	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Uncensored Full Data Sets**											
2												
3	User Selected Options											
4	Date/Time of Computation			3/2/2015 7:17:47 PM								
5	From File			EPC_013Surf_EU04.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	**Iron**											
12												
13	**General Statistics**											
14	Total Number of Observations					10	Number of Distinct Observations					10
15							Number of Missing Observations					0
16	Minimum					17066	Mean					23601
17	Maximum					36780	Median					20377
18	SD					6701	Std. Error of Mean					2119
19	Coefficient of Variation					0.284	Skewness					0.891
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic					0.862	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk Critical Value					0.842	Data appear Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.281	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.28	Data Not Normal at 5% Significance Level					
26	**Data appear Approximate Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL					27485	95% Adjusted-CLT UCL (Chen-1995)					27724
31							95% Modified-t UCL (Johnson-1978)					27585
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					0.62	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.725	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.275	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.266	Data Not Gamma Distributed at 5% Significance Level					
38	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)					14.99	k star (bias corrected MLE)					10.56
42	Theta hat (MLE)					1574	Theta star (bias corrected MLE)					2235
43	nu hat (MLE)					299.8	nu star (bias corrected)					211.2
44	MLE Mean (bias corrected)					23601	MLE Sd (bias corrected)					7263
45							Approximate Chi Square Value (0.05)					178.6
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					173.3
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50))					27913	95% Adjusted Gamma UCL (use when n<50)					28753
50												
51	**Lognormal GOF Test**											
52	Shapiro Wilk Test Statistic					0.885	**Shapiro Wilk Lognormal GOF Test**					

	A	B	C	D	E	F	G	H	I	J	K	L
53					5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.258	**Lilliefors Lognormal GOF Test**					
55					5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level					
56	**Data appear Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59					Minimum of Logged Data	9.745				Mean of logged Data		10.04
60					Maximum of Logged Data	10.51				SD of logged Data		0.269
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	28166				90% Chebyshev (MVUE) UCL		29618
64					95% Chebyshev (MVUE) UCL	32358				97.5% Chebyshev (MVUE) UCL		36160
65					99% Chebyshev (MVUE) UCL	43629						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71					95% CLT UCL	27086				95% Jackknife UCL		27485
72					95% Standard Bootstrap UCL	26967				95% Bootstrap-t UCL		28330
73					95% Hall's Bootstrap UCL	27057				95% Percentile Bootstrap UCL		27026
74					95% BCA Bootstrap UCL	27220						
75					90% Chebyshev(Mean, Sd) UCL	29958				95% Chebyshev(Mean, Sd) UCL		32838
76					97.5% Chebyshev(Mean, Sd) UCL	36834				99% Chebyshev(Mean, Sd) UCL		44685
77												
78	**Suggested UCL to Use**											
79					95% Student's-t UCL	27485						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												
86												
87	**PAH, Total**											
88												
89	**General Statistics**											
90					Total Number of Observations	10				Number of Distinct Observations		3
91										Number of Missing Observations		0
92					Minimum	0.0511				Mean		0.271
93					Maximum	0.49				Median		0.271
94					SD	0.103				Std. Error of Mean		0.0327
95					Coefficient of Variation	0.382				Skewness		-4.35E-16
96												
97	**Normal GOF Test**											
98					Shapiro Wilk Test Statistic	0.659	**Shapiro Wilk GOF Test**					
99					5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level					
100					Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**					
101					5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level					
102	**Data Not Normal at 5% Significance Level**											
103												
104	**Assuming Normal Distribution**											

	A	B	C	D	E	F	G	H	I	J	K	L
105	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
106					95% Student's-t UCL	0.331				95% Adjusted-CLT UCL (Chen-1995)		0.324
107										95% Modified-t UCL (Johnson-1978)		0.331
108												
109	Gamma GOF Test											
110					A-D Test Statistic	2.181	Anderson-Darling Gamma GOF Test					
111					5% A-D Critical Value	0.729	Data Not Gamma Distributed at 5% Significance Level					
112					K-S Test Statistic	0.461	Kolmogrov-Smirnoff Gamma GOF Test					
113					5% K-S Critical Value	0.267	Data Not Gamma Distributed at 5% Significance Level					
114	Data Not Gamma Distributed at 5% Significance Level											
115												
116	Gamma Statistics											
117					k hat (MLE)	4.821				k star (bias corrected MLE)		3.442
118					Theta hat (MLE)	0.0561				Theta star (bias corrected MLE)		0.0786
119					nu hat (MLE)	96.43				nu star (bias corrected)		68.83
120					MLE Mean (bias corrected)	0.271				MLE Sd (bias corrected)		0.146
121										Approximate Chi Square Value (0.05)		50.74
122					Adjusted Level of Significance	0.0267				Adjusted Chi Square Value		48.05
123												
124	Assuming Gamma Distribution											
125					95% Approximate Gamma UCL (use when n>=50))	0.367				95% Adjusted Gamma UCL (use when n<50)		0.388
126												
127	Lognormal GOF Test											
128					Shapiro Wilk Test Statistic	0.558	Shapiro Wilk Lognormal GOF Test					
129					5% Shapiro Wilk Critical Value	0.842	Data Not Lognormal at 5% Significance Level					
130					Lilliefors Test Statistic	0.474	Lilliefors Lognormal GOF Test					
131					5% Lilliefors Critical Value	0.28	Data Not Lognormal at 5% Significance Level					
132	Data Not Lognormal at 5% Significance Level											
133												
134	Lognormal Statistics											
135					Minimum of Logged Data	-2.974				Mean of logged Data		-1.415
136					Maximum of Logged Data	-0.713				SD of logged Data		0.579
137												
138	Assuming Lognormal Distribution											
139					95% H-UCL	0.451				90% Chebyshev (MVUE) UCL		0.44
140					95% Chebyshev (MVUE) UCL	0.512				97.5% Chebyshev (MVUE) UCL		0.612
141					99% Chebyshev (MVUE) UCL	0.807						
142												
143	Nonparametric Distribution Free UCL Statistics											
144	Data do not follow a Discernible Distribution (0.05)											
145												
146	Nonparametric Distribution Free UCLs											
147					95% CLT UCL	0.324				95% Jackknife UCL		0.331
148					95% Standard Bootstrap UCL	N/A				95% Bootstrap-t UCL		N/A
149					95% Hall's Bootstrap UCL	N/A				95% Percentile Bootstrap UCL		N/A
150					95% BCA Bootstrap UCL	N/A						
151					90% Chebyshev(Mean, Sd) UCL	0.369				95% Chebyshev(Mean, Sd) UCL		0.413
152					97.5% Chebyshev(Mean, Sd) UCL	0.475				99% Chebyshev(Mean, Sd) UCL		0.596
153												
154	Suggested UCL to Use											
155					95% Chebyshev (Mean, Sd) UCL	0.413						
156												

	A	B	C	D	E	F	G	H	I	J	K	L
157	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
158	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
159	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
160	For additional insight the user may want to consult a statistician.											
161												
162	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
163	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
164												
165												
166	**PCB, Total**											
167												
168	**General Statistics**											
169	Total Number of Observations					10	Number of Distinct Observations					2
170							Number of Missing Observations					0
171	Minimum					0.1	Mean					4.02
172	Maximum					5	Median					5
173	SD					2.066	Std. Error of Mean					0.653
174	Coefficient of Variation					0.514	Skewness					-1.779
175												
176	**Normal GOF Test**											
177	Shapiro Wilk Test Statistic					0.51	**Shapiro Wilk GOF Test**					
178	5% Shapiro Wilk Critical Value					0.842	Data Not Normal at 5% Significance Level					
179	Lilliefors Test Statistic					0.482	**Lilliefors GOF Test**					
180	5% Lilliefors Critical Value					0.28	Data Not Normal at 5% Significance Level					
181	**Data Not Normal at 5% Significance Level**											
182												
183	**Assuming Normal Distribution**											
184	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
185	95% Student's-t UCL					5.218	95% Adjusted-CLT UCL (Chen-1995)					4.702
186							95% Modified-t UCL (Johnson-1978)					5.156
187												
188	**Gamma GOF Test**											
189	A-D Test Statistic					2.814	**Anderson-Darling Gamma GOF Test**					
190	5% A-D Critical Value					0.748	Data Not Gamma Distributed at 5% Significance Level					
191	K-S Test Statistic					0.511	**Kolmogrov-Smirnoff Gamma GOF Test**					
192	5% K-S Critical Value					0.274	Data Not Gamma Distributed at 5% Significance Level					
193	**Data Not Gamma Distributed at 5% Significance Level**											
194												
195	**Gamma Statistics**											
196	k hat (MLE)					1.021	k star (bias corrected MLE)					0.781
197	Theta hat (MLE)					3.939	Theta star (bias corrected MLE)					5.147
198	nu hat (MLE)					20.41	nu star (bias corrected)					15.62
199	MLE Mean (bias corrected)					4.02	MLE Sd (bias corrected)					4.549
200							Approximate Chi Square Value (0.05)					7.696
201	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					6.751
202												
203	**Assuming Gamma Distribution**											
204	95% Approximate Gamma UCL (use when n>=50))					8.16	95% Adjusted Gamma UCL (use when n<50)					9.302
205												
206	**Lognormal GOF Test**											
207	Shapiro Wilk Test Statistic					0.51	**Shapiro Wilk Lognormal GOF Test**					
208	5% Shapiro Wilk Critical Value					0.842	Data Not Lognormal at 5% Significance Level					

	A	B	C	D	E	F	G	H	I	J	K	L
209					Lilliefors Test Statistic	0.482	**Lilliefors Lognormal GOF Test**					
210					5% Lilliefors Critical Value	0.28	Data Not Lognormal at 5% Significance Level					
211	**Data Not Lognormal at 5% Significance Level**											
212												
213	**Lognormal Statistics**											
214					Minimum of Logged Data	-2.303				Mean of logged Data		0.827
215					Maximum of Logged Data	1.609				SD of logged Data		1.649
216												
217	**Assuming Lognormal Distribution**											
218					95% H-UCL	109.1				90% Chebyshev (MVUE) UCL		18.43
219					95% Chebyshev (MVUE) UCL	23.62				97.5% Chebyshev (MVUE) UCL		30.83
220					99% Chebyshev (MVUE) UCL	44.98						
221												
222	**Nonparametric Distribution Free UCL Statistics**											
223	**Data do not follow a Discernible Distribution (0.05)**											
224												
225	**Nonparametric Distribution Free UCLs**											
226					95% CLT UCL	5.095				95% Jackknife UCL		N/A
227					95% Standard Bootstrap UCL	N/A				95% Bootstrap-t UCL		N/A
228					95% Hall's Bootstrap UCL	N/A				95% Percentile Bootstrap UCL		N/A
229					95% BCA Bootstrap UCL	N/A						
230					90% Chebyshev(Mean, Sd) UCL	5.98				95% Chebyshev(Mean, Sd) UCL		6.868
231					97.5% Chebyshev(Mean, Sd) UCL	8.1				99% Chebyshev(Mean, Sd) UCL		10.52
232												
233	**Suggested UCL to Use**											
234					99% Chebyshev (Mean, Sd) UCL	10.52						
235												
236	**Recommended UCL exceeds the maximum observation**											
237												
238	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
239	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
240	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
241	For additional insight the user may want to consult a statistician.											
242												
243	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
244	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
245												
246												
247	**Uranium-238**											
248												
249	**General Statistics**											
250					Total Number of Observations	10				Number of Distinct Observations		3
251										Number of Missing Observations		0
252					Minimum	1.32				Mean		1.68
253					Maximum	2.04				Median		1.68
254					SD	0.17				Std. Error of Mean		0.0537
255					Coefficient of Variation	0.101				Skewness		-2.37E-15
256												
257	**Normal GOF Test**											
258					Shapiro Wilk Test Statistic	0.659	**Shapiro Wilk GOF Test**					
259					5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level					
260					Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**					

	A	B	C	D	E	F	G	H	I	J	K	L
261					5% Lilliefors Critical Value	0.28	Data Not Normal at 5% Significance Level					
262	**Data Not Normal at 5% Significance Level**											
263												
264	**Assuming Normal Distribution**											
265	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
266					95% Student's-t UCL	1.778				95% Adjusted-CLT UCL (Chen-1995)		1.768
267										95% Modified-t UCL (Johnson-1978)		1.778
268												
269	**Gamma GOF Test**											
270					A-D Test Statistic	2.02	**Anderson-Darling Gamma GOF Test**					
271					5% A-D Critical Value	0.724	Data Not Gamma Distributed at 5% Significance Level					
272					K-S Test Statistic	0.413	**Kolmogrov-Smirnoff Gamma GOF Test**					
273					5% K-S Critical Value	0.266	Data Not Gamma Distributed at 5% Significance Level					
274	**Data Not Gamma Distributed at 5% Significance Level**											
275												
276	**Gamma Statistics**											
277					k hat (MLE)	106.5				k star (bias corrected MLE)		74.64
278					Theta hat (MLE)	0.0158				Theta star (bias corrected MLE)		0.0225
279					nu hat (MLE)	2131				nu star (bias corrected)		1493
280					MLE Mean (bias corrected)	1.68				MLE Sd (bias corrected)		0.194
281										Approximate Chi Square Value (0.05)		1404
282					Adjusted Level of Significance	0.0267				Adjusted Chi Square Value		1389
283												
284	**Assuming Gamma Distribution**											
285					95% Approximate Gamma UCL (use when n>=50))	1.786				95% Adjusted Gamma UCL (use when n<50)		1.805
286												
287	**Lognormal GOF Test**											
288					Shapiro Wilk Test Statistic	0.653	**Shapiro Wilk Lognormal GOF Test**					
289					5% Shapiro Wilk Critical Value	0.842	Data Not Lognormal at 5% Significance Level					
290					Lilliefors Test Statistic	0.418	**Lilliefors Lognormal GOF Test**					
291					5% Lilliefors Critical Value	0.28	Data Not Lognormal at 5% Significance Level					
292	**Data Not Lognormal at 5% Significance Level**											
293												
294	**Lognormal Statistics**											
295					Minimum of Logged Data	0.278				Mean of logged Data		0.514
296					Maximum of Logged Data	0.713				SD of logged Data		0.103
297												
298	**Assuming Lognormal Distribution**											
299					95% H-UCL	1.789				90% Chebyshev (MVUE) UCL		1.845
300					95% Chebyshev (MVUE) UCL	1.919				97.5% Chebyshev (MVUE) UCL		2.022
301					99% Chebyshev (MVUE) UCL	2.226						
302												
303	**Nonparametric Distribution Free UCL Statistics**											
304	**Data do not follow a Discernible Distribution (0.05)**											
305												
306	**Nonparametric Distribution Free UCLs**											
307					95% CLT UCL	1.768				95% Jackknife UCL		1.778
308					95% Standard Bootstrap UCL	N/A				95% Bootstrap-t UCL		N/A
309					95% Hall's Bootstrap UCL	N/A				95% Percentile Bootstrap UCL		N/A
310					95% BCA Bootstrap UCL	N/A						
311					90% Chebyshev(Mean, Sd) UCL	1.841				95% Chebyshev(Mean, Sd) UCL		1.914
312					97.5% Chebyshev(Mean, Sd) UCL	2.015				99% Chebyshev(Mean, Sd) UCL		2.214

	A	B	C	D	E	F	G	H	I	J	K	L
313												
314						Suggested UCL to Use						
315					95% Student's-t UCL	1.778					or 95% Modified-t UCL	1.778
316												
317					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
318					These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)							
319					and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.							
320					For additional insight the user may want to consult a statistician.							
321												
322					**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**							
323					**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**							
324												
325												
326	**Vanadium**											
327												
328						General Statistics						
329					Total Number of Observations	10					Number of Distinct Observations	9
330											Number of Missing Observations	0
331					Minimum	78					Mean	90.7
332					Maximum	110					Median	87.5
333					SD	12.83					Std. Error of Mean	4.058
334					Coefficient of Variation	0.141					Skewness	0.548
335												
336						Normal GOF Test						
337					Shapiro Wilk Test Statistic	0.853					**Shapiro Wilk GOF Test**	
338					5% Shapiro Wilk Critical Value	0.842					Data appear Normal at 5% Significance Level	
339					Lilliefors Test Statistic	0.198					**Lilliefors GOF Test**	
340					5% Lilliefors Critical Value	0.28					Data appear Normal at 5% Significance Level	
341						**Data appear Normal at 5% Significance Level**						
342												
343						Assuming Normal Distribution						
344					**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**	
345					95% Student's-t UCL	98.14					95% Adjusted-CLT UCL (Chen-1995)	98.13
346											95% Modified-t UCL (Johnson-1978)	98.26
347												
348						Gamma GOF Test						
349					A-D Test Statistic	0.622					**Anderson-Darling Gamma GOF Test**	
350					5% A-D Critical Value	0.724					Detected data appear Gamma Distributed at 5% Significance Level	
351					K-S Test Statistic	0.212					**Kolmogrov-Smirnoff Gamma GOF Test**	
352					5% K-S Critical Value	0.266					Detected data appear Gamma Distributed at 5% Significance Level	
353						**Detected data appear Gamma Distributed at 5% Significance Level**						
354												
355						Gamma Statistics						
356					k hat (MLE)	57.26					k star (bias corrected MLE)	40.15
357					Theta hat (MLE)	1.584					Theta star (bias corrected MLE)	2.259
358					nu hat (MLE)	1145					nu star (bias corrected)	803
359					MLE Mean (bias corrected)	90.7					MLE Sd (bias corrected)	14.31
360											Approximate Chi Square Value (0.05)	738.3
361					Adjusted Level of Significance	0.0267					Adjusted Chi Square Value	727.4
362												
363						Assuming Gamma Distribution						
364					95% Approximate Gamma UCL (use when n>=50))	98.66					95% Adjusted Gamma UCL (use when n<50)	100.1

	A	B	C	D	E	F	G	H	I	J	K	L
365												
366						Lognormal GOF Test						
367					Shapiro Wilk Test Statistic	0.861	Shapiro Wilk Lognormal GOF Test					
368					5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level					
369					Lilliefors Test Statistic	0.2	Lilliefors Lognormal GOF Test					
370					5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level					
371					Data appear Lognormal at 5% Significance Level							
372												
373					Lognormal Statistics							
374					Minimum of Logged Data	4.357	Mean of logged Data					4.499
375					Maximum of Logged Data	4.7	SD of logged Data					0.138
376												
377					Assuming Lognormal Distribution							
378					95% H-UCL	98.78	90% Chebyshev (MVUE) UCL					102.6
379					95% Chebyshev (MVUE) UCL	108	97.5% Chebyshev (MVUE) UCL					115.5
380					99% Chebyshev (MVUE) UCL	130.3						
381												
382					Nonparametric Distribution Free UCL Statistics							
383					Data appear to follow a Discernible Distribution at 5% Significance Level							
384												
385					Nonparametric Distribution Free UCLs							
386					95% CLT UCL	97.37	95% Jackknife UCL					98.14
387					95% Standard Bootstrap UCL	96.83	95% Bootstrap-t UCL					99.89
388					95% Hall's Bootstrap UCL	96.47	95% Percentile Bootstrap UCL					97.3
389					95% BCA Bootstrap UCL	97.2						
390					90% Chebyshev(Mean, Sd) UCL	102.9	95% Chebyshev(Mean, Sd) UCL					108.4
391					97.5% Chebyshev(Mean, Sd) UCL	116	99% Chebyshev(Mean, Sd) UCL					131.1
392												
393					Suggested UCL to Use							
394					95% Student's-t UCL	98.14						
395												
396					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
397					These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)							
398					and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.							
399					For additional insight the user may want to consult a statistician.							
400												