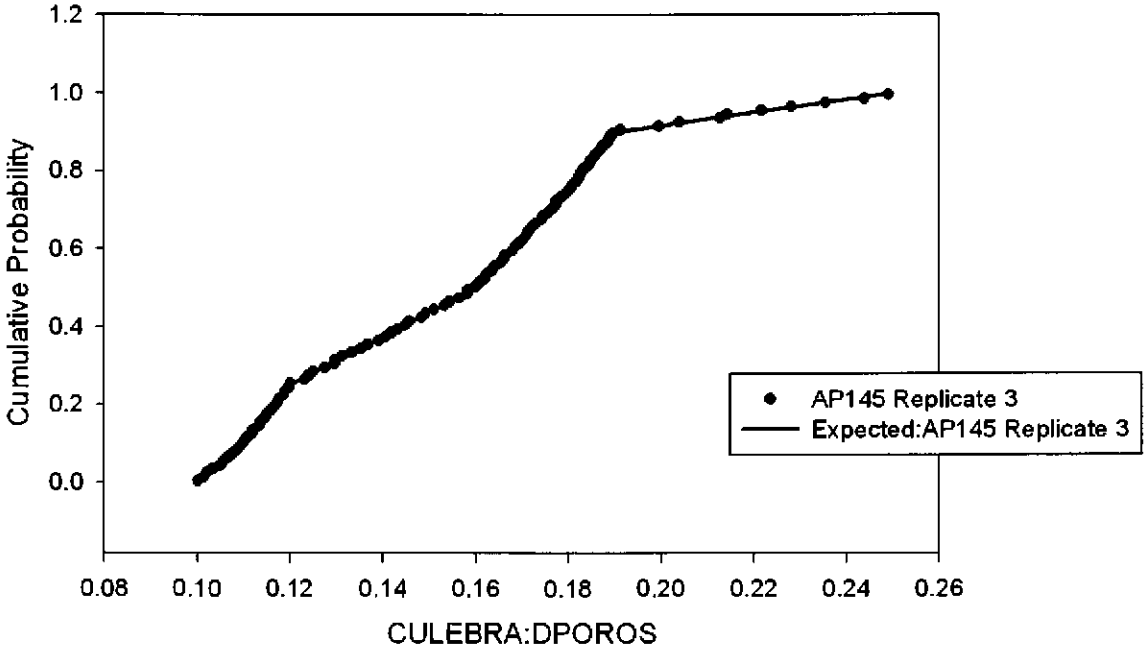

Figure 129. Observed and Expected CDFs for CULEBRA:DPOROS (User Continuous Distribution) Rep. 3.

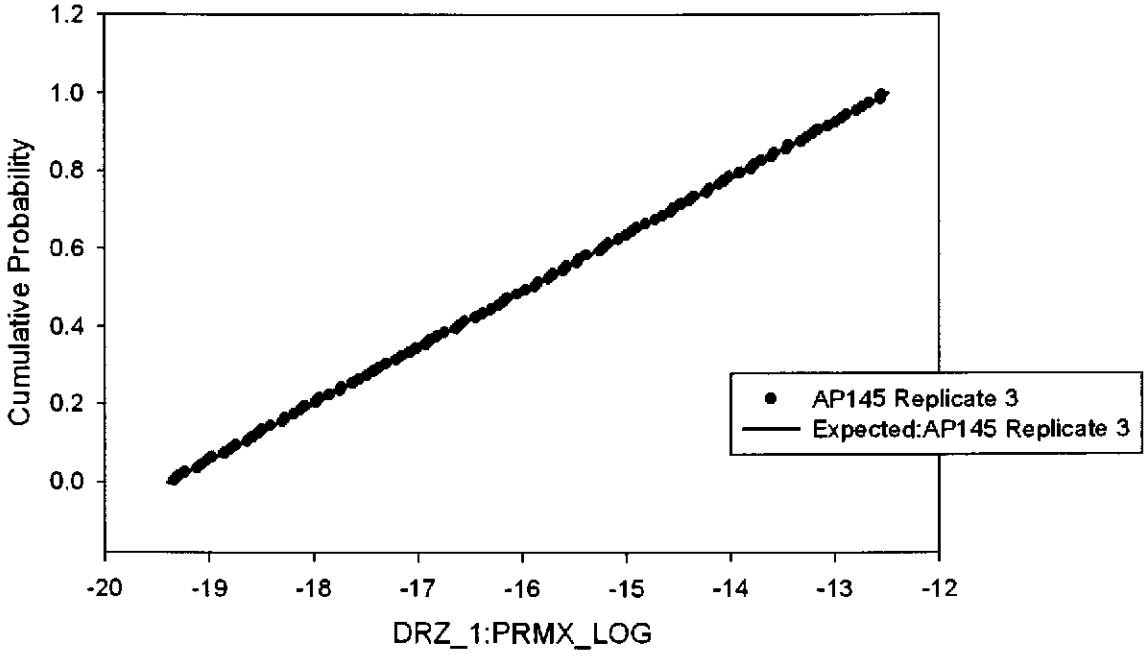

Figure 130. Observed and Expected CDFs for DRZ_1:PRMX_LOG (Uniform Distribution) Rep. 3.

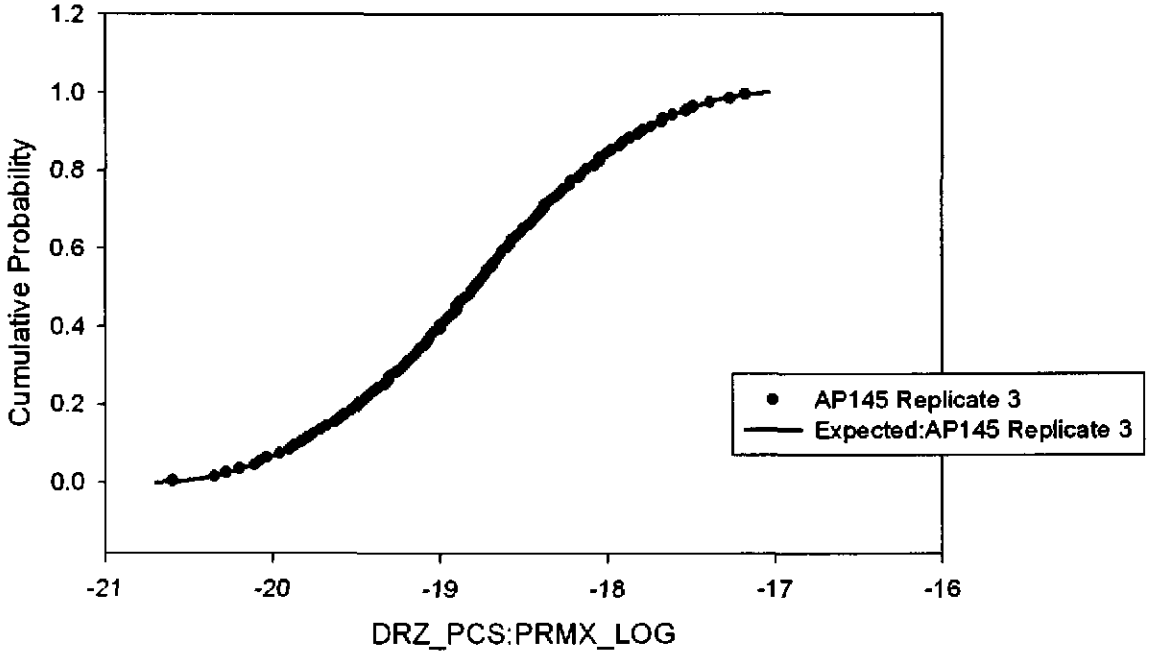

Figure 131. Observed and Expected CDFs for DRZ_PCS:PRMX_LOG (Triangular Distribution) Rep. 3.

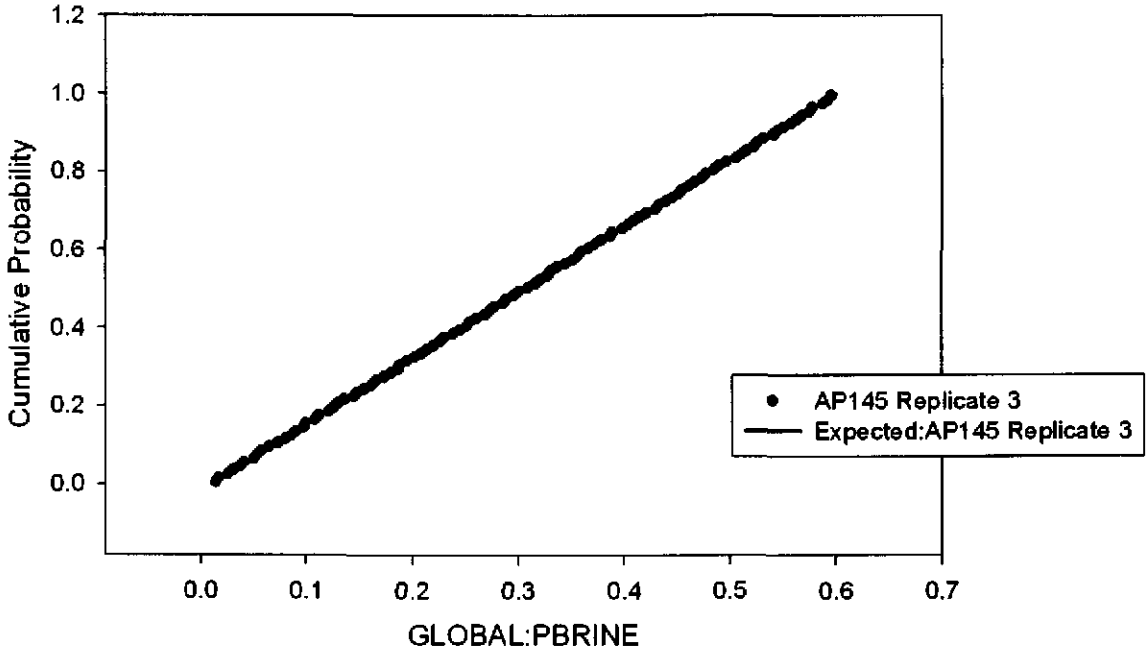

Figure 132. Observed and Expected CDFs for GLOBAL:PBRINE (Uniform Distribution) Rep. 3.

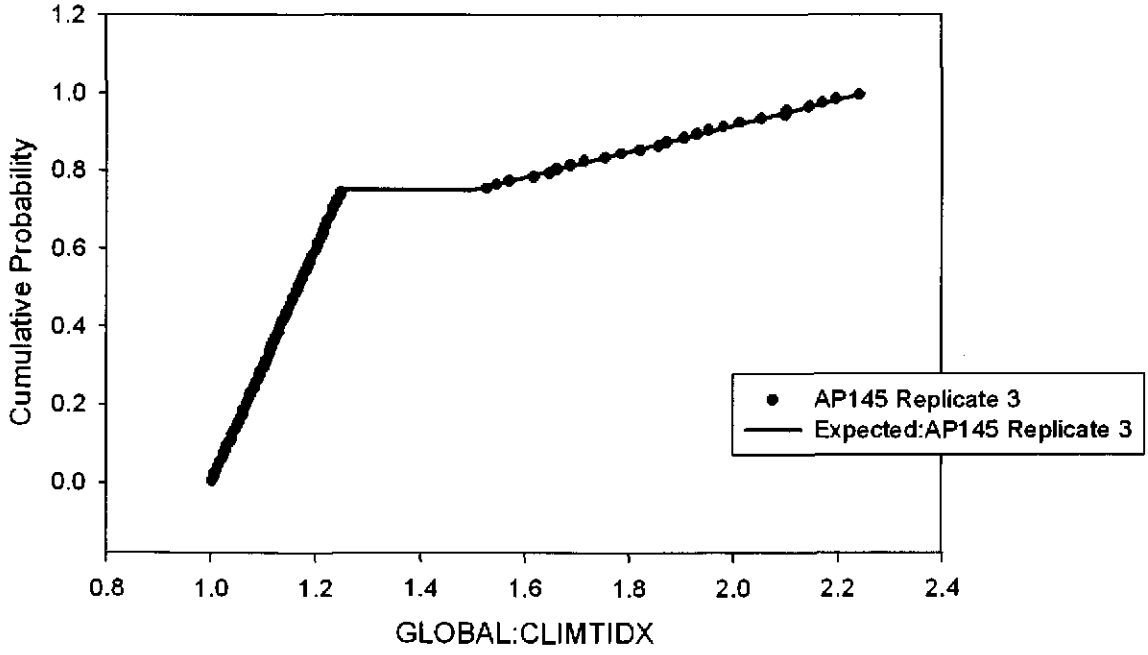

Figure 133. Observed and Expected CDFs for GLOBAL:CLIMTIDX (User Continuous Distribution) Rep. 3.

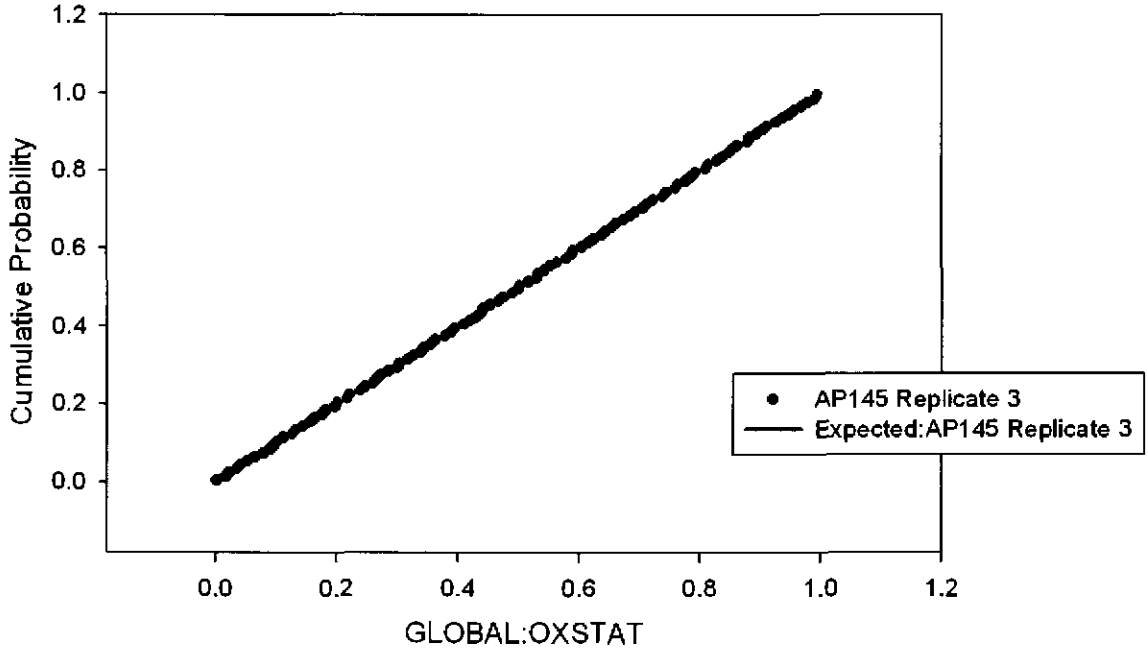

Figure 134. Observed and Expected CDFs for GLOBAL:OXSTAT (Uniform Distribution) Rep. 3.

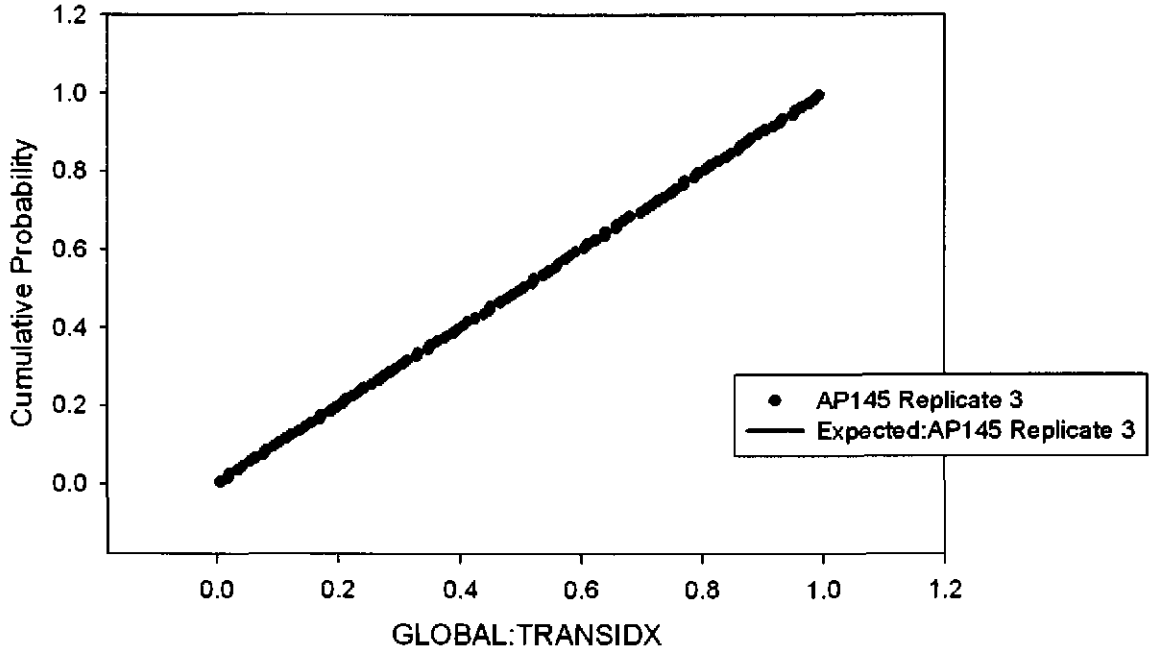

Figure 135. Observed and Expected CDFs for GLOBAL:TRANSIDX (Uniform Distribution) Rep. 3.

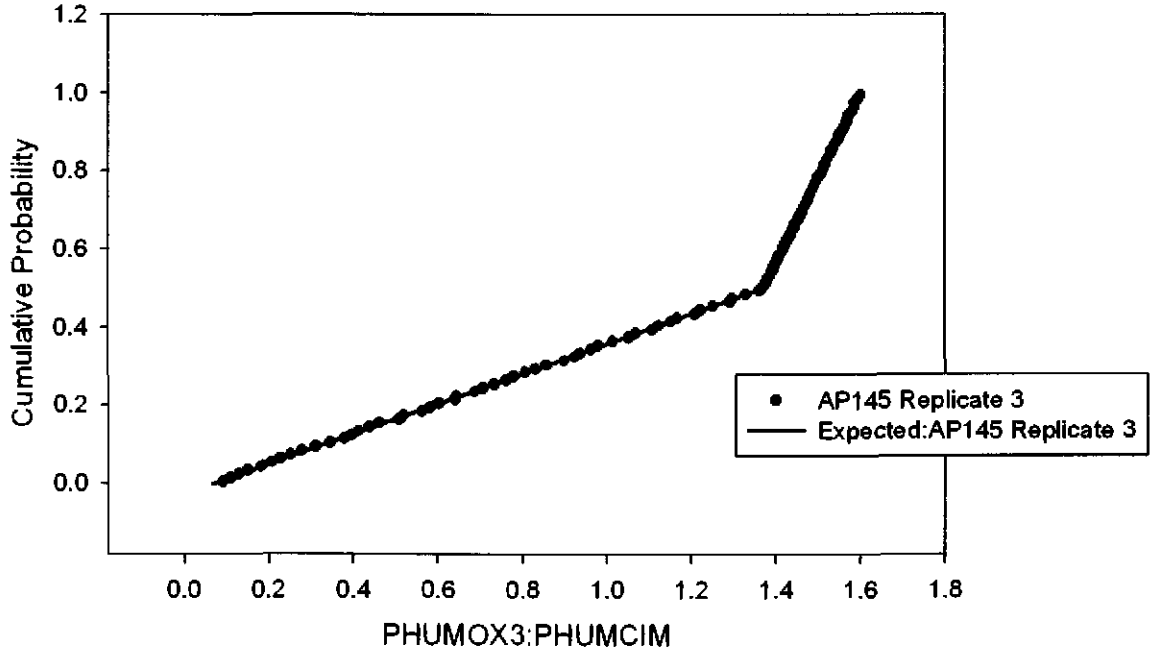

Figure 136. Observed and Expected CDFs for PHUMOX3:PHUMCIM (User Continuous Distribution) Rep. 3.

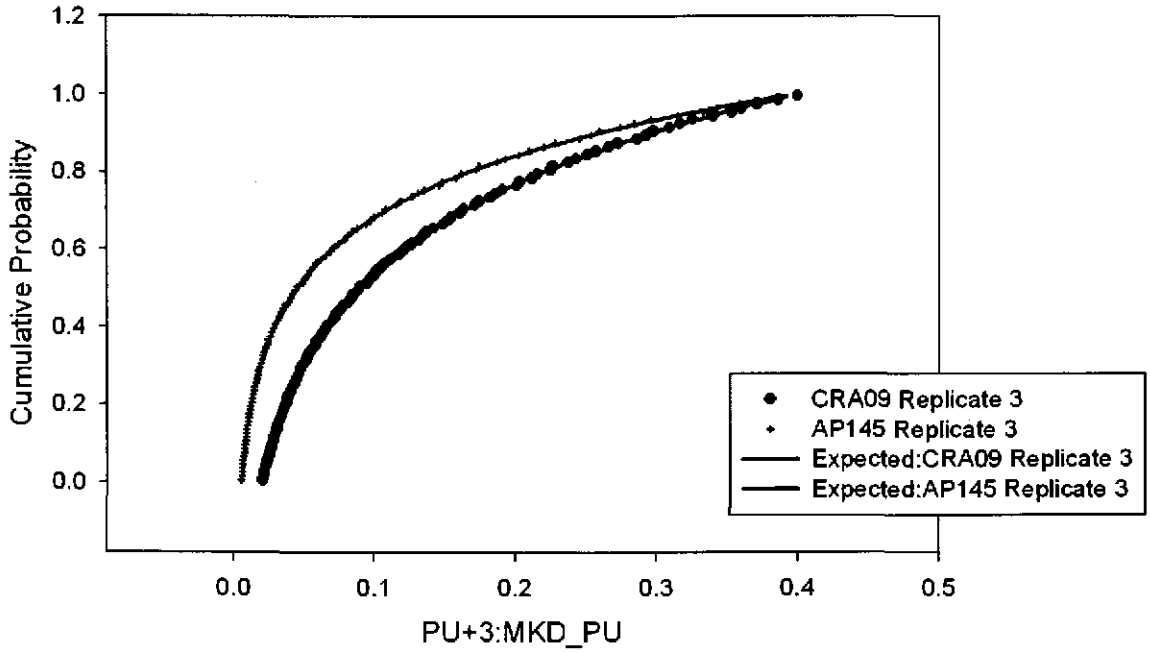

Figure 137. Observed and Expected CDFs for PU+3:MKD_PU (Loguniform Distribution) Rep. 3.

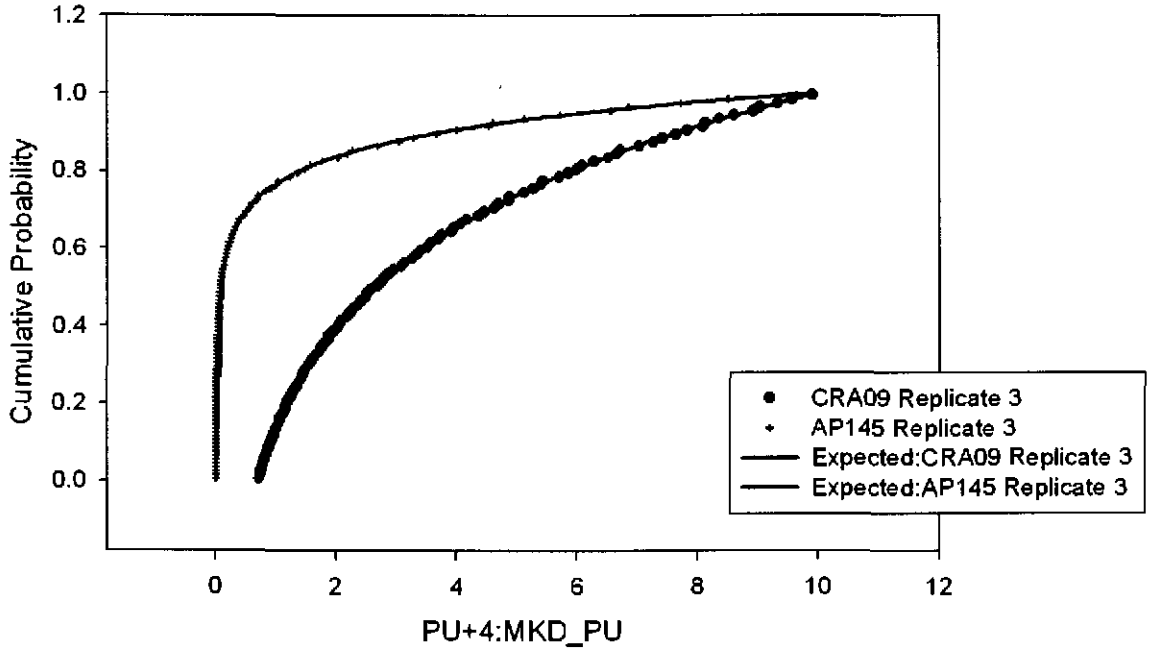

Figure 138. Observed and Expected CDFs for PU+4:MKD_PU (Loguniform Distribution) Rep. 3.

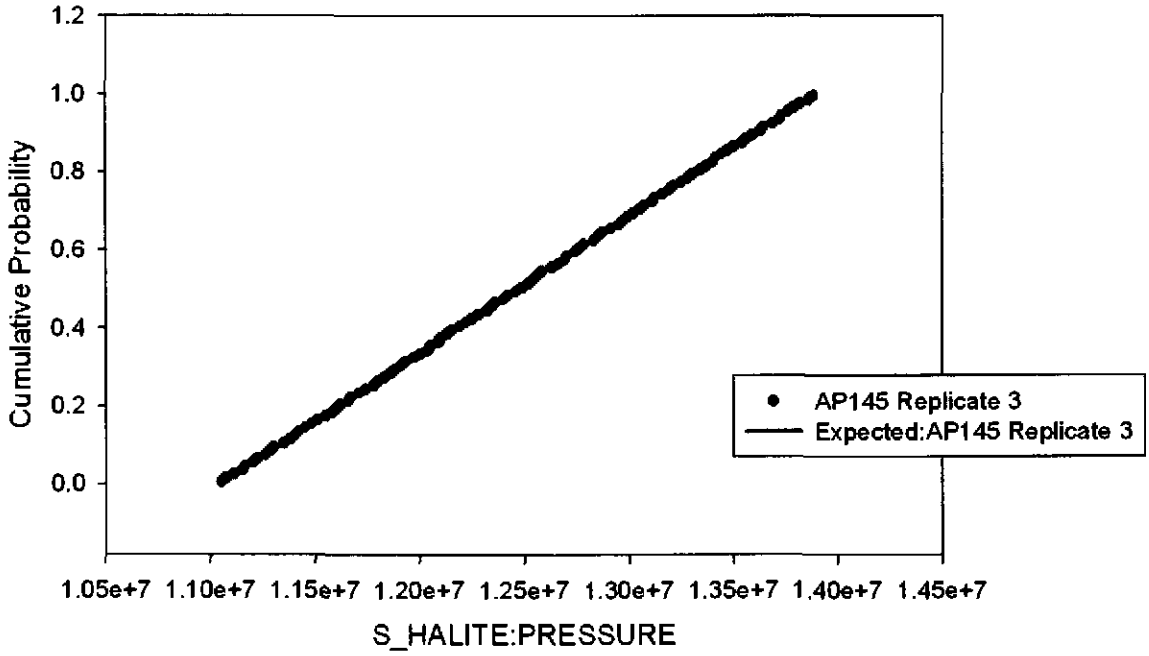

Figure 139. Observed and Expected CDFs for S_HALITE:PRESSURE (Uniform Distribution) Rep. 3.

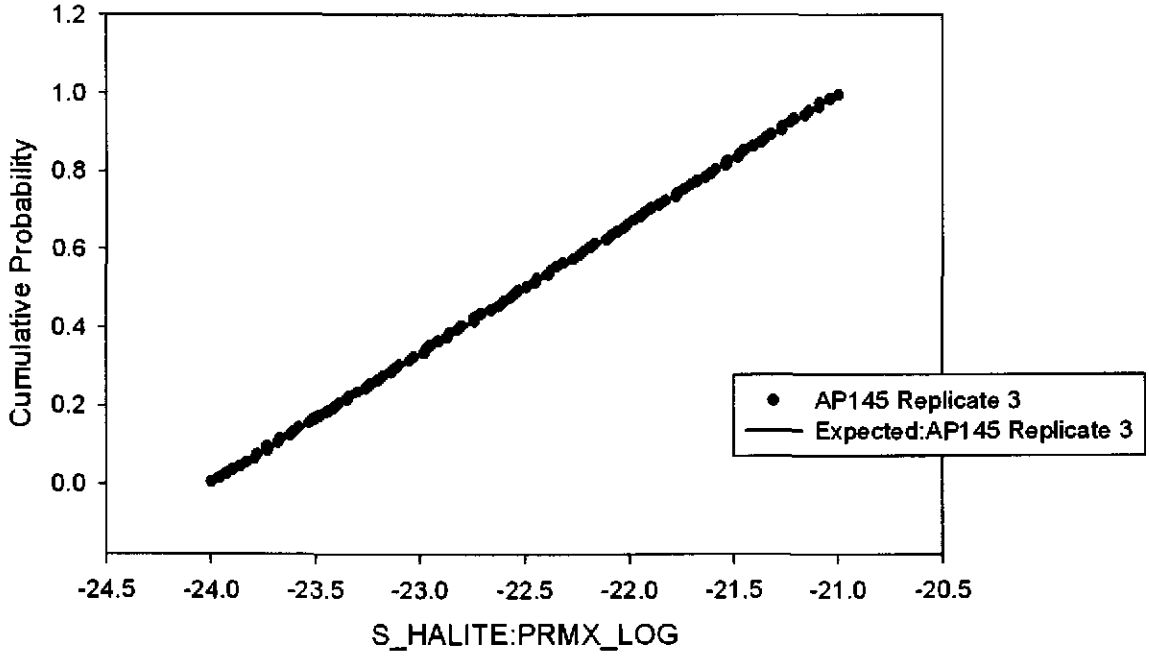

Figure 140. Observed and Expected CDFs for S_HALITE:PRMX_LOG (Uniform Distribution) Rep. 3.

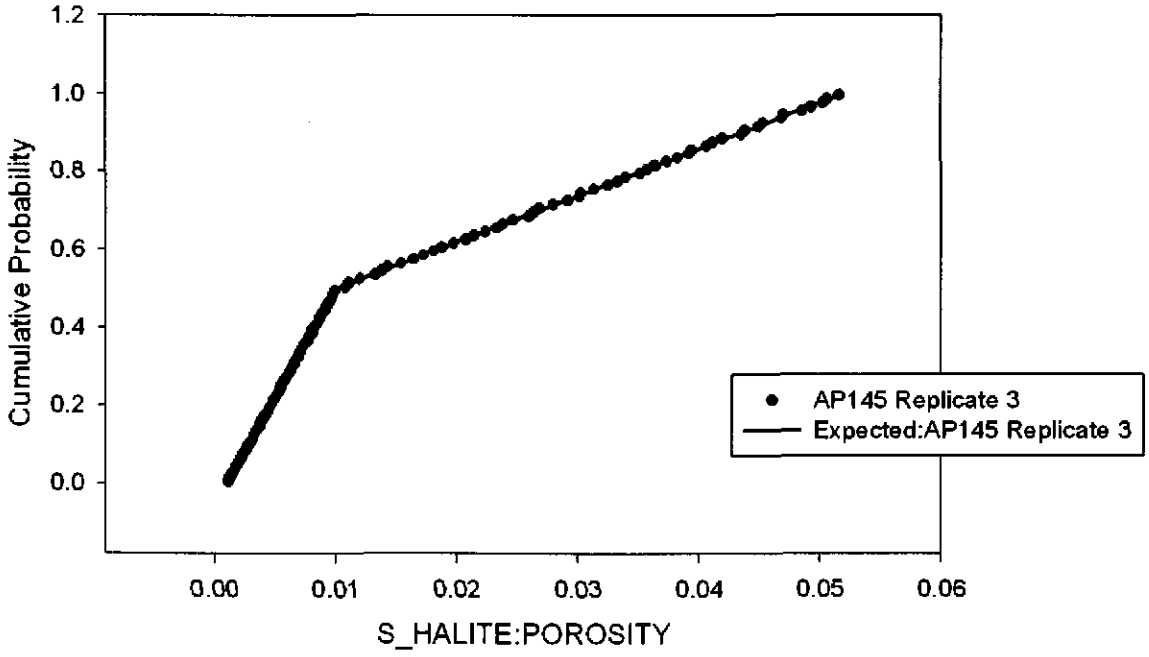

Figure 141. Observed and Expected CDFs for S_HALITE:POROSITY (User Continuous Distribution) Rep. 3.

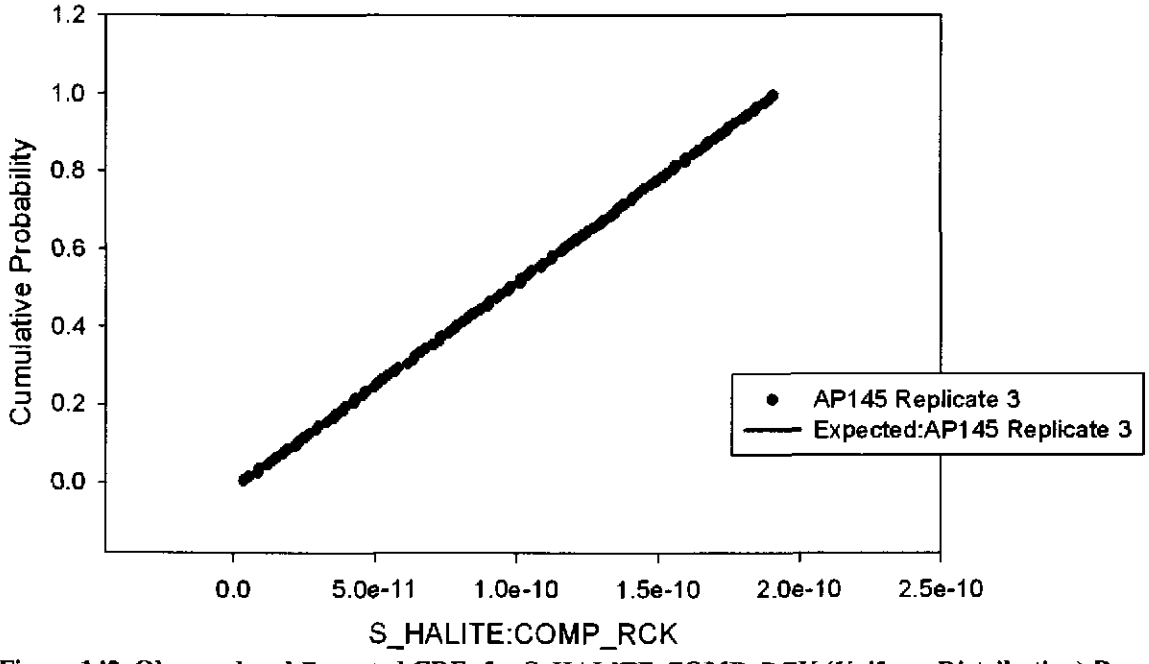

Figure 142. Observed and Expected CDFs for S_HALITE:COMP_RCK (Uniform Distribution) Rep. 3.

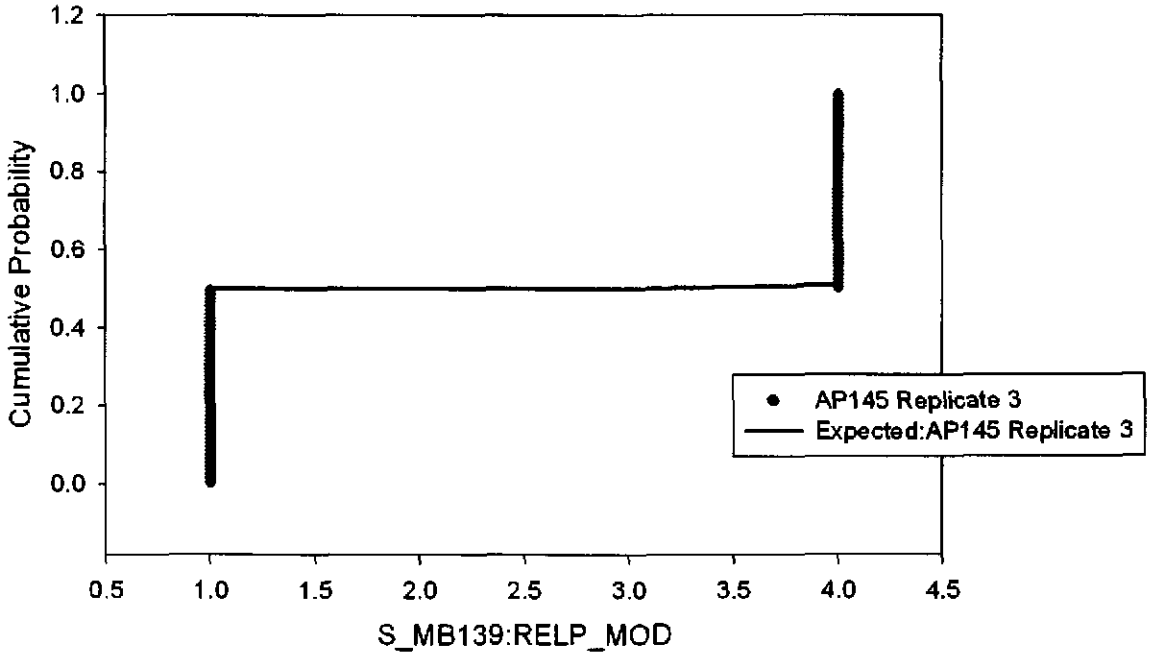

Figure 143. Observed and Expected CDFs for S_MB139:RELP_MOD (User Discrete (Delta) Distribution) Rep. 3.

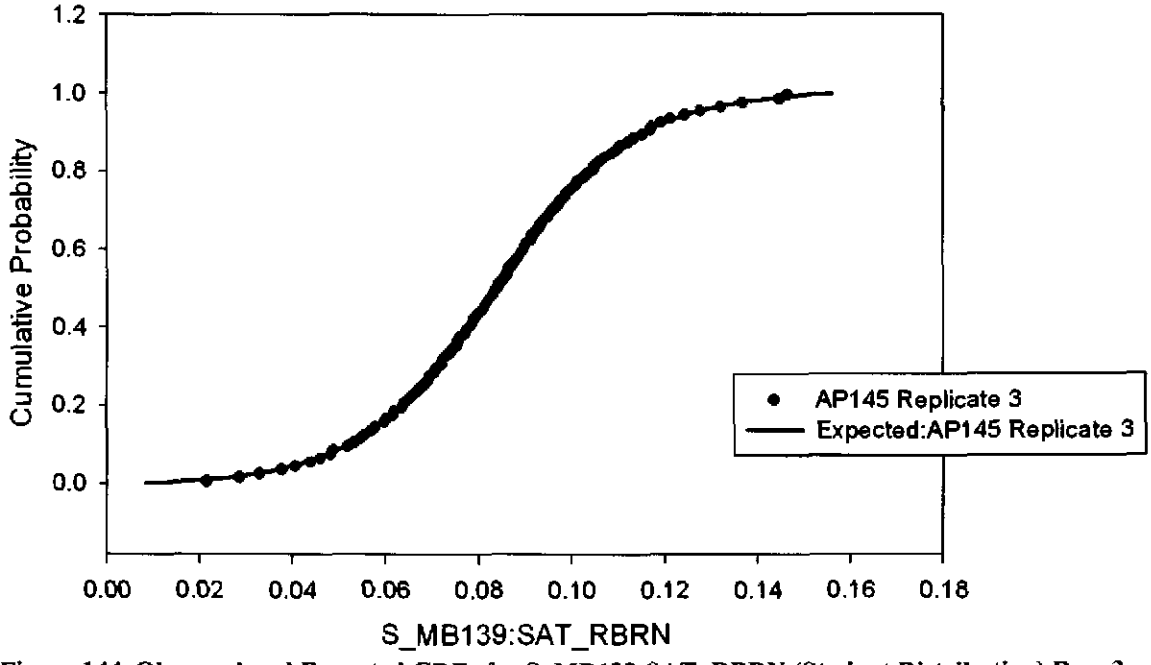

Figure 144. Observed and Expected CDFs for S_MB139:SAT_RBRN (Student Distribution) Rep. 3.

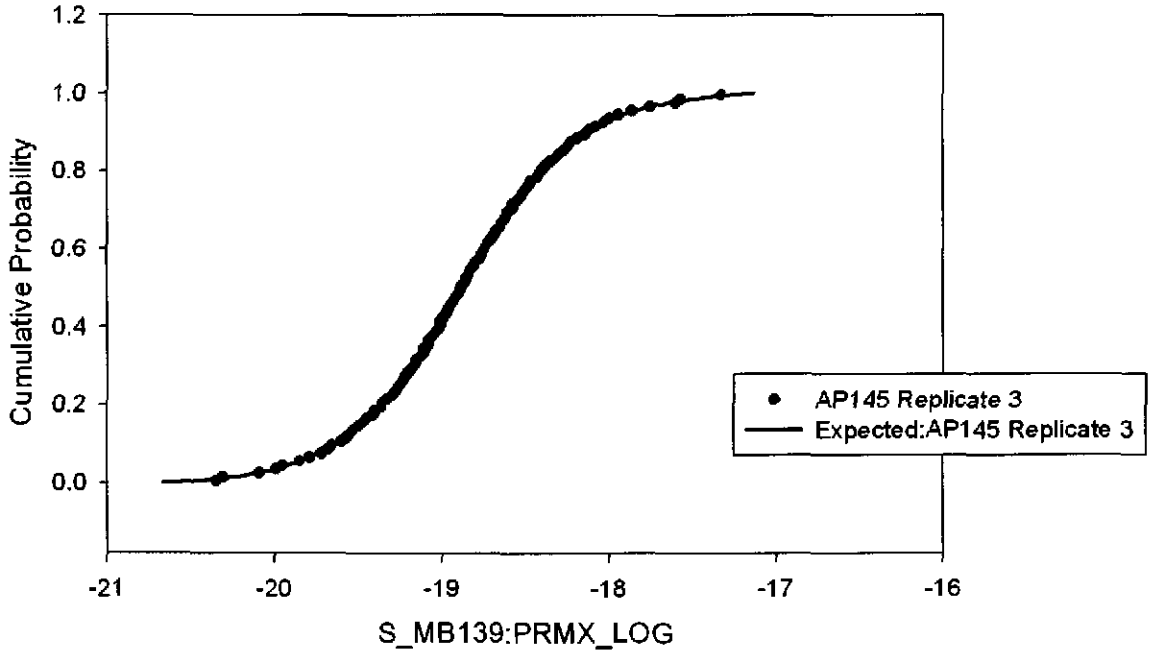

Figure 145. Observed and Expected CDFs for S_MB139:PRMX_LOG (Student Distribution) Rep. 3.

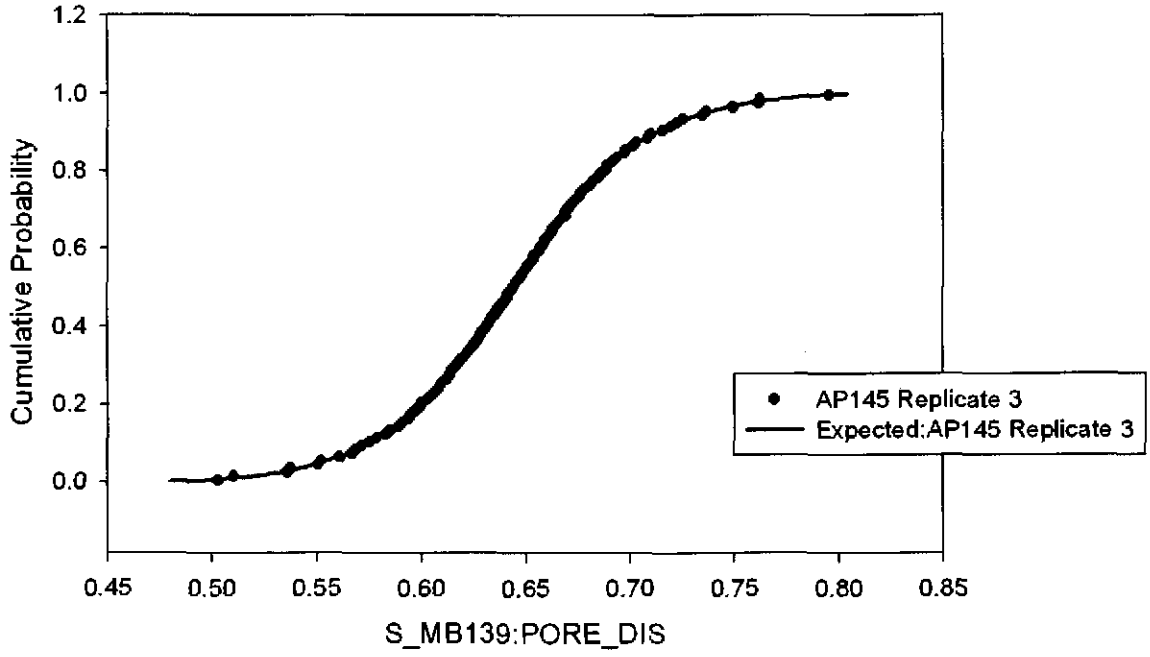

Figure 146. Observed and Expected CDFs for S_MB139:PORE_DIS (Student Distribution) Rep. 3.

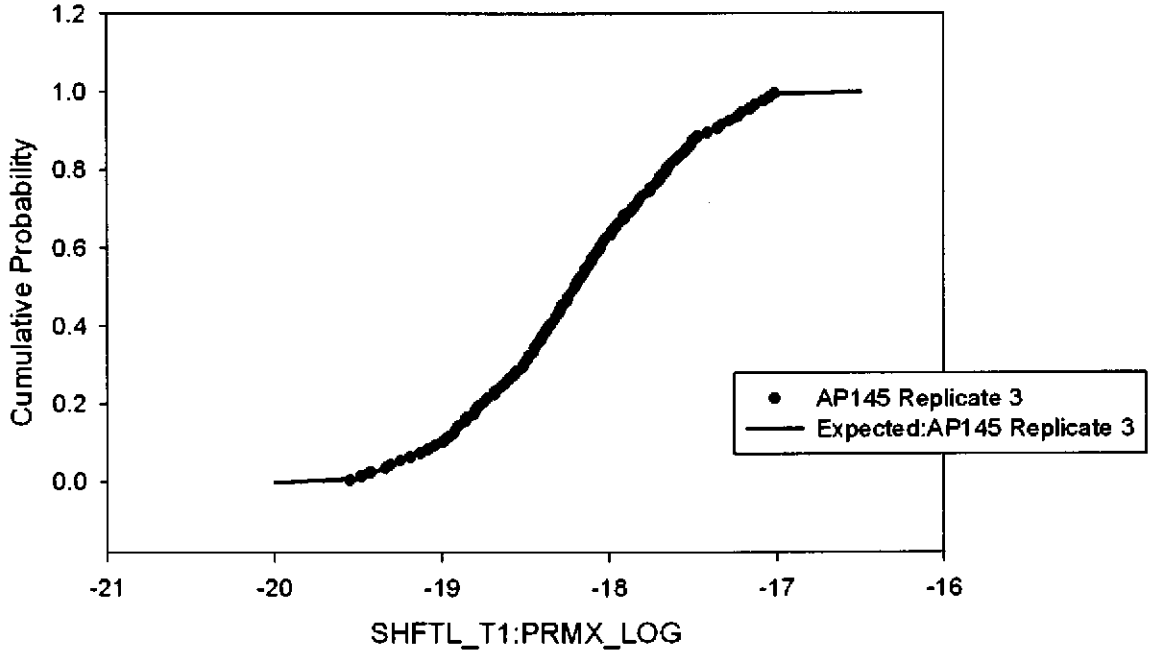

Figure 147. Observed and Expected CDFs for SHFTL_T1:PRMX_LOG (User Continuous Distribution) Rep. 3.

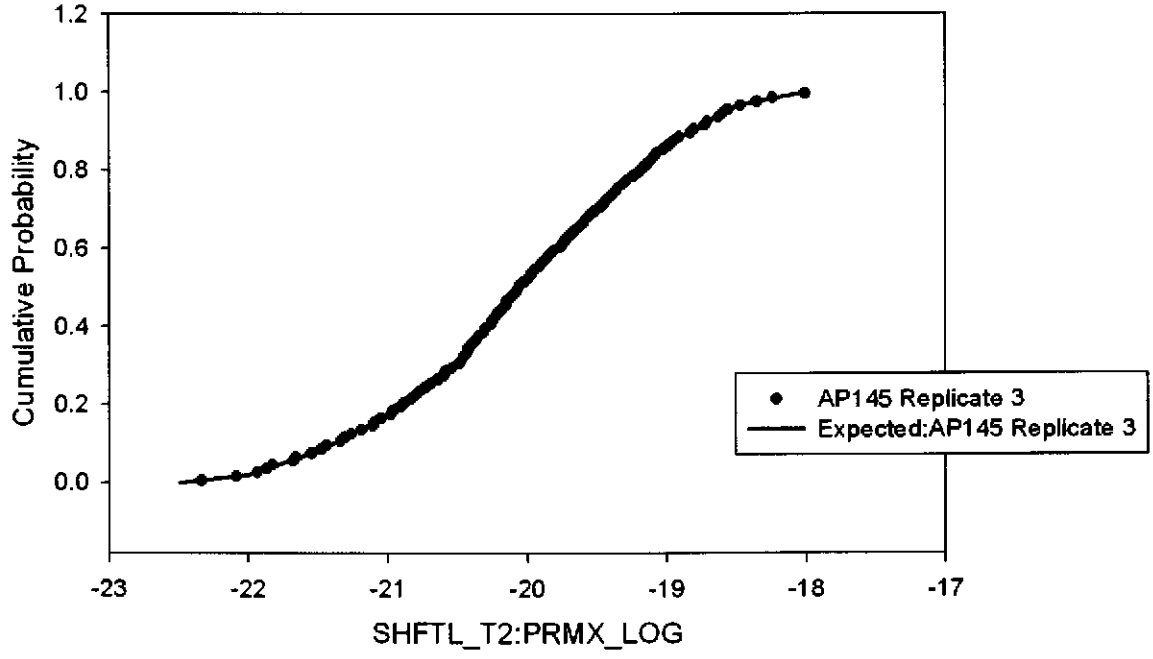

Figure 148. Observed and Expected CDFs for SHFTL_T2:PRMX_LOG (User Continuous Distribution) Rep. 3.

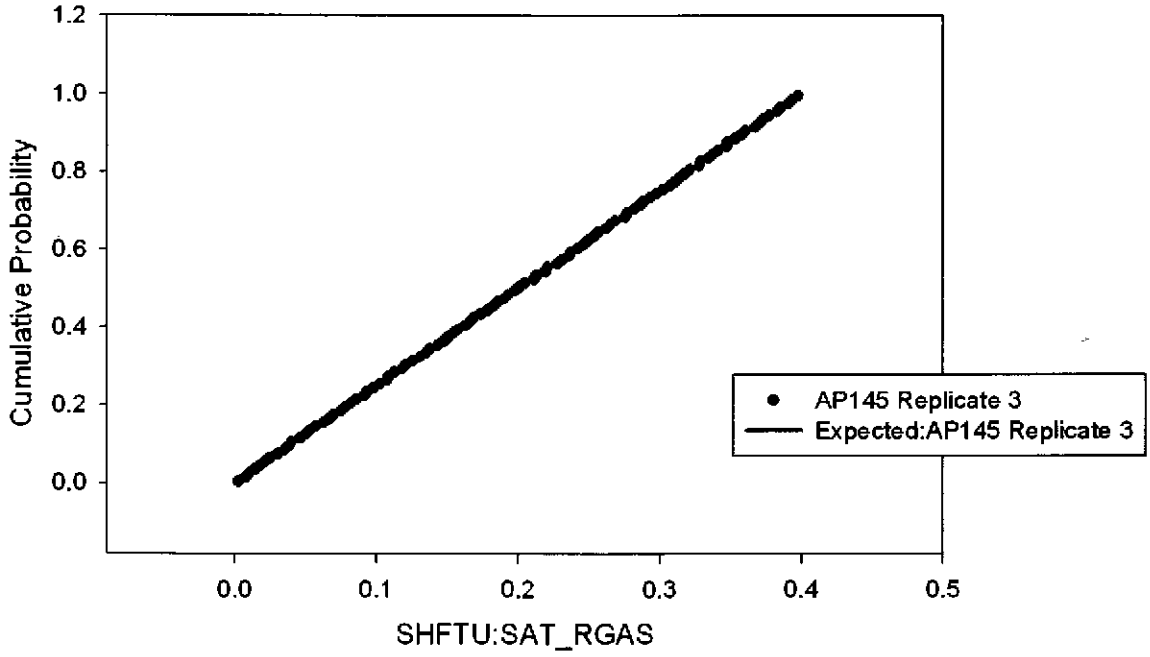

Figure 149. Observed and Expected CDFs for SHFTU:SAT_RGAS (Uniform Distribution) Rep. 3.

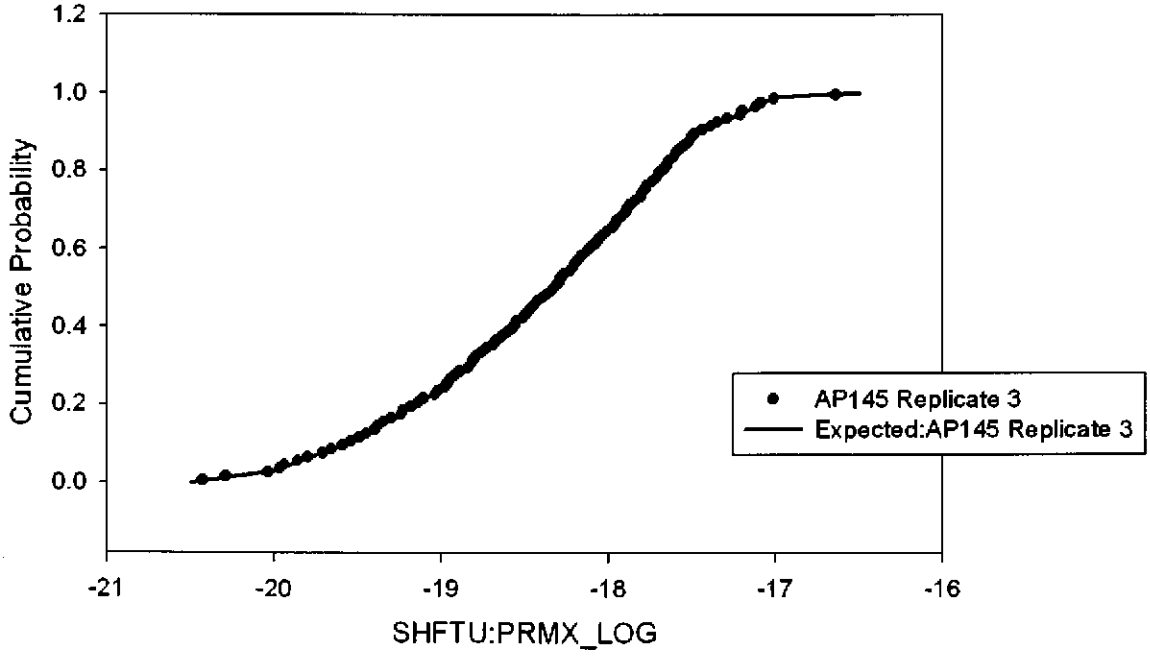

Figure 150. Observed and Expected CDFs for SHFTU:PRMX_LOG (User Continuous Distribution) Rep. 3.

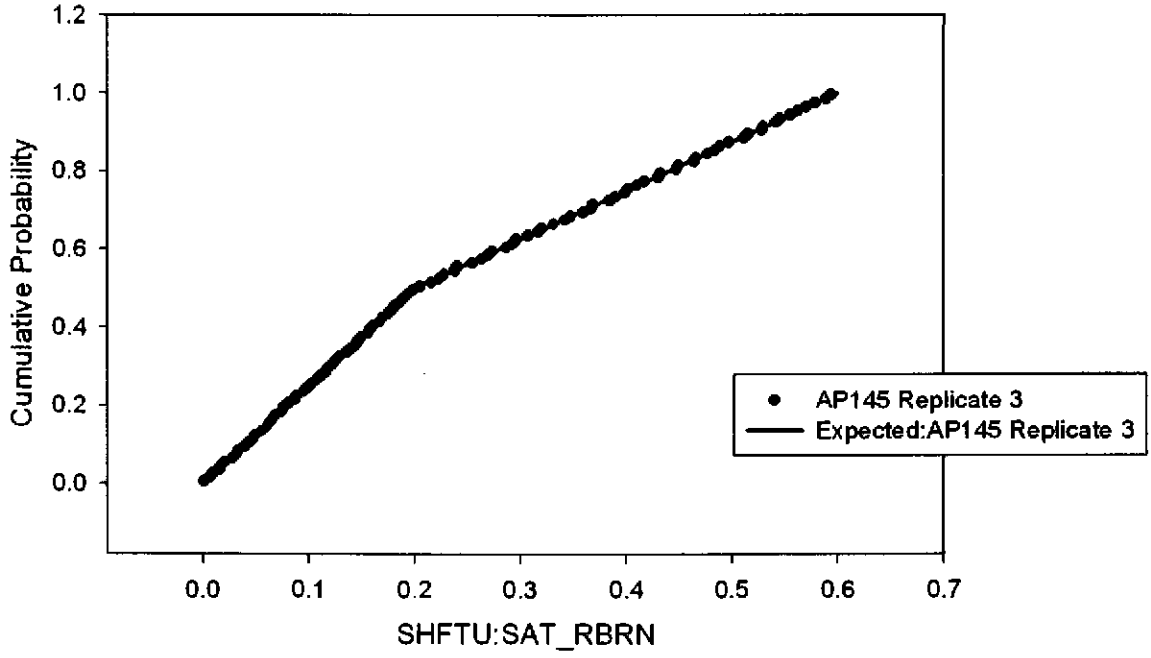

Figure 151. Observed and Expected CDFs for SHFTU:SAT_RBRN (User Continuous Distribution) Rep. 3.

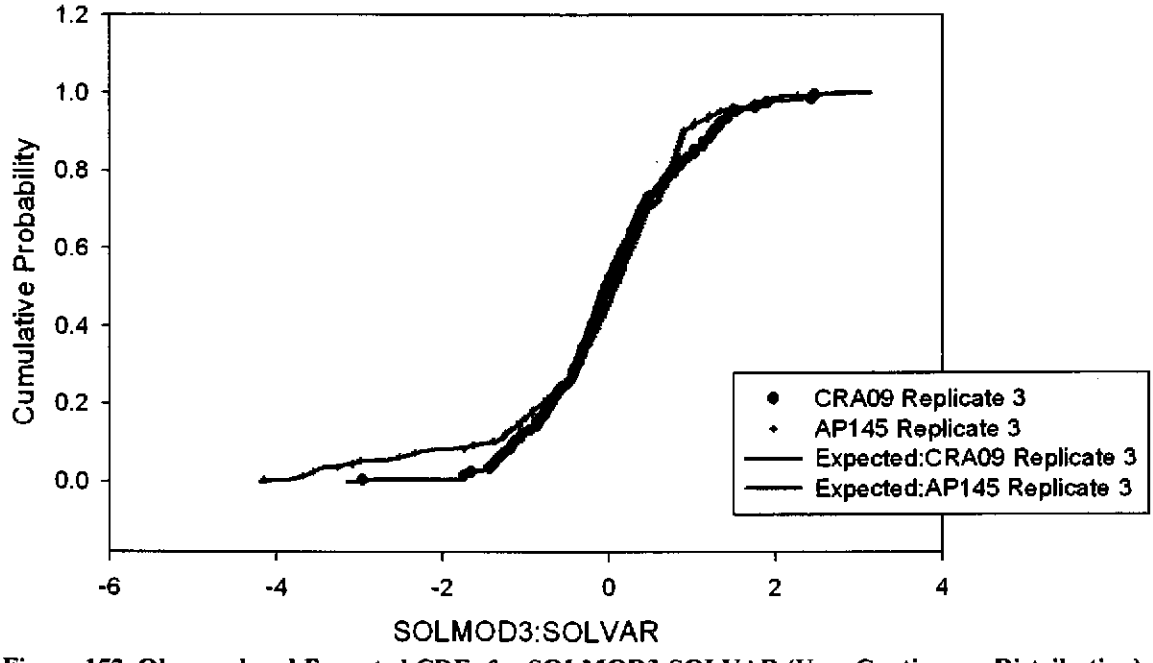

Figure 152. Observed and Expected CDFs for SOLMOD3:SOLVAR (User Continuous Distribution) Rep. 3.

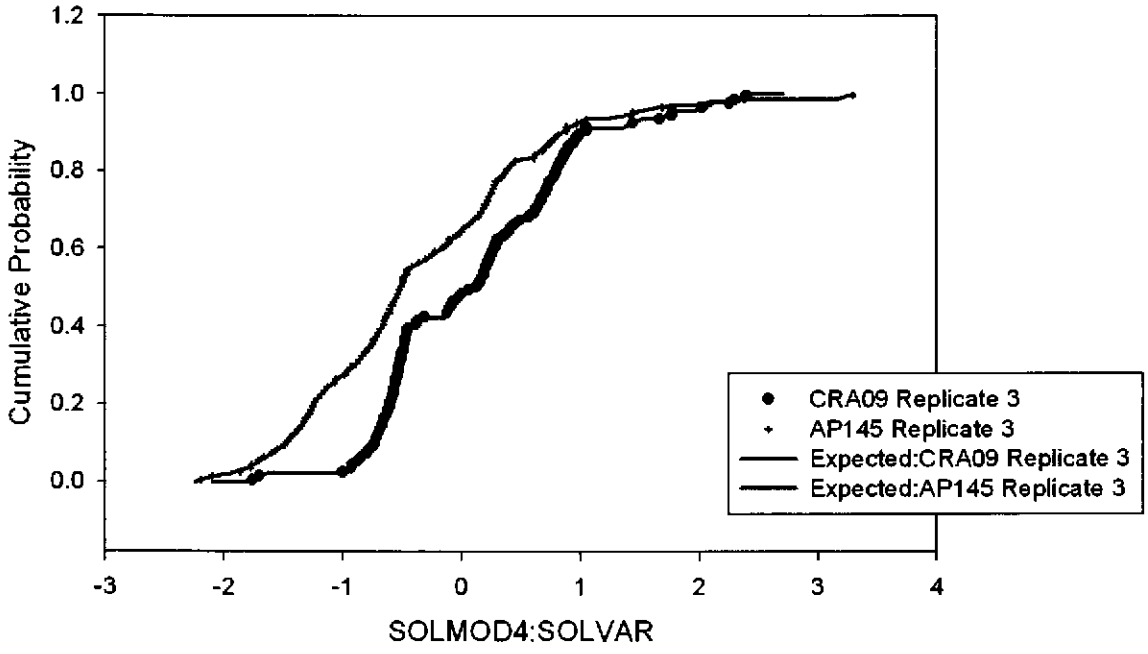

Figure 153. Observed and Expected CDFs for SOLMOD4:SOLVAR (User Continuous Distribution) Rep. 3.

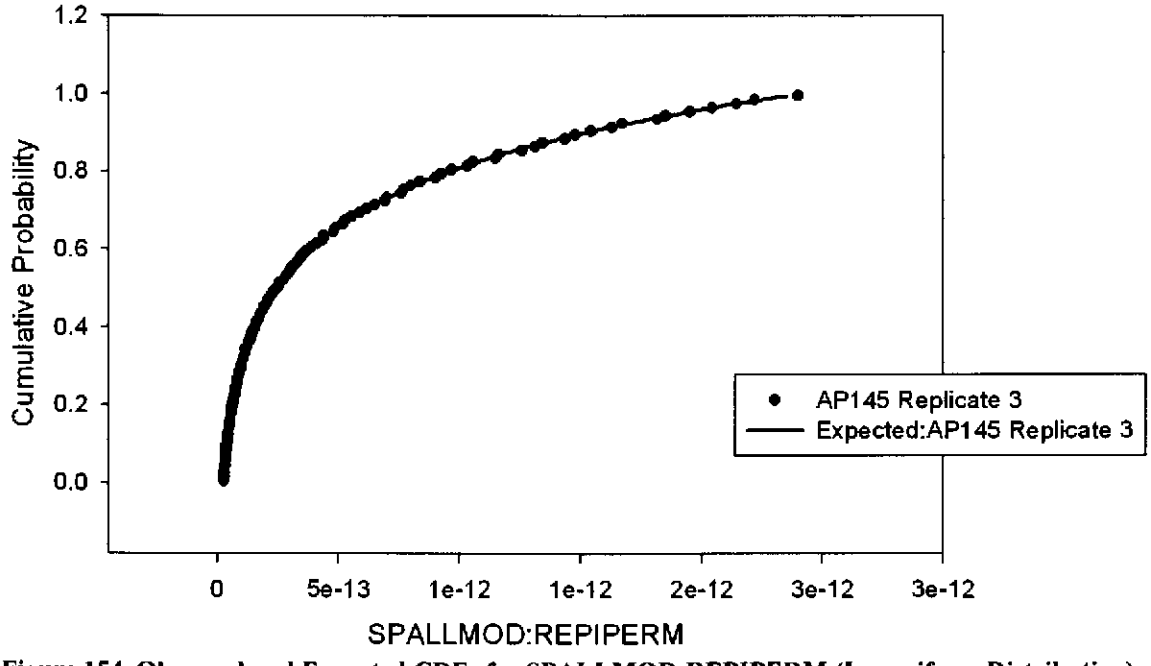

Figure 154. Observed and Expected CDFs for SPALLMOD:REPIPERM (Loguniform Distribution) Rep. 3.

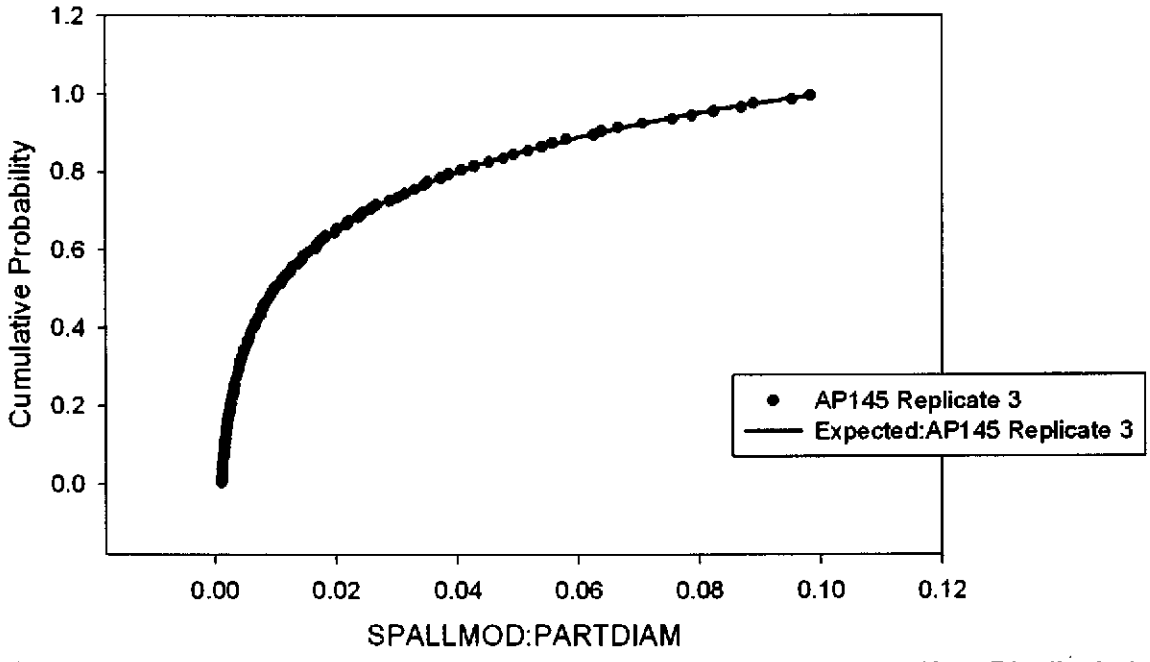

Figure 155. Observed and Expected CDFs for SPALLMOD:PARTDIAM (Loguniform Distribution) Rep. 3.

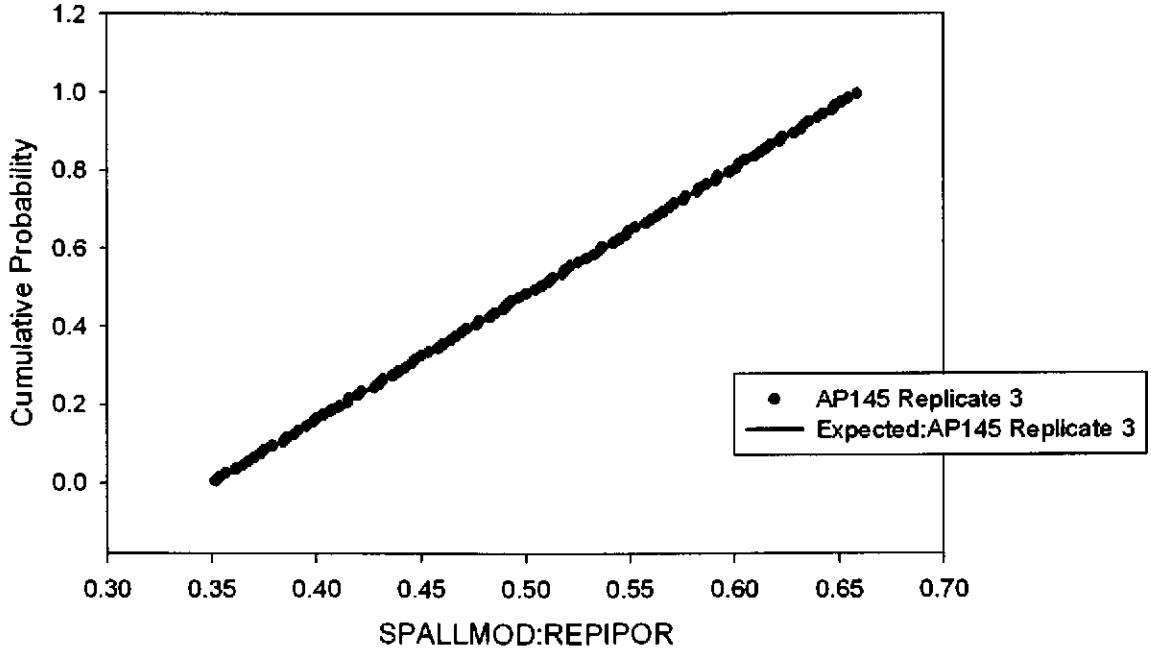

Figure 156. Observed and Expected CDFs for SPALLMOD:REPIPOR (Uniform Distribution) Rep. 3.

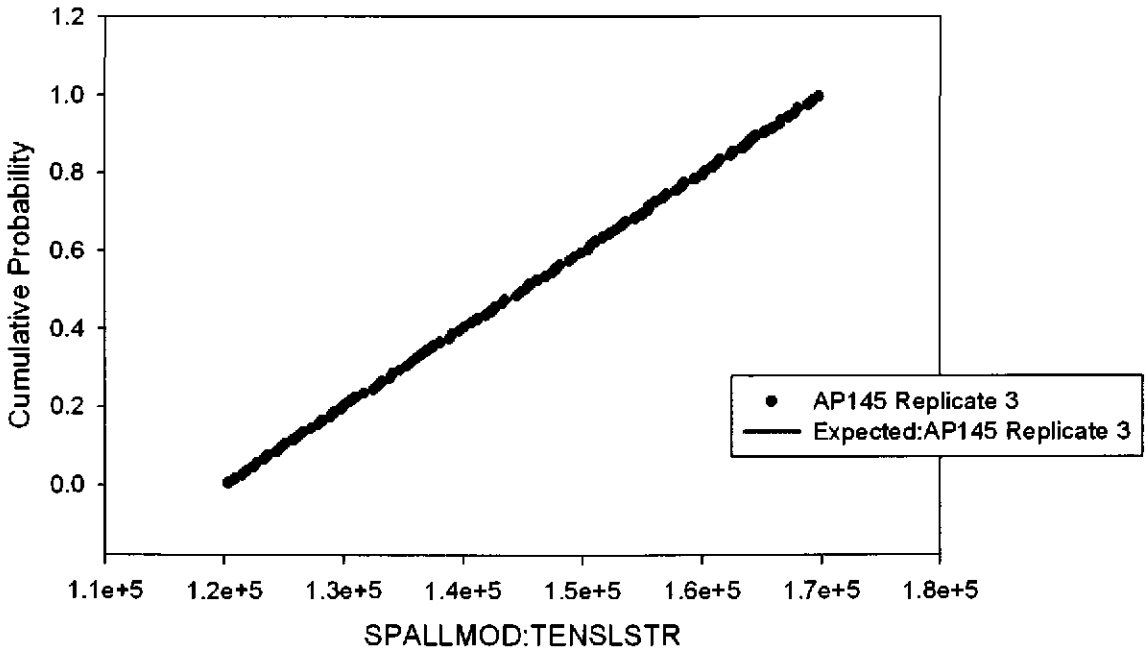

Figure 157. Observed and Expected CDFs for SPALLMOD:TENSLSTR (Uniform Distribution) Rep. 3.

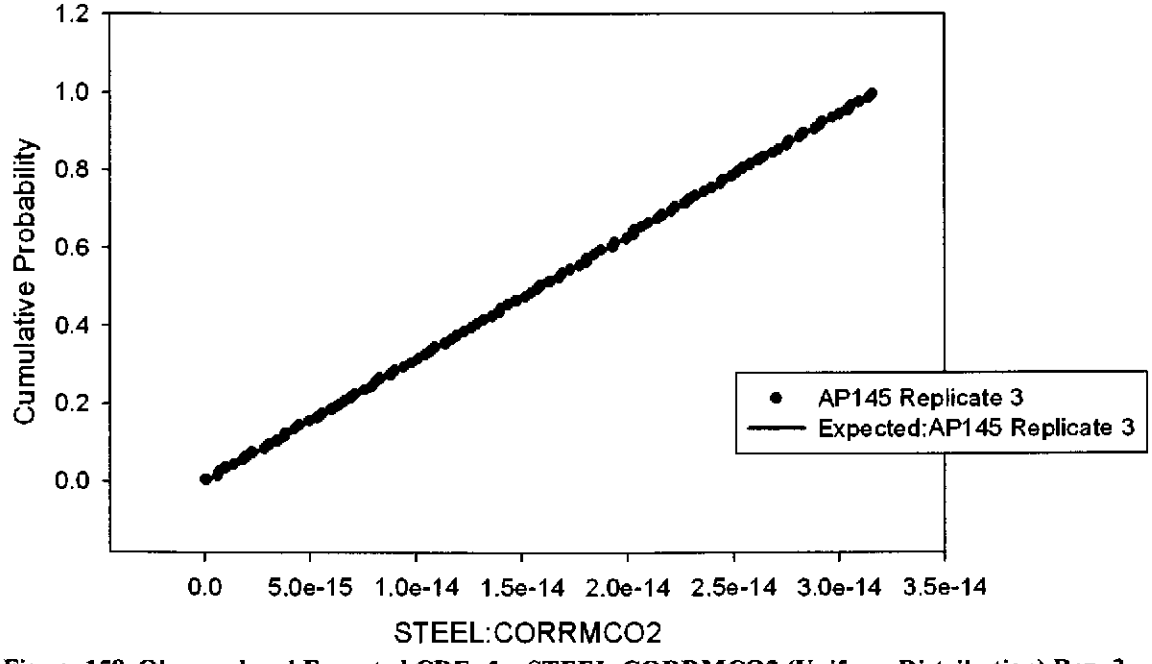

Figure 158. Observed and Expected CDFs for STEEL:CORRMCO2 (Uniform Distribution) Rep. 3.

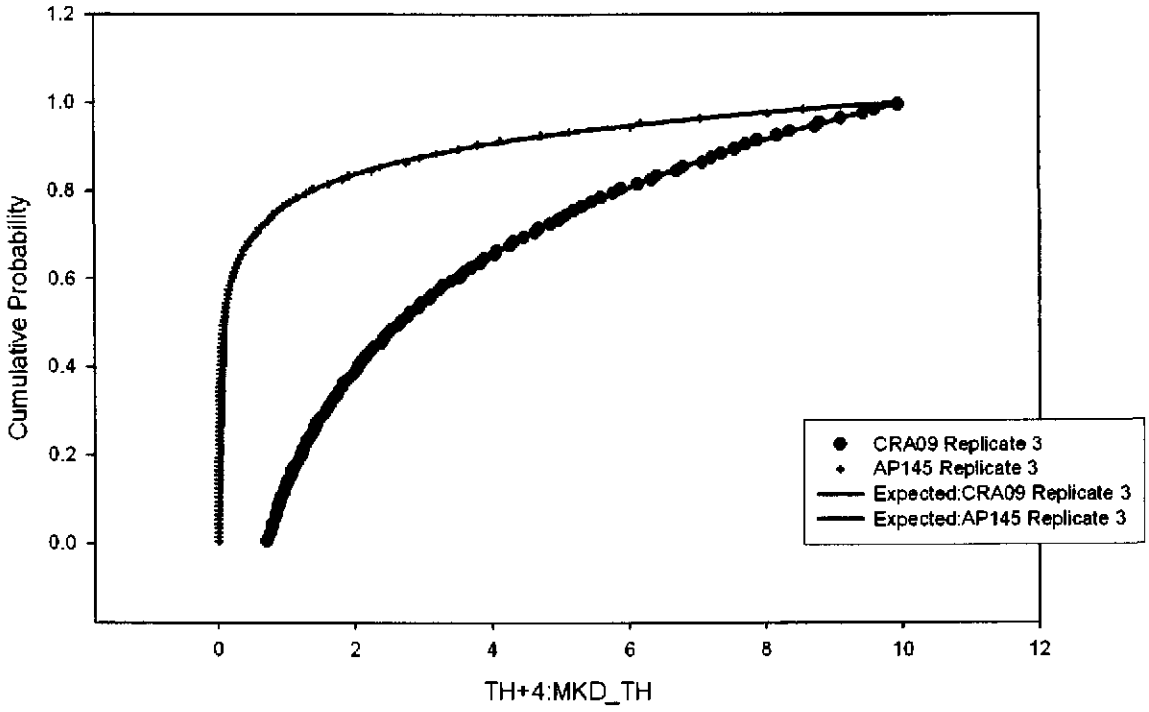

Figure 159. Observed and Expected CDFs for TH+4:MKD_TH (Loguniform Distribution) Rep. 3.

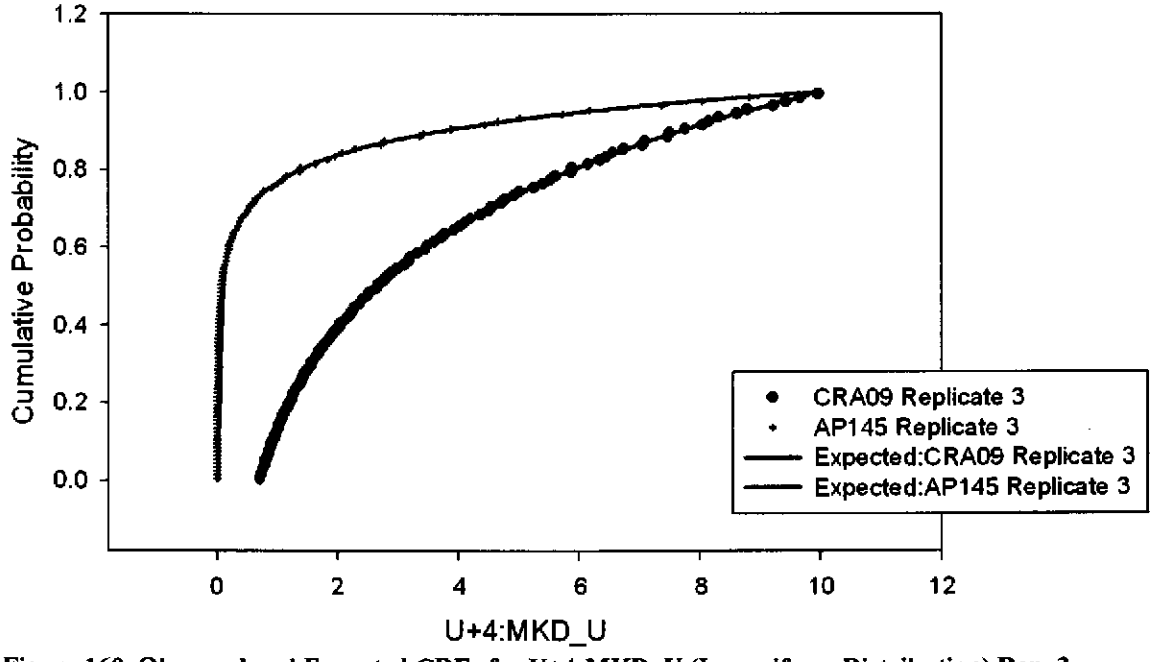

Figure 160. Observed and Expected CDFs for U+4:MKD_U (Loguniform Distribution) Rep. 3.

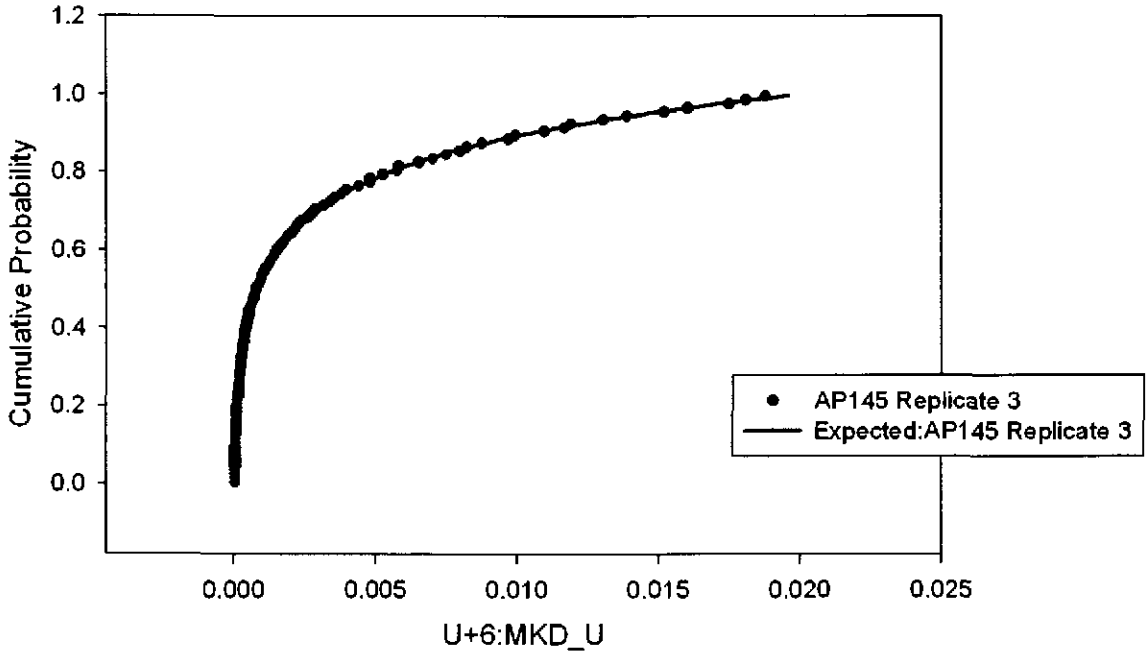

Figure 161. Observed and Expected CDFs for U+6:MKD_U (Loguniform Distribution) Rep. 3.

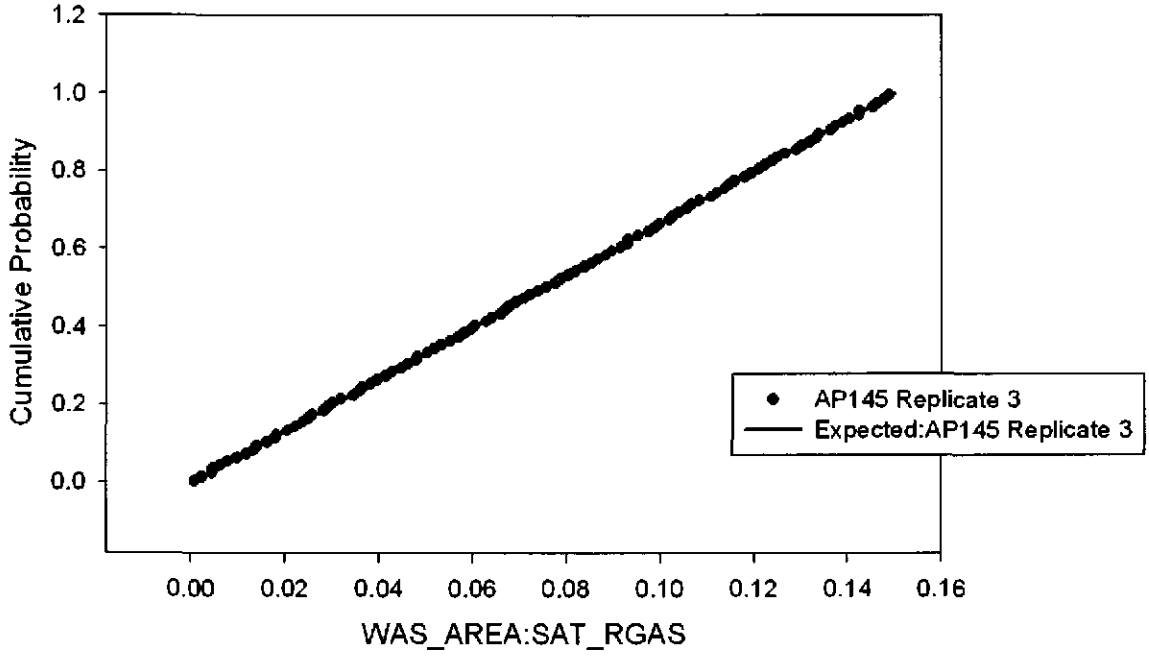

Figure 162. Observed and Expected CDFs for WAS_AREA:SAT_RGAS (Uniform Distribution) Rep. 3.

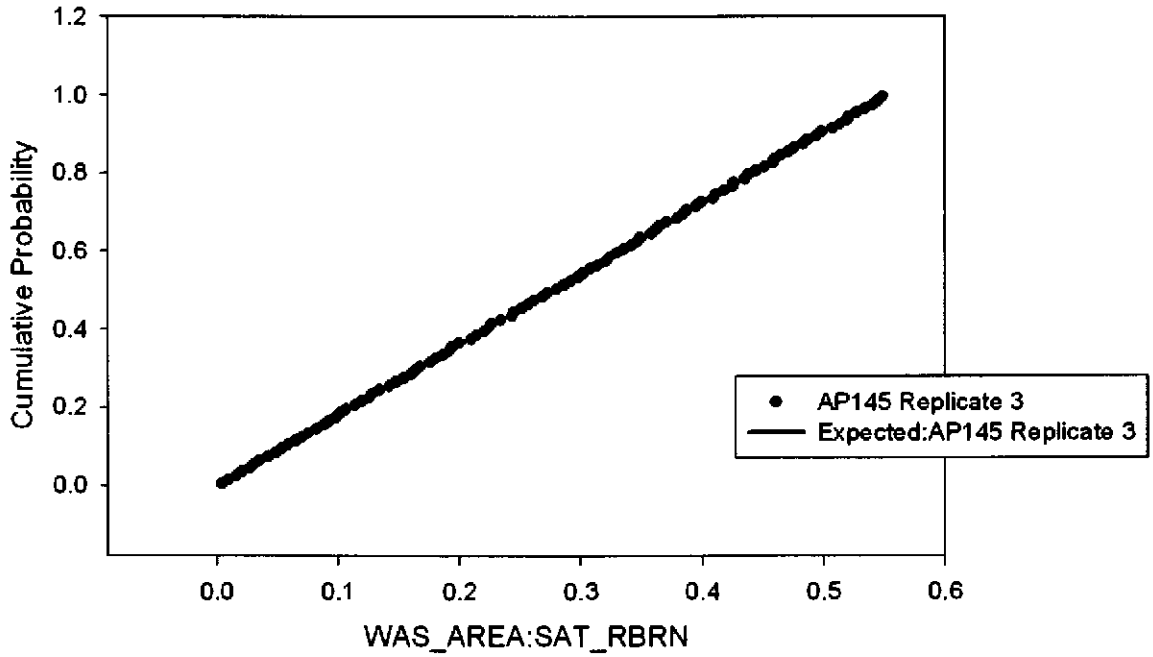

Figure 163. Observed and Expected CDFs for WAS_AREA:SAT_RBRN (Uniform Distribution) Rep. 3.

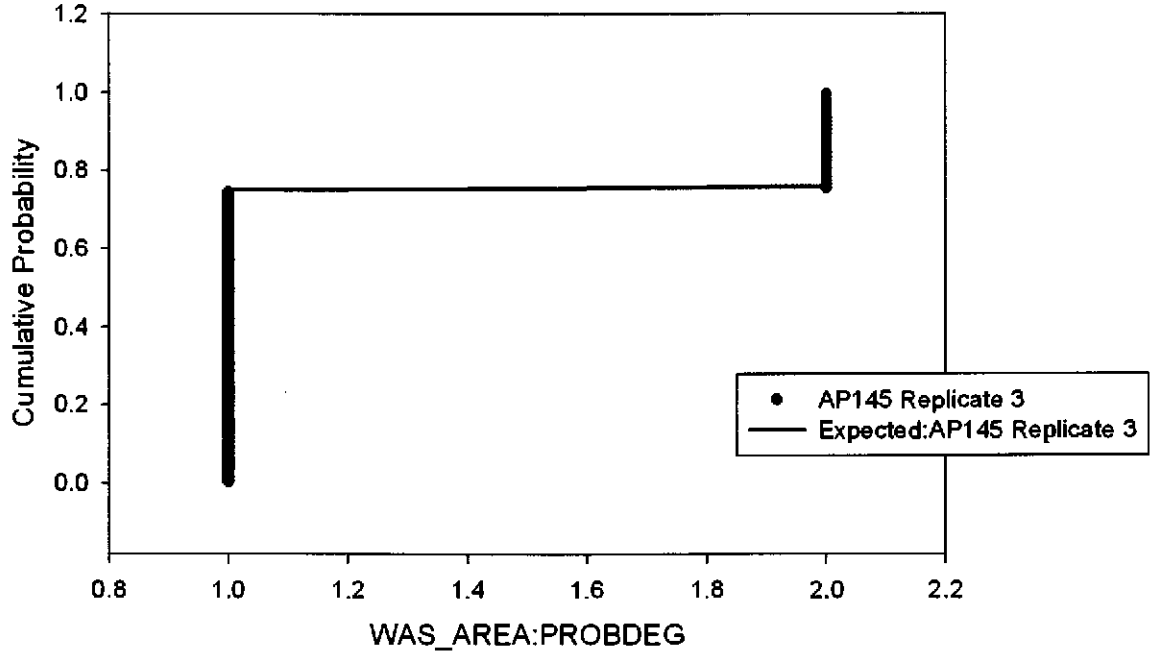

Figure 164. Observed and Expected CDFs for WAS_AREA:PROBDEG (User Discrete (Delta) Distribution) Rep. 3.

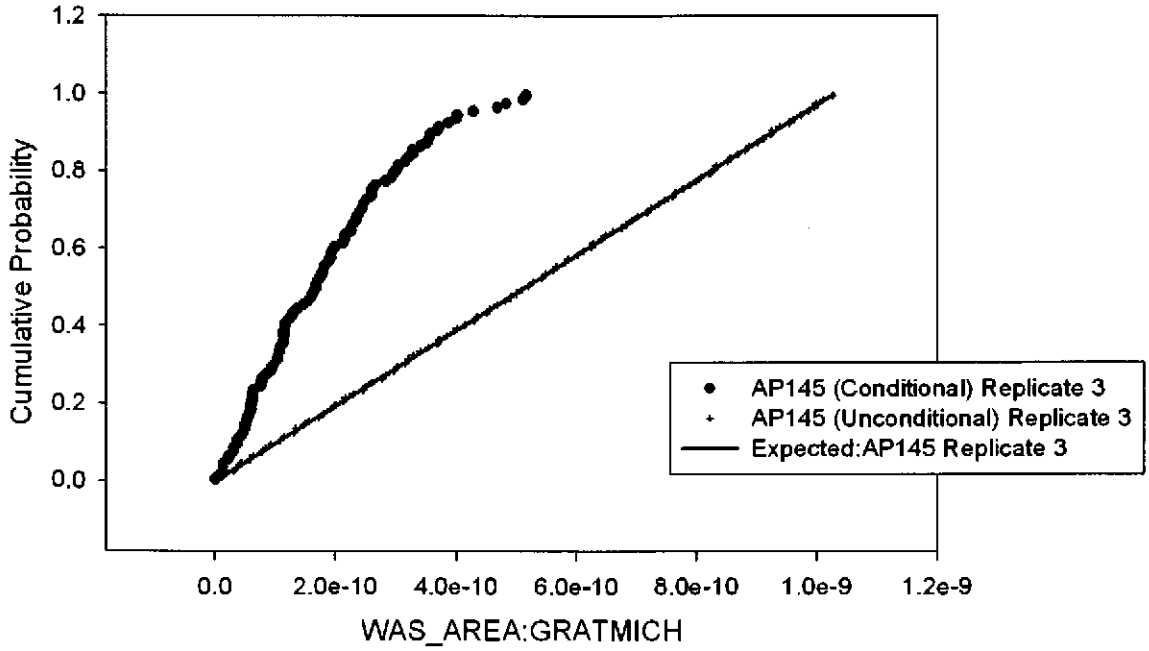

Figure 165. Observed and Expected CDFs for WAS_AREA:GRATMICH (Uniform Distribution) Rep. 3.

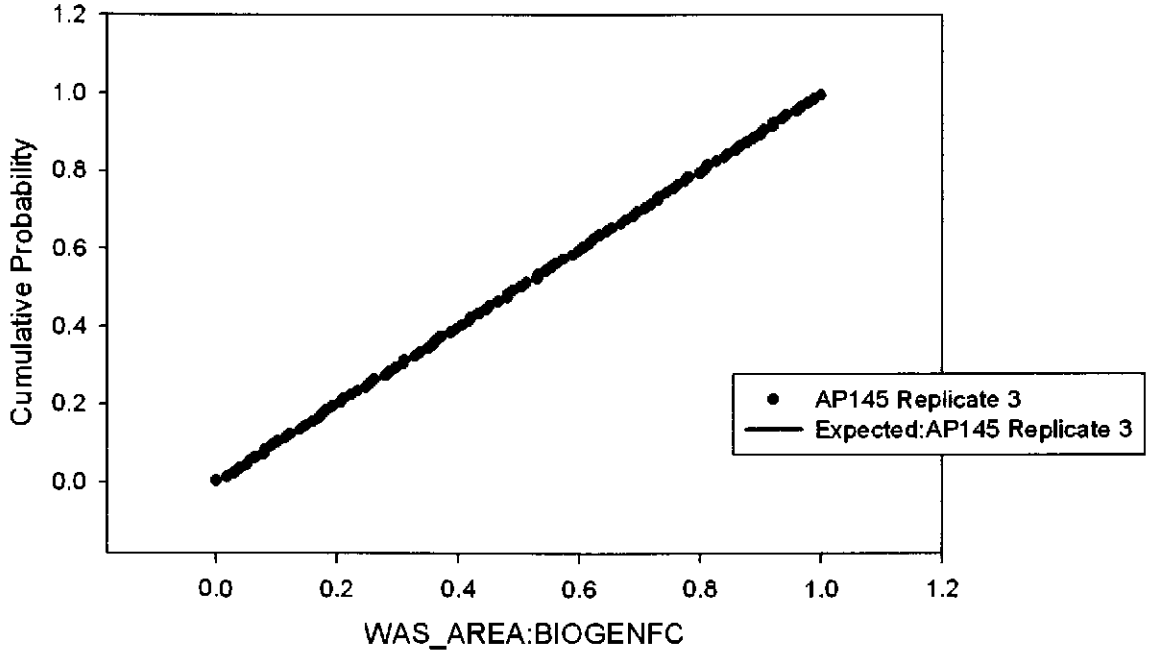

Figure 166. Observed and Expected CDFs for WAS_AREA:BIOGENFC (Uniform Distribution) Rep. 3.

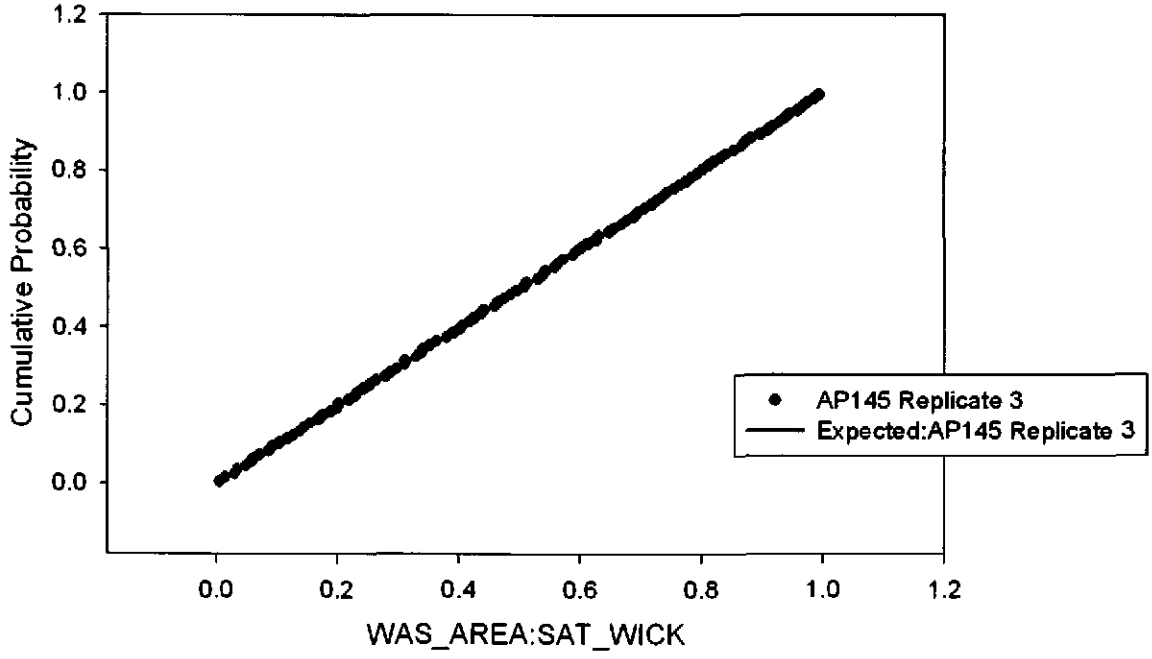

Figure 167. Observed and Expected CDFs for WAS_AREA:SAT_WICK (Uniform Distribution) Rep. 3.

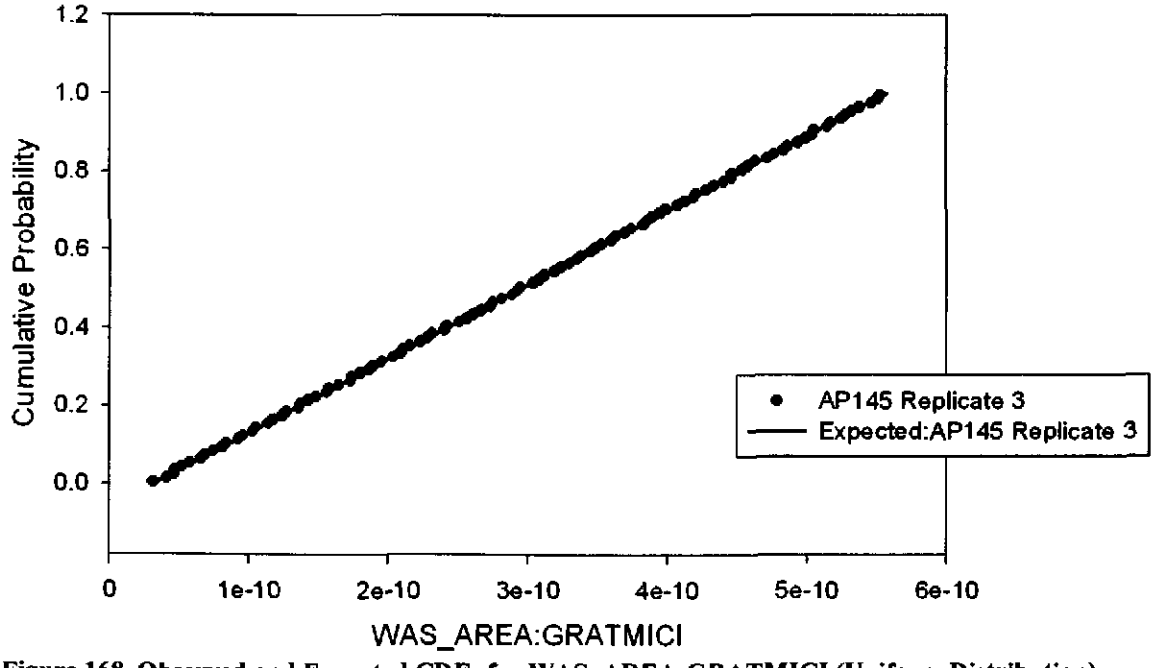

Figure 168. Observed and Expected CDFs for WAS_AREA:GRATMICI (Uniform Distribution) Rep. 3.

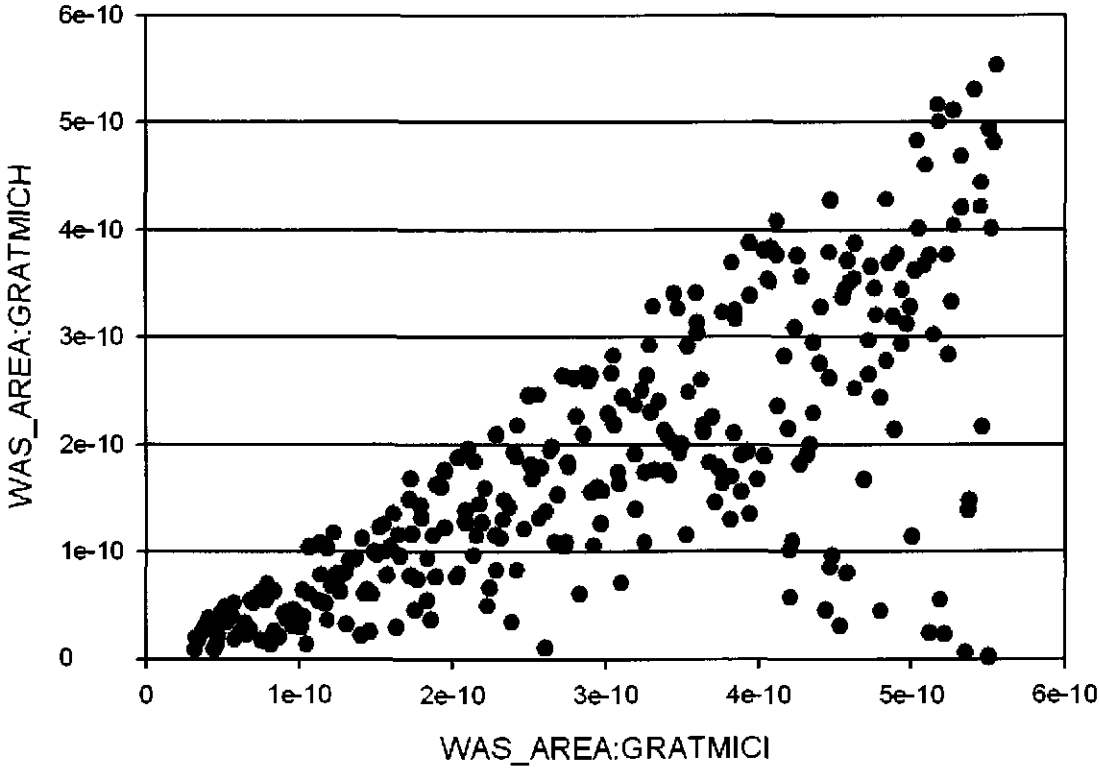

Figure 169. The conditional relationship introduced between WAS_AREA:GRATMICI and WAS_AREA:GRATMICH also produces a correlation between the variables.

Appendix I. Input file to PRELHS for Replicate 1

```
! TITLE:          PABC-2009 PRELHS (LHS1) Input File
! ANALYSIS PLAN: AP-145
! ANALYST:        Tom Kirchner
! CREATED:        June  2009
!
!  LHSCALC = PABC09 REALIZATION 1
!=============================================================================
===
!
!  DESCRIPTION:
!
!  WIPP 2009 Performance Assessment Baseline Calculation,
!  aka  (AP145)
!
!  This input file to PRELHS is used to generate, as an output file, an
LHS
!  input file containing all distribution information and execution
options
!  required to create a sample for Replicate R1 for the WIPP 2009 PABC
!
!  Changes from CRA-2009 analyses: None but changes to the header
!========= No Comments Allowed between *ECHOLHS and *ENDECHO
===============
!
*ECHOLHS
TITLE PABC09, AP145, Replicate R1 Input File for the LHS Code
NOBS            100
RANDOM SEED     582592385
CORRELATION MATRIX
    2
    53  54 -0.99
    61  62 -0.75
OUTPUT CORR HIST DATA
*ENDECHO
!
!== PROPERTIES TO BE RETRIEVED FROM WIPP PA CALCULATION DATABASE ==
!
*RETRIEVE
!1    CCDFGF
      MATERIALS,  GLOBAL
      PROPERTIES, PBRINE
!2
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!3
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!4    CUTTINGS_S
      MATERIALS,  BOREHOLE
      PROPERTIES, DOMEGA
!5    CUTTINGS_S
      MATERIALS,  BOREHOLE
      PROPERTIES, TAUFAIL
!6
```

```
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!7
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!8    DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, REPIPERM
!9    DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, TENSLSTR
!10   DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, PARTDIAM
!11   DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, REPIPOR
!12
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!13
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!14
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!15   PANEL
        MATERIALS,      SOLMOD3
        PROPERTIES,     SOLVAR
!16   PANEL
        MATERIALS,      SOLMOD4
        PROPERTIES,     SOLVAR
!17   PANEL
      MATERIALS,  PHUMOX3
      PROPERTIES, PHUMCIM
!18   PANEL/SECOTP2D
      MATERIALS,  GLOBAL
      PROPERTIES, OXSTAT
!19
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!20
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!21
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!22
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!23   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, MINP_FAC
!24   SECOTP2D
      MATERIALS,  GLOBAL
      PROPERTIES, TRANSIDX
!25   SECOTP2D
```

```
      MATERIALS,  GLOBAL
      PROPERTIES, CLIMTIDX
!26   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, HMBLKLT
!27   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, APOROS
!28   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, DPOROS
!29   SECOTP2D
      MATERIALS,  U+6
      PROPERTIES, MKD_U
!30   SECOTP2D
      MATERIALS,  U+4
      PROPERTIES, MKD_U
!31   SECOTP2D
      MATERIALS,  PU+3
      PROPERTIES, MKD_PU
!32   SECOTP2D
      MATERIALS,  PU+4
      PROPERTIES, MKD_PU
!33   SECOTP2D
      MATERIALS,  TH+4
      PROPERTIES, MKD_TH
!34   SECOTP2D
      MATERIALS,  AM+3
      PROPERTIES, MKD_AM
!35
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!36
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!37
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!38
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!39   BRAGFLO
      MATERIALS,  STEEL
      PROPERTIES, CORRMCO2
!40   BRAGFLO/PANEL
      MATERIALS,  WAS_AREA
      PROPERTIES, PROBDEG
!41   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, GRATMICI
!42   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, GRATMICH
!43   BRAGFLO
      MATERIALS,  CELLULS
      PROPERTIES, FBETA
!44   BRAGFLO
```

```
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_RGAS
!45   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_RBRN
!46   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_WICK
!47   BRAGFLO
      MATERIALS,  DRZ_PCS
      PROPERTIES, PRMX_LOG
!48   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, PRMX_LOG
!49   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, SAT_RGAS
!50   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, SAT_RBRN
!51   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, PORE_DIS
!52   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, POROSITY
!53   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, PRMX_LOG
!54   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, COMP_RCK
!55   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, PRMX_LOG
!56   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, RELP_MOD
!57   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, SAT_RBRN
!58   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, PORE_DIS
!59   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, PRESSURE
!60   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, PRESSURE
!61   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, PRMX_LOG
!62   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, COMP_RCK
!63   BRAGFLO
```

```
      MATERIALS,  BH_SAND
      PROPERTIES, PRMX_LOG
!64   BRAGFLO
      MATERIALS,  DRZ_1
      PROPERTIES, PRMX_LOG
!65   BRAGFLO
      MATERIALS,  CONC_PLG
      PROPERTIES, PRMX_LOG
!66   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, SAT_RBRN
!67   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, SAT_RGAS
!68   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, PRMX_LOG
!69   BRAGFLO
      MATERIALS,  SHFTL_T1
      PROPERTIES, PRMX_LOG
!70   BRAGFLO
      MATERIALS,  SHFTL_T2
      PROPERTIES, PRMX_LOG
!71   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, BIOGENFC
!72
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!73
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!74
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!75
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!
!=============================================================================
===
!
*END
```

Appendix II. Input file to PRELHS for Replicate 2

```
! TITLE:          PABC-2009 PRELHS (LHS1) Input File
! ANALYSIS PLAN: AP-145
! ANALYST:        Tom Kirchner
! CREATED:        June  2009
!
!  LHSCALC = PABC09 REALIZATION 2
!=============================================================================
===
!
!  DESCRIPTION:
!
!  WIPP 2009 Performance Assessment Baseline Calculation,
!  aka  (AP145)
!
!  This input file to PRELHS is used to generate, as an output file, an
LHS
!  input file containing all distribution information and execution
options
!  required to create a sample for Replicate R2 for the WIPP 2009 PABC
!
!  Changes from CRA-2009 analyses: None but changes to the header
!========= No Comments Allowed between *ECHOLHS and *ENDECHO
===============
!
*ECHOLHS
TITLE PABC09, AP145, Replicate R2 Input File for the LHS Code
NOBS            100
RANDOM SEED     168866235
CORRELATION MATRIX
    2
    53  54 -0.99
    61  62 -0.75
OUTPUT CORR HIST DATA
*ENDECHO
!
!== PROPERTIES TO BE RETRIEVED FROM WIPP PA CALCULATION DATABASE ==
!
*RETRIEVE
!1    CCDFGF
      MATERIALS,  GLOBAL
      PROPERTIES, PBRINE
!2
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!3
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!4    CUTTINGS_S
      MATERIALS,  BOREHOLE
      PROPERTIES, DOMEGA
!5    CUTTINGS_S
      MATERIALS,  BOREHOLE
      PROPERTIES, TAUFAIL
!6
```

```
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!7
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!8    DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, REPIPERM
!9    DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, TENSLSTR
!10   DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, PARTDIAM
!11   DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, REPIPOR
!12
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!13
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!14
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!15   PANEL
        MATERIALS,       SOLMOD3
        PROPERTIES,      SOLVAR
!16   PANEL
        MATERIALS,       SOLMOD4
        PROPERTIES,      SOLVAR
!17   PANEL
      MATERIALS,  PHUMOX3
      PROPERTIES, PHUMCIM
!18   PANEL/SECOTP2D
      MATERIALS,  GLOBAL
      PROPERTIES, OXSTAT
!19
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!20
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!21
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!22
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!23   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, MINP_FAC
!24   SECOTP2D
      MATERIALS,  GLOBAL
      PROPERTIES, TRANSIDX
!25   SECOTP2D
```

```
      MATERIALS,  GLOBAL
      PROPERTIES, CLIMTIDX
!26   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, HMBLKLT
!27   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, APOROS
!28   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, DPOROS
!29   SECOTP2D
      MATERIALS,  U+6
      PROPERTIES, MKD_U
!30   SECOTP2D
      MATERIALS,  U+4
      PROPERTIES, MKD_U
!31   SECOTP2D
      MATERIALS,  PU+3
      PROPERTIES, MKD_PU
!32   SECOTP2D
      MATERIALS,  PU+4
      PROPERTIES, MKD_PU
!33   SECOTP2D
      MATERIALS,  TH+4
      PROPERTIES, MKD_TH
!34   SECOTP2D
      MATERIALS,  AM+3
      PROPERTIES, MKD_AM
!35
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!36
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!37
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!38
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!39   BRAGFLO
      MATERIALS,  STEEL
      PROPERTIES, CORRMCO2
!40   BRAGFLO/PANEL
      MATERIALS,  WAS_AREA
      PROPERTIES, PROBDEG
!41   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, GRATMICI
!42   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, GRATMICH
!43   BRAGFLO
      MATERIALS,  CELLULS
      PROPERTIES, FBETA
!44   BRAGFLO
```

```
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_RGAS
!45   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_RBRN
!46   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_WICK
!47   BRAGFLO
      MATERIALS,  DRZ_PCS
      PROPERTIES, PRMX_LOG
!48   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, PRMX_LOG
!49   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, SAT_RGAS
!50   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, SAT_RBRN
!51   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, PORE_DIS
!52   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, POROSITY
!53   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, PRMX_LOG
!54   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, COMP_RCK
!55   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, PRMX_LOG
!56   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, RELP_MOD
!57   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, SAT_RBRN
!58   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, PORE_DIS
!59   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, PRESSURE
!60   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, PRESSURE
!61   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, PRMX_LOG
!62   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, COMP_RCK
!63   BRAGFLO
```

```
      MATERIALS,  BH_SAND
      PROPERTIES, PRMX_LOG
!64   BRAGFLO
      MATERIALS,  DRZ_1
      PROPERTIES, PRMX_LOG
!65   BRAGFLO
      MATERIALS,  CONC_PLG
      PROPERTIES, PRMX_LOG
!66   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, SAT_RBRN
!67   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, SAT_RGAS
!68   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, PRMX_LOG
!69   BRAGFLO
      MATERIALS,  SHFTL_T1
      PROPERTIES, PRMX_LOG
!70   BRAGFLO
      MATERIALS,  SHFTL_T2
      PROPERTIES, PRMX_LOG
!71   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, BIOGENFC
!72
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!73
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!74
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!75
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!
!=============================================================================
===
!
*END
```

Appendix III. Input file to PRELHS for Replicate 3

```
! TITLE:          PABC-2009 PRELHS (LHS1) Input File
! ANALYSIS PLAN: AP-145
! ANALYST:        Tom Kirchner
! CREATED:        June  2009
!
!  LHSCALC = PABC09 REALIZATION 3
!=============================================================================
===
!
!  DESCRIPTION:
!
!  WIPP 2009 Performance Assessment Baseline Calculation,
!  aka  (AP145)
!
!  This input file to PRELHS is used to generate, as an output file, an
LHS
!  input file containing all distribution information and execution
options
!  required to create a sample for Replicate R3 for the WIPP 2009 PABC
!
!  Changes from CRA-2009 analyses: None but changes to the header
!========= No Comments Allowed between *ECHOLHS and *ENDECHO
================
!
*ECHOLHS
TITLE PABC09, AP145, Replicate R3 Input File for the LHS Code
NOBS            100
RANDOM SEED     292058223
CORRELATION MATRIX
    2
    53   54 -0.99
    61   62 -0.75
OUTPUT CORR HIST DATA
*ENDECHO
!
!== PROPERTIES TO BE RETRIEVED FROM WIPP PA CALCULATION DATABASE ==
!
*RETRIEVE
!1    CCDFGF
      MATERIALS,  GLOBAL
      PROPERTIES, PBRINE
!2
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!3
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!4    CUTTINGS_S
      MATERIALS,  BOREHOLE
      PROPERTIES, DOMEGA
!5    CUTTINGS_S
      MATERIALS,  BOREHOLE
      PROPERTIES, TAUFAIL
!6
```

```
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!7
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!8    DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, REPIPERM
!9    DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, TENSLSTR
!10   DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, PARTDIAM
!11   DRSPALL
      MATERIALS,  SPALLMOD
      PROPERTIES, REPIPOR
!12
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!13
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!14
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!15   PANEL
        MATERIALS,       SOLMOD3
        PROPERTIES,      SOLVAR
!16   PANEL
        MATERIALS,       SOLMOD4
        PROPERTIES,      SOLVAR
!17   PANEL
      MATERIALS,  PHUMOX3
      PROPERTIES, PHUMCIM
!18   PANEL/SECOTP2D
      MATERIALS,  GLOBAL
      PROPERTIES, OXSTAT
!19
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!20
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!21
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!22
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!23   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, MINP_FAC
!24   SECOTP2D
      MATERIALS,  GLOBAL
      PROPERTIES, TRANSIDX
!25   SECOTP2D
```

```
      MATERIALS,  GLOBAL
      PROPERTIES, CLIMTIDX
!26   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, HMBLKLT
!27   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, APOROS
!28   SECOTP2D
      MATERIALS,  CULEBRA
      PROPERTIES, DPOROS
!29   SECOTP2D
      MATERIALS,  U+6
      PROPERTIES, MKD_U
!30   SECOTP2D
      MATERIALS,  U+4
      PROPERTIES, MKD_U
!31   SECOTP2D
      MATERIALS,  PU+3
      PROPERTIES, MKD_PU
!32   SECOTP2D
      MATERIALS,  PU+4
      PROPERTIES, MKD_PU
!33   SECOTP2D
      MATERIALS,  TH+4
      PROPERTIES, MKD_TH
!34   SECOTP2D
      MATERIALS,  AM+3
      PROPERTIES, MKD_AM
!35
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!36
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!37
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!38
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!39   BRAGFLO
      MATERIALS,  STEEL
      PROPERTIES, CORRMCO2
!40   BRAGFLO/PANEL
      MATERIALS,  WAS_AREA
      PROPERTIES, PROBDEG
!41   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, GRATMICI
!42   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, GRATMICH
!43   BRAGFLO
      MATERIALS,  CELLULS
      PROPERTIES, FBETA
!44   BRAGFLO
```

```
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_RGAS
!45   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_RBRN
!46   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, SAT_WICK
!47   BRAGFLO
      MATERIALS,  DRZ_PCS
      PROPERTIES, PRMX_LOG
!48   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, PRMX_LOG
!49   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, SAT_RGAS
!50   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, SAT_RBRN
!51   BRAGFLO
      MATERIALS,  CONC_PCS
      PROPERTIES, PORE_DIS
!52   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, POROSITY
!53   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, PRMX_LOG
!54   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, COMP_RCK
!55   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, PRMX_LOG
!56   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, RELP_MOD
!57   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, SAT_RBRN
!58   BRAGFLO
      MATERIALS,  S_MB139
      PROPERTIES, PORE_DIS
!59   BRAGFLO
      MATERIALS,  S_HALITE
      PROPERTIES, PRESSURE
!60   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, PRESSURE
!61   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, PRMX_LOG
!62   BRAGFLO
      MATERIALS,  CASTILER
      PROPERTIES, COMP_RCK
!63   BRAGFLO
```

```
      MATERIALS,  BH_SAND
      PROPERTIES, PRMX_LOG
!64   BRAGFLO
      MATERIALS,  DRZ_1
      PROPERTIES, PRMX_LOG
!65   BRAGFLO
      MATERIALS,  CONC_PLG
      PROPERTIES, PRMX_LOG
!66   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, SAT_RBRN
!67   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, SAT_RGAS
!68   BRAGFLO
      MATERIALS,  SHFTU
      PROPERTIES, PRMX_LOG
!69   BRAGFLO
      MATERIALS,  SHFTL_T1
      PROPERTIES, PRMX_LOG
!70   BRAGFLO
      MATERIALS,  SHFTL_T2
      PROPERTIES, PRMX_LOG
!71   BRAGFLO
      MATERIALS,  WAS_AREA
      PROPERTIES, BIOGENFC
!72
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!73
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!74
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!75
      MATERIALS,  REFCON
      PROPERTIES, LHSBLANK
!
!=============================================================================
===
!
*END
```

Appendix IV. PRELHS Output (Transfer) File for Replicate 1

```
TITLE SDB: PARAMETER_PROD     Calc: PABC09       Ver: 1.00     12/02/09
18:43:17
TITLE PABC09, AP145, Replicate R1 Input File for the LHS Code
NOBS            100
RANDOM SEED     582592385
UNIFORM                  GLOBAL    PBRINE
    1.00000E-02    6.00000E-01
UNIFORM                  REFCON    LHSBLANK
```

```
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)       BOREHOLE  DOMEGA
        10          SPECIFIED    CONTINUOUS
    4.20000E+00   0.15000
    6.30000E+00   0.50000
    8.40000E+00   0.15000
    1.05000E+01   0.10000
    1.26000E+01   0.05000
    1.47000E+01   0.02000
    1.68000E+01   0.01000
    1.88000E+01   0.01000
    2.09000E+01   0.01000
    2.30000E+01   0.00000
LOGUNIFORM              BOREHOLE  TAUFAIL
    5.00000E-02    7.70000E+01
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
LOGUNIFORM              SPALLMOD  REPIPERM
    2.40000E-14    2.40000E-12
UNIFORM                 SPALLMOD  TENSLSTR
    1.20000E+05    1.70000E+05
LOGUNIFORM              SPALLMOD  PARTDIAM
    1.00000E-03    1.00000E-01
UNIFORM                 SPALLMOD  REPIPOR
    3.50000E-01    6.60000E-01
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)       SOLMOD3   SOLVAR
        48          SPECIFIED    CONTINUOUS
   -4.20000E+00   0.00290
   -4.05000E+00   0.00000
   -3.90000E+00   0.00580
   -3.75000E+00   0.01150
   -3.60000E+00   0.01450
   -3.45000E+00   0.00290
   -3.30000E+00   0.00580
   -3.15000E+00   0.00860
   -3.00000E+00   0.00290
   -2.85000E+00   0.00000
   -2.70000E+00   0.00580
   -2.55000E+00   0.00870
   -2.40000E+00   0.00860
   -2.25000E+00   0.00580
   -2.10000E+00   0.00000
   -1.95000E+00   0.00290
   -1.80000E+00   0.00580
   -1.65000E+00   0.00580
   -1.50000E+00   0.00570
   -1.35000E+00   0.02610
```

```
   -1.20000E+00   0.02600
   -1.05000E+00   0.02890
   -9.00000E-01   0.02600
   -7.50000E-01   0.02890
   -6.00000E-01   0.03760
   -4.50000E-01   0.06070
   -3.00000E-01   0.05200
   -1.50000E-01   0.07220
    0.00000E+00   0.07810
    1.50000E-01   0.07800
    3.00000E-01   0.07800
    4.50000E-01   0.03470
    6.00000E-01   0.08380
    7.50000E-01   0.08960
    9.00000E-01   0.02030
    1.05000E+00   0.01440
    1.20000E+00   0.01450
    1.35000E+00   0.00860
    1.50000E+00   0.00290
    1.65000E+00   0.01160
    1.80000E+00   0.00860
    1.95000E+00   0.00580
    2.10000E+00   0.00000
    2.25000E+00   0.00290
    2.40000E+00   0.00290
    2.55000E+00   0.00290
    2.70000E+00   0.00000
    2.85000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)        SOLMOD4    SOLVAR
        38           SPECIFIED    CONTINUOUS
   -2.25000E+00   0.01430
   -2.10000E+00   0.00710
   -1.95000E+00   0.01430
   -1.80000E+00   0.02860
   -1.65000E+00   0.02860
   -1.50000E+00   0.05000
   -1.35000E+00   0.07850
   -1.20000E+00   0.04290
   -1.05000E+00   0.03570
   -9.00000E-01   0.05710
   -7.50000E-01   0.08580
   -6.00000E-01   0.10710
   -4.50000E-01   0.02140
   -3.00000E-01   0.03570
   -1.50000E-01   0.04290
    0.00000E+00   0.03570
    1.50000E-01   0.09290
    3.00000E-01   0.05000
    4.50000E-01   0.00710
    6.00000E-01   0.04290
    7.50000E-01   0.03570
    9.00000E-01   0.02140
    1.05000E+00   0.00000
    1.20000E+00   0.00720
    1.35000E+00   0.01420
    1.50000E+00   0.00720
    1.65000E+00   0.00710
```

```
    1.80000E+00   0.00000
    1.95000E+00   0.00720
    2.10000E+00   0.00000
    2.25000E+00   0.00710
    2.40000E+00   0.00000
    2.55000E+00   0.00000
    2.70000E+00   0.00000
    2.85000E+00   0.00000
    3.00000E+00   0.00000
    3.15000E+00   0.01430
    3.30000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)       PHUMOX3   PHUMCIM
         3          SPECIFIED    CONTINUOUS
    6.50000E-02   0.50000
    1.37000E+00   0.50000
    1.60000E+00   0.00000
UNIFORM                GLOBAL    OXSTAT
    0.00000E+00    1.00000E+00
UNIFORM                REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                CULEBRA   MINP_FAC
    1.00000E+00    1.00000E+03
UNIFORM                GLOBAL    TRANSIDX
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)       GLOBAL    CLIMTIDX
         4          SPECIFIED    CONTINUOUS
    1.00000E+00   0.75000
    1.25000E+00   0.00000
    1.50000E+00   0.25000
    2.25000E+00   0.00000
UNIFORM                CULEBRA   HMBLKLT
    5.00000E-02    5.00000E-01
LOGUNIFORM             CULEBRA   APOROS
    1.00000E-04    1.00000E-02
USER DISTRIBUTION  (CUMULATIVE)       CULEBRA   DPOROS
         7          SPECIFIED    CONTINUOUS
    1.00000E-01   0.10000
    1.10000E-01   0.15000
    1.20000E-01   0.25000
    1.60000E-01   0.25000
    1.80000E-01   0.15000
    1.90000E-01   0.10000
    2.50000E-01   0.00000
LOGUNIFORM             U+6       MKD_U
    3.00000E-05    2.00000E-02
LOGUNIFORM             U+4       MKD_U
    5.00000E-04    1.00000E+01
LOGUNIFORM             PU+3      MKD_PU
    5.00000E-03    4.00000E-01
LOGUNIFORM             PU+4      MKD_PU
    5.00000E-04    1.00000E+01
```

```
LOGUNIFORM              TH+4      MKD_TH
    5.00000E-04    1.00000E+01
LOGUNIFORM              AM+3      MKD_AM
    5.00000E-03    4.00000E-01
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 STEEL     CORRMCO2
    0.00000E+00    3.17000E-14
USER DISTRIBUTION  (DELTA)           WAS_AREA  PROBDEG
         2          SPECIFIED    DISCRETE
    1.00000E+00   0.75000
    2.00000E+00   0.25000
UNIFORM                 WAS_AREA  GRATMICI
    3.08269E-11    5.56921E-10
UNIFORM                 WAS_AREA  GRATMICH
    0.00000E+00    1.02717E-09
UNIFORM                 CELLULS   FBETA
    0.00000E+00    1.00000E+00
UNIFORM                 WAS_AREA  SAT_RGAS
    0.00000E+00    1.50000E-01
UNIFORM                 WAS_AREA  SAT_RBRN
    0.00000E+00    5.52000E-01
UNIFORM                 WAS_AREA  SAT_WICK
    0.00000E+00    1.00000E+00
TRIANGULAR              DRZ_PCS   PRMX_LOG
   -2.06990E+01   -1.87496E+01   -1.70000E+01
TRIANGULAR              CONC_PCS  PRMX_LOG
   -2.06990E+01   -1.87496E+01   -1.70000E+01
UNIFORM                 CONC_PCS  SAT_RGAS
    0.00000E+00    4.00000E-01
USER DISTRIBUTION  (CUMULATIVE)      CONC_PCS  SAT_RBRN
         3          SPECIFIED    CONTINUOUS
    0.00000E+00   0.50000
    2.00000E-01   0.50000
    6.00000E-01   0.00000
USER DISTRIBUTION  (CUMULATIVE)      CONC_PCS  PORE_DIS
         3          SPECIFIED    CONTINUOUS
    1.10000E-01   0.50000
    9.40000E-01   0.50000
    8.10000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)      S_HALITE  POROSITY
         3          SPECIFIED    CONTINUOUS
    1.00000E-03   0.50000
    1.00000E-02   0.50000
    5.19000E-02   0.00000
UNIFORM                 S_HALITE  PRMX_LOG
   -2.40000E+01   -2.10000E+01
UNIFORM                 S_HALITE  COMP_RCK
    2.94000E-12    1.92000E-10
STUDENT                 S_MB139   PRMX_LOG
         6
```

```
 -2.10000E+01 -1.92000E+01 -1.91000E+01 -1.88000E+01 -1.81000E+01 -
1.71000E+01
USER DISTRIBUTION  (DELTA)           S_MB139   RELP_MOD
         4          SPECIFIED    DISCRETE
    1.00000E+00   0.50000
    2.00000E+00   0.00000
    3.00000E+00   0.00000
    4.00000E+00   0.50000
STUDENT                 S_MB139   SAT_RBRN
         6
  7.78460E-03  6.88420E-02  6.98600E-02  7.26200E-02  1.08610E-01
1.74010E-01
STUDENT                 S_MB139   PORE_DIS
         6
  4.90530E-01  5.57750E-01  6.52000E-01  6.55000E-01  6.64520E-01
8.41780E-01
UNIFORM                 S_HALITE  PRESSURE
    1.10400E+07    1.38900E+07
TRIANGULAR              CASTILER  PRESSURE
    1.11000E+07    1.27000E+07    1.70000E+07
TRIANGULAR              CASTILER  PRMX_LOG
   -1.47000E+01   -1.18000E+01   -9.80000E+00
TRIANGULAR              CASTILER  COMP_RCK
    2.00000E-11    4.00000E-11    1.00000E-10
UNIFORM                 BH_SAND   PRMX_LOG
   -1.63000E+01   -1.10000E+01
UNIFORM                 DRZ_1     PRMX_LOG
   -1.94000E+01   -1.25000E+01
UNIFORM                 CONC_PLG  PRMX_LOG
   -1.90000E+01   -1.70000E+01
USER DISTRIBUTION  (CUMULATIVE)       SHFTU     SAT_RBRN
         3          SPECIFIED    CONTINUOUS
    0.00000E+00   0.50000
    2.00000E-01   0.50000
    6.00000E-01   0.00000
UNIFORM                 SHFTU     SAT_RGAS
    0.00000E+00    4.00000E-01
USER DISTRIBUTION  (CUMULATIVE)       SHFTU     PRMX_LOG
         9          SPECIFIED    CONTINUOUS
   -2.05000E+01   0.03000
   -2.00000E+01   0.08000
   -1.95000E+01   0.13000
   -1.90000E+01   0.19000
   -1.85000E+01   0.22000
   -1.80000E+01   0.24000
   -1.75000E+01   0.10000
   -1.70000E+01   0.01000
   -1.65000E+01   0.00000
USER DISTRIBUTION  (CUMULATIVE)       SHFTL_T1  PRMX_LOG
         8          SPECIFIED    CONTINUOUS
   -2.00000E+01   0.01000
   -1.95000E+01   0.09000
   -1.90000E+01   0.20700
   -1.85000E+01   0.33000
   -1.80000E+01   0.23600
   -1.75000E+01   0.12000
   -1.70000E+01   0.00700
```

```
   -1.65000E+01   0.00000
USER DISTRIBUTION  (CUMULATIVE)        SHFTL_T2  PRMX_LOG
        10          SPECIFIED    CONTINUOUS
   -2.25000E+01   0.02000
   -2.20000E+01   0.06000
   -2.15000E+01   0.09000
   -2.10000E+01   0.13500
   -2.05000E+01   0.22000
   -2.00000E+01   0.17500
   -1.95000E+01   0.16500
   -1.90000E+01   0.10000
   -1.85000E+01   0.03500
   -1.80000E+01   0.00000
UNIFORM                 WAS_AREA  BIOGENFC
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
CORRELATION MATRIX
    2
    53  54 -0.99
    61  62 -0.75
OUTPUT CORR HIST DATA
TITLE SDB: PARAMETER_PROD     Calc: PABC09       Ver: 1.00     12/02/09
18:43:17
```

Appendix V. PRELHS Output (Transfer) File for Replicate 2

```
TITLE SDB: PARAMETER_PROD     Calc: PABC09       Ver: 1.00     12/02/09
18:44:12
TITLE PABC09, AP145, Replicate R2 Input File for the LHS Code
NOBS            100
RANDOM SEED     168866235
UNIFORM                 GLOBAL    PBRINE
    1.00000E-02    6.00000E-01
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)       BOREHOLE  DOMEGA
        10          SPECIFIED    CONTINUOUS
    4.20000E+00   0.15000
    6.30000E+00   0.50000
    8.40000E+00   0.15000
    1.05000E+01   0.10000
    1.26000E+01   0.05000
    1.47000E+01   0.02000
    1.68000E+01   0.01000
    1.88000E+01   0.01000
    2.09000E+01   0.01000
    2.30000E+01   0.00000
LOGUNIFORM              BOREHOLE  TAUFAIL
    5.00000E-02    7.70000E+01
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
LOGUNIFORM              SPALLMOD  REPIPERM
    2.40000E-14    2.40000E-12
UNIFORM                 SPALLMOD  TENSLSTR
    1.20000E+05    1.70000E+05
LOGUNIFORM              SPALLMOD  PARTDIAM
    1.00000E-03    1.00000E-01
UNIFORM                 SPALLMOD  REPIPOR
    3.50000E-01    6.60000E-01
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)       SOLMOD3   SOLVAR
        48          SPECIFIED    CONTINUOUS
   -4.20000E+00   0.00290
   -4.05000E+00   0.00000
   -3.90000E+00   0.00580
   -3.75000E+00   0.01150
   -3.60000E+00   0.01450
   -3.45000E+00   0.00290
   -3.30000E+00   0.00580
```

```
   -3.15000E+00   0.00860
   -3.00000E+00   0.00290
   -2.85000E+00   0.00000
   -2.70000E+00   0.00580
   -2.55000E+00   0.00870
   -2.40000E+00   0.00860
   -2.25000E+00   0.00580
   -2.10000E+00   0.00000
   -1.95000E+00   0.00290
   -1.80000E+00   0.00580
   -1.65000E+00   0.00580
   -1.50000E+00   0.00570
   -1.35000E+00   0.02610
   -1.20000E+00   0.02600
   -1.05000E+00   0.02890
   -9.00000E-01   0.02600
   -7.50000E-01   0.02890
   -6.00000E-01   0.03760
   -4.50000E-01   0.06070
   -3.00000E-01   0.05200
   -1.50000E-01   0.07220
    0.00000E+00   0.07810
    1.50000E-01   0.07800
    3.00000E-01   0.07800
    4.50000E-01   0.03470
    6.00000E-01   0.08380
    7.50000E-01   0.08960
    9.00000E-01   0.02030
    1.05000E+00   0.01440
    1.20000E+00   0.01450
    1.35000E+00   0.00860
    1.50000E+00   0.00290
    1.65000E+00   0.01160
    1.80000E+00   0.00860
    1.95000E+00   0.00580
    2.10000E+00   0.00000
    2.25000E+00   0.00290
    2.40000E+00   0.00290
    2.55000E+00   0.00290
    2.70000E+00   0.00000
    2.85000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)        SOLMOD4    SOLVAR
       38           SPECIFIED    CONTINUOUS
   -2.25000E+00   0.01430
   -2.10000E+00   0.00710
   -1.95000E+00   0.01430
   -1.80000E+00   0.02860
   -1.65000E+00   0.02860
   -1.50000E+00   0.05000
   -1.35000E+00   0.07850
   -1.20000E+00   0.04290
   -1.05000E+00   0.03570
   -9.00000E-01   0.05710
   -7.50000E-01   0.08580
   -6.00000E-01   0.10710
   -4.50000E-01   0.02140
   -3.00000E-01   0.03570
```

```
   -1.50000E-01   0.04290
    0.00000E+00   0.03570
    1.50000E-01   0.09290
    3.00000E-01   0.05000
    4.50000E-01   0.00710
    6.00000E-01   0.04290
    7.50000E-01   0.03570
    9.00000E-01   0.02140
    1.05000E+00   0.00000
    1.20000E+00   0.00720
    1.35000E+00   0.01420
    1.50000E+00   0.00720
    1.65000E+00   0.00710
    1.80000E+00   0.00000
    1.95000E+00   0.00720
    2.10000E+00   0.00000
    2.25000E+00   0.00710
    2.40000E+00   0.00000
    2.55000E+00   0.00000
    2.70000E+00   0.00000
    2.85000E+00   0.00000
    3.00000E+00   0.00000
    3.15000E+00   0.01430
    3.30000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)       PHUMOX3   PHUMCIM
        3           SPECIFIED    CONTINUOUS
    6.50000E-02   0.50000
    1.37000E+00   0.50000
    1.60000E+00   0.00000
UNIFORM                 GLOBAL    OXSTAT
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 CULEBRA   MINP_FAC
    1.00000E+00    1.00000E+03
UNIFORM                 GLOBAL    TRANSIDX
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)       GLOBAL    CLIMTIDX
        4           SPECIFIED    CONTINUOUS
    1.00000E+00   0.75000
    1.25000E+00   0.00000
    1.50000E+00   0.25000
    2.25000E+00   0.00000
UNIFORM                 CULEBRA   HMBLKLT
    5.00000E-02    5.00000E-01
LOGUNIFORM              CULEBRA   APOROS
    1.00000E-04    1.00000E-02
USER DISTRIBUTION  (CUMULATIVE)       CULEBRA   DPOROS
        7           SPECIFIED    CONTINUOUS
    1.00000E-01   0.10000
    1.10000E-01   0.15000
```

```
    1.20000E-01   0.25000
    1.60000E-01   0.25000
    1.80000E-01   0.15000
    1.90000E-01   0.10000
    2.50000E-01   0.00000
LOGUNIFORM              U+6       MKD_U
    3.00000E-05    2.00000E-02
LOGUNIFORM              U+4       MKD_U
    5.00000E-04    1.00000E+01
LOGUNIFORM              PU+3      MKD_PU
    5.00000E-03    4.00000E-01
LOGUNIFORM              PU+4      MKD_PU
    5.00000E-04    1.00000E+01
LOGUNIFORM              TH+4      MKD_TH
    5.00000E-04    1.00000E+01
LOGUNIFORM              AM+3      MKD_AM
    5.00000E-03    4.00000E-01
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 STEEL     CORRMCO2
    0.00000E+00    3.17000E-14
USER DISTRIBUTION  (DELTA)          WAS_AREA  PROBDEG
         2          SPECIFIED    DISCRETE
    1.00000E+00   0.75000
    2.00000E+00   0.25000
UNIFORM                 WAS_AREA  GRATMICI
    3.08269E-11    5.56921E-10
UNIFORM                 WAS_AREA  GRATMICH
    0.00000E+00    1.02717E-09
UNIFORM                 CELLULS   FBETA
    0.00000E+00    1.00000E+00
UNIFORM                 WAS_AREA  SAT_RGAS
    0.00000E+00    1.50000E-01
UNIFORM                 WAS_AREA  SAT_RBRN
    0.00000E+00    5.52000E-01
UNIFORM                 WAS_AREA  SAT_WICK
    0.00000E+00    1.00000E+00
TRIANGULAR              DRZ_PCS   PRMX_LOG
   -2.06990E+01   -1.87496E+01   -1.70000E+01
TRIANGULAR              CONC_PCS  PRMX_LOG
   -2.06990E+01   -1.87496E+01   -1.70000E+01
UNIFORM                 CONC_PCS  SAT_RGAS
    0.00000E+00    4.00000E-01
USER DISTRIBUTION  (CUMULATIVE)       CONC_PCS  SAT_RBRN
         3          SPECIFIED    CONTINUOUS
    0.00000E+00   0.50000
    2.00000E-01   0.50000
    6.00000E-01   0.00000
USER DISTRIBUTION  (CUMULATIVE)       CONC_PCS  PORE_DIS
         3          SPECIFIED    CONTINUOUS
    1.10000E-01   0.50000
```

```
    9.40000E-01   0.50000
    8.10000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)        S_HALITE  POROSITY
         3          SPECIFIED    CONTINUOUS
    1.00000E-03   0.50000
    1.00000E-02   0.50000
    5.19000E-02   0.00000
UNIFORM                 S_HALITE  PRMX_LOG
   -2.40000E+01   -2.10000E+01
UNIFORM                 S_HALITE  COMP_RCK
    2.94000E-12    1.92000E-10
STUDENT                 S_MB139   PRMX_LOG
         6
 -2.10000E+01 -1.92000E+01 -1.91000E+01 -1.88000E+01 -1.81000E+01 -
1.71000E+01
USER DISTRIBUTION  (DELTA)           S_MB139   RELP_MOD
         4          SPECIFIED    DISCRETE
    1.00000E+00   0.50000
    2.00000E+00   0.00000
    3.00000E+00   0.00000
    4.00000E+00   0.50000
STUDENT                 S_MB139   SAT_RBRN
         6
  7.78460E-03  6.88420E-02  6.98600E-02  7.26200E-02  1.08610E-01
1.74010E-01
STUDENT                 S_MB139   PORE_DIS
         6
  4.90530E-01  5.57750E-01  6.52000E-01  6.55000E-01  6.64520E-01
8.41780E-01
UNIFORM                 S_HALITE  PRESSURE
    1.10400E+07    1.38900E+07
TRIANGULAR              CASTILER  PRESSURE
    1.11000E+07    1.27000E+07    1.70000E+07
TRIANGULAR              CASTILER  PRMX_LOG
   -1.47000E+01   -1.18000E+01   -9.80000E+00
TRIANGULAR              CASTILER  COMP_RCK
    2.00000E-11    4.00000E-11    1.00000E-10
UNIFORM                 BH_SAND   PRMX_LOG
   -1.63000E+01   -1.10000E+01
UNIFORM                 DRZ_1     PRMX_LOG
   -1.94000E+01   -1.25000E+01
UNIFORM                 CONC_PLG  PRMX_LOG
   -1.90000E+01   -1.70000E+01
USER DISTRIBUTION  (CUMULATIVE)        SHFTU     SAT_RBRN
         3          SPECIFIED    CONTINUOUS
    0.00000E+00   0.50000
    2.00000E-01   0.50000
    6.00000E-01   0.00000
UNIFORM                 SHFTU     SAT_RGAS
    0.00000E+00    4.00000E-01
USER DISTRIBUTION  (CUMULATIVE)        SHFTU     PRMX_LOG
         9          SPECIFIED    CONTINUOUS
   -2.05000E+01   0.03000
   -2.00000E+01   0.08000
   -1.95000E+01   0.13000
   -1.90000E+01   0.19000
   -1.85000E+01   0.22000
```

```
   -1.80000E+01   0.24000
   -1.75000E+01   0.10000
   -1.70000E+01   0.01000
   -1.65000E+01   0.00000
USER DISTRIBUTION  (CUMULATIVE)       SHFTL_T1  PRMX_LOG
        8           SPECIFIED    CONTINUOUS
   -2.00000E+01   0.01000
   -1.95000E+01   0.09000
   -1.90000E+01   0.20700
   -1.85000E+01   0.33000
   -1.80000E+01   0.23600
   -1.75000E+01   0.12000
   -1.70000E+01   0.00700
   -1.65000E+01   0.00000
USER DISTRIBUTION  (CUMULATIVE)       SHFTL_T2  PRMX_LOG
        10          SPECIFIED    CONTINUOUS
   -2.25000E+01   0.02000
   -2.20000E+01   0.06000
   -2.15000E+01   0.09000
   -2.10000E+01   0.13500
   -2.05000E+01   0.22000
   -2.00000E+01   0.17500
   -1.95000E+01   0.16500
   -1.90000E+01   0.10000
   -1.85000E+01   0.03500
   -1.80000E+01   0.00000
UNIFORM                 WAS_AREA  BIOGENFC
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
CORRELATION MATRIX
    2
    53  54 -0.99
    61  62 -0.75
OUTPUT CORR HIST DATA
TITLE SDB: PARAMETER_PROD     Calc: PABC09       Ver: 1.00     12/02/09
18:44:12
```

Appendix VI. PRELHS Output (Transfer) File for Replicate 3

```
TITLE SDB: PARAMETER_PROD     Calc: PABC09       Ver: 1.00     12/02/09
18:44:54
TITLE PABC09, AP145, Replicate R3 Input File for the LHS Code
NOBS            100
RANDOM SEED     292058223
UNIFORM                  GLOBAL     PBRINE
    1.00000E-02    6.00000E-01
UNIFORM                  REFCON     LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                  REFCON     LHSBLANK
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)        BOREHOLE   DOMEGA
        10          SPECIFIED     CONTINUOUS
    4.20000E+00   0.15000
    6.30000E+00   0.50000
    8.40000E+00   0.15000
    1.05000E+01   0.10000
    1.26000E+01   0.05000
    1.47000E+01   0.02000
    1.68000E+01   0.01000
    1.88000E+01   0.01000
    2.09000E+01   0.01000
    2.30000E+01   0.00000
LOGUNIFORM               BOREHOLE   TAUFAIL
    5.00000E-02    7.70000E+01
UNIFORM                  REFCON     LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                  REFCON     LHSBLANK
    0.00000E+00    1.00000E+00
LOGUNIFORM               SPALLMOD   REPIPERM
    2.40000E-14    2.40000E-12
UNIFORM                  SPALLMOD   TENSLSTR
    1.20000E+05    1.70000E+05
LOGUNIFORM               SPALLMOD   PARTDIAM
    1.00000E-03    1.00000E-01
UNIFORM                  SPALLMOD   REPIPOR
    3.50000E-01    6.60000E-01
UNIFORM                  REFCON     LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                  REFCON     LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                  REFCON     LHSBLANK
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)        SOLMOD3    SOLVAR
        48          SPECIFIED     CONTINUOUS
   -4.20000E+00   0.00290
   -4.05000E+00   0.00000
   -3.90000E+00   0.00580
   -3.75000E+00   0.01150
   -3.60000E+00   0.01450
   -3.45000E+00   0.00290
   -3.30000E+00   0.00580
```

```
   -3.15000E+00   0.00860
   -3.00000E+00   0.00290
   -2.85000E+00   0.00000
   -2.70000E+00   0.00580
   -2.55000E+00   0.00870
   -2.40000E+00   0.00860
   -2.25000E+00   0.00580
   -2.10000E+00   0.00000
   -1.95000E+00   0.00290
   -1.80000E+00   0.00580
   -1.65000E+00   0.00580
   -1.50000E+00   0.00570
   -1.35000E+00   0.02610
   -1.20000E+00   0.02600
   -1.05000E+00   0.02890
   -9.00000E-01   0.02600
   -7.50000E-01   0.02890
   -6.00000E-01   0.03760
   -4.50000E-01   0.06070
   -3.00000E-01   0.05200
   -1.50000E-01   0.07220
    0.00000E+00   0.07810
    1.50000E-01   0.07800
    3.00000E-01   0.07800
    4.50000E-01   0.03470
    6.00000E-01   0.08380
    7.50000E-01   0.08960
    9.00000E-01   0.02030
    1.05000E+00   0.01440
    1.20000E+00   0.01450
    1.35000E+00   0.00860
    1.50000E+00   0.00290
    1.65000E+00   0.01160
    1.80000E+00   0.00860
    1.95000E+00   0.00580
    2.10000E+00   0.00000
    2.25000E+00   0.00290
    2.40000E+00   0.00290
    2.55000E+00   0.00290
    2.70000E+00   0.00000
    2.85000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)        SOLMOD4    SOLVAR
       38           SPECIFIED    CONTINUOUS
   -2.25000E+00   0.01430
   -2.10000E+00   0.00710
   -1.95000E+00   0.01430
   -1.80000E+00   0.02860
   -1.65000E+00   0.02860
   -1.50000E+00   0.05000
   -1.35000E+00   0.07850
   -1.20000E+00   0.04290
   -1.05000E+00   0.03570
   -9.00000E-01   0.05710
   -7.50000E-01   0.08580
   -6.00000E-01   0.10710
   -4.50000E-01   0.02140
   -3.00000E-01   0.03570
```

```
   -1.50000E-01   0.04290
    0.00000E+00   0.03570
    1.50000E-01   0.09290
    3.00000E-01   0.05000
    4.50000E-01   0.00710
    6.00000E-01   0.04290
    7.50000E-01   0.03570
    9.00000E-01   0.02140
    1.05000E+00   0.00000
    1.20000E+00   0.00720
    1.35000E+00   0.01420
    1.50000E+00   0.00720
    1.65000E+00   0.00710
    1.80000E+00   0.00000
    1.95000E+00   0.00720
    2.10000E+00   0.00000
    2.25000E+00   0.00710
    2.40000E+00   0.00000
    2.55000E+00   0.00000
    2.70000E+00   0.00000
    2.85000E+00   0.00000
    3.00000E+00   0.00000
    3.15000E+00   0.01430
    3.30000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)        PHUMOX3    PHUMCIM
         3          SPECIFIED    CONTINUOUS
    6.50000E-02   0.50000
    1.37000E+00   0.50000
    1.60000E+00   0.00000
UNIFORM                 GLOBAL    OXSTAT
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 CULEBRA   MINP_FAC
    1.00000E+00    1.00000E+03
UNIFORM                 GLOBAL    TRANSIDX
    0.00000E+00    1.00000E+00
USER DISTRIBUTION  (CUMULATIVE)        GLOBAL    CLIMTIDX
         4          SPECIFIED    CONTINUOUS
    1.00000E+00   0.75000
    1.25000E+00   0.00000
    1.50000E+00   0.25000
    2.25000E+00   0.00000
UNIFORM                 CULEBRA   HMBLKLT
    5.00000E-02    5.00000E-01
LOGUNIFORM              CULEBRA   APOROS
    1.00000E-04    1.00000E-02
USER DISTRIBUTION  (CUMULATIVE)        CULEBRA   DPOROS
         7          SPECIFIED    CONTINUOUS
    1.00000E-01   0.10000
    1.10000E-01   0.15000
```

```
    1.20000E-01   0.25000
    1.60000E-01   0.25000
    1.80000E-01   0.15000
    1.90000E-01   0.10000
    2.50000E-01   0.00000
LOGUNIFORM              U+6       MKD_U
    3.00000E-05    2.00000E-02
LOGUNIFORM              U+4       MKD_U
    5.00000E-04    1.00000E+01
LOGUNIFORM              PU+3      MKD_PU
    5.00000E-03    4.00000E-01
LOGUNIFORM              PU+4      MKD_PU
    5.00000E-04    1.00000E+01
LOGUNIFORM              TH+4      MKD_TH
    5.00000E-04    1.00000E+01
LOGUNIFORM              AM+3      MKD_AM
    5.00000E-03    4.00000E-01
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                 STEEL     CORRMCO2
    0.00000E+00    3.17000E-14
USER DISTRIBUTION  (DELTA)          WAS_AREA  PROBDEG
         2          SPECIFIED    DISCRETE
    1.00000E+00   0.75000
    2.00000E+00   0.25000
UNIFORM                 WAS_AREA  GRATMICI
    3.08269E-11    5.56921E-10
UNIFORM                 WAS_AREA  GRATMICH
    0.00000E+00    1.02717E-09
UNIFORM                 CELLULS   FBETA
    0.00000E+00    1.00000E+00
UNIFORM                 WAS_AREA  SAT_RGAS
    0.00000E+00    1.50000E-01
UNIFORM                 WAS_AREA  SAT_RBRN
    0.00000E+00    5.52000E-01
UNIFORM                 WAS_AREA  SAT_WICK
    0.00000E+00    1.00000E+00
TRIANGULAR              DRZ_PCS   PRMX_LOG
   -2.06990E+01   -1.87496E+01   -1.70000E+01
TRIANGULAR              CONC_PCS  PRMX_LOG
   -2.06990E+01   -1.87496E+01   -1.70000E+01
UNIFORM                 CONC_PCS  SAT_RGAS
    0.00000E+00    4.00000E-01
USER DISTRIBUTION  (CUMULATIVE)       CONC_PCS  SAT_RBRN
         3          SPECIFIED    CONTINUOUS
    0.00000E+00   0.50000
    2.00000E-01   0.50000
    6.00000E-01   0.00000
USER DISTRIBUTION  (CUMULATIVE)       CONC_PCS  PORE_DIS
         3          SPECIFIED    CONTINUOUS
    1.10000E-01   0.50000
```

```
    9.40000E-01   0.50000
    8.10000E+00   0.00000
USER DISTRIBUTION  (CUMULATIVE)       S_HALITE  POROSITY
         3          SPECIFIED    CONTINUOUS
    1.00000E-03   0.50000
    1.00000E-02   0.50000
    5.19000E-02   0.00000
UNIFORM                 S_HALITE  PRMX_LOG
   -2.40000E+01   -2.10000E+01
UNIFORM                 S_HALITE  COMP_RCK
    2.94000E-12    1.92000E-10
STUDENT                 S_MB139   PRMX_LOG
         6
 -2.10000E+01 -1.92000E+01 -1.91000E+01 -1.88000E+01 -1.81000E+01 -
1.71000E+01
USER DISTRIBUTION  (DELTA)          S_MB139   RELP_MOD
         4          SPECIFIED    DISCRETE
    1.00000E+00   0.50000
    2.00000E+00   0.00000
    3.00000E+00   0.00000
    4.00000E+00   0.50000
STUDENT                 S_MB139   SAT_RBRN
         6
  7.78460E-03  6.88420E-02  6.98600E-02  7.26200E-02  1.08610E-01
1.74010E-01
STUDENT                 S_MB139   PORE_DIS
         6
  4.90530E-01  5.57750E-01  6.52000E-01  6.55000E-01  6.64520E-01
8.41780E-01
UNIFORM                 S_HALITE  PRESSURE
    1.10400E+07    1.38900E+07
TRIANGULAR              CASTILER  PRESSURE
    1.11000E+07    1.27000E+07    1.70000E+07
TRIANGULAR              CASTILER  PRMX_LOG
   -1.47000E+01   -1.18000E+01   -9.80000E+00
TRIANGULAR              CASTILER  COMP_RCK
    2.00000E-11    4.00000E-11    1.00000E-10
UNIFORM                 BH_SAND   PRMX_LOG
   -1.63000E+01   -1.10000E+01
UNIFORM                 DRZ_1     PRMX_LOG
   -1.94000E+01   -1.25000E+01
UNIFORM                 CONC_PLG  PRMX_LOG
   -1.90000E+01   -1.70000E+01
USER DISTRIBUTION  (CUMULATIVE)       SHFTU     SAT_RBRN
         3          SPECIFIED    CONTINUOUS
    0.00000E+00   0.50000
    2.00000E-01   0.50000
    6.00000E-01   0.00000
UNIFORM                 SHFTU     SAT_RGAS
    0.00000E+00    4.00000E-01
USER DISTRIBUTION  (CUMULATIVE)       SHFTU     PRMX_LOG
         9          SPECIFIED    CONTINUOUS
   -2.05000E+01   0.03000
   -2.00000E+01   0.08000
   -1.95000E+01   0.13000
   -1.90000E+01   0.19000
   -1.85000E+01   0.22000
```

```
   -1.80000E+01   0.24000
   -1.75000E+01   0.10000
   -1.70000E+01   0.01000
   -1.65000E+01   0.00000
USER DISTRIBUTION  (CUMULATIVE)       SHFTL_T1  PRMX_LOG
        8           SPECIFIED    CONTINUOUS
   -2.00000E+01   0.01000
   -1.95000E+01   0.09000
   -1.90000E+01   0.20700
   -1.85000E+01   0.33000
   -1.80000E+01   0.23600
   -1.75000E+01   0.12000
   -1.70000E+01   0.00700
   -1.65000E+01   0.00000
USER DISTRIBUTION  (CUMULATIVE)       SHFTL_T2  PRMX_LOG
        10          SPECIFIED    CONTINUOUS
   -2.25000E+01   0.02000
   -2.20000E+01   0.06000
   -2.15000E+01   0.09000
   -2.10000E+01   0.13500
   -2.05000E+01   0.22000
   -2.00000E+01   0.17500
   -1.95000E+01   0.16500
   -1.90000E+01   0.10000
   -1.85000E+01   0.03500
   -1.80000E+01   0.00000
UNIFORM                 WAS_AREA  BIOGENFC
    0.00000E+00    1.00000E+00
UNIFORM                  REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                  REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                  REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
UNIFORM                  REFCON    LHSBLANK
    0.00000E+00    1.00000E+00
CORRELATION MATRIX
    2
    53  54 -0.99
    61  62 -0.75
OUTPUT CORR HIST DATA
TITLE SDB: PARAMETER_PROD     Calc: PABC09       Ver: 1.00     12/02/09
18:44:54
```

Appendix VII. Parameter Ranges for AP137 (conditional)

Parameter Ranges For AP145

Material Property	*Parameter Replicate*	*Minimum*	*Maximum*	*Mean*
AM+3				
MKD_AM	*CMKDAM3*			
	1	5.02E-03	3.97E-01	9.0040E-02
	2	5.17E-03	3.89E-01	9.0275E-02
	3	5.21E-03	3.93E-01	8.9972E-02
BH_SAND				
PRMX_LOG	*BHPERM*			
	1	-1.63E+01	-1.10E+01	-1.3648E+01
	2	-1.63E+01	-1.10E+01	-1.3649E+01
	3	-1.63E+01	-1.10E+01	-1.3648E+01
BOREHOLE				
DOMEGA	*DOMEGA*			
	1	4.34E+00	2.16E+01	8.6254E+00
	2	4.27E+00	2.27E+01	8.6183E+00
	3	4.27E+00	2.30E+01	8.6407E+00
TAUFAIL	*WTAUFAIL*			
	1	5.00E-02	7.67E+01	1.0500E+01
	2	5.10E-02	7.22E+01	1.0427E+01
	3	5.12E-02	7.50E+01	1.0521E+01
CASTILER				
COMP_RCK	*BPCOMP*			
	1	2.07E-11	9.36E-11	5.3286E-11
	2	2.28E-11	9.48E-11	5.3349E-11
	3	2.14E-11	9.49E-11	5.3273E-11
PRESSURE	*BPINTPRS*			
	1	1.12E+07	1.65E+07	1.3595E+07
	2	1.14E+07	1.67E+07	1.3606E+07
	3	1.14E+07	1.69E+07	1.3602E+07

Material Property	*Parameter Replicate*	*Minimum*	*Maximum*	*Mean*
PRMX_LOG	*BPPRM*			
	1	-1.45E+01	-9.94E+00	-1.2099E+01
	2	-1.45E+01	-1.01E+01	-1.2101E+01
	3	-1.44E+01	-9.89E+00	-1.2096E+01
CELLULS				
FBETA	*WFBETCEL*			
	1	1.03E-03	1.00E+00	5.0032E-01
	2	9.13E-03	9.92E-01	4.9969E-01
	3	1.65E-03	9.98E-01	4.9969E-01
CONC_PCS				
PORE_DIS	*CONBCEXP*			
	1	1.20E-01	8.06E+00	2.5202E+00
	2	1.10E-01	8.02E+00	2.5170E+00
	3	1.26E-01	8.06E+00	2.5231E+00
SAT_RBRN	*CONBRSAT*			
	1	1.96E-03	5.95E-01	2.5009E-01
	2	6.93E-04	5.95E-01	2.4978E-01
	3	2.91E-03	5.94E-01	2.5013E-01
SAT_RGAS	*CONGSSAT*			
	1	9.61E-04	3.98E-01	2.0010E-01
	2	2.78E-03	3.99E-01	2.0019E-01
	3	5.95E-04	3.99E-01	1.9982E-01
PRMX_LOG	*CONPRM*			
	1	-2.05E+01	-1.72E+01	-1.8817E+01
	2	-2.07E+01	-1.72E+01	-1.8819E+01
	3	-2.05E+01	-1.72E+01	-1.8816E+01
CONC_PLG				
PRMX_LOG	*PLGPRM*			
	1	-1.90E+01	-1.70E+01	-1.8001E+01
	2	-1.90E+01	-1.70E+01	-1.8000E+01
	3	-1.90E+01	-1.70E+01	-1.7999E+01

Material Property	Parameter Replicate	Minimum	Maximum	Mean
CULEBRA				
APOROS	*CFRACPOR*			
	1	1.01E-04	9.82E-03	2.1380E-03
	2	1.02E-04	9.58E-03	2.1522E-03
	3	1.01E-04	9.70E-03	2.1448E-03
HMBLKLT	*CFRACSP*			
	1	5.26E-02	4.99E-01	2.7524E-01
	2	5.39E-02	4.96E-01	2.7502E-01
	3	5.41E-02	4.96E-01	2.7484E-01
DPOROS	*CMTRXPOR*			
	1	1.00E-01	2.46E-01	1.5495E-01
	2	1.00E-01	2.48E-01	1.5499E-01
	3	1.00E-01	2.49E-01	1.5498E-01
MINP_FAC	*CTRANSFM*			
	1	1.02E+00	9.95E+02	5.0069E+02
	2	5.56E+00	9.96E+02	5.0051E+02
	3	4.34E+00	9.92E+02	5.0036E+02
DRZ_1				
PRMX_LOG	*DRZPRM*			
	1	-1.94E+01	-1.25E+01	-1.5949E+01
	2	-1.94E+01	-1.26E+01	-1.5951E+01
	3	-1.93E+01	-1.26E+01	-1.5948E+01
DRZ_PCS				
PRMX_LOG	*DRZPCPRM*			
	1	-2.05E+01	-1.72E+01	-1.8815E+01
	2	-2.06E+01	-1.72E+01	-1.8819E+01
	3	-2.06E+01	-1.72E+01	-1.8816E+01
GLOBAL				
PBRINE	*BPPROB*			
	1	1.53E-02	5.98E-01	3.0496E-01
	2	1.36E-02	5.97E-01	3.0508E-01

Material Property	*Parameter*	*Replicate*	*Minimum*	*Maximum*	*Mean*
		3	1.41E-02	5.95E-01	3.0522E-01
CLIMTIDX	*CCLIMSF*				
		1	1.00E+00	2.23E+00	1.3121E+00
		2	1.00E+00	2.25E+00	1.3128E+00
		3	1.00E+00	2.24E+00	1.3121E+00
TRANSIDX	*CTRAN*				
		1	7.95E-03	9.98E-01	4.9977E-01
		2	6.83E-03	9.92E-01	4.9963E-01
		3	6.61E-03	9.92E-01	5.0027E-01
OXSTAT	*WOXSTAT*				
		1	4.38E-03	9.95E-01	5.0010E-01
		2	7.89E-03	9.92E-01	5.0070E-01
		3	8.11E-04	9.94E-01	5.0016E-01
PHUMOX3					
PHUMCIM	*WPHUMOX3*				
		1	8.48E-02	1.60E+00	1.1019E+00
		2	7.88E-02	1.60E+00	1.1012E+00
		3	9.04E-02	1.60E+00	1.1012E+00
PU+3					
MKD_PU	*CMKDPU3*				
		1	5.02E-03	3.96E-01	9.0271E-02
		2	5.06E-03	3.95E-01	9.0160E-02
		3	5.04E-03	4.00E-01	9.0145E-02
PU+4					
MKD_PU	*CMKDPU4*				
		1	5.20E-04	9.69E+00	1.0052E+00
		2	5.21E-04	9.55E+00	1.0141E+00
		3	5.38E-04	9.64E+00	1.0128E+00
S_HALITE					
COMP_RCK	*HALCROCK*				
		1	3.77E-12	1.92E-10	9.7462E-11

Material Property	Parameter	Replicate	Minimum	Maximum	Mean
		2	3.20E-12	1.90E-10	9.7516E-11
		3	3.46E-12	1.91E-10	9.7436E-11
POROSITY	*HALPOR*				
		1	1.13E-03	5.12E-02	1.8230E-02
		2	1.05E-03	5.12E-02	1.8224E-02
		3	1.11E-03	5.16E-02	1.8243E-02
PRMX_LOG	*HALPRM*				
		1	-2.40E+01	-2.10E+01	-2.2499E+01
		2	-2.40E+01	-2.10E+01	-2.2500E+01
		3	-2.40E+01	-2.10E+01	-2.2502E+01
PRESSURE	*SALPRES*				
		1	1.11E+07	1.39E+07	1.2465E+07
		2	1.11E+07	1.39E+07	1.2464E+07
		3	1.11E+07	1.39E+07	1.2466E+07
S_MB139					
PORE_DIS	*ANHBCEXP*				
		1	4.99E-01	8.02E-01	6.4383E-01
		2	5.00E-01	7.99E-01	6.4367E-01
		3	5.03E-01	7.95E-01	6.4362E-01
RELP_MOD	*ANHBCVGP*				
		1	1.00E+00	4.00E+00	2.5000E+00
		2	1.00E+00	4.00E+00	2.5000E+00
		3	1.00E+00	4.00E+00	2.5000E+00
PRMX_LOG	*ANHPRM*				
		1	-2.04E+01	-1.71E+01	-1.8880E+01
		2	-2.07E+01	-1.72E+01	-1.8883E+01
		3	-2.04E+01	-1.73E+01	-1.8884E+01
SAT_RBRN	*ANRBRSAT*				
		1	1.50E-02	1.57E-01	8.3627E-02
		2	2.13E-02	1.57E-01	8.3789E-02
		3	2.14E-02	1.46E-01	8.3763E-02

Material Property	*Parameter Replicate*	*Minimum*	*Maximum*	*Mean*
SHFTL_T1				
PRMX_LOG	*SHLPRM2*			
	1	-2.00E+01	-1.69E+01	-1.8214E+01
	2	-1.99E+01	-1.70E+01	-1.8214E+01
	3	-1.96E+01	-1.70E+01	-1.8210E+01
SHFTL_T2				
PRMX_LOG	*SHLPRM3*			
	1	-2.24E+01	-1.80E+01	-2.0063E+01
	2	-2.23E+01	-1.81E+01	-2.0064E+01
	3	-2.23E+01	-1.80E+01	-2.0065E+01
SHFTU				
PRMX_LOG	*SHUPRM*			
	1	-2.05E+01	-1.69E+01	-1.8422E+01
	2	-2.04E+01	-1.68E+01	-1.8420E+01
	3	-2.04E+01	-1.66E+01	-1.8421E+01
SAT_RBRN	*SHURBRN*			
	1	1.79E-03	6.00E-01	2.5011E-01
	2	2.76E-03	5.97E-01	2.5008E-01
	3	9.67E-04	5.93E-01	2.5007E-01
SAT_RGAS	*SHURGAS*			
	1	9.09E-04	3.98E-01	2.0013E-01
	2	2.05E-03	3.98E-01	1.9999E-01
	3	2.70E-03	3.98E-01	1.9997E-01
SOLMOD3				
SOLVAR	*WSOLVAR3*			
	1	-3.88E+00	2.44E+00	-1.4695E-01
	2	-3.76E+00	2.57E+00	-1.3553E-01
	3	-4.15E+00	2.27E+00	-1.4769E-01
SOLMOD4				
SOLVAR	*WSOLVAR4*			

Material Property	*Parameter*	*Replicate*	*Minimum*	*Maximum*	*Mean*
		1	-2.17E+00	3.24E+00	-3.4862E-01
		2	-2.18E+00	3.21E+00	-3.3934E-01
		3	-2.20E+00	3.29E+00	-3.4969E-01
SPALLMOD					
REPIPERM	*REPIPERM*				
		1	2.42E-14	2.32E-12	5.1466E-13
		2	2.49E-14	2.37E-12	5.1489E-13
		3	2.45E-14	2.40E-12	5.1606E-13
PARTDIAM	*SPLPTDIA*				
		1	1.01E-03	9.65E-02	2.1478E-02
		2	1.00E-03	9.76E-02	2.1560E-02
		3	1.04E-03	9.82E-02	2.1569E-02
REPIPOR	*SPLRPOR*				
		1	3.51E-01	6.58E-01	5.0482E-01
		2	3.51E-01	6.58E-01	5.0501E-01
		3	3.52E-01	6.58E-01	5.0508E-01
TENSLSTR	*TENSLSTR*				
		1	1.21E+05	1.70E+05	1.4499E+05
		2	1.20E+05	1.70E+05	1.4497E+05
		3	1.20E+05	1.70E+05	1.4501E+05
STEEL					
CORRMCO2	*WGRCOR*				
		1	2.16E-16	3.16E-14	1.5849E-14
		2	2.37E-16	3.14E-14	1.5860E-14
		3	5.60E-17	3.15E-14	1.5855E-14
TH+4					
MKD_TH	*CMKDTH4*				
		1	5.20E-04	9.69E+00	1.0108E+00
		2	5.25E-04	9.76E+00	1.0153E+00
		3	5.24E-04	9.75E+00	1.0098E+00
U+4					

Material Property	Parameter Replicate	Minimum	Maximum	Mean
MKD_U	*CMKDU4*			
	1	5.45E-04	9.42E+00	1.0034E+00
	2	5.20E-04	9.74E+00	1.0082E+00
	3	5.07E-04	9.88E+00	1.0138E+00
U+6				
MKD_U	*CMKDU6*			
	1	3.14E-05	1.97E-02	3.0715E-03
	2	3.11E-05	1.99E-02	3.0796E-03
	3	3.07E-05	1.88E-02	3.0749E-03
WAS_AREA				
SAT_WICK	*WASTWICK*			
	1	3.06E-03	9.92E-01	5.0024E-01
	2	2.32E-03	9.99E-01	5.0047E-01
	3	4.40E-03	9.93E-01	4.9988E-01
BIOGENFC	*WBIOGENF*			
	1	2.82E-03	9.97E-01	5.0055E-01
	2	1.81E-03	9.97E-01	5.0033E-01
	3	2.65E-04	9.99E-01	5.0033E-01
GRATMICH	*WGRMICH*			
	1	5.57E-12	5.54E-10	1.7965E-10
	2	2.65E-12	5.31E-10	1.7812E-10
	3	6.73E-13	5.16E-10	1.8351E-10
GRATMICI	*WGRMICI*			
	1	3.26E-11	5.55E-10	2.9402E-10
	2	3.40E-11	5.53E-10	2.9363E-10
	3	3.15E-11	5.52E-10	2.9375E-10
PROBDEG	*WMICDFLG*			
	1	1.00E+00	2.00E+00	1.2500E+00
	2	1.00E+00	2.00E+00	1.2500E+00
	3	1.00E+00	2.00E+00	1.2500E+00
SAT_RBRN	*WRBRNSAT*			

Material Property	*Parameter*	*Replicate*	*Minimum*	*Maximum*	*Mean*
		1	2.71E-03	5.51E-01	2.7620E-01
		2	6.63E-04	5.47E-01	2.7587E-01
		3	3.97E-03	5.48E-01	2.7631E-01
SAT_RGAS	*WRGSSAT*				
		1	7.72E-04	1.48E-01	7.4990E-02
		2	6.34E-04	1.50E-01	7.4972E-02

Appendix VIII. LHS_EDIT

1.1. Description and Requirements

LHS_EDIT was created to impose conditional relationships between pairs of variables for the case where 1) one variable was restricted to having values less than or equal to the other "controlling" variable and 2) the restricted, or conditioned, variable has a uniform distribution. LHS_EDIT is designed to read the LHS output (transfer) file and:

1) Extract the upper and lower bounds for the uniform distribution of the variable to be restricted,
2) Extract the sampled values for each pair of variables,
3) Compare the value of the variable to be restricted to the value of the controlling variable,
4) Rescale the restricted value if it exceeds the value of the controlling variable, and
5) Write a new transfer file containing the modified data.

The restricted value is rescaled by assuming that the distribution of the restricted value is a uniform distribution with an upper bound that is the minimum of the upper bound assigned to the parameter in the parameter data base and the sampled value of the controlling variable. The conditioned value of the restricted variable is computed using:

$$v_i' = \frac{v_i - U_{V,lower}}{U_{V,upper} - U_{V,lower}} \times \left(Min(x_i, U_{V,upper}) - U_{V,lower} \right) + U_{V,lower} \quad (2)$$

where v_i' is the conditioned value of the restricted variable, v_i is the sampled value of the restricted variable, x_i is the sampled value of the controlling variable, and $U_{V,lower}$ and $U_{V,upper}$ are the bounds of the uniform distribution assigned to the restricted variable. This method preserves the probability associated with the value of the restricted variable but will affect the rank-order correlations with the other variables.

The format of the numbers in the listing of the distribution parameters in the LHS transfer file is limited to four digits after the decimal point, whereas the database can store more significant digits. The variable WAS_AREA:GRATMICH that was modified by LHS_EDIT has 1 more digit stored in the database than can be represented by the LHS format, thus introducing a small error in the rescaling calculation. However, the error is insignificant because the rounding occurs in the fourth digit after the decimal point, i.e. the fifth significant digit.

1.2. Platform and Source Code Description

The LHS_EDIT source code was written in FORTRAN 90 and executed on OpenVMS Version 7.3-1 operating system.

1.3. Usage

Files

LHS_EDIT requires as input the LHS output (transfer) file and a control file listing the pairs of variables to be related. The control file contains a record for each pair of

variables and the variables are identified by a number corresponding to the numeric sequence of the variables in the PRELHS input file. The format for the record is (I2,1x,I2). The output files for LHS_EDIT are a new transfer file having the conditioned data and a file called CHECK.TXT. CHECK.TXT lists the values of the controlling, restricted and conditioned variables in a comma-delimited format. CHECK.TXT is meant to be used to easily check whether LHS_EDIT is functioning properly.

Execution

File names are passed to LHS_EDIT using VMS logical variables. These variables are assigned values using the define command. The logical variables are LHS_CONTROL, LHS2_TRN, and LHS_EDIT_OUT for the control, LHS transfer file and the new transfer file, respectively. For example:

```
$  define LHS_CONTROL lhs_control_R1.inp
$  define LHS2_TRN lhs2_AP132_R1.trn
$  define LHS_EDIT_OUT lhs2_AP132_R1_CON.trn
$  run LHS_EDIT
```

For the CRA-2009 PA LHS_EDIT was executed using the EVAL_LHS.COM script and the file names were passed to EVAL_LHS.COM through its input file (EVAL_LHS_AP132_R*n*.INP, where *n* is 1, 2 or 3 for the three replicates). The script and input files are stored in the SCMS library PACMS2:[CMS_CRA09.CRA09_EVAL]

1.4. Testing of LHS_EDIT

Test Procedure

The test of the performance of LHS_EDIT was conducted by examining the data for Replicate 1 in the LHS transfer file and the LHS_EDIT output file produced for AP145. This case was run using the WIPP PA run control system and is documented in Long (2010).The data were imported into the CCDGGF_Analysis database and selecting the values for WAS_AREA:GRATMICHI and WAS_AREA:GRATMICH from the LHS transfer file sheets and WAS_AREA:GRATMICH from the LHS_EDIT transfer file sheet. The maximum (1.02717E-09) and minimum (0) for the uniform distribution of WAS_AREA:GRATMICH were also transcribed from the LHS transfer file to the equation for the [TEST VALUE} column of the query LHS_EDIT_Test.

The "Test Value" was computed using the formula:

Test Value: IIf([GRATMICHV]>[GRATMICIV],Format(([GRATMICHV]-0)/(0.00000000102727-0)*([GRATMICIV]-0)+0,"0.00E+00"),"")

This formula is equivalent to Eq. 2. The complete query is:

```
SELECT LHS_ParamValues.Vector, LHS_ParamValues.Value AS GRATMICIV,
LHS_ParamValues_1.Value AS GRATMICHV,
Format([LHS_ParamValues]![Value],"0.00e+00") AS GRATMICI,
Format([LHS_ParamValues_1]![Value],"0.00E+00") AS GRATMICH,
Format([LHS_ParamValues_2]![Value],"0.00E+00") AS [GRATMICH(cond)],
IIf([GRATMICHV]>[GRATMICIV],Format(([GRATMICHV]-0)/(0.00000000102727-
0)*([GRATMICIV]-0)+0,"0.00E+00"),"") AS [Test Value]
FROM (LHS_ParamValues INNER JOIN LHS_ParamValues AS LHS_ParamValues_1
ON (LHS_ParamValues.FileID = LHS_ParamValues_1.FileID) AND
```

```
(LHS_ParamValues.Vector = LHS_ParamValues_1.Vector)) INNER JOIN
LHS_ParamValues AS LHS_ParamValues_2 ON LHS_ParamValues_1.Vector =
LHS_ParamValues_2.Vector
WHERE (((LHS_ParamValues.Material)="was_area") AND
((LHS_ParamValues.Property)="gratmici") AND
((LHS_ParamValues_1.Material)="was_area") AND
((LHS_ParamValues_1.Property)="gratmich") AND ((LHS_ParamValues.FileID)=30)
AND ((LHS_ParamValues_2.FileID)=26) AND
((LHS_ParamValues_2.Material)="was_area") AND
((LHS_ParamValues_2.Property)="gratmich"))
ORDER BY LHS_ParamValues.Vector;
```

Table 3. Query results showing independently computed values (Test Value) for WAS_AREA: GRATMICH.

Vector	GRATMICI	GRATMICH	GRATMICH (conditional)	Test Value
1	2.39e-10	3.39E-11	3.39E-11	
2	7.82e-11	7.24E-10	5.51E-11	5.51E-11
3	3.29e-10	2.92E-10	2.92E-10	
4	7.93e-11	9.08E-10	7.01E-11	7.01E-11
5	5.28e-10	7.87E-10	4.04E-10	4.04E-10
6	4.09e-10	9.65E-10	3.84E-10	3.84E-10
7	5.09e-10	4.60E-10	4.60E-10	
8	3.04e-10	9.55E-10	2.83E-10	2.83E-10
9	5.45e-10	7.94E-10	4.21E-10	4.21E-10
10	3.32e-10	1.76E-10	1.76E-10	
11	5.35e-10	5.57E-12	5.57E-12	
12	1.22e-10	5.75E-10	6.80E-11	6.80E-11
13	3.19e-10	4.50E-10	1.40E-10	1.40E-10
14	1.31e-10	6.29E-10	7.99E-11	7.99E-11
15	1.83e-10	5.24E-10	9.35E-11	9.34E-11
16	1.72e-10	8.89E-10	1.49E-10	1.49E-10
17	2.61e-10	1.03E-11	1.03E-11	
18	3.26e-11	6.24E-10	1.98E-11	1.98E-11
19	1.92e-10	8.52E-10	1.60E-10	1.60E-10
20	2.85e-10	7.52E-10	2.09E-10	2.09E-10
21	4.89e-10	2.13E-10	2.13E-10	
22	2.25e-10	3.04E-10	6.66E-11	6.66E-11
23	2.08e-10	6.38E-10	1.29E-10	1.29E-10
24	3.95e-11	8.54E-10	3.28E-11	3.28E-11
25	4.44e-10	4.51E-11	4.51E-11	
26	1.14e-10	7.01E-10	7.80E-11	7.80E-11
27	2.33e-10	6.52E-10	1.48E-10	1.48E-10
28	4.36e-10	6.95E-10	2.95E-10	2.95E-10
29	4.32e-11	7.34E-10	3.09E-11	3.09E-11
30	3.81e-10	1.29E-10	1.29E-10	
31	9.19e-11	4.25E-10	3.80E-11	3.80E-11
32	2.65e-10	1.98E-10	1.98E-10	

33	4.72e-10	2.65E-10	2.65E-10	
34	4.04e-10	4.81E-10	1.89E-10	1.89E-10
35	2.50e-10	1.01E-09	2.46E-10	2.46E-10
36	1.51e-10	6.63E-10	9.72E-11	9.72E-11
37	4.60e-10	3.51E-10	3.51E-10	
38	3.89e-10	5.00E-10	1.89E-10	1.89E-10
39	3.59e-10	9.74E-10	3.41E-10	3.41E-10
40	3.54e-10	2.49E-10	2.49E-10	
41	4.20e-10	1.01E-10	1.01E-10	
42	1.61e-10	8.64E-10	1.36E-10	1.36E-10
43	4.47e-10	9.82E-10	4.27E-10	4.27E-10
44	5.18e-10	9.93E-10	5.00E-10	5.00E-10
45	8.36e-11	3.11E-10	2.53E-11	2.53E-11
46	2.52e-10	6.83E-10	1.68E-10	1.68E-10
47	1.03e-10	3.94E-10	3.94E-11	3.94E-11
48	2.29e-10	3.72E-10	8.28E-11	8.28E-11
49	3.25e-10	1.74E-10	1.74E-10	
50	5.03e-10	3.63E-10	3.63E-10	
51	2.72e-10	9.99E-10	2.64E-10	2.64E-10
52	5.37e-10	1.38E-10	1.38E-10	
53	3.49e-10	5.88E-10	2.00E-10	2.00E-10
54	2.90e-10	5.49E-10	1.55E-10	1.55E-10
55	4.84e-10	2.78E-10	2.78E-10	
56	5.06e-11	8.39E-10	4.13E-11	4.13E-11
57	4.56e-10	7.75E-10	3.44E-10	3.44E-10
58	3.09e-10	5.42E-10	1.63E-10	1.63E-10
59	4.22e-10	1.10E-10	1.10E-10	
60	5.23e-10	7.40E-10	3.77E-10	3.77E-10
61	1.07e-10	5.76E-10	5.98E-11	5.98E-11
62	3.63e-10	6.13E-10	2.17E-10	2.17E-10
63	1.41e-10	8.14E-10	1.12E-10	1.12E-10
64	6.74e-11	4.16E-10	2.73E-11	2.73E-11
65	5.12e-10	2.36E-11	2.36E-11	
66	9.68e-11	4.84E-10	4.56E-11	4.56E-11
67	1.95e-10	9.25E-10	1.76E-10	1.76E-10
68	2.83e-10	6.04E-11	6.04E-11	
69	3.95e-10	8.82E-10	3.39E-10	3.39E-10
70	1.64e-10	1.86E-10	2.97E-11	2.97E-11
71	5.50e-10	9.22E-10	4.94E-10	4.94E-10
72	2.42e-10	2.18E-10	2.18E-10	
73	4.76e-10	3.46E-10	3.46E-10	
74	3.44e-10	6.01E-10	2.01E-10	2.01E-10
75	2.97e-10	1.56E-10	1.56E-10	
76	5.56e-10	1.02E-09	5.54E-10	5.54E-10
77	1.76e-10	2.67E-10	4.57E-11	4.57E-11

78	1.44e-10	6.38E-11	6.38E-11	
79	1.33e-10	9.12E-11	9.12E-11	
80	7.02e-11	7.61E-10	5.20E-11	5.20E-11
81	3.68e-10	5.10E-10	1.83E-10	1.83E-10
82	1.18e-10	8.95E-10	1.03E-10	1.03E-10
83	2.04e-10	7.85E-11	7.85E-11	
84	5.26e-11	6.73E-10	3.45E-11	3.45E-11
85	4.79e-10	2.43E-10	2.43E-10	
86	5.76e-11	3.29E-10	1.84E-11	1.84E-11
87	4.94e-10	7.16E-10	3.45E-10	3.45E-10
88	2.74e-10	4.09E-10	1.09E-10	1.09E-10
89	4.27e-10	4.37E-10	1.82E-10	1.82E-10
90	1.87e-10	1.15E-10	1.15E-10	
91	3.11e-10	8.04E-10	2.44E-10	2.44E-10
92	1.55e-10	8.29E-10	1.25E-10	1.25E-10
93	4.35e-10	2.29E-10	2.29E-10	
94	4.63e-10	3.87E-10	3.87E-10	
95	3.84e-10	5.62E-10	2.10E-10	2.10E-10
96	3.76e-10	3.23E-10	3.23E-10	
97	3.40e-10	5.29E-10	1.75E-10	1.75E-10
98	4.12e-10	9.42E-10	3.78E-10	3.77E-10
99	2.17e-10	1.45E-10	1.45E-10	
100	2.13e-10	4.65E-10	9.65E-11	9.65E-11

Acceptance Criteria

The acceptance criteria for the test is that an independent calculation of the conditioned value for WAS_AREA:GRATMICH match with the reported precision the value computed by LHS_EDIT.

Evaluation
The Test Values matched the values computed by LHS_EDIT in every case where WAS_AREA:GRATMICH exceeded WAS_AREA:GRATMICI.

Source Code

The source code for LHS_EDIT Version 1.0 can be found in the file LHS_EDIT.FOR in the SCMS library PACMS2:[CMS_AP132.AP132_LHS] (LIBAP132_LHS) in the LHS_EDIT_V1.0 class. The executable LHS_EDIT.EXE is found in the same library and class. The source code is reproduced below.

```
Program LHSedit
```

```
!.....Purpose: Edit a LHS output file by restricting the value in
column col2 to
!              to never exceed the value in col1
!     Author: Tom Kirchner
!     Version: 1.0

!.....Edit a LHS output file by restricting the value in column col2 to
!     never exceed the value in col1
      Character*160 line
      Double precision a,b    !Endpoints of the first (rightmost)
distribution
      Double precision c,d    !Endpoints of the second (leftmost)
distribution
      Integer col1, col2      !The primary and conditional variables
      Double precision current(100,75)
      Character*160 spacer(4,7)
      Common/NewData/current,spacer

!.....Load the data into value()
      Call ReadFloats(current,spacer)

!.....Open the "control" file
      OPEN(2,file='LHS_CONTROL')
      Open(3,FILE="check.txt")
    5 Read(2,'(i2,1x,i2)',END=50) col1, col2
!.........Read the distribution definition section
          Call ReadDistInfo(col1, a, b, col2, c, d)
          write(*,*) "Column 1: ", col1," Range: ",a,b
          write(*,*) "Column 2: ", col2," Range: ",c,d
          write(*,'(a,i2,2a,i2)') " Data in column ",col2," to be ",
     &             "conditioned on column ",col1

!.........Now mofify the file
          Call MakeConditional(col1,col2,a,b,c,d)
      GoTo 5
   50 Close(2)
      Close(3)

!.....Now write the new file
      Call WriteFile

      Stop
  100 Format(a160)
  110 Format(a160)
      End

      Subroutine ReadFloats(fpvalue,spacer)
!.....Read the sampled values into the fpvalue array, preserving the
!     headers between "pages" in the spacer array
      Double precision fpvalue(100,75)
      Character*160 spacer(4,7)
      Character*160 line
      Integer LineNum

      Open(1,FILE='LHS2_TRN',ERR=75)
      Do While (.not.eof(1))
          Read(1,210) line
```

```
        If (line(1:14).eq." RUN NO.  X(1)") then
              Do k=1,7
                  Do i=1,100
                    Read(1,200) LineNum,(fpvalue(i,(k-1)*10+j),j=1,10)
                End Do
                Do i=1,4
                    Read(1,210) spacer(i,k)
                End Do
               End Do

              Do i=1,100
                Read(1,200) LineNum,(fpvalue(i,70+j),j=1,5)
              End Do
              Close(1)
              Return
           End If
      End Do
      Close (1)
      Return
   75 Write(*,*) "Error opening file"
  200 Format(3x,i3,10(1x,f10.3))
  210 Format(a160)
      End

      Subroutine MakeConditional(col1,col2,a,b,c,d)
!.....Modify values in column col2
!     by 1) reading values from columns col1 and col2 of LHS2_TRN
!        2) rescaling the value in col2 so that it is alway greater
than
!           that in col1
!     A new file is written which leaves all the data in LHS2_TRN above
and
!     below the sampled values unchanged.
      Integer col1, col2
      Character*160 line
      Double precision current(100,75)
      Character*160 spacer(4,7)
      Common/NewData/current,spacer
      Double precision Rescale, v, a, b, c, d, upper

!..... Now replace the data
        Write(3,*) "Column 1, Column 2, Conditioned Column 2"
      Do i=1,100
          v=Rescale(i,current,col1,col2, a,b,c,d)
          Write(3,*) current(i,col1),",",current(i,col2),',',v
          current(i,col2)=v
      End Do
      Return
      End

      Subroutine WriteFile
!.......Write out the file with the modify values
!     A new file is written which leaves all the data in LHS2_TRN above
and
!     below the sampled values unchanged.
      character*160 line
      Double precision current(100,75)
```

```
      character*160 spacer(4,7)
      Common/NewData/current,spacer
      Character*3 fmt

      fmt="0  "

      Open(1,FILE='LHS2_TRN')
      Open(2,FILE='LHS_EDIT_OUT',recl=160)
        Write(2,'(a)') "1"
      Do While (.not.eof(1))
          Read(1,410) line
          If (line(1:14).eq." RUN NO.  X(1)") then
              Write(2,'(a)') trim(line)
!           and write the new values out
            Do k=1,7
                Do i=1,100
                    Write(2,400)fmt,i,(current(i,(k-1)*10+j),
     &                          j=1,10)
                End Do
                Do i=1,4
                      Write(2,'(a)') trim(spacer(i,k))
                End Do
            End Do
            Do i=1,100
                Write(2,400) fmt,i,(current(i,70+j),j=1,5)
            End Do

          Else
              Write(2,'(a)') trim(line)
          End If
      End Do
      Return
  400   Format(a3,i3,10(1x,1pE10.3))
  410   Format(a160)
      End

      Double Precision Function Rescale(i,current,col1, col2, a, b, c,
d)
!.....Adjust col2 so that it never exceeds col1
!     The distribution of col2 ranges from [c-d]
!     The distribution of col1 ranges from [a-b]
      Double precision current(100,75), a, b, c, d, upper
      Integer i, col1, col2
      Double precision v

      v=current(i,col2)
      If (current(i,col2).GT.current(i,col1)) then
          upper=current(i,col1)
          v=(current(i,col2)-c)/(d-c)*(upper-c)+c
      End If

      Rescale = v

      Return
      End

      Subroutine ReadDistInfo(col1, a, b, col2, c, d)
```

```
!.....Read the distribution information and save the range limits
!     for the uniform distribution for the col1 variable
      Integer col2, col1
      Integer VarNum
      Double Precision a, b, c, d
      Character*160 line
!     Open the file
      Open(1,FILE='LHS2_TRN')
!     Skip the first page of the header
      Do While (line(1:26).ne."    VARIABLE  DISTRIBUTION")
          Read(1,800) line
      End Do
!.....Now process the definitions
      Do While (line(1:1).ne."1")          !marks the end of the data
        Read(1,800) line
        If (line(11:21).eq."    UNIFORM") Then
!             Get the variable number
              Read(line,'(7x,i2)') VarNum
            If (VarNum.eq.col2) Then
!             Get the minimum and maximum
                  Read(line,'(33x,e10.4)') c
                  Read(line,'(49x,e10.4)') d
            Else if (VarNum.eq.col1) Then
!             Get the minimum and maximum
                  Read(line,'(33x,e10.4)') a
                  Read(line,'(49x,e10.4)') b
            End if
        End If
      End Do
      Close (1)
      return
  800 Format(a160)
      End
```