

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	e/Time of Computation		8/13/2015 1:44:01 PM									
5	From File		ProUCLinput_12-001(a)-99_0-5.xls									
6	Full Precision		OFF									
7	Confidence Coefficient		95%									
8	f Bootstrap Operations		2000									
9												
10												
11	Aluminum											
12												
13	General Statistics											
14	Total Number of Observations				80		Number of Distinct Observations				65	
15							Number of Missing Observations				0	
16	Minimum				2230		Mean				10973	
17	Maximum				23200		Median				11000	
18	SD				5143		Std. Error of Mean				575	
19	Coefficient of Variation				0.46		Skewness				-0.063	
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic				0.95		Shapiro Wilk GOF Test					
23	5% Shapiro Wilk P Value				0.01		Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic				0.08		Lilliefors GOF Test					
25	5% Lilliefors Critical Value				0.09		Data appear 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				11930		95% Adjusted-CLT UCL (Chen-1995)				11914	
31							95% Modified-t UCL (Johnson-1978)				11929	
32												
33	Gamma GOF Test											
34	A-D Test Statistic				2.28		Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value				0.75		Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic				0.15		Kolmogrov-Smirnoff Gamma GOF Test					
37	5% K-S Critical Value				0.1		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)				3.47		k star (bias corrected MLE)				3.34	
42	Theta hat (MLE)				3163		Theta star (bias corrected MLE)				3278	
43	nu hat (MLE)				555.1		nu star (bias corrected)				535.6	
44	MLE Mean (bias corrected)				10973		MLE Sd (bias corrected)				5997	
45							Approximate Chi Square Value (0.05)				483	
46	Adjusted Level of Significance				0.04		Adjusted Chi Square Value				482.1	
47												
48	Assuming Gamma Distribution											
49	ximate Gamma UCL (use when n>=50))				12170		Adjusted Gamma UCL (use when n<50)				12193	
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic				0.87		Shapiro Wilk Lognormal GOF Test					
53	5% Shapiro Wilk P Value				3.3426E-05		Data Not Lognormal at 5% Significance Level					
54	Lilliefors Test Statistic				0.19		Lilliefors Lognormal GOF Test					
55	5% Lilliefors Critical Value				0.09		Data Not Lognormal at 5% Significance Level					
56	Data Not Lognormal at 5% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data				7.71		Mean of logged Data				9.15	
60	Maximum of Logged Data				10.0		SD of logged Data				0.61	
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL				12985		90% Chebyshev (MVUE) UCL				13847	

	A	B	C	D	E	F	G	H	I	J	K	L
64	95% Chebyshev (MVUE) UCL					14982	97.5% Chebyshev (MVUE) UCL					16559
65	99% Chebyshev (MVUE) UCL					19655						
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					11919	95% Jackknife UCL					11930
72	95% Standard Bootstrap UCL					11922	95% Bootstrap-t UCL					11964
73	95% Hall's Bootstrap UCL					11921	95% Percentile Bootstrap UCL					11926
74	95% BCA Bootstrap UCL					11969						
75	90% Chebyshev(Mean, Sd) UCL					12698	95% Chebyshev(Mean, Sd) UCL					13479
76	97.5% Chebyshev(Mean, Sd) UCL					14564	99% Chebyshev(Mean, Sd) UCL					16694
77												
78	Suggested UCL to Use											
79	95% Student's-t UCL					11930						
80												
81	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
82	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
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	highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may											
87	reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.											
88												
89												
90	Barium											
91												
92	General Statistics											
93	Total Number of Observations					80	Number of Distinct Observations					68
94							Number of Missing Observations					0
95	Minimum					19.6	Mean					169
96	Maximum					503	Median					195.5
97	SD					91.0	Std. Error of Mean					10.1
98	Coefficient of Variation					0.53	Skewness					0.41
99												
100	Normal GOF Test											
101	Shapiro Wilk Test Statistic					0.89	Shapiro Wilk GOF Test					
102	5% Shapiro Wilk P Value					4.1010E	Data Not Normal at 5% Significance Level					
103	Lilliefors Test Statistic					0.15	Lilliefors GOF Test					
104	5% Lilliefors Critical Value					0.09	Data Not Normal at 5% Significance Level					
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					185.9	95% Adjusted-CLT UCL (Chen-1995)					186.2
110							95% Modified-t UCL (Johnson-1978)					186
111												
112	Gamma GOF Test											
113	A-D Test Statistic					5.16	Anderson-Darling Gamma GOF Test					
114	5% A-D Critical Value					0.76	Data Not Gamma Distributed at 5% Significance Level					
115	K-S Test Statistic					0.22	Kolmogrov-Smirnoff Gamma GOF Test					
116	5% K-S Critical Value					0.10	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)					2.43	k star (bias corrected MLE)					2.35
121	Theta hat (MLE)					69.4	Theta star (bias corrected MLE)					71.9
122	nu hat (MLE)					389.2	nu star (bias corrected)					375.9
123	MLE Mean (bias corrected)					169	MLE Sd (bias corrected)					110.2
124							Approximate Chi Square Value (0.05)					332
125	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					331.3
126												

	A	B	C	D	E	F	G	H	I	J	K	L	
127	Assuming Gamma Distribution												
128	Approximate Gamma UCL (use when n>=50))					191.4	Adjusted Gamma UCL (use when n<50)					191.8	
129													
130	Lognormal GOF Test												
131	Shapiro Wilk Test Statistic					0.81	Shapiro Wilk Lognormal GOF Test						
132	5% Shapiro Wilk P Value					4.130E-05	Data Not Lognormal at 5% Significance Level						
133	Lilliefors Test Statistic					0.24	Lilliefors Lognormal GOF Test						
134	5% Lilliefors Critical Value					0.099	Data Not Lognormal at 5% Significance Level						
135	Data Not Lognormal at 5% Significance Level												
136													
137	Lognormal Statistics												
138	Minimum of Logged Data					2.97	Mean of logged Data					4.91	
139	Maximum of Logged Data					6.22	SD of logged Data					0.76	
140													
141	Assuming Lognormal Distribution												
142	95% H-UCL					217.8	90% Chebyshev (MVUE) UCL					234.1	
143	95% Chebyshev (MVUE) UCL					257.9	97.5% Chebyshev (MVUE) UCL					290.9	
144	99% Chebyshev (MVUE) UCL					355.7							
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					185.7	95% Jackknife UCL					185.9	
151	95% Standard Bootstrap UCL					185.2	95% Bootstrap-t UCL					185.7	
152	95% Hall's Bootstrap UCL					187.3	95% Percentile Bootstrap UCL					185.8	
153	95% BCA Bootstrap UCL					186.6							
154	90% Chebyshev(Mean, Sd) UCL					199.5	95% Chebyshev(Mean, Sd) UCL					213.4	
155	97.5% Chebyshev(Mean, Sd) UCL					232.6	99% Chebyshev(Mean, Sd) UCL					270.3	
156													
157	Suggested UCL to Use												
158	95% Chebyshev (Mean, Sd) UCL					213.4							
159													
160	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
161	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Singh												
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	Cadmium												
166													
167	General Statistics												
168	Total Number of Observations					80	Number of Distinct Observations					69	
169	Number of Detects					44	Number of Non-Detects					36	
170	Number of Distinct Detects					40	Number of Distinct Non-Detects					29	
171	Minimum Detect					0.12	Minimum Non-Detect					0.51	
172	Maximum Detect					0.36	Maximum Non-Detect					0.60	
173	Variance Detects					0.002	Percent Non-Detects					45%	
174	Mean Detects					0.21	SD Detects					0.05	
175	Median Detects					0.20	CV Detects					0.24	
176	Skewness Detects					0.54	Kurtosis Detects					0.19	
177	Mean of Logged Detects					-1.56	SD of Logged Detects					0.24	
178													
179	Normal GOF Test on Detects Only												
180	Shapiro Wilk Test Statistic					0.96	Shapiro Wilk GOF Test						
181	5% Shapiro Wilk Critical Value					0.94	Detected Data appear Normal at 5% Significance Level						
182	Lilliefors Test Statistic					0.10	Lilliefors GOF Test						
183	5% Lilliefors Critical Value					0.13	Detected Data appear Normal at 5% Significance Level						
184	Detected Data appear Normal at 5% Significance Level												
185													
186	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs												
187	Mean					0.21	Standard Error of Mean					0.007	
188	SD					0.05	95% KM (BCA) UCL					0.22	
189	95% KM (t) UCL					0.22	95% KM (Percentile Bootstrap) UCL					0.22	

	A	B	C	D	E	F	G	H	I	J	K	L
190				95% KM (z) UCL	0.22			95% KM Bootstrap t UCL			0.22	
191				90% KM Chebyshev UCL	0.23			95% KM Chebyshev UCL			0.24	
192				97.5% KM Chebyshev UCL	0.26			99% KM Chebyshev UCL			0.29	
193												
194				Gamma GOF Tests on Detected Observations Only								
195				A-D Test Statistic	0.24			Anderson-Darling GOF Test				
196				5% A-D Critical Value	0.74			data appear Gamma Distributed at 5% Significance Level				
197				K-S Test Statistic	0.07			Kolmogrov-Smirnoff GOF				
198				5% K-S Critical Value	0.13			data appear Gamma Distributed at 5% Significance Level				
199				Detected data appear Gamma Distributed at 5% Significance Level								
200												
201				Gamma Statistics on Detected Data Only								
202				k hat (MLE)	17.8			k star (bias corrected MLE)			16.6	
203				Theta hat (MLE)	0.01			Theta star (bias corrected MLE)			0.01	
204				nu hat (MLE)	1570			nu star (bias corrected)			1464	
205				MLE Mean (bias corrected)	0.21			MLE Sd (bias corrected)			0.05	
206												
207				Gamma Kaplan-Meier (KM) Statistics								
208				k hat (KM)	17.5			nu hat (KM)			2804	
209				Approximate Chi Square Value (N/A, α)	2682			Adjusted Chi Square Value (N/A, β)			2680	
210				Approximate KM-UCL (use when $n \geq 50$)	0.22			Gamma Adjusted KM-UCL (use when $n < 50$)			0.22	
211												
212				Gamma ROS Statistics using Imputed Non-Detects								
213				GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs								
214				GROS may not be used when kstar of detected data is small such as < 0.1								
215				For such situations, GROS method tends to yield inflated values of UCLs and BTVs								
216				Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates								
217				Minimum	0.12			Mean			0.21	
218				Maximum	0.36			Median			0.21	
219				SD	0.03			CV			0.18	
220				k hat (MLE)	30.1			k star (bias corrected MLE)			29.0	
221				Theta hat (MLE)	0.007			Theta star (bias corrected MLE)			0.007	
222				nu hat (MLE)	4824			nu star (bias corrected)			4644	
223				MLE Mean (bias corrected)	0.21			MLE Sd (bias corrected)			0.03	
224								Adjusted Level of Significance (β)			0.04	
225				Approximate Chi Square Value (N/A, α)	4487			Adjusted Chi Square Value (N/A, β)			4484	
226				Gamma Approximate UCL (use when $n \geq 50$)	0.22			Gamma Adjusted UCL (use when $n < 50$)			0.22	
227												
228				Lognormal GOF Test on Detected Observations Only								
229				Shapiro Wilk Test Statistic	0.98			Shapiro Wilk GOF Test				
230				5% Shapiro Wilk Critical Value	0.94			Detected Data appear Lognormal at 5% Significance Level				
231				Lilliefors Test Statistic	0.06			Lilliefors GOF Test				
232				5% Lilliefors Critical Value	0.13			Detected Data appear Lognormal at 5% Significance Level				
233				Detected Data appear Lognormal at 5% Significance Level								
234												
235				Lognormal ROS Statistics Using Imputed Non-Detects								
236				Mean in Original Scale	0.21			Mean in Log Scale			-1.56	
237				SD in Original Scale	0.03			SD in Log Scale			0.18	
238				5% t UCL (assumes normality of ROS data)	0.22			95% Percentile Bootstrap UCL			0.22	
239				95% BCA Bootstrap UCL	0.22			95% Bootstrap t UCL			0.22	
240				95% H-UCL (Log ROS)	0.22							
241												
242				DLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed								
243				KM Mean (logged)	-1.56			95% H-UCL (KM -Log)			0.22	
244				KM SD (logged)	0.23			95% Critical H Value (KM-Log)			1.72	
245				KM Standard Error of Mean (logged)	0.03							
246												
247				DL/2 Statistics								
248				DL/2 Normal				DL/2 Log-Transformed				
249				Mean in Original Scale	0.24			Mean in Log Scale			-1.43	
250				SD in Original Scale	0.05			SD in Log Scale			0.22	
251				95% t UCL (Assumes normality)	0.25			95% H-Stat UCL			0.25	
252				DL/2 is not a recommended method, provided for comparisons and historical reasons								

	A	B	C	D	E	F	G	H	I	J	K	L
253												
254	Nonparametric Distribution Free UCL Statistics											
255	Detected Data appear Normal Distributed at 5% Significance Level											
256												
257	Suggested UCL to Use											
258	95% KM (t) UCL				0.22	95% KM (Percentile Bootstrap) UCL				0.22		
259												
260	utions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
261	Recommendations are based upon data size, data distribution, and skewness.											
262	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and											
263	Recommendations results will not cover all Real World data sets; for additional insight the user may want to consult											
264												
265												
266	Calcium											
267												
268	General Statistics											
269	Total Number of Observations				80	Number of Distinct Observations				64		
270						Number of Missing Observations				0		
271	Minimum				526	Mean				2039		
272	Maximum				4640	Median				2210		
273	SD				723.8	Std. Error of Mean				80.9		
274	Coefficient of Variation				0.35	Skewness				-0.12		
275												
276	Normal GOF Test											
277	Shapiro Wilk Test Statistic				0.90	Shapiro Wilk GOF Test						
278	5% Shapiro Wilk P Value				2.5287E-	Data Not Normal at 5% Significance Level						
279	Lilliefors Test Statistic				0.20	Lilliefors GOF Test						
280	5% Lilliefors Critical Value				0.09	Data Not Normal at 5% Significance Level						
281	Data Not Normal at 5% Significance Level											
282												
283	Assuming Normal Distribution											
284	95% Normal UCL					95% UCLs (Adjusted for Skewness)						
285	95% Student's-t UCL				2174	95% Adjusted-CLT UCL (Chen-1995)				2171		
286						95% Modified-t UCL (Johnson-1978)				2173		
287												
288	Gamma GOF Test											
289	A-D Test Statistic				5.28	Anderson-Darling Gamma GOF Test						
290	5% A-D Critical Value				0.75	Data Not Gamma Distributed at 5% Significance Level						
291	K-S Test Statistic				0.25	Kolmogrov-Smirnov Gamma GOF Test						
292	5% K-S Critical Value				0.09	Data Not Gamma Distributed at 5% Significance Level						
293	Data Not Gamma Distributed at 5% Significance Level											
294												
295	Gamma Statistics											
296	k hat (MLE)				6.14	k star (bias corrected MLE)				5.92		
297	Theta hat (MLE)				331.9	Theta star (bias corrected MLE)				344.4		
298	nu hat (MLE)				982.9	nu star (bias corrected)				947.3		
299	MLE Mean (bias corrected)				2039	MLE Sd (bias corrected)				837.9		
300						Approximate Chi Square Value (0.05)				876.9		
301	Adjusted Level of Significance				0.04	Adjusted Chi Square Value				875.7		
302												
303	Assuming Gamma Distribution											
304	Approximate Gamma UCL (use when n>=50)				2203	Adjusted Gamma UCL (use when n<50)				2206		
305												
306	Lognormal GOF Test											
307	Shapiro Wilk Test Statistic				0.82	Shapiro Wilk Lognormal GOF Test						
308	5% Shapiro Wilk P Value				1.328E-	Data Not Lognormal at 5% Significance Level						
309	Lilliefors Test Statistic				0.27	Lilliefors Lognormal GOF Test						
310	5% Lilliefors Critical Value				0.09	Data Not Lognormal at 5% Significance Level						
311	Data Not Lognormal at 5% Significance Level											
312												
313	Lognormal Statistics											
314	Minimum of Logged Data				6.26	Mean of logged Data				7.53		
315	Maximum of Logged Data				8.44	SD of logged Data				0.45		

A	B	C	D	E	F	G	H	I	J	K	L
316											
317	Assuming Lognormal Distribution										
318	95% H-UCL				2279	90% Chebyshev (MVUE) UCL				2401	
319	95% Chebyshev (MVUE) UCL				2550	97.5% Chebyshev (MVUE) UCL				2756	
320	99% Chebyshev (MVUE) UCL				3161						
321											
322	Nonparametric Distribution Free UCL Statistics										
323	Data do not follow a Discernible Distribution (0.05)										
324											
325	Nonparametric Distribution Free UCLs										
326	95% CLT UCL				2172	95% Jackknife UCL				2174	
327	95% Standard Bootstrap UCL				2169	95% Bootstrap-t UCL				2170	
328	95% Hall's Bootstrap UCL				2165	95% Percentile Bootstrap UCL				2172	
329	95% BCA Bootstrap UCL				2164						
330	90% Chebyshev(Mean, Sd) UCL				2282	95% Chebyshev(Mean, Sd) UCL				2392	
331	97.5% Chebyshev(Mean, Sd) UCL				2544	99% Chebyshev(Mean, Sd) UCL				2844	
332											
333	Suggested UCL to Use										
334	95% Student's-t UCL				2174	or 95% Modified-t UCL				2173	
335											
336	tions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate										
337	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and										
338	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets										
339	For additional insight the user may want to consult a statistician.										
340											
341	highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may										
342	reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.										
343											
344	Cesium-137										
345											
346	General Statistics										
347	Total Number of Observations				79	Number of Distinct Observations				77	
348						Number of Missing Observations				1	
349	Number of Detects				38	Number of Non-Detects				41	
350	Number of Distinct Detects				36	Number of Distinct Non-Detects				41	
351	Minimum Detect				0.07	Minimum Non-Detect				-0.05	
352	Maximum Detect				0.83	Maximum Non-Detect				0.09	
353	Variance Detects				0.04	Percent Non-Detects				51.9	
354	Mean Detects				0.30	SD Detects				0.22	
355	Median Detects				0.22	CV Detects				0.74	
356	Skewness Detects				1.22	Kurtosis Detects				0.24	
357											
358	Normal GOF Test on Detects Only										
359	Shapiro Wilk Test Statistic				0.80	Shapiro Wilk GOF Test					
360	5% Shapiro Wilk Critical Value				0.93	Detected Data Not Normal at 5% Significance Level					
361	Lilliefors Test Statistic				0.20	Lilliefors GOF Test					
362	5% Lilliefors Critical Value				0.14	Detected Data Not Normal at 5% Significance Level					
363	Detected Data Not Normal at 5% Significance Level										
364											
365	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs										
366	Mean		0.11	Standard Error of Mean		0.02					
367	SD		0.23	95% KM (BCA) UCL		0.17					
368	95% KM (t) UCL		0.16	95% KM (Percentile Bootstrap) UCL		0.16					
369	95% KM (z) UCL		0.16	95% KM Bootstrap t UCL		0.16					
370	90% KM Chebyshev UCL		0.19	95% KM Chebyshev UCL		0.23					
371	97.5% KM Chebyshev UCL		0.28	99% KM Chebyshev UCL		0.38					
372											
373	Gamma GOF Tests on Detected Observations Only										
374	A-D Test Statistic		1.35	Anderson-Darling GOF Test							
375	5% A-D Critical Value		0.75	ed Data Not Gamma Distributed at 5% Significance Level							
376	K-S Test Statistic		0.15	Kolmogrov-Smirnoff GOF							
377	5% K-S Critical Value		0.14	ed Data Not Gamma Distributed at 5% Significance Level							
378	Detected Data Not Gamma Distributed at 5% Significance Level										

	A	B	C	D	E	F	G	H	I	J	K	L
379												
380	Gamma Statistics on Detected Data Only											
381	k hat (MLE)				2.28		k star (bias corrected MLE)				2.12	
382	Theta hat (MLE)				0.13		Theta star (bias corrected MLE)				0.14	
383	nu hat (MLE)				173.6		nu star (bias corrected)				161.2	
384	MLE Mean (bias corrected)				0.30		MLE Sd (bias corrected)				0.20	
385												
386	Gamma Kaplan-Meier (KM) Statistics											
387	k hat (KM)				0.25		nu hat (KM)				40.5	
388					Adjusted Level of Significance (β)				0.04			
389	Approximate Chi Square Value (40.57, α)				26.9		Adjusted Chi Square Value (40.57, β)				26.7	
390	Approximate KM-UCL (use when $n \geq 50$)				0.17		Approximate Adjusted KM-UCL (use when $n < 50$)				0.17	
391												
392	DL/2 Statistics											
393	Mean in Original Scale				0.14		SD in Original Scale				0.21	
394	95% t UCL (Assumes normality)				0.18							
395	DL/2 is not a recommended method, provided for comparisons and historical reasons											
396												
397	Nonparametric Distribution Free UCL Statistics											
398	Data do not follow a Discernible Distribution at 5% Significance Level											
399												
400	Suggested UCL to Use											
401	97.5% KM (Chebyshev) UCL				0.28							
402												
403	Instructions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
404	Recommendations are based upon data size, data distribution, and skewness.											
405	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and											
406	Simulation results will not cover all Real World data sets; for additional insight the user may want to consult											
407												
408												
409	Chromium											
410												
411	General Statistics											
412	Total Number of Observations				80		Number of Distinct Observations				69	
413							Number of Missing Observations				0	
414	Minimum				2.33		Mean				17.8	
415	Maximum				74.3		Median				13.2	
416	SD				13.8		Std. Error of Mean				1.55	
417	Coefficient of Variation				0.77		Skewness				2.53	
418												
419	Normal GOF Test											
420	Shapiro Wilk Test Statistic				0.69		Shapiro Wilk GOF Test					
421	5% Shapiro Wilk P Value				0		Data Not Normal at 5% Significance Level					
422	Lilliefors Test Statistic				0.23		Lilliefors GOF Test					
423	5% Lilliefors Critical Value				0.09		Data Not Normal at 5% Significance Level					
424	Data Not Normal at 5% Significance Level											
425												
426	Assuming Normal Distribution											
427	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
428	95% Student's-t UCL				20.4		95% Adjusted-CLT UCL (Chen-1995)				20.9	
429							95% Modified-t UCL (Johnson-1978)				20.5	
430												
431	Gamma GOF Test											
432	A-D Test Statistic				3.40		Anderson-Darling Gamma GOF Test					
433	5% A-D Critical Value				0.76		Data Not Gamma Distributed at 5% Significance Level					
434	K-S Test Statistic				0.18		Kolmogorov-Smirnov Gamma GOF Test					
435	5% K-S Critical Value				0.10		Data Not Gamma Distributed at 5% Significance Level					
436	Data Not Gamma Distributed at 5% Significance Level											
437												
438	Gamma Statistics											
439	k hat (MLE)				2.61		k star (bias corrected MLE)				2.52	
440	Theta hat (MLE)				6.83		Theta star (bias corrected MLE)				7.07	
441	nu hat (MLE)				418.6		nu star (bias corrected)				404.2	

	A	B	C	D	E	F	G	H	I	J	K	L
442	MLE Mean (bias corrected)					17.84	MLE Sd (bias corrected)					11.24
443							Approximate Chi Square Value (0.05)					358.64
444	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					357.94
445												
446	Assuming Gamma Distribution											
447	Approximate Gamma UCL (use when n>=50))					20.14	Adjusted Gamma UCL (use when n<50)					20.24
448												
449	Lognormal GOF Test											
450	Shapiro Wilk Test Statistic					0.93	Shapiro Wilk Lognormal GOF Test					
451	5% Shapiro Wilk P Value					9.4286E-05	Data Not Lognormal at 5% Significance Level					
452	Lilliefors Test Statistic					0.14	Lilliefors Lognormal GOF Test					
453	5% Lilliefors Critical Value					0.099	Data Not Lognormal at 5% Significance Level					
454	Data Not Lognormal at 5% Significance Level											
455												
456	Lognormal Statistics											
457	Minimum of Logged Data					0.84	Mean of logged Data					2.68
458	Maximum of Logged Data					4.30	SD of logged Data					0.62
459												
460	Assuming Lognormal Distribution											
461	95% H-UCL					20.24	90% Chebyshev (MVUE) UCL					21.64
462	95% Chebyshev (MVUE) UCL					23.34	97.5% Chebyshev (MVUE) UCL					25.84
463	99% Chebyshev (MVUE) UCL					30.74						
464												
465	Nonparametric Distribution Free UCL Statistics											
466	Data do not follow a Discernible Distribution (0.05)											
467												
468	Nonparametric Distribution Free UCLs											
469	95% CLT UCL					20.44	95% Jackknife UCL					20.44
470	95% Standard Bootstrap UCL					20.34	95% Bootstrap-t UCL					21.14
471	95% Hall's Bootstrap UCL					21.14	95% Percentile Bootstrap UCL					20.44
472	95% BCA Bootstrap UCL					20.84						
473	90% Chebyshev(Mean, Sd) UCL					22.54	95% Chebyshev(Mean, Sd) UCL					24.64
474	97.5% Chebyshev(Mean, Sd) UCL					27.54	99% Chebyshev(Mean, Sd) UCL					33.34
475												
476	Suggested UCL to Use											
477	95% Chebyshev (Mean, Sd) UCL					24.64						
478												
479	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
480	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Singh											
481	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
482	For additional insight the user may want to consult a statistician.											
483												
484												
485	Cobalt											
486												
487	General Statistics											
488	Total Number of Observations					80	Number of Distinct Observations					73
489							Number of Missing Observations					0
490	Minimum					0.80	Mean					5.41
491	Maximum					22.8	Median					5.73
492	SD					3.45	Std. Error of Mean					0.38
493	Coefficient of Variation					0.63	Skewness					2.22
494												
495	Normal GOF Test											
496	Shapiro Wilk Test Statistic					0.77	Shapiro Wilk GOF Test					
497	5% Shapiro Wilk P Value					0	Data Not Normal at 5% Significance Level					
498	Lilliefors Test Statistic					0.22	Lilliefors GOF Test					
499	5% Lilliefors Critical Value					0.099	Data Not Normal at 5% Significance Level					
500	Data Not Normal at 5% Significance Level											
501												
502	Assuming Normal Distribution											
503	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
504	95% Student's-t UCL					6.05	95% Adjusted-CLT UCL (Chen-1995)					6.15

	A	B	C	D	E	F	G	H	I	J	K	L
505						95% Modified-t UCL (Johnson-1978)						6.07
506												
507	Gamma GOF Test											
508	A-D Test Statistic					4.38	Anderson-Darling Gamma GOF Test					
509	5% A-D Critical Value					0.76	Data Not Gamma Distributed at 5% Significance Level					
510	K-S Test Statistic					0.19	Kolmogrov-Smirnoff Gamma GOF Test					
511	5% K-S Critical Value					0.10	Data Not Gamma Distributed at 5% Significance Level					
512	Data Not Gamma Distributed at 5% Significance Level											
513												
514	Gamma Statistics											
515	k hat (MLE)					2.52	k star (bias corrected MLE)					2.44
516	Theta hat (MLE)					2.13	Theta star (bias corrected MLE)					2.21
517	nu hat (MLE)					404.7	nu star (bias corrected)					390.9
518	MLE Mean (bias corrected)					5.41	MLE Sd (bias corrected)					3.46
519							Approximate Chi Square Value (0.05)					346
520	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					345.3
521												
522	Assuming Gamma Distribution											
523	Approximate Gamma UCL (use when n>=50))					6.11	Adjusted Gamma UCL (use when n<50)					6.12
524												
525	Lognormal GOF Test											
526	Shapiro Wilk Test Statistic					0.84	Shapiro Wilk Lognormal GOF Test					
527	5% Shapiro Wilk P Value					2.300E-	Data Not Lognormal at 5% Significance Level					
528	Lilliefors Test Statistic					0.22	Lilliefors Lognormal GOF Test					
529	5% Lilliefors Critical Value					0.09	Data Not Lognormal at 5% Significance Level					
530	Data Not Lognormal at 5% Significance Level											
531												
532	Lognormal Statistics											
533	Minimum of Logged Data					-0.22	Mean of logged Data					1.47
534	Maximum of Logged Data					3.12	SD of logged Data					0.71
535												
536	Assuming Lognormal Distribution											
537	95% H-UCL					6.65	90% Chebyshev (MVUE) UCL					7.14
538	95% Chebyshev (MVUE) UCL					7.81	97.5% Chebyshev (MVUE) UCL					8.76
539	99% Chebyshev (MVUE) UCL					10.6						
540												
541	Nonparametric Distribution Free UCL Statistics											
542	Data do not follow a Discernible Distribution (0.05)											
543												
544	Nonparametric Distribution Free UCLs											
545	95% CLT UCL					6.04	95% Jackknife UCL					6.05
546	95% Standard Bootstrap UCL					6.03	95% Bootstrap-t UCL					6.19
547	95% Hall's Bootstrap UCL					6.31	95% Percentile Bootstrap UCL					6.05
548	95% BCA Bootstrap UCL					6.16						
549	90% Chebyshev(Mean, Sd) UCL					6.57	95% Chebyshev(Mean, Sd) UCL					7.09
550	97.5% Chebyshev(Mean, Sd) UCL					7.82	99% Chebyshev(Mean, Sd) UCL					9.25
551												
552	Suggested UCL to Use											
553	95% Chebyshev (Mean, Sd) UCL					7.09						
554												
555	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
556	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
557	Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
558	For additional insight the user may want to consult a statistician.											
559												
560												
561	Copper											
562												
563	General Statistics											
564	Total Number of Observations					80	Number of Distinct Observations					78
565							Number of Missing Observations					0
566	Minimum					1.87	Mean					7.40
567	Maximum					29	Median					7.28

	A	B	C	D	E	F	G	H	I	J	K	L
568					SD	3.65					Std. Error of Mean	0.40
569					Coefficient of Variation	0.49					Skewness	2.84
570												
571					Normal GOF Test							
572					Shapiro Wilk Test Statistic	0.77					Shapiro Wilk GOF Test	
573					5% Shapiro Wilk P Value	0					Data Not Normal at 5% Significance Level	
574					Lilliefors Test Statistic	0.20					Lilliefors GOF Test	
575					5% Lilliefors Critical Value	0.09					Data Not Normal at 5% Significance Level	
576					Data Not Normal at 5% Significance Level							
577												
578					Assuming Normal Distribution							
579					95% Normal UCL			95% UCLs (Adjusted for Skewness)				
580					95% Student's-t UCL	8.08					95% Adjusted-CLT UCL (Chen-1995)	8.21
581											95% Modified-t UCL (Johnson-1978)	8.10
582												
583					Gamma GOF Test							
584					A-D Test Statistic	3.33					Anderson-Darling Gamma GOF Test	
585					5% A-D Critical Value	0.75					Data Not Gamma Distributed at 5% Significance Level	
586					K-S Test Statistic	0.19					Kolmogrov-Smirnoff Gamma GOF Test	
587					5% K-S Critical Value	0.09					Data Not Gamma Distributed at 5% Significance Level	
588					Data Not Gamma Distributed at 5% Significance Level							
589												
590					Gamma Statistics							
591					k hat (MLE)	5.00					k star (bias corrected MLE)	4.82
592					Theta hat (MLE)	1.48					Theta star (bias corrected MLE)	1.53
593					nu hat (MLE)	800.4					nu star (bias corrected)	771.8
594					MLE Mean (bias corrected)	7.40					MLE Sd (bias corrected)	3.37
595											Approximate Chi Square Value (0.05)	708.3
596					Adjusted Level of Significance	0.04					Adjusted Chi Square Value	707.2
597												
598					Assuming Gamma Distribution							
599					Approximate Gamma UCL (use when n>=50))	8.06					Adjusted Gamma UCL (use when n<50)	8.08
600												
601					Lognormal GOF Test							
602					Shapiro Wilk Test Statistic	0.89					Shapiro Wilk Lognormal GOF Test	
603					5% Shapiro Wilk P Value	6.0181E					Data Not Lognormal at 5% Significance Level	
604					Lilliefors Test Statistic	0.22					Lilliefors Lognormal GOF Test	
605					5% Lilliefors Critical Value	0.09					Data Not Lognormal at 5% Significance Level	
606					Data Not Lognormal at 5% Significance Level							
607												
608					Lognormal Statistics							
609					Minimum of Logged Data	0.62					Mean of logged Data	1.89
610					Maximum of Logged Data	3.36					SD of logged Data	0.46
611												
612					Assuming Lognormal Distribution							
613					95% H-UCL	8.21					90% Chebyshev (MVUE) UCL	8.66
614					95% Chebyshev (MVUE) UCL	9.22					97.5% Chebyshev (MVUE) UCL	9.99
615					99% Chebyshev (MVUE) UCL	11.5						
616												
617					Nonparametric Distribution Free UCL Statistics							
618					Data do not follow a Discernible Distribution (0.05)							
619												
620					Nonparametric Distribution Free UCLs							
621					95% CLT UCL	8.07					95% Jackknife UCL	8.08
622					95% Standard Bootstrap UCL	8.07					95% Bootstrap-t UCL	8.30
623					95% Hall's Bootstrap UCL	8.60					95% Percentile Bootstrap UCL	8.08
624					95% BCA Bootstrap UCL	8.22						
625					90% Chebyshev(Mean, Sd) UCL	8.63					95% Chebyshev(Mean, Sd) UCL	9.18
626					97.5% Chebyshev(Mean, Sd) UCL	9.96					99% Chebyshev(Mean, Sd) UCL	11.4
627												
628					Suggested UCL to Use							
629					95% Student's-t UCL	8.08					or 95% Modified-t UCL	8.10
630												

	A	B	C	D	E	F	G	H	I	J	K	L
631	tions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
632	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
633	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
634	For additional insight the user may want to consult a statistician.											
635												
636	HMX											
637												
638	General Statistics											
639	Total Number of Observations				80	Number of Distinct Observations				7		
640	Number of Detects				6	Number of Non-Detects				74		
641	Number of Distinct Detects				6	Number of Distinct Non-Detects				1		
642	Minimum Detect				0.17	Minimum Non-Detect				0.5		
643	Maximum Detect				11.4	Maximum Non-Detect				0.5		
644	Variance Detects				19.4	Percent Non-Detects				92.5		
645	Mean Detects				2.50	SD Detects				4.40		
646	Median Detects				0.62	CV Detects				1.75		
647	Skewness Detects				2.32	Kurtosis Detects				5.49		
648	Mean of Logged Detects				-0.19	SD of Logged Detects				1.56		
649												
650	Normal GOF Test on Detects Only											
651	Shapiro Wilk Test Statistic				0.61	Shapiro Wilk GOF Test						
652	5% Shapiro Wilk Critical Value				0.78	Detected Data Not Normal at 5% Significance Level						
653	Lilliefors Test Statistic				0.37	Lilliefors GOF Test						
654	5% Lilliefors Critical Value				0.36	Detected Data Not Normal at 5% Significance Level						
655	Detected Data Not Normal at 5% Significance Level											
656												
657	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
658	Mean				0.45	Standard Error of Mean				0.17		
659	SD				1.25	95% KM (BCA) UCL				0.83		
660	95% KM (t) UCL				0.74	95% KM (Percentile Bootstrap) UCL				0.79		
661	95% KM (z) UCL				0.74	95% KM Bootstrap t UCL				1.74		
662	90% KM Chebyshev UCL				0.98	95% KM Chebyshev UCL				1.21		
663	97.5% KM Chebyshev UCL				1.54	99% KM Chebyshev UCL				2.19		
664												
665	Gamma GOF Tests on Detected Observations Only											
666	A-D Test Statistic				0.55	Anderson-Darling GOF Test						
667	5% A-D Critical Value				0.73	data appear Gamma Distributed at 5% Significance Level						
668	K-S Test Statistic				0.27	Kolmogrov-Smirnoff GOF						
669	5% K-S Critical Value				0.34	data appear Gamma Distributed at 5% Significance Level						
670	Detected data appear Gamma Distributed at 5% Significance Level											
671												
672	Gamma Statistics on Detected Data Only											
673	k hat (MLE)				0.56	k star (bias corrected MLE)				0.39		
674	Theta hat (MLE)				4.46	Theta star (bias corrected MLE)				6.39		
675	nu hat (MLE)				6.74	nu star (bias corrected)				4.70		
676	MLE Mean (bias corrected)				2.50	MLE Sd (bias corrected)				4.00		
677												
678	Gamma Kaplan-Meier (KM) Statistics											
679	k hat (KM)				0.13	nu hat (KM)				21.39		
680	Approximate Chi Square Value (21.39, α)				11.8	Adjusted Chi Square Value (21.39, β)				11.7		
681	Approximate KM-UCL (use when $n \geq 50$)				0.82	Gamma Adjusted KM-UCL (use when $n < 50$)				0.83		
682												
683	Gamma ROS Statistics using Imputed Non-Detects											
684	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
685	GROS may not be used when kstar of detected data is small such as < 0.1											
686	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
687	Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM e											
688	Minimum				0.01	Mean				0.56		
689	Maximum				11.4	Median				0.01		
690	SD				1.44	CV				2.56		
691	k hat (MLE)				0.3	k star (bias corrected MLE)				0.29		
692	Theta hat (MLE)				1.87	Theta star (bias corrected MLE)				1.89		
693	nu hat (MLE)				47.9	nu star (bias corrected)				47.4		

	A	B	C	D	E	F	G	H	I	J	K	L
694	MLE Mean (bias corrected)					0.56	MLE Sd (bias corrected)					1.03
695							Adjusted Level of Significance (β)					0.04
696	Approximate Chi Square Value (47.46, α)					32.65	Adjusted Chi Square Value (47.46, β)					32.47
697	Gamma Approximate UCL (use when $n \geq 50$)					0.81	Gamma Adjusted UCL (use when $n < 50$)					0.82
698												
699	Lognormal GOF Test on Detected Observations Only											
700	Shapiro Wilk Test Statistic					0.92	Shapiro Wilk GOF Test					
701	5% Shapiro Wilk Critical Value					0.78	Detected Data appear Lognormal at 5% Significance Level					
702	Lilliefors Test Statistic					0.18	Lilliefors GOF Test					
703	5% Lilliefors Critical Value					0.36	Detected Data appear Lognormal at 5% Significance Level					
704	Detected Data appear Lognormal at 5% Significance Level											
705												
706	Lognormal ROS Statistics Using Imputed Non-Detects											
707	Mean in Original Scale					0.53	Mean in Log Scale					-1.30
708	SD in Original Scale					1.28	SD in Log Scale					1.06
709	95% t UCL (assumes normality of ROS data)					0.77	95% Percentile Bootstrap UCL					0.79
710	95% BCA Bootstrap UCL					0.97	95% Bootstrap t UCL					1.24
711	95% H-UCL (Log ROS)					0.62						
712												
713	Estimates using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed											
714	KM Mean (logged)					-1.24	95% H-UCL (KM -Log)					0.41
715	KM SD (logged)					0.65	95% Critical H Value (KM-Log)					1.95
716	KM Standard Error of Mean (logged)					0.27						
717												
718	DL/2 Statistics											
719	DL/2 Normal						DL/2 Log-Transformed					
720	Mean in Original Scale					0.41	Mean in Log Scale					-1.29
721	SD in Original Scale					1.26	SD in Log Scale					0.50
722	95% t UCL (Assumes normality)					0.65	95% H-Stat UCL					0.34
723	DL/2 is not a recommended method, provided for comparisons and historical reasons											
724												
725	Nonparametric Distribution Free UCL Statistics											
726	Detected Data appear Gamma Distributed at 5% Significance Level											
727												
728	Suggested UCL to Use											
729	95% KM (t) UCL					0.74	95% GROS Approximate Gamma UCL					0.81
730	95% Approximate Gamma KM-UCL					0.82						
731												
732	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate UCL.											
733	Recommendations are based upon data size, data distribution, and skewness.											
734	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Singh (2010).											
735	Simulation results will not cover all Real World data sets; for additional insight the user may want to consult the literature.											
736												
737												
738	Iron											
739												
740	General Statistics											
741	Total Number of Observations					80	Number of Distinct Observations					52
742							Number of Missing Observations					0
743	Minimum					7800	Mean					13471
744	Maximum					22100	Median					13900
745	SD					2492	Std. Error of Mean					278.7
746	Coefficient of Variation					0.18	Skewness					-0.15
747												
748	Normal GOF Test											
749	Shapiro Wilk Test Statistic					0.95	Shapiro Wilk GOF Test					
750	5% Shapiro Wilk P Value					0.02	Data Not Normal at 5% Significance Level					
751	Lilliefors Test Statistic					0.12	Lilliefors GOF Test					
752	5% Lilliefors Critical Value					0.09	Data Not Normal at 5% Significance Level					
753	Data Not Normal at 5% Significance Level											
754												
755	Assuming Normal Distribution											
756	95% Normal UCL						95% UCLs (Adjusted for Skewness)					

	A	B	C	D	E	F	G	H	I	J	K	L
757	95% Student's-t UCL					13935	95% Adjusted-CLT UCL (Chen-1995)					13925
758							95% Modified-t UCL (Johnson-1978)					13934
759												
760	Gamma GOF Test											
761	A-D Test Statistic					1.92	Anderson-Darling Gamma GOF Test					
762	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level					
763	K-S Test Statistic					0.15	Kolmogorov-Smirnov Gamma GOF Test					
764	5% K-S Critical Value					0.09	Data Not Gamma Distributed at 5% Significance Level					
765	Data Not Gamma Distributed at 5% Significance Level											
766												
767	Gamma Statistics											
768	k hat (MLE)					27.34	k star (bias corrected MLE)					26.3
769	Theta hat (MLE)					492.7	Theta star (bias corrected MLE)					511.7
770	nu hat (MLE)					4375	nu star (bias corrected)					4212
771	MLE Mean (bias corrected)					13471	MLE Sd (bias corrected)					2626
772							Approximate Chi Square Value (0.05)					4062
773	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					4060
774												
775	Assuming Gamma Distribution											
776	Approximate Gamma UCL (use when n>=50)					13968	Adjusted Gamma UCL (use when n<50)					13977
777												
778	Lognormal GOF Test											
779	Shapiro Wilk Test Statistic					0.92	Shapiro Wilk Lognormal GOF Test					
780	5% Shapiro Wilk P Value					3.4797E	Data Not Lognormal at 5% Significance Level					
781	Lilliefors Test Statistic					0.16	Lilliefors Lognormal GOF Test					
782	5% Lilliefors Critical Value					0.09	Data Not Lognormal at 5% Significance Level					
783	Data Not Lognormal at 5% Significance Level											
784												
785	Lognormal Statistics											
786	Minimum of Logged Data					8.96	Mean of logged Data					9.49
787	Maximum of Logged Data					10	SD of logged Data					0.19
788												
789	Assuming Lognormal Distribution											
790	95% H-UCL					14012	90% Chebyshev (MVUE) UCL					14390
791	95% Chebyshev (MVUE) UCL					14800	97.5% Chebyshev (MVUE) UCL					15368
792	99% Chebyshev (MVUE) UCL					16486						
793												
794	Nonparametric Distribution Free UCL Statistics											
795	Data do not follow a Discernible Distribution (0.05)											
796												
797	Nonparametric Distribution Free UCLs											
798	95% CLT UCL					13930	95% Jackknife UCL					13935
799	95% Standard Bootstrap UCL					13921	95% Bootstrap-t UCL					13946
800	95% Hall's Bootstrap UCL					13934	95% Percentile Bootstrap UCL					13924
801	95% BCA Bootstrap UCL					13913						
802	90% Chebyshev(Mean, Sd) UCL					14307	95% Chebyshev(Mean, Sd) UCL					14686
803	97.5% Chebyshev(Mean, Sd) UCL					15211	99% Chebyshev(Mean, Sd) UCL					16244
804												
805	Suggested UCL to Use											
806	95% Student's-t UCL					13935	or 95% Modified-t UCL					13934
807												
808	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
809	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
810	Singh and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
811	For additional insight the user may want to consult a statistician.											
812												
813	Highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may											
814	be unreliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.											
815												
816												
817	Lead											
818												
819	General Statistics											

	A	B	C	D	E	F	G	H	I	J	K	L
820	Total Number of Observations					80	Number of Distinct Observations					57
821							Number of Missing Observations					0
822	Minimum					3.17	Mean					13.04
823	Maximum					41	Median					14.34
824	SD					5.34	Std. Error of Mean					0.59
825	Coefficient of Variation					0.41	Skewness					1.38
826												
827	Normal GOF Test											
828	Shapiro Wilk Test Statistic					0.85	Shapiro Wilk GOF Test					
829	5% Shapiro Wilk P Value					1.331E-	Data Not Normal at 5% Significance Level					
830	Lilliefors Test Statistic					0.15	Lilliefors GOF Test					
831	5% Lilliefors Critical Value					0.099	Data Not Normal at 5% Significance Level					
832	Data Not Normal at 5% Significance Level											
833												
834	Assuming Normal Distribution											
835	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
836	95% Student's-t UCL					14.04	95% Adjusted-CLT UCL (Chen-1995)					14.11
837							95% Modified-t UCL (Johnson-1978)					14.04
838												
839	Gamma GOF Test											
840	A-D Test Statistic					4.31	Anderson-Darling Gamma GOF Test					
841	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level					
842	K-S Test Statistic					0.19	Kolmogrov-Smirnoff Gamma GOF Test					
843	5% K-S Critical Value					0.099	Data Not Gamma Distributed at 5% Significance Level					
844	Data Not Gamma Distributed at 5% Significance Level											
845												
846	Gamma Statistics											
847	k hat (MLE)					5.45	k star (bias corrected MLE)					5.25
848	Theta hat (MLE)					2.39	Theta star (bias corrected MLE)					2.48
849	nu hat (MLE)					872.8	nu star (bias corrected)					841.4
850	MLE Mean (bias corrected)					13.04	MLE Sd (bias corrected)					5.68
851							Approximate Chi Square Value (0.05)					775
852	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					773.9
853												
854	Assuming Gamma Distribution											
855	Approximate Gamma UCL (use when n>=50))					14.11	Adjusted Gamma UCL (use when n<50)					14.11
856												
857	Lognormal GOF Test											
858	Shapiro Wilk Test Statistic					0.85	Shapiro Wilk Lognormal GOF Test					
859	5% Shapiro Wilk P Value					5.788E-	Data Not Lognormal at 5% Significance Level					
860	Lilliefors Test Statistic					0.22	Lilliefors Lognormal GOF Test					
861	5% Lilliefors Critical Value					0.099	Data Not Lognormal at 5% Significance Level					
862	Data Not Lognormal at 5% Significance Level											
863												
864	Lognormal Statistics											
865	Minimum of Logged Data					1.15	Mean of logged Data					2.47
866	Maximum of Logged Data					3.71	SD of logged Data					0.47
867												
868	Assuming Lognormal Distribution											
869	95% H-UCL					14.61	90% Chebyshev (MVUE) UCL					15.4
870	95% Chebyshev (MVUE) UCL					16.43	97.5% Chebyshev (MVUE) UCL					17.8
871	99% Chebyshev (MVUE) UCL					20.52						
872												
873	Nonparametric Distribution Free UCL Statistics											
874	Data do not follow a Discernible Distribution (0.05)											
875												
876	Nonparametric Distribution Free UCLs											
877	95% CLT UCL					14.04	95% Jackknife UCL					14.04
878	95% Standard Bootstrap UCL					14.04	95% Bootstrap-t UCL					14.11
879	95% Hall's Bootstrap UCL					14.34	95% Percentile Bootstrap UCL					14.04
880	95% BCA Bootstrap UCL					14.11						
881	90% Chebyshev(Mean, Sd) UCL					14.84	95% Chebyshev(Mean, Sd) UCL					15.61
882	97.5% Chebyshev(Mean, Sd) UCL					16.71	99% Chebyshev(Mean, Sd) UCL					18.9

	A	B	C	D	E	F	G	H	I	J	K	L	
883													
884	Suggested UCL to Use												
885	95% Student's-t UCL					14.04	or 95% Modified-t UCL					14.04	
886													
887	Options regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
888	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and												
889	Singh and Singh and Singh (2003). However, simulation results will not cover all Real World data sets												
890	For additional insight the user may want to consult a statistician.												
891													
892													
893	Magnesium												
894													
895	General Statistics												
896	Total Number of Observations					80	Number of Distinct Observations					68	
897							Number of Missing Observations					0	
898	Minimum					320	Mean					1812	
899	Maximum					2800	Median					1960	
900	SD					669.3	Std. Error of Mean					74.81	
901	Coefficient of Variation					0.36	Skewness					-0.73	
902													
903	Normal GOF Test												
904	Shapiro Wilk Test Statistic					0.89	Shapiro Wilk GOF Test						
905	5% Shapiro Wilk P Value					3.4439E-05	Data Not Normal at 5% Significance Level						
906	Lilliefors Test Statistic					0.17	Lilliefors GOF Test						
907	5% Lilliefors Critical Value					0.095	Data Not Normal at 5% Significance Level						
908	Data Not Normal at 5% Significance Level												
909													
910	Assuming Normal Distribution												
911	95% Normal UCL						95% UCLs (Adjusted for Skewness)						
912	95% Student's-t UCL					1937	95% Adjusted-CLT UCL (Chen-1995)					1929	
913							95% Modified-t UCL (Johnson-1978)					1936	
914													
915	Gamma GOF Test												
916	A-D Test Statistic					4.86	Anderson-Darling Gamma GOF Test						
917	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level						
918	K-S Test Statistic					0.23	Kolmogorov-Smirnoff Gamma GOF Test						
919	5% K-S Critical Value					0.1	Data Not Gamma Distributed at 5% Significance Level						
920	Data Not Gamma Distributed at 5% Significance Level												
921													
922	Gamma Statistics												
923	k hat (MLE)					4.97	k star (bias corrected MLE)					4.8	
924	Theta hat (MLE)					364	Theta star (bias corrected MLE)					377.5	
925	nu hat (MLE)					796.6	nu star (bias corrected)					768	
926	MLE Mean (bias corrected)					1812	MLE Sd (bias corrected)					827.2	
927							Approximate Chi Square Value (0.05)					704.7	
928	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					703.6	
929													
930	Assuming Gamma Distribution												
931	Approximate Gamma UCL (use when n>=50))					1975	Adjusted Gamma UCL (use when n<50)					1978	
932													
933	Lognormal GOF Test												
934	Shapiro Wilk Test Statistic					0.79	Shapiro Wilk Lognormal GOF Test						
935	5% Shapiro Wilk P Value					1.221E-05	Data Not Lognormal at 5% Significance Level						
936	Lilliefors Test Statistic					0.25	Lilliefors Lognormal GOF Test						
937	5% Lilliefors Critical Value					0.095	Data Not Lognormal at 5% Significance Level						
938	Data Not Lognormal at 5% Significance Level												
939													
940	Lognormal Statistics												
941	Minimum of Logged Data					5.76	Mean of logged Data					7.39	
942	Maximum of Logged Data					7.93	SD of logged Data					0.51	
943													
944	Assuming Lognormal Distribution												
945	95% H-UCL					2083	90% Chebyshev (MVUE) UCL					2207	

	A	B	C	D	E	F	G	H	I	J	K	L
946	95% Chebyshev (MVUE) UCL					2362	97.5% Chebyshev (MVUE) UCL					2577
947	99% Chebyshev (MVUE) UCL					3000						
948												
949	Nonparametric Distribution Free UCL Statistics											
950	Data do not follow a Discernible Distribution (0.05)											
951												
952	Nonparametric Distribution Free UCLs											
953	95% CLT UCL					1935	95% Jackknife UCL					1937
954	95% Standard Bootstrap UCL					1934	95% Bootstrap-t UCL					1931
955	95% Hall's Bootstrap UCL					1929	95% Percentile Bootstrap UCL					1937
956	95% BCA Bootstrap UCL					1929						
957	90% Chebyshev(Mean, Sd) UCL					2037	95% Chebyshev(Mean, Sd) UCL					2138
958	97.5% Chebyshev(Mean, Sd) UCL					2280	99% Chebyshev(Mean, Sd) UCL					2557
959												
960	Suggested UCL to Use											
961	95% Chebyshev (Mean, Sd) UCL					2138						
962												
963	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
964	mmendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
965	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
966	For additional insight the user may want to consult a statistician.											
967												
968	highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may											
969	reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.											
970												
971												
972	Manganese											
973												
974	General Statistics											
975	Total Number of Observations					80	Number of Distinct Observations					67
976							Number of Missing Observations					0
977	Minimum					145	Mean					409.3
978	Maximum					2150	Median					385
979	SD					250.6	Std. Error of Mean					28.0
980	Coefficient of Variation					0.61	Skewness					5.05
981												
982	Normal GOF Test											
983	Shapiro Wilk Test Statistic					0.54	Shapiro Wilk GOF Test					
984	5% Shapiro Wilk P Value					0	Data Not Normal at 5% Significance Level					
985	Lilliefors Test Statistic					0.29	Lilliefors GOF Test					
986	5% Lilliefors Critical Value					0.09	Data Not Normal at 5% Significance Level					
987	Data Not Normal at 5% Significance Level											
988												
989	Assuming Normal Distribution											
990	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
991	95% Student's-t UCL					455.9	95% Adjusted-CLT UCL (Chen-1995)					472.3
992							95% Modified-t UCL (Johnson-1978)					458.5
993												
994	Gamma GOF Test											
995	A-D Test Statistic					3.56	Anderson-Darling Gamma GOF Test					
996	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level					
997	K-S Test Statistic					0.20	Kolmogrov-Smirnoff Gamma GOF Test					
998	5% K-S Critical Value					0.09	Data Not Gamma Distributed at 5% Significance Level					
999	Data Not Gamma Distributed at 5% Significance Level											
1000												
1001	Gamma Statistics											
1002	k hat (MLE)					5.45	k star (bias corrected MLE)					5.25
1003	Theta hat (MLE)					75.0	Theta star (bias corrected MLE)					77.8
1004	nu hat (MLE)					872.9	nu star (bias corrected)					841.5
1005	MLE Mean (bias corrected)					409.3	MLE Sd (bias corrected)					178.5
1006							Approximate Chi Square Value (0.05)					775.2
1007	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					774
1008												

	A	B	C	D	E	F	G	H	I	J	K	L
1009	Assuming Gamma Distribution											
1010	Approximate Gamma UCL (use when n>=50))					444.3	Adjusted Gamma UCL (use when n<50)					444.9
1011												
1012	Lognormal GOF Test											
1013	Shapiro Wilk Test Statistic					0.89	Shapiro Wilk Lognormal GOF Test					
1014	5% Shapiro Wilk P Value					1.3763E	Data Not Lognormal at 5% Significance Level					
1015	Lilliefors Test Statistic					0.16	Lilliefors Lognormal GOF Test					
1016	5% Lilliefors Critical Value					0.09	Data Not Lognormal at 5% Significance Level					
1017	Data Not Lognormal at 5% Significance Level											
1018												
1019	Lognormal Statistics											
1020	Minimum of Logged Data					4.97	Mean of logged Data					5.92
1021	Maximum of Logged Data					7.67	SD of logged Data					0.39
1022												
1023	Assuming Lognormal Distribution											
1024	95% H-UCL					436.8	90% Chebyshev (MVUE) UCL					458.2
1025	95% Chebyshev (MVUE) UCL					483.3	97.5% Chebyshev (MVUE) UCL					518.3
1026	99% Chebyshev (MVUE) UCL					586.9						
1027												
1028	Nonparametric Distribution Free UCL Statistics											
1029	Data do not follow a Discernible Distribution (0.05)											
1030												
1031	Nonparametric Distribution Free UCLs											
1032	95% CLT UCL					455.3	95% Jackknife UCL					455.9
1033	95% Standard Bootstrap UCL					454.5	95% Bootstrap-t UCL					501.1
1034	95% Hall's Bootstrap UCL					700.7	95% Percentile Bootstrap UCL					459.1
1035	95% BCA Bootstrap UCL					476.8						
1036	90% Chebyshev(Mean, Sd) UCL					493.3	95% Chebyshev(Mean, Sd) UCL					531.4
1037	97.5% Chebyshev(Mean, Sd) UCL					584.2	99% Chebyshev(Mean, Sd) UCL					688
1038												
1039	Suggested UCL to Use											
1040	95% Student's-t UCL					455.9	or 95% Modified-t UCL					458.5
1041												
1042	Instructions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
1043	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
1044	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
1045	For additional insight the user may want to consult a statistician.											
1046												
1047												
1048	Nickel											
1049												
1050	General Statistics											
1051	Total Number of Observations					80	Number of Distinct Observations					74
1052							Number of Missing Observations					0
1053	Minimum					1.76	Mean					7.21
1054	Maximum					12.1	Median					7.84
1055	SD					2.43	Std. Error of Mean					0.27
1056	Coefficient of Variation					0.33	Skewness					-0.67
1057												
1058	Normal GOF Test											
1059	Shapiro Wilk Test Statistic					0.91	Shapiro Wilk GOF Test					
1060	5% Shapiro Wilk P Value					1.3311E	Data Not Normal at 5% Significance Level					
1061	Lilliefors Test Statistic					0.16	Lilliefors GOF Test					
1062	5% Lilliefors Critical Value					0.09	Data Not Normal at 5% Significance Level					
1063	Data Not Normal at 5% Significance Level											
1064												
1065	Assuming Normal Distribution											
1066	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
1067	95% Student's-t UCL					7.66	95% Adjusted-CLT UCL (Chen-1995)					7.63
1068							95% Modified-t UCL (Johnson-1978)					7.66
1069												
1070	Gamma GOF Test											
1071	A-D Test Statistic					4.67	Anderson-Darling Gamma GOF Test					

	A	B	C	D	E	F	G	H	I	J	K	L	
1072	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level						
1073	K-S Test Statistic					0.21	Kolmogrov-Smirnoff Gamma GOF Test						
1074	5% K-S Critical Value					0.09	Data Not Gamma Distributed at 5% Significance Level						
1075	Data Not Gamma Distributed at 5% Significance Level												
1076													
1077	Gamma Statistics												
1078	k hat (MLE)					6.29	k star (bias corrected MLE)					6.06	
1079	Theta hat (MLE)					1.14	Theta star (bias corrected MLE)					1.18	
1080	nu hat (MLE)					1008	nu star (bias corrected)					971.1	
1081	MLE Mean (bias corrected)					7.21	MLE Sd (bias corrected)					2.92	
1082							Approximate Chi Square Value (0.05)					899.8	
1083	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					898.5	
1084													
1085	Assuming Gamma Distribution												
1086	Approximate Gamma UCL (use when n>=50))					7.78	Adjusted Gamma UCL (use when n<50)					7.79	
1087													
1088	Lognormal GOF Test												
1089	Shapiro Wilk Test Statistic					0.80	Shapiro Wilk Lognormal GOF Test						
1090	5% Shapiro Wilk P Value					7.105E-	Data Not Lognormal at 5% Significance Level						
1091	Lilliefors Test Statistic					0.23	Lilliefors Lognormal GOF Test						
1092	5% Lilliefors Critical Value					0.09	Data Not Lognormal at 5% Significance Level						
1093	Data Not Lognormal at 5% Significance Level												
1094													
1095	Lognormal Statistics												
1096	Minimum of Logged Data					0.56	Mean of logged Data					1.89	
1097	Maximum of Logged Data					2.49	SD of logged Data					0.45	
1098													
1099	Assuming Lognormal Distribution												
1100	95% H-UCL					8.08	90% Chebyshev (MVUE) UCL					8.52	
1101	95% Chebyshev (MVUE) UCL					9.04	97.5% Chebyshev (MVUE) UCL					9.78	
1102	99% Chebyshev (MVUE) UCL					11.21							
1103													
1104	Nonparametric Distribution Free UCL Statistics												
1105	Data do not follow a Discernible Distribution (0.05)												
1106													
1107	Nonparametric Distribution Free UCLs												
1108	95% CLT UCL					7.66	95% Jackknife UCL					7.66	
1109	95% Standard Bootstrap UCL					7.65	95% Bootstrap-t UCL					7.61	
1110	95% Hall's Bootstrap UCL					7.64	95% Percentile Bootstrap UCL					7.66	
1111	95% BCA Bootstrap UCL					7.64							
1112	90% Chebyshev(Mean, Sd) UCL					8.02	95% Chebyshev(Mean, Sd) UCL					8.39	
1113	97.5% Chebyshev(Mean, Sd) UCL					8.91	99% Chebyshev(Mean, Sd) UCL					9.91	
1114													
1115	Suggested UCL to Use												
1116	95% Student's-t UCL					7.66	or 95% Modified-t UCL					7.66	
1117													
1118	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
1119	recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and												
1120	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets												
1121	For additional insight the user may want to consult a statistician.												
1122													
1123	Highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may												
1124	be unreliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.												
1125													
1126	Plutonium-239/240												
1127													
1128	General Statistics												
1129	Total Number of Observations					80	Number of Distinct Observations					76	
1130	Number of Detects					7	Number of Non-Detects					73	
1131	Number of Distinct Detects					7	Number of Distinct Non-Detects					69	
1132	Minimum Detect					0.02	Minimum Non-Detect					-0.005	
1133	Maximum Detect					0.06	Maximum Non-Detect					0.02	
1134	Variance Detects					1.6916E	Percent Non-Detects					91.2	

	A	B	C	D	E	F	G	H	I	J	K	L
1135	Mean Detects					0.04	SD Detects					0.01
1136	Median Detects					0.04	CV Detects					0.30
1137	Skewness Detects					1.30	Kurtosis Detects					2.10
1138												
1139	Normal GOF Test on Detects Only											
1140	Shapiro Wilk Test Statistic					0.90	Shapiro Wilk GOF Test					
1141	5% Shapiro Wilk Critical Value					0.80	Detected Data appear Normal at 5% Significance Level					
1142	Lilliefors Test Statistic					0.21	Lilliefors GOF Test					
1143	5% Lilliefors Critical Value					0.33	Detected Data appear Normal at 5% Significance Level					
1144	Detected Data appear Normal at 5% Significance Level											
1145												
1146	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
1147	Mean					-0.001	Standard Error of Mean					0.001
1148	SD					0.01	95% KM (BCA) UCL					0.003
1149	95% KM (t) UCL					0.001	95% KM (Percentile Bootstrap) UCL					0.002
1150	95% KM (z) UCL					0.001	95% KM Bootstrap t UCL					8.1913E
1151	90% KM Chebyshev UCL					0.003	95% KM Chebyshev UCL					0.006
1152	97.5% KM Chebyshev UCL					0.009	99% KM Chebyshev UCL					0.01
1153												
1154	Gamma GOF Tests on Detected Observations Only											
1155	A-D Test Statistic					0.26	Anderson-Darling GOF Test					
1156	5% A-D Critical Value					0.70	Detected data appear Gamma Distributed at 5% Significance Level					
1157	K-S Test Statistic					0.16	Kolmogrov-Smirnov GOF					
1158	5% K-S Critical Value					0.31	Detected data appear Gamma Distributed at 5% Significance Level					
1159	Detected data appear Gamma Distributed at 5% Significance Level											
1160												
1161	Gamma Statistics on Detected Data Only											
1162	k hat (MLE)					14.2	k star (bias corrected MLE)					8.20
1163	Theta hat (MLE)					0.003	Theta star (bias corrected MLE)					0.005
1164	nu hat (MLE)					198.8	nu star (bias corrected)					114.9
1165	MLE Mean (bias corrected)					0.04	MLE Sd (bias corrected)					0.01
1166												
1167	Gamma Kaplan-Meier (KM) Statistics											
1168	k hat (KM)					0.009	nu hat (KM)					1.46
1169							Adjusted Level of Significance (β)					0.04
1170	Approximate Chi Square Value (1.46, α)					0.11	Adjusted Chi Square Value (1.46, β)					0.11
1171	Approximate KM-UCL (use when $n \geq 50$)					-0.016	Gamma Adjusted KM-UCL (use when $n < 50$)					-0.017
1172	Gamma (KM) may not be used when k hat (KM) is < 0.1											
1173												
1174	DL/2 Statistics											
1175	Mean in Original Scale					0.006	SD in Original Scale					0.01
1176	95% t UCL (Assumes normality)					0.008						
1177	DL/2 is not a recommended method, provided for comparisons and historical reasons											
1178												
1179	Nonparametric Distribution Free UCL Statistics											
1180	Detected Data appear Normal Distributed at 5% Significance Level											
1181												
1182	Suggested UCL to Use											
1183	95% KM (t) UCL					0.001	95% KM (Percentile Bootstrap) UCL					0.002
1184												
1185	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate UCL.											
1186	Recommendations are based upon data size, data distribution, and skewness.											
1187	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Singh.											
1188	Recommendations results will not cover all Real World data sets; for additional insight the user may want to consult the literature.											
1189												
1190	RDX											
1191												
1192	General Statistics											
1193	Total Number of Observations					80	Number of Distinct Observations					9
1194	Number of Detects					8	Number of Non-Detects					72
1195	Number of Distinct Detects					8	Number of Distinct Non-Detects					1
1196	Minimum Detect					0.11	Minimum Non-Detect					0.5
1197	Maximum Detect					49.4	Maximum Non-Detect					0.5

	A	B	C	D	E	F	G	H	I	J	K	L
1198				Variance Detects		301.8			Percent Non-Detects			90%
1199				Mean Detects		6.40			SD Detects			17.3
1200				Median Detects		0.26			CV Detects			2.71
1201				Skewness Detects		2.82			Kurtosis Detects			7.99
1202				Mean of Logged Detects		-0.77			SD of Logged Detects			1.94
1203												
1204				Normal GOF Test on Detects Only								
1205				Shapiro Wilk Test Statistic		0.42			Shapiro Wilk GOF Test			
1206				5% Shapiro Wilk Critical Value		0.81			Detected Data Not Normal at 5% Significance Level			
1207				Lilliefors Test Statistic		0.51			Lilliefors GOF Test			
1208				5% Lilliefors Critical Value		0.31			Detected Data Not Normal at 5% Significance Level			
1209				Detected Data Not Normal at 5% Significance Level								
1210												
1211				Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs								
1212				Mean		0.87			Standard Error of Mean			0.65
1213				SD		5.46			95% KM (BCA) UCL			2.16
1214				95% KM (t) UCL		1.96			95% KM (Percentile Bootstrap) UCL			2.10
1215				95% KM (z) UCL		1.95			95% KM Bootstrap t UCL			14.4
1216				90% KM Chebyshev UCL		2.83			95% KM Chebyshev UCL			3.72
1217				97.5% KM Chebyshev UCL		4.96			99% KM Chebyshev UCL			7.38
1218												
1219				Gamma GOF Tests on Detected Observations Only								
1220				A-D Test Statistic		1.95			Anderson-Darling GOF Test			
1221				5% A-D Critical Value		0.81			Detected Data Not Gamma Distributed at 5% Significance Level			
1222				K-S Test Statistic		0.5			Kolmogrov-Smirnoff GOF			
1223				5% K-S Critical Value		0.31			Detected Data Not Gamma Distributed at 5% Significance Level			
1224				Detected Data Not Gamma Distributed at 5% Significance Level								
1225												
1226				Gamma Statistics on Detected Data Only								
1227				k hat (MLE)		0.26			k star (bias corrected MLE)			0.25
1228				Theta hat (MLE)		24			Theta star (bias corrected MLE)			25.6
1229				nu hat (MLE)		4.26			nu star (bias corrected)			4.00
1230				MLE Mean (bias corrected)		6.40			MLE Sd (bias corrected)			12.8
1231												
1232				Gamma Kaplan-Meier (KM) Statistics								
1233				k hat (KM)		0.02			nu hat (KM)			4.12
1234				Approximate Chi Square Value (4.12, α)		0.77			Adjusted Chi Square Value (4.12, β)			0.74
1235				Approximate KM-UCL (use when $n \geq 50$)		4.69			Gamma Adjusted KM-UCL (use when $n < 50$)			4.84
1236				Gamma (KM) may not be used when k hat (KM) is < 0.1								
1237												
1238				Gamma ROS Statistics using Imputed Non-Detects								
1239				GROS may not be used when data set has $> 50\%$ NDs with many tied observations at multiple DLs								
1240				GROS may not be used when kstar of detected data is small such as < 0.1								
1241				For such situations, GROS method tends to yield inflated values of UCLs and BTVs								
1242				Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM e								
1243				Minimum		0.01			Mean			3.06
1244				Maximum		49.4			Median			0.01
1245				SD		7.52			CV			2.45
1246				k hat (MLE)		0.21			k star (bias corrected MLE)			0.21
1247				Theta hat (MLE)		14.1			Theta star (bias corrected MLE)			14.1
1248				nu hat (MLE)		34.6			nu star (bias corrected)			34.7
1249				MLE Mean (bias corrected)		3.06			MLE Sd (bias corrected)			6.58
1250									Adjusted Level of Significance (β)			0.04
1251				Approximate Chi Square Value (34.72, α)		22.2			Adjusted Chi Square Value (34.72, β)			22.0
1252				Gamma Approximate UCL (use when $n \geq 50$)		4.78			Gamma Adjusted UCL (use when $n < 50$)			4.82
1253												
1254				Lognormal GOF Test on Detected Observations Only								
1255				Shapiro Wilk Test Statistic		0.65			Shapiro Wilk GOF Test			
1256				5% Shapiro Wilk Critical Value		0.81			Detected Data Not Lognormal at 5% Significance Level			
1257				Lilliefors Test Statistic		0.39			Lilliefors GOF Test			
1258				5% Lilliefors Critical Value		0.31			Detected Data Not Lognormal at 5% Significance Level			
1259				Detected Data Not Lognormal at 5% Significance Level								
1260												

	A	B	C	D	E	F	G	H	I	J	K	L	
1261	Lognormal ROS Statistics Using Imputed Non-Detects												
1262	Mean in Original Scale					1.25	Mean in Log Scale					-1.22	
1263	SD in Original Scale					5.54	SD in Log Scale					1.47	
1264	95% t UCL (assumes normality of ROS data)					2.28	95% Percentile Bootstrap UCL					2.46	
1265	95% BCA Bootstrap UCL					3.23	95% Bootstrap t UCL					6.56	
1266	95% H-UCL (Log ROS)					1.39							
1267													
1268	DL/2 Statistics												
1269	DL/2 Normal					DL/2 Log-Transformed							
1270	Mean in Original Scale					0.86	Mean in Log Scale					-1.32	
1271	SD in Original Scale					5.49	SD in Log Scale					0.60	
1272	95% t UCL (Assumes normality)					1.88	95% H-Stat UCL					0.36	
1273	DL/2 is not a recommended method, provided for comparisons and historical reasons												
1274													
1275	Nonparametric Distribution Free UCL Statistics												
1276	Data do not follow a Discernible Distribution at 5% Significance Level												
1277													
1278	Suggested UCL to Use												
1279	95% KM (Chebyshev) UCL					3.72							
1280													
1281	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate UCL.												
1282	Recommendations are based upon data size, data distribution, and skewness.												
1283	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Singh (2010).												
1284	Simulation results will not cover all Real World data sets; for additional insight the user may want to consult the literature.												
1285													
1286	Silver												
1287													
1288	General Statistics												
1289	Total Number of Observations					80	Number of Distinct Observations					70	
1290	Number of Detects					54	Number of Non-Detects					26	
1291	Number of Distinct Detects					50	Number of Distinct Non-Detects					24	
1292	Minimum Detect					0.11	Minimum Non-Detect					0.49	
1293	Maximum Detect					1.11	Maximum Non-Detect					0.66	
1294	Variance Detects					0.052	Percent Non-Detects					32.5%	
1295	Mean Detects					0.56	SD Detects					0.23	
1296	Median Detects					0.59	CV Detects					0.40	
1297	Skewness Detects					-0.063	Kurtosis Detects					-0.43	
1298	Mean of Logged Detects					-0.68	SD of Logged Detects					0.52	
1299													
1300	Normal GOF Test on Detects Only												
1301	Shapiro Wilk Test Statistic					0.97	Normal GOF Test on Detected Observations Only						
1302	5% Shapiro Wilk P Value					0.66	Detected Data appear Normal at 5% Significance Level						
1303	Lilliefors Test Statistic					0.065	Lilliefors GOF Test						
1304	5% Lilliefors Critical Value					0.12	Detected Data appear Normal at 5% Significance Level						
1305	Detected Data appear Normal at 5% Significance Level												
1306													
1307	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs												
1308	Mean					0.49	Standard Error of Mean					0.027	
1309	SD					0.22	95% KM (BCA) UCL					0.54	
1310	95% KM (t) UCL					0.54	95% KM (Percentile Bootstrap) UCL					0.54	
1311	95% KM (z) UCL					0.54	95% KM Bootstrap t UCL					0.54	
1312	90% KM Chebyshev UCL					0.58	95% KM Chebyshev UCL					0.61	
1313	97.5% KM Chebyshev UCL					0.67	99% KM Chebyshev UCL					0.77	
1314													
1315	Gamma GOF Tests on Detected Observations Only												
1316	A-D Test Statistic					0.96	Anderson-Darling GOF Test						
1317	5% A-D Critical Value					0.75	Detected Data Not Gamma Distributed at 5% Significance Level						
1318	K-S Test Statistic					0.12	Kolmogorov-Smirnov GOF						
1319	5% K-S Critical Value					0.12	Detected Data Not Gamma Distributed at 5% Significance Level						
1320	Detected Data Not Gamma Distributed at 5% Significance Level												
1321													
1322	Gamma Statistics on Detected Data Only												
1323	k hat (MLE)					4.73	k star (bias corrected MLE)					4.48	

	A	B	C	D	E	F	G	H	I	J	K	L
1324	Theta hat (MLE)					0.11	Theta star (bias corrected MLE)					0.12
1325	nu hat (MLE)					511.7	nu star (bias corrected)					484.6
1326	MLE Mean (bias corrected)					0.56	MLE Sd (bias corrected)					0.26
1327												
1328	Gamma Kaplan-Meier (KM) Statistics											
1329	k hat (KM)					4.94	nu hat (KM)					791.1
1330	Approximate Chi Square Value (791.13, α)					726.9	Adjusted Chi Square Value (791.13, β)					725.7
1331	Approximate KM-UCL (use when n>=50)					0.54	Gamma Adjusted KM-UCL (use when n<50)					0.54
1332												
1333	Gamma ROS Statistics using Imputed Non-Detects											
1334	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
1335	GROS may not be used when kstar of detected data is small such as < 0.1											
1336	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
1337	Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM e											
1338	Minimum					0.11	Mean					0.5
1339	Maximum					1.11	Median					0.41
1340	SD					0.20	CV					0.41
1341	k hat (MLE)					5.54	k star (bias corrected MLE)					5.34
1342	Theta hat (MLE)					0.09	Theta star (bias corrected MLE)					0.09
1343	nu hat (MLE)					886.6	nu star (bias corrected)					854.7
1344	MLE Mean (bias corrected)					0.5	MLE Sd (bias corrected)					0.21
1345							Adjusted Level of Significance (β)					0.04
1346	Approximate Chi Square Value (854.67, α)					787.8	Adjusted Chi Square Value (854.67, β)					786.7
1347	Gamma Approximate UCL (use when n>=50)					0.54	Gamma Adjusted UCL (use when n<50)					0.54
1348												
1349	Lognormal GOF Test on Detected Observations Only											
1350	Lilliefors Test Statistic					0.14	Lilliefors GOF Test					
1351	5% Lilliefors Critical Value					0.12	Detected Data Not Lognormal at 5% Significance Level					
1352	Detected Data Not Lognormal at 5% Significance Level											
1353												
1354	Lognormal ROS Statistics Using Imputed Non-Detects											
1355	Mean in Original Scale					0.49	Mean in Log Scale					-0.81
1356	SD in Original Scale					0.21	SD in Log Scale					0.46
1357	95% t UCL (assumes normality of ROS data)					0.53	95% Percentile Bootstrap UCL					0.53
1358	95% BCA Bootstrap UCL					0.53	95% Bootstrap t UCL					0.53
1359	95% H-UCL (Log ROS)					0.54						
1360												
1361	DL/2 Statistics											
1362	DL/2 Normal						DL/2 Log-Transformed					
1363	Mean in Original Scale					0.47	Mean in Log Scale					-0.87
1364	SD in Original Scale					0.23	SD in Log Scale					0.50
1365	95% t UCL (Assumes normality)					0.51	95% H-Stat UCL					0.52
1366	DL/2 is not a recommended method, provided for comparisons and historical reasons											
1367												
1368	Nonparametric Distribution Free UCL Statistics											
1369	Detected Data appear Normal Distributed at 5% Significance Level											
1370												
1371	Suggested UCL to Use											
1372	95% KM (t) UCL					0.54	95% KM (Percentile Bootstrap) UCL					0.54
1373												
1374	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
1375	Recommendations are based upon data size, data distribution, and skewness.											
1376	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and											
1377	Recommendations results will not cover all Real World data sets; for additional insight the user may want to cons											
1378												
1379												
1380	Uranium											
1381												
1382	General Statistics											
1383	Total Number of Observations					80	Number of Distinct Observations					73
1384							Number of Missing Observations					0
1385	Minimum					0.39	Mean					2.26
1386	Maximum					19.1	Median					1.47

	A	B	C	D	E	F	G	H	I	J	K	L	
1387					SD	2.57				Std. Error of Mean		0.28	
1388					Coefficient of Variation	1.13				Skewness		4.19	
1389													
1390					Normal GOF Test								
1391					Shapiro Wilk Test Statistic	0.59				Shapiro Wilk GOF Test			
1392					5% Shapiro Wilk P Value	0				Data Not Normal at 5% Significance Level			
1393					Lilliefors Test Statistic	0.26				Lilliefors GOF Test			
1394					5% Lilliefors Critical Value	0.091				Data Not Normal at 5% Significance Level			
1395					Data Not Normal at 5% Significance Level								
1396													
1397					Assuming Normal Distribution								
1398					95% Normal UCL					95% UCLs (Adjusted for Skewness)			
1399					95% Student's-t UCL		2.74		95% Adjusted-CLT UCL (Chen-1995)				2.88
1400									95% Modified-t UCL (Johnson-1978)				2.76
1401													
1402					Gamma GOF Test								
1403					A-D Test Statistic	3.35				Anderson-Darling Gamma GOF Test			
1404					5% A-D Critical Value	0.76				Data Not Gamma Distributed at 5% Significance Level			
1405					K-S Test Statistic	0.18				Kolmogorov-Smirnov Gamma GOF Test			
1406					5% K-S Critical Value	0.10				Data Not Gamma Distributed at 5% Significance Level			
1407					Data Not Gamma Distributed at 5% Significance Level								
1408													
1409					Gamma Statistics								
1410					k hat (MLE)	1.73				k star (bias corrected MLE)		1.67	
1411					Theta hat (MLE)	1.30				Theta star (bias corrected MLE)		1.35	
1412					nu hat (MLE)	277.6				nu star (bias corrected)		268.5	
1413					MLE Mean (bias corrected)	2.26				MLE Sd (bias corrected)		1.75	
1414										Approximate Chi Square Value (0.05)		231.6	
1415					Adjusted Level of Significance	0.04				Adjusted Chi Square Value		230.9	
1416													
1417					Assuming Gamma Distribution								
1418					Approximate Gamma UCL (use when n>=50))	2.62				Adjusted Gamma UCL (use when n<50)		2.63	
1419													
1420					Lognormal GOF Test								
1421					Shapiro Wilk Test Statistic	0.95				Shapiro Wilk Lognormal GOF Test			
1422					5% Shapiro Wilk P Value	0.01				Data Not Lognormal at 5% Significance Level			
1423					Lilliefors Test Statistic	0.11				Lilliefors Lognormal GOF Test			
1424					5% Lilliefors Critical Value	0.091				Data Not Lognormal at 5% Significance Level			
1425					Data Not Lognormal at 5% Significance Level								
1426													
1427					Lognormal Statistics								
1428					Minimum of Logged Data	-0.92				Mean of logged Data		0.50	
1429					Maximum of Logged Data	2.95				SD of logged Data		0.72	
1430													
1431					Assuming Lognormal Distribution								
1432					95% H-UCL	2.52				90% Chebyshev (MVUE) UCL		2.70	
1433					95% Chebyshev (MVUE) UCL	2.96				97.5% Chebyshev (MVUE) UCL		3.32	
1434					99% Chebyshev (MVUE) UCL	4.02							
1435													
1436					Nonparametric Distribution Free UCL Statistics								
1437					Data do not follow a Discernible Distribution (0.05)								
1438													
1439					Nonparametric Distribution Free UCLs								
1440					95% CLT UCL	2.74				95% Jackknife UCL		2.74	
1441					95% Standard Bootstrap UCL	2.75				95% Bootstrap-t UCL		3.02	
1442					95% Hall's Bootstrap UCL	3.51				95% Percentile Bootstrap UCL		2.73	
1443					95% BCA Bootstrap UCL	2.93							
1444					90% Chebyshev(Mean, Sd) UCL	3.13				95% Chebyshev(Mean, Sd) UCL		3.52	
1445					97.5% Chebyshev(Mean, Sd) UCL	4.06				99% Chebyshev(Mean, Sd) UCL		5.13	
1446													
1447					Suggested UCL to Use								
1448					95% Chebyshev (Mean, Sd) UCL	3.52							
1449													

	A	B	C	D	E	F	G	H	I	J	K	L	
1450	Instructions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
1451	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and												
1452	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets												
1453	For additional insight the user may want to consult a statistician.												
1454													
1455													
1456	Uranium-234												
1457													
1458	General Statistics												
1459	Total Number of Observations					80	Number of Distinct Observations					64	
1460							Number of Missing Observations					0	
1461	Minimum					0.39	Mean					1.33	
1462	Maximum					4.15	Median					1.19	
1463	SD					0.61	Std. Error of Mean					0.06	
1464	Coefficient of Variation					0.45	Skewness					1.73	
1465													
1466	Normal GOF Test												
1467	Shapiro Wilk Test Statistic					0.88	Shapiro Wilk GOF Test						
1468	5% Shapiro Wilk P Value					2.1525E	Data Not Normal at 5% Significance Level						
1469	Lilliefors Test Statistic					0.15	Lilliefors GOF Test						
1470	5% Lilliefors Critical Value					0.09	Data Not Normal at 5% Significance Level						
1471	Data Not Normal at 5% Significance Level												
1472													
1473	Assuming Normal Distribution												
1474	95% Normal UCL						95% UCLs (Adjusted for Skewness)						
1475	95% Student's-t UCL					1.44	95% Adjusted-CLT UCL (Chen-1995)					1.45	
1476							95% Modified-t UCL (Johnson-1978)					1.44	
1477													
1478	Gamma GOF Test												
1479	A-D Test Statistic					0.81	Anderson-Darling Gamma GOF Test						
1480	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level						
1481	K-S Test Statistic					0.10	Kolmogrov-Smirnoff Gamma GOF Test						
1482	5% K-S Critical Value					0.09	Data Not Gamma Distributed at 5% Significance Level						
1483	Data Not Gamma Distributed at 5% Significance Level												
1484													
1485	Gamma Statistics												
1486	k hat (MLE)					5.63	k star (bias corrected MLE)					5.43	
1487	Theta hat (MLE)					0.23	Theta star (bias corrected MLE)					0.24	
1488	nu hat (MLE)					902.1	nu star (bias corrected)					869.6	
1489	MLE Mean (bias corrected)					1.33	MLE Sd (bias corrected)					0.57	
1490							Approximate Chi Square Value (0.05)					802.2	
1491	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					801	
1492													
1493	Assuming Gamma Distribution												
1494	Approximate Gamma UCL (use when n>=50)					1.44	Adjusted Gamma UCL (use when n<50)					1.44	
1495													
1496	Lognormal GOF Test												
1497	Shapiro Wilk Test Statistic					0.98	Shapiro Wilk Lognormal GOF Test						
1498	5% Shapiro Wilk P Value					0.70	Data appear Lognormal at 5% Significance Level						
1499	Lilliefors Test Statistic					0.10	Lilliefors Lognormal GOF Test						
1500	5% Lilliefors Critical Value					0.09	Data Not Lognormal at 5% Significance Level						
1501	Data appear Approximate Lognormal at 5% Significance Level												
1502													
1503	Lognormal Statistics												
1504	Minimum of Logged Data					-0.93	Mean of logged Data					0.19	
1505	Maximum of Logged Data					1.42	SD of logged Data					0.42	
1506													
1507	Assuming Lognormal Distribution												
1508	95% H-UCL					1.45	90% Chebyshev (MVUE) UCL					1.53	
1509	95% Chebyshev (MVUE) UCL					1.62	97.5% Chebyshev (MVUE) UCL					1.74	
1510	99% Chebyshev (MVUE) UCL					1.99							
1511													
1512	Nonparametric Distribution Free UCL Statistics												

	A	B	C	D	E	F	G	H	I	J	K	L
1513	Data appear to follow a Discernible Distribution at 5% Significance Level											
1514												
1515	Nonparametric Distribution Free UCLs											
1516	95% CLT UCL				1.44	95% Jackknife UCL				1.44		
1517	95% Standard Bootstrap UCL				1.44	95% Bootstrap-t UCL				1.46		
1518	95% Hall's Bootstrap UCL				1.46	95% Percentile Bootstrap UCL				1.45		
1519	95% BCA Bootstrap UCL				1.46							
1520	90% Chebyshev(Mean, Sd) UCL				1.53	95% Chebyshev(Mean, Sd) UCL				1.63		
1521	97.5% Chebyshev(Mean, Sd) UCL				1.76	99% Chebyshev(Mean, Sd) UCL				2.01		
1522												
1523	Suggested UCL to Use											
1524	95% Student's-t UCL				1.44	or 95% Modified-t UCL				1.44		
1525												
1526	Directions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
1527	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
1528	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
1529	For additional insight the user may want to consult a statistician.											
1530												
1531	Uranium-235/236											
1532												
1533	General Statistics											
1534	Total Number of Observations				80	Number of Distinct Observations				74		
1535	Number of Detects				47	Number of Non-Detects				33		
1536	Number of Distinct Detects				42	Number of Distinct Non-Detects				32		
1537	Minimum Detect				0.05	Minimum Non-Detect				0.006		
1538	Maximum Detect				0.22	Maximum Non-Detect				0.08		
1539	Variance Detects				0.001	Percent Non-Detects				41.2		
1540	Mean Detects				0.10	SD Detects				0.03		
1541	Median Detects				0.09	CV Detects				0.33		
1542	Skewness Detects				1.54	Kurtosis Detects				2.48		
1543	Mean of Logged Detects				-2.28	SD of Logged Detects				0.29		
1544												
1545	Normal GOF Test on Detects Only											
1546	Shapiro Wilk Test Statistic				0.85	Shapiro Wilk GOF Test						
1547	5% Shapiro Wilk Critical Value				0.94	Detected Data Not Normal at 5% Significance Level						
1548	Lilliefors Test Statistic				0.17	Lilliefors GOF Test						
1549	5% Lilliefors Critical Value				0.12	Detected Data Not Normal at 5% Significance Level						
1550	Detected Data Not Normal at 5% Significance Level											
1551												
1552	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
1553	Mean		0.06	Standard Error of Mean		0.006						
1554	SD		0.05	95% KM (BCA) UCL		0.08						
1555	95% KM (t) UCL		0.07	95% KM (Percentile Bootstrap) UCL		0.07						
1556	95% KM (z) UCL		0.07	95% KM Bootstrap t UCL		0.07						
1557	90% KM Chebyshev UCL		0.08	95% KM Chebyshev UCL		0.09						
1558	97.5% KM Chebyshev UCL		0.10	99% KM Chebyshev UCL		0.12						
1559												
1560	Gamma GOF Tests on Detected Observations Only											
1561	A-D Test Statistic		0.94	Anderson-Darling GOF Test								
1562	5% A-D Critical Value		0.74	Detected Data Not Gamma Distributed at 5% Significance Level								
1563	K-S Test Statistic		0.13	Kolmogrov-Smirnov GOF								
1564	5% K-S Critical Value		0.12	Detected Data Not Gamma Distributed at 5% Significance Level								
1565	Detected Data Not Gamma Distributed at 5% Significance Level											
1566												
1567	Gamma Statistics on Detected Data Only											
1568	k hat (MLE)		10.9	k star (bias corrected MLE)		10.2						
1569	Theta hat (MLE)		0.009	Theta star (bias corrected MLE)		0.01						
1570	nu hat (MLE)		1026	nu star (bias corrected)		961.8						
1571	MLE Mean (bias corrected)		0.10	MLE Sd (bias corrected)		0.03						
1572												
1573	Gamma Kaplan-Meier (KM) Statistics											
1574	k hat (KM)		1.41	nu hat (KM)		225.8						
1575	Approximate Chi Square Value (225.76, α)		192	Adjusted Chi Square Value (225.76, β)		191.4						

	A	B	C	D	E	F	G	H	I	J	K	L	
1576	Approximate KM-UCL (use when n>=50)					0.07	Gamma Adjusted KM-UCL (use when n<50)					0.07	
1577													
1578	Gamma ROS Statistics using Imputed Non-Detects												
1579	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs												
1580	GROS may not be used when kstar of detected data is small such as < 0.1												
1581	For such situations, GROS method tends to yield inflated values of UCLs and BTVs												
1582	Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM e												
1583					Minimum	0.02					Mean	0.07	
1584					Maximum	0.22					Median	0.07	
1585					SD	0.04					CV	0.57	
1586					k hat (MLE)	3.26					k star (bias corrected MLE)	3.14	
1587					Theta hat (MLE)	0.02					Theta star (bias corrected MLE)	0.02	
1588					nu hat (MLE)	522.1					nu star (bias corrected)	503.9	
1589					MLE Mean (bias corrected)	0.07					MLE Sd (bias corrected)	0.04	
1590											Adjusted Level of Significance (β)	0.04	
1591	pproximate Chi Square Value (503.89, α)					452.8	Adjusted Chi Square Value (503.89, β)				452		
1592	Gamma Approximate UCL (use when n>=50)					0.08	Gamma Adjusted UCL (use when n<50)					0.08	
1593													
1594	Lognormal GOF Test on Detected Observations Only												
1595	Shapiro Wilk Test Statistic					0.95	Shapiro Wilk GOF Test						
1596	5% Shapiro Wilk Critical Value					0.94	ected Data appear Lognormal at 5% Significance L						
1597	Lilliefors Test Statistic					0.11	Lilliefors GOF Test						
1598	5% Lilliefors Critical Value					0.12	ected Data appear Lognormal at 5% Significance L						
1599	Detected Data appear Lognormal at 5% Significance Level												
1600													
1601	Lognormal ROS Statistics Using Imputed Non-Detects												
1602	Mean in Original Scale					0.08	Mean in Log Scale					-2.57	
1603	SD in Original Scale					0.03	SD in Log Scale					0.41	
1604	t UCL (assumes normality of ROS data)					0.09	95% Percentile Bootstrap UCL					0.09	
1605	95% BCA Bootstrap UCL					0.09	95% Bootstrap t UCL					0.09	
1606	95% H-UCL (Log ROS)					0.09							
1607													
1608	UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed												
1609	KM Mean (logged)					-3.37	95% H-UCL (KM -Log)					0.12	
1610	KM SD (logged)					1.34	95% Critical H Value (KM-Log)					2.63	
1611	KM Standard Error of Mean (logged)					0.15							
1612													
1613	DL/2 Statistics												
1614	DL/2 Normal						DL/2 Log-Transformed						
1615	Mean in Original Scale					0.07	Mean in Log Scale					-2.90	
1616	SD in Original Scale					0.04	SD in Log Scale					0.83	
1617	95% t UCL (Assumes normality)					0.08	95% H-Stat UCL					0.09	
1618	DL/2 is not a recommended method, provided for comparisons and historical reasons												
1619													
1620	Nonparametric Distribution Free UCL Statistics												
1621	Detected Data appear Lognormal Distributed at 5% Significance Level												
1622													
1623	Suggested UCL to Use												
1624	95% KM (t) UCL					0.07	95% KM (% Bootstrap) UCL					0.07	
1625													
1626	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropri												
1627	Recommendations are based upon data size, data distribution, and skewness.												
1628	mmendations are based upon the results of the simulation studies summarized in Singh, Maichle, and												
1629	ations results will not cover all Real World data sets; for additional insight the user may want to cons												
1630													
1631													
1632	Uranium-238												
1633													
1634	General Statistics												
1635	Total Number of Observations					80	Number of Distinct Observations					65	
1636							Number of Missing Observations					0	
1637	Minimum					0.32	Mean					1.50	
1638	Maximum					4.47	Median					1.32	

	A	B	C	D	E	F	G	H	I	J	K	L
1639					SD	0.77					Std. Error of Mean	0.08
1640					Coefficient of Variation	0.51					Skewness	1.48
1641												
1642					Normal GOF Test							
1643					Shapiro Wilk Test Statistic	0.88					Shapiro Wilk GOF Test	
1644					5% Shapiro Wilk P Value	1.9192E					Data Not Normal at 5% Significance Level	
1645					Lilliefors Test Statistic	0.17					Lilliefors GOF Test	
1646					5% Lilliefors Critical Value	0.09					Data Not Normal at 5% Significance Level	
1647					Data Not Normal at 5% Significance Level							
1648												
1649					Assuming Normal Distribution							
1650					95% Normal UCL			95% UCLs (Adjusted for Skewness)				
1651					95% Student's-t UCL	1.64		95% Adjusted-CLT UCL (Chen-1995)			1.66	
1652								95% Modified-t UCL (Johnson-1978)			1.65	
1653												
1654					Gamma GOF Test							
1655					A-D Test Statistic	0.77					Anderson-Darling Gamma GOF Test	
1656					5% A-D Critical Value	0.75					Data Not Gamma Distributed at 5% Significance Level	
1657					K-S Test Statistic	0.11					Kolmogrov-Smirnoff Gamma GOF Test	
1658					5% K-S Critical Value	0.1					Data Not Gamma Distributed at 5% Significance Level	
1659					Data Not Gamma Distributed at 5% Significance Level							
1660												
1661					Gamma Statistics							
1662					k hat (MLE)	4.40		k star (bias corrected MLE)			4.24	
1663					Theta hat (MLE)	0.34		Theta star (bias corrected MLE)			0.35	
1664					nu hat (MLE)	704.6		nu star (bias corrected)			679.5	
1665					MLE Mean (bias corrected)	1.50		MLE Sd (bias corrected)			0.73	
1666								Approximate Chi Square Value (0.05)			620	
1667					Adjusted Level of Significance	0.04		Adjusted Chi Square Value			619	
1668												
1669					Assuming Gamma Distribution							
1670					Approximate Gamma UCL (use when n>=50))	1.64		Adjusted Gamma UCL (use when n<50)			1.65	
1671												
1672					Lognormal GOF Test							
1673					Shapiro Wilk Test Statistic	0.98					Shapiro Wilk Lognormal GOF Test	
1674					5% Shapiro Wilk P Value	0.65					Data appear Lognormal at 5% Significance Level	
1675					Lilliefors Test Statistic	0.08					Lilliefors Lognormal GOF Test	
1676					5% Lilliefors Critical Value	0.09					Data appear Lognormal at 5% Significance Level	
1677					Data appear Lognormal at 5% Significance Level							
1678												
1679					Lognormal Statistics							
1680					Minimum of Logged Data	-1.12		Mean of logged Data			0.29	
1681					Maximum of Logged Data	1.49		SD of logged Data			0.49	
1682												
1683					Assuming Lognormal Distribution							
1684					95% H-UCL	1.67		90% Chebyshev (MVUE) UCL			1.76	
1685					95% Chebyshev (MVUE) UCL	1.88		97.5% Chebyshev (MVUE) UCL			2.05	
1686					99% Chebyshev (MVUE) UCL	2.37						
1687												
1688					Nonparametric Distribution Free UCL Statistics							
1689					Data appear to follow a Discernible Distribution at 5% Significance Level							
1690												
1691					Nonparametric Distribution Free UCLs							
1692					95% CLT UCL	1.64		95% Jackknife UCL			1.64	
1693					95% Standard Bootstrap UCL	1.64		95% Bootstrap-t UCL			1.67	
1694					95% Hall's Bootstrap UCL	1.67		95% Percentile Bootstrap UCL			1.65	
1695					95% BCA Bootstrap UCL	1.65						
1696					90% Chebyshev(Mean, Sd) UCL	1.76		95% Chebyshev(Mean, Sd) UCL			1.88	
1697					97.5% Chebyshev(Mean, Sd) UCL	2.04		99% Chebyshev(Mean, Sd) UCL			2.36	
1698												
1699					Suggested UCL to Use							
1700					95% Student's-t UCL	1.64		or 95% Modified-t UCL			1.65	
1701					or 95% H-UCL	1.67						

	A	B	C	D	E	F	G	H	I	J	K	L
1702												
1703	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
1704	mmendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
1705	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
1706	For additional insight the user may want to consult a statistician.											
1707												
1708	ProUCL computes and outputs H-statistic based UCLs for historical reasons only.											
1709	often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical											
1710	It is therefore recommended to avoid the use of H-statistic based 95% UCLs.											
1711	metric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma											
1712												
1713												
1714	Vanadium											
1715												
1716	General Statistics											
1717	Total Number of Observations					80	Number of Distinct Observations					67
1718							Number of Missing Observations					0
1719	Minimum					5.29	Mean					23.34
1720	Maximum					35.4	Median					26.34
1721	SD					8.69	Std. Error of Mean					0.97
1722	Coefficient of Variation					0.37	Skewness					-0.90
1723												
1724	Normal GOF Test											
1725	Shapiro Wilk Test Statistic					0.83	Shapiro Wilk GOF Test					
1726	5% Shapiro Wilk P Value					3.899E-	Data Not Normal at 5% Significance Level					
1727	Lilliefors Test Statistic					0.20	Lilliefors GOF Test					
1728	5% Lilliefors Critical Value					0.091	Data Not Normal at 5% Significance Level					
1729	Data Not Normal at 5% Significance Level											
1730												
1731	Assuming Normal Distribution											
1732	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
1733	95% Student's-t UCL					24.91	95% Adjusted-CLT UCL (Chen-1995)					24.88
1734							95% Modified-t UCL (Johnson-1978)					24.91
1735												
1736	Gamma GOF Test											
1737	A-D Test Statistic					6.98	Anderson-Darling Gamma GOF Test					
1738	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level					
1739	K-S Test Statistic					0.26	Kolmogorov-Smirnov Gamma GOF Test					
1740	5% K-S Critical Value					0.1	Data Not Gamma Distributed at 5% Significance Level					
1741	Data Not Gamma Distributed at 5% Significance Level											
1742												
1743	Gamma Statistics											
1744	k hat (MLE)					4.77	k star (bias corrected MLE)					4.60
1745	Theta hat (MLE)					4.88	Theta star (bias corrected MLE)					5.07
1746	nu hat (MLE)					764.4	nu star (bias corrected)					737.1
1747	MLE Mean (bias corrected)					23.34	MLE Sd (bias corrected)					10.8
1748							Approximate Chi Square Value (0.05)					675.1
1749	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					674
1750												
1751	Assuming Gamma Distribution											
1752	Approximate Gamma UCL (use when n>=50)					25.5	Adjusted Gamma UCL (use when n<50)					25.5
1753												
1754	Lognormal GOF Test											
1755	Shapiro Wilk Test Statistic					0.75	Shapiro Wilk Lognormal GOF Test					
1756	5% Shapiro Wilk P Value					0	Data Not Lognormal at 5% Significance Level					
1757	Lilliefors Test Statistic					0.28	Lilliefors Lognormal GOF Test					
1758	5% Lilliefors Critical Value					0.091	Data Not Lognormal at 5% Significance Level					
1759	Data Not Lognormal at 5% Significance Level											
1760												
1761	Lognormal Statistics											
1762	Minimum of Logged Data					1.66	Mean of logged Data					3.04
1763	Maximum of Logged Data					3.56	SD of logged Data					0.52
1764												

	A	B	C	D	E	F	G	H	I	J	K	L
1765	Assuming Lognormal Distribution											
1766	95% H-UCL				26.94	90% Chebyshev (MVUE) UCL				28.54		
1767	95% Chebyshev (MVUE) UCL				30.62	97.5% Chebyshev (MVUE) UCL				33.47		
1768	99% Chebyshev (MVUE) UCL				39.04							
1769												
1770	Nonparametric Distribution Free UCL Statistics											
1771	Data do not follow a Discernible Distribution (0.05)											
1772												
1773	Nonparametric Distribution Free UCLs											
1774	95% CLT UCL				24.94	95% Jackknife UCL				24.94		
1775	95% Standard Bootstrap UCL				24.94	95% Bootstrap-t UCL				24.84		
1776	95% Hall's Bootstrap UCL				24.84	95% Percentile Bootstrap UCL				24.84		
1777	95% BCA Bootstrap UCL				24.84							
1778	90% Chebyshev(Mean, Sd) UCL				26.24	95% Chebyshev(Mean, Sd) UCL				27.64		
1779	97.5% Chebyshev(Mean, Sd) UCL				29.44	99% Chebyshev(Mean, Sd) UCL				33.04		
1780												
1781	Suggested UCL to Use											
1782	95% Chebyshev (Mean, Sd) UCL				27.64							
1783												
1784	ptions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
1785	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
1786	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
1787	For additional insight the user may want to consult a statistician.											
1788												
1789	highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may											
1790	reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.											
1791												
1792												
1793	Zinc											
1794												
1795	General Statistics											
1796	Total Number of Observations				80	Number of Distinct Observations				65		
1797						Number of Missing Observations				0		
1798	Minimum				21.1	Mean				32.84		
1799	Maximum				85.6	Median				29.94		
1800	SD				9.20	Std. Error of Mean				1.02		
1801	Coefficient of Variation				0.28	Skewness				2.87		
1802												
1803	Normal GOF Test											
1804	Shapiro Wilk Test Statistic				0.77	Shapiro Wilk GOF Test						
1805	5% Shapiro Wilk P Value				0	Data Not Normal at 5% Significance Level						
1806	Lilliefors Test Statistic				0.20	Lilliefors GOF Test						
1807	5% Lilliefors Critical Value				0.094	Data Not Normal at 5% Significance Level						
1808	Data Not Normal at 5% Significance Level											
1809												
1810	Assuming Normal Distribution											
1811	95% Normal UCL					95% UCLs (Adjusted for Skewness)						
1812	95% Student's-t UCL				34.54	95% Adjusted-CLT UCL (Chen-1995)				34.84		
1813						95% Modified-t UCL (Johnson-1978)				34.54		
1814												
1815	Gamma GOF Test											
1816	A-D Test Statistic				2.87	Anderson-Darling Gamma GOF Test						
1817	5% A-D Critical Value				0.75	Data Not Gamma Distributed at 5% Significance Level						
1818	K-S Test Statistic				0.18	Kolmogrov-Smirnoff Gamma GOF Test						
1819	5% K-S Critical Value				0.094	Data Not Gamma Distributed at 5% Significance Level						
1820	Data Not Gamma Distributed at 5% Significance Level											
1821												
1822	Gamma Statistics											
1823	k hat (MLE)				17.24	k star (bias corrected MLE)				16.64		
1824	Theta hat (MLE)				1.90	Theta star (bias corrected MLE)				1.97		
1825	nu hat (MLE)				2762	nu star (bias corrected)				2660		
1826	MLE Mean (bias corrected)				32.84	MLE Sd (bias corrected)				8.04		
1827						Approximate Chi Square Value (0.05)				2541		

	A	B	C	D	E	F	G	H	I	J	K	L
1828	Adjusted Level of Significance					0.04	Adjusted Chi Square Value					2539
1829												
1830	Assuming Gamma Distribution											
1831	Approximate Gamma UCL (use when n>=50)					34.3	Adjusted Gamma UCL (use when n<50)					34.3
1832												
1833	Lognormal GOF Test											
1834	Shapiro Wilk Test Statistic					0.90	Shapiro Wilk Lognormal GOF Test					
1835	5% Shapiro Wilk P Value					2.2930E	Data Not Lognormal at 5% Significance Level					
1836	Lilliefors Test Statistic					0.17	Lilliefors Lognormal GOF Test					
1837	5% Lilliefors Critical Value					0.09	Data Not Lognormal at 5% Significance Level					
1838	Data Not Lognormal at 5% Significance Level											
1839												
1840	Lognormal Statistics											
1841	Minimum of Logged Data					3.04	Mean of logged Data					3.46
1842	Maximum of Logged Data					4.45	SD of logged Data					0.23
1843												
1844	Assuming Lognormal Distribution											
1845	95% H-UCL					34.2	90% Chebyshev (MVUE) UCL					35.2
1846	95% Chebyshev (MVUE) UCL					36.4	97.5% Chebyshev (MVUE) UCL					38.0
1847	99% Chebyshev (MVUE) UCL					41.1						
1848												
1849	Nonparametric Distribution Free UCL Statistics											
1850	Data do not follow a Discernible Distribution (0.05)											
1851												
1852	Nonparametric Distribution Free UCLs											
1853	95% CLT UCL					34.5	95% Jackknife UCL					34.5
1854	95% Standard Bootstrap UCL					34.4	95% Bootstrap-t UCL					34.9
1855	95% Hall's Bootstrap UCL					35.5	95% Percentile Bootstrap UCL					34.6
1856	95% BCA Bootstrap UCL					34.9						
1857	90% Chebyshev(Mean, Sd) UCL					35.9	95% Chebyshev(Mean, Sd) UCL					37.3
1858	97.5% Chebyshev(Mean, Sd) UCL					39.2	99% Chebyshev(Mean, Sd) UCL					43.0
1859												
1860	Suggested UCL to Use											
1861	95% Student's-t UCL					34.5	or 95% Modified-t UCL					34.5
1862												
1863	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
1864	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Singh											
1865	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
1866	For additional insight the user may want to consult a statistician.											
1867												