	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			3/1/2015 12:51:53 PM								
5	From File			EPC_204Surf.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	**Aluminum**											
12												
13	**General Statistics**											
14	Total Number of Observations					11	Number of Distinct Observations					4
15							Number of Missing Observations					0
16	Minimum					7900	Mean					11067
17	Maximum					13700	Median					11067
18	SD					1313	Std. Error of Mean					396
19	Coefficient of Variation					0.119	Skewness					-0.72
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic					0.68	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.409	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.267	Data Not Normal at 5% Significance Level					
26	**Data Not 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					11784	95% Adjusted-CLT UCL (Chen-1995)					11626
31							95% Modified-t UCL (Johnson-1978)					11770
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					2.03	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.727	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.425	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.255	Data Not Gamma Distributed at 5% Significance Level					
38	**Data Not Gamma Distributed at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)					72.02	k star (bias corrected MLE)					52.44
42	Theta hat (MLE)					153.7	Theta star (bias corrected MLE)					211.1
43	nu hat (MLE)					1584	nu star (bias corrected)					1154
44	MLE Mean (bias corrected)					11067	MLE Sd (bias corrected)					1528
45							Approximate Chi Square Value (0.05)					1076
46	Adjusted Level of Significance					0.0278	Adjusted Chi Square Value					1063
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50))					11868	95% Adjusted Gamma UCL (use when n<50)					12005
50												
51	**Lognormal GOF Test**											
52	Shapiro Wilk Test Statistic					0.652	**Shapiro Wilk Lognormal GOF Test**					

	A	B	C	D	E	F	G	H	I	J	K	L
53					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.431	**Lilliefors Lognormal GOF Test**					
55					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
56	**Data Not Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59					Minimum of Logged Data	8.975	Mean of logged Data					9.305
60					Maximum of Logged Data	9.525	SD of logged Data					0.127
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	11910	90% Chebyshev (MVUE) UCL					12343
64					95% Chebyshev (MVUE) UCL	12919	97.5% Chebyshev (MVUE) UCL					13718
65					99% Chebyshev (MVUE) UCL	15289						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data do not follow a Discernible Distribution (0.05)**											
69												
70	**Nonparametric Distribution Free UCLs**											
71					95% CLT UCL	11718	95% Jackknife UCL					11784
72					95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL					N/A
73					95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL					N/A
74					95% BCA Bootstrap UCL	N/A						
75					90% Chebyshev(Mean, Sd) UCL	12255	95% Chebyshev(Mean, Sd) UCL					12793
76					97.5% Chebyshev(Mean, Sd) UCL	13539	99% Chebyshev(Mean, Sd) UCL					15006
77												
78	**Suggested UCL to Use**											
79					95% Student's-t UCL	11784	or 95% Modified-t UCL					11770
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	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
87	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
88												
89												
90	**Chromium**											
91												
92	**General Statistics**											
93					Total Number of Observations	11	Number of Distinct Observations					4
94							Number of Missing Observations					0
95					Minimum	12	Mean					13.03
96					Maximum	18	Median					12
97					SD	2.095	Std. Error of Mean					0.632
98					Coefficient of Variation	0.161	Skewness					1.986
99												
100	**Normal GOF Test**											
101					Shapiro Wilk Test Statistic	0.572	**Shapiro Wilk GOF Test**					
102					5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level					
103					Lilliefors Test Statistic	0.415	**Lilliefors GOF Test**					
104					5% Lilliefors Critical Value	0.267	Data Not Normal at 5% Significance Level					

	A	B	C	D	E	F	G	H	I	J	K	L
105	Data Not Normal at 5% Significance Level											
106												
107	Assuming Normal Distribution											
108	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
109					95% Student's-t UCL	14.17			95% Adjusted-CLT UCL (Chen-1995)			14.47
110									95% Modified-t UCL (Johnson-1978)			14.24
111												
112	Gamma GOF Test											
113					A-D Test Statistic	2.373	Anderson-Darling Gamma GOF Test					
114					5% A-D Critical Value	0.728	Data Not Gamma Distributed at 5% Significance Level					
115					K-S Test Statistic	0.426	Kolmogrov-Smirnoff Gamma GOF Test					
116					5% K-S Critical Value	0.255	Data Not Gamma Distributed at 5% Significance Level					
117	Data Not Gamma Distributed at 5% Significance Level											
118												
119	Gamma Statistics											
120					k hat (MLE)	49.38			k star (bias corrected MLE)			35.97
121					Theta hat (MLE)	0.264			Theta star (bias corrected MLE)			0.362
122					nu hat (MLE)	1086			nu star (bias corrected)			791.4
123					MLE Mean (bias corrected)	13.03			MLE Sd (bias corrected)			2.172
124									Approximate Chi Square Value (0.05)			727.1
125					Adjusted Level of Significance	0.0278			Adjusted Chi Square Value			717.1
126												
127	Assuming Gamma Distribution											
128				95% Approximate Gamma UCL (use when n>=50))		14.18			95% Adjusted Gamma UCL (use when n<50)			14.38
129												
130	Lognormal GOF Test											
131					Shapiro Wilk Test Statistic	0.579	Shapiro Wilk Lognormal GOF Test					
132					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
133					Lilliefors Test Statistic	0.419	Lilliefors Lognormal GOF Test					
134					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
135	Data Not Lognormal at 5% Significance Level											
136												
137	Lognormal Statistics											
138					Minimum of Logged Data	2.485			Mean of logged Data			2.557
139					Maximum of Logged Data	2.89			SD of logged Data			0.144
140												
141	Assuming Lognormal Distribution											
142					95% H-UCL	14.15			90% Chebyshev (MVUE) UCL			14.72
143					95% Chebyshev (MVUE) UCL	15.49			97.5% Chebyshev (MVUE) UCL			16.56
144					99% Chebyshev (MVUE) UCL	18.66						
145												
146	Nonparametric Distribution Free UCL Statistics											
147	Data do not follow a Discernible Distribution (0.05)											
148												
149	Nonparametric Distribution Free UCLs											
150					95% CLT UCL	14.07			95% Jackknife UCL			14.17
151					95% Standard Bootstrap UCL	N/A			95% Bootstrap-t UCL			N/A
152					95% Hall's Bootstrap UCL	N/A			95% Percentile Bootstrap UCL			N/A
153					95% BCA Bootstrap UCL	N/A						
154					90% Chebyshev(Mean, Sd) UCL	14.92			95% Chebyshev(Mean, Sd) UCL			15.78
155					97.5% Chebyshev(Mean, Sd) UCL	16.97			99% Chebyshev(Mean, Sd) UCL			19.31
156												

	A	B	C	D	E	F	G	H	I	J	K	L
157						Suggested UCL to Use						
158					95% Student's-t UCL	14.17				or 95% Modified-t UCL		14.24
159												
160					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
161					These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)							
162					and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.							
163					For additional insight the user may want to consult a statistician.							
164												
165												
166	PAH, Total											
167												
168						General Statistics						
169					Total Number of Observations	11				Number of Distinct Observations		3
170										Number of Missing Observations		0
171					Minimum	0.00806				Mean		0.329
172					Maximum	0.49				Median		0.329
173					SD	0.124				Std. Error of Mean		0.0375
174					Coefficient of Variation	0.378				Skewness		-1.578
175												
176						Normal GOF Test						
177					Shapiro Wilk Test Statistic	0.675				Shapiro Wilk GOF Test		
178					5% Shapiro Wilk Critical Value	0.85				Data Not Normal at 5% Significance Level		
179					Lilliefors Test Statistic	0.409				Lilliefors GOF Test		
180					5% Lilliefors Critical Value	0.267				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	0.397				95% Adjusted-CLT UCL (Chen-1995)		0.372
186										95% Modified-t UCL (Johnson-1978)		0.394
187												
188						Gamma GOF Test						
189					A-D Test Statistic	2.675				Anderson-Darling Gamma GOF Test		
190					5% A-D Critical Value	0.739				Data Not Gamma Distributed at 5% Significance Level		
191					K-S Test Statistic	0.502				Kolmogrov-Smirnoff Gamma GOF Test		
192					5% K-S Critical Value	0.258				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)	2.037				k star (bias corrected MLE)		1.542
197					Theta hat (MLE)	0.162				Theta star (bias corrected MLE)		0.214
198					nu hat (MLE)	44.82				nu star (bias corrected)		33.93
199					MLE Mean (bias corrected)	0.329				MLE Sd (bias corrected)		0.265
200										Approximate Chi Square Value (0.05)		21.61
201					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		20.02
202												
203						Assuming Gamma Distribution						
204					95% Approximate Gamma UCL (use when n>=50))	0.517				95% Adjusted Gamma UCL (use when n<50)		0.558
205												
206						Lognormal GOF Test						
207					Shapiro Wilk Test Statistic	0.445				Shapiro Wilk Lognormal GOF Test		
208					5% Shapiro Wilk Critical Value	0.85				Data Not Lognormal at 5% Significance Level		

	A	B	C	D	E	F	G	H	I	J	K	L
209					Lilliefors Test Statistic	0.5	**Lilliefors Lognormal GOF Test**					
210					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
211	**Data Not Lognormal at 5% Significance Level**											
212												
213	**Lognormal Statistics**											
214					Minimum of Logged Data	-4.821				Mean of logged Data		-1.376
215					Maximum of Logged Data	-0.713				SD of logged Data		1.154
216												
217	**Assuming Lognormal Distribution**											
218					95% H-UCL	1.639				90% Chebyshev (MVUE) UCL		0.952
219					95% Chebyshev (MVUE) UCL	1.179				97.5% Chebyshev (MVUE) UCL		1.495
220					99% Chebyshev (MVUE) UCL	2.115						
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	0.391				95% Jackknife UCL		0.397
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	0.442				95% Chebyshev(Mean, Sd) UCL		0.493
231					97.5% Chebyshev(Mean, Sd) UCL	0.564				99% Chebyshev(Mean, Sd) UCL		0.703
232												
233	**Suggested UCL to Use**											
234					95% Chebyshev (Mean, Sd) UCL	0.493						
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	11				Number of Distinct Observations		4
251										Number of Missing Observations		0
252					Minimum	0.168				Mean		0.764
253					Maximum	1.76				Median		0.764
254					SD	0.388				Std. Error of Mean		0.117
255					Coefficient of Variation	0.508				Skewness		1.488
256												
257	**Normal GOF Test**											
258					Shapiro Wilk Test Statistic	0.696	**Shapiro Wilk GOF Test**					
259					5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level					
260					Lilliefors Test Statistic	0.409	**Lilliefors GOF Test**					

	A	B	C	D	E	F	G	H	I	J	K	L
261					5% Lilliefors Critical Value	0.267	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	0.976				95% Adjusted-CLT UCL (Chen-1995)		1.013
267										95% Modified-t UCL (Johnson-1978)		0.985
268												
269	**Gamma GOF Test**											
270					A-D Test Statistic	1.66	**Anderson-Darling Gamma GOF Test**					
271					5% A-D Critical Value	0.733	Data Not Gamma Distributed at 5% Significance Level					
272					K-S Test Statistic	0.384	**Kolmogrov-Smirnoff Gamma GOF Test**					
273					5% K-S Critical Value	0.256	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)	4.028				k star (bias corrected MLE)		2.99
278					Theta hat (MLE)	0.19				Theta star (bias corrected MLE)		0.255
279					nu hat (MLE)	88.62				nu star (bias corrected)		65.79
280					MLE Mean (bias corrected)	0.764				MLE Sd (bias corrected)		0.442
281										Approximate Chi Square Value (0.05)		48.12
282					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		45.67
283												
284	**Assuming Gamma Distribution**											
285					95% Approximate Gamma UCL (use when n>=50))	1.044				95% Adjusted Gamma UCL (use when n<50)		1.101
286												
287	**Lognormal GOF Test**											
288					Shapiro Wilk Test Statistic	0.726	**Shapiro Wilk Lognormal GOF Test**					
289					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
290					Lilliefors Test Statistic	0.406	**Lilliefors Lognormal GOF Test**					
291					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
292	**Data Not Lognormal at 5% Significance Level**											
293												
294	**Lognormal Statistics**											
295					Minimum of Logged Data	-1.784				Mean of logged Data		-0.398
296					Maximum of Logged Data	0.565				SD of logged Data		0.579
297												
298	**Assuming Lognormal Distribution**											
299					95% H-UCL	1.207				90% Chebyshev (MVUE) UCL		1.201
300					95% Chebyshev (MVUE) UCL	1.391				97.5% Chebyshev (MVUE) UCL		1.655
301					99% Chebyshev (MVUE) UCL	2.174						
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	0.957				95% Jackknife UCL		0.976
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	1.115				95% Chebyshev(Mean, Sd) UCL		1.274
312					97.5% Chebyshev(Mean, Sd) UCL	1.495				99% Chebyshev(Mean, Sd) UCL		1.929

	A	B	C	D	E	F	G	H	I	J	K	L
313												
314						**Suggested UCL to Use**						
315					95% Chebyshev (Mean, Sd) UCL	1.274						
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												
323	**Vanadium**											
324												
325						**General Statistics**						
326					Total Number of Observations	11	Number of Distinct Observations					10
327							Number of Missing Observations					0
328					Minimum	90	Mean					112.4
329					Maximum	131	Median					114
330					SD	13.87	Std. Error of Mean					4.183
331					Coefficient of Variation	0.123	Skewness					-0.433
332												
333						**Normal GOF Test**						
334					Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**					
335					5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level					
336					Lilliefors Test Statistic	0.16	**Lilliefors GOF Test**					
337					5% Lilliefors Critical Value	0.267	Data appear Normal at 5% Significance Level					
338						**Data appear Normal at 5% Significance Level**						
339												
340						**Assuming Normal Distribution**						
341					**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**					
342					95% Student's-t UCL	119.9	95% Adjusted-CLT UCL (Chen-1995)					118.7
343							95% Modified-t UCL (Johnson-1978)					119.9
344												
345						**Gamma GOF Test**						
346					A-D Test Statistic	0.362	**Anderson-Darling Gamma GOF Test**					
347					5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level					
348					K-S Test Statistic	0.173	**Kolmogrov-Smirnoff Gamma GOF Test**					
349					5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level					
350						**Detected data appear Gamma Distributed at 5% Significance Level**						
351												
352						**Gamma Statistics**						
353					k hat (MLE)	69.25	k star (bias corrected MLE)					50.42
354					Theta hat (MLE)	1.623	Theta star (bias corrected MLE)					2.228
355					nu hat (MLE)	1523	nu star (bias corrected)					1109
356					MLE Mean (bias corrected)	112.4	MLE Sd (bias corrected)					15.82
357							Approximate Chi Square Value (0.05)					1033
358					Adjusted Level of Significance	0.0278	Adjusted Chi Square Value					1021
359												
360						**Assuming Gamma Distribution**						
361					95% Approximate Gamma UCL (use when n>=50))	120.7	95% Adjusted Gamma UCL (use when n<50)					122.1
362												
363						**Lognormal GOF Test**						
364					Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**					

	A	B	C	D	E	F	G	H	I	J	K	L
365					5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level					
366					Lilliefors Test Statistic	0.184	**Lilliefors Lognormal GOF Test**					
367					5% Lilliefors Critical Value	0.267	Data appear Lognormal at 5% Significance Level					
368	**Data appear Lognormal at 5% Significance Level**											
369												
370	**Lognormal Statistics**											
371					Minimum of Logged Data	4.5				Mean of logged Data		4.715
372					Maximum of Logged Data	4.875				SD of logged Data		0.128
373												
374	**Assuming Lognormal Distribution**											
375					95% H-UCL	121				90% Chebyshev (MVUE) UCL		125.4
376					95% Chebyshev (MVUE) UCL	131.3				97.5% Chebyshev (MVUE) UCL		139.4
377					99% Chebyshev (MVUE) UCL	155.5						
378												
379	**Nonparametric Distribution Free UCL Statistics**											
380	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
381												
382	**Nonparametric Distribution Free UCLs**											
383					95% CLT UCL	119.2				95% Jackknife UCL		119.9
384					95% Standard Bootstrap UCL	118.9				95% Bootstrap-t UCL		119.1
385					95% Hall's Bootstrap UCL	118.4				95% Percentile Bootstrap UCL		118.9
386					95% BCA Bootstrap UCL	118.2						
387					90% Chebyshev(Mean, Sd) UCL	124.9				95% Chebyshev(Mean, Sd) UCL		130.6
388					97.5% Chebyshev(Mean, Sd) UCL	138.5				99% Chebyshev(Mean, Sd) UCL		154
389												
390	**Suggested UCL to Use**											
391					95% Student's-t UCL	119.9						
392												
393	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
394	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
395	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
396	For additional insight the user may want to consult a statistician.											
397												
398	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
399	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
400												