

	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	Time of Computation		8/13/2015 2:11:58 PM									
5	From File		ProUCLinput_15-009(b)_0-10.xls									
6	Full Precision		OFF									
7	Confidence Coefficient		95%									
8	Number of Bootstrap Operations		2000									
9												
10												
11	Barium											
12												
13	General Statistics											
14	Total Number of Observations				11		Number of Distinct Observations				11	
15							Number of Missing Observations				0	
16	Minimum				18.7		Mean				63.0	
17	Maximum				134		Median				49.3	
18	SD				32.5		Std. Error of Mean				9.81	
19	Coefficient of Variation				0.51		Skewness				0.92	
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic				0.93		Shapiro Wilk GOF Test					
23	5% Shapiro Wilk Critical Value				0.85		Data appear Normal at 5% Significance Level					
24	Lilliefors Test Statistic				0.20		Lilliefors GOF Test					
25	5% Lilliefors Critical Value				0.26		Data appear Normal at 5% Significance Level					
26	Data appear 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				80.8		95% Adjusted-CLT UCL (Chen-1995)				82.0	
31							95% Modified-t UCL (Johnson-1978)				81.2	
32												
33	Gamma GOF Test											
34	A-D Test Statistic				0.21		Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value				0.73		Data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic				0.16		Kolmogorov-Smirnov Gamma GOF Test					
37	5% K-S Critical Value				0.25		Data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)				4.12		k star (bias corrected MLE)				3.06	
42	Theta hat (MLE)				15.2		Theta star (bias corrected MLE)				20.5	
43	nu hat (MLE)				90.7		nu star (bias corrected)				67.3	
44	MLE Mean (bias corrected)				63.0		MLE Sd (bias corrected)				36.0	
45							Approximate Chi Square Value (0.05)				49.4	
46	Adjusted Level of Significance				0.02		Adjusted Chi Square Value				46.9	
47												
48	Assuming Gamma Distribution											
49	Approximate Gamma UCL (use when n>=50)				85.8		Adjusted Gamma UCL (use when n<50)				90.3	
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic				0.97		Shapiro Wilk Lognormal GOF Test					
53	5% Shapiro Wilk Critical Value				0.85		Data appear Lognormal at 5% Significance Level					
54	Lilliefors Test Statistic				0.13		Lilliefors Lognormal GOF Test					
55	5% Lilliefors Critical Value				0.26		Data appear Lognormal at 5% Significance Level					
56	Data appear Lognormal at 5% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data				2.92		Mean of logged Data				4.01	
60	Maximum of Logged Data				4.89		SD of logged Data				0.54	
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL				94.5		90% Chebyshev (MVUE) UCL				95.4	

	A	B	C	D	E	F	G	H	I	J	K	L
64	95% Chebyshev (MVUE) UCL					109.9	97.5% Chebyshev (MVUE) UCL					130
65	99% Chebyshev (MVUE) UCL					169.4						
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					79.14	95% Jackknife UCL					80.8
72	95% Standard Bootstrap UCL					78.0	95% Bootstrap-t UCL					86.9
73	95% Hall's Bootstrap UCL					84.2	95% Percentile Bootstrap UCL					78.9
74	95% BCA Bootstrap UCL					80.74						
75	90% Chebyshev(Mean, Sd) UCL					92.44	95% Chebyshev(Mean, Sd) UCL					105.8
76	97.5% Chebyshev(Mean, Sd) UCL					124.3	99% Chebyshev(Mean, Sd) UCL					160.6
77												
78	Suggested UCL to Use											
79	95% Student's-t UCL					80.8						
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												
87	Calcium											
88												
89	General Statistics											
90	Total Number of Observations					11	Number of Distinct Observations					11
91							Number of Missing Observations					0
92	Minimum					664	Mean					2049
93	Maximum					6640	Median					1320
94	SD					1732	Std. Error of Mean					522.3
95	Coefficient of Variation					0.84	Skewness					2.17
96												
97	Normal GOF Test											
98	Shapiro Wilk Test Statistic					0.74	Shapiro Wilk GOF Test					
99	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
100	Lilliefors Test Statistic					0.25	Lilliefors GOF Test					
101	5% Lilliefors Critical Value					0.26	Data appear Normal at 5% Significance Level					
102	Data appear Approximate Normal at 5% Significance Level											
103												
104	Assuming Normal Distribution											
105	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
106	95% Student's-t UCL					2995	95% Adjusted-CLT UCL (Chen-1995)					3273
107							95% Modified-t UCL (Johnson-1978)					3052
108												
109	Gamma GOF Test											
110	A-D Test Statistic					0.51	Anderson-Darling Gamma GOF Test					
111	5% A-D Critical Value					0.73	data appear Gamma Distributed at 5% Significance Level					
112	K-S Test Statistic					0.20	Kolmogorov-Smirnov Gamma GOF Test					
113	5% K-S Critical Value					0.25	data appear Gamma Distributed at 5% Significance Level					
114	Detected data appear Gamma Distributed at 5% Significance Level											
115												
116	Gamma Statistics											
117	k hat (MLE)					2.28	k star (bias corrected MLE)					1.72
118	Theta hat (MLE)					896.7	Theta star (bias corrected MLE)					1190
119	nu hat (MLE)					50.2	nu star (bias corrected)					37.8
120	MLE Mean (bias corrected)					2049	MLE Sd (bias corrected)					1561
121							Approximate Chi Square Value (0.05)					24.8
122	Adjusted Level of Significance					0.02	Adjusted Chi Square Value					23.0
123												
124	Assuming Gamma Distribution											
125	Approximate Gamma UCL (use when n>=50))					3131	Adjusted Gamma UCL (use when n<50)					3363
126												

	A	B	C	D	E	F	G	H	I	J	K	L
127	Lognormal GOF Test											
128	Shapiro Wilk Test Statistic				0.94	Shapiro Wilk Lognormal GOF Test						
129	5% Shapiro Wilk Critical Value				0.85	Data appear Lognormal at 5% Significance Level						
130	Lilliefors Test Statistic				0.16	Lilliefors Lognormal GOF Test						
131	5% Lilliefors Critical Value				0.26	Data appear Lognormal at 5% Significance Level						
132	Data appear Lognormal at 5% Significance Level											
133												
134	Lognormal Statistics											
135	Minimum of Logged Data				6.49	Mean of logged Data						7.39
136	Maximum of Logged Data				8.80	SD of logged Data						0.67
137												
138	Assuming Lognormal Distribution											
139	95% H-UCL				3414	90% Chebyshev (MVUE) UCL						3240
140	95% Chebyshev (MVUE) UCL				3808	97.5% Chebyshev (MVUE) UCL						4596
141	99% Chebyshev (MVUE) UCL				6145							
142												
143	Nonparametric Distribution Free UCL Statistics											
144	Data appear to follow a Discernible Distribution at 5% Significance Level											
145												
146	Nonparametric Distribution Free UCLs											
147	95% CLT UCL				2908	95% Jackknife UCL						2995
148	95% Standard Bootstrap UCL				2884	95% Bootstrap-t UCL						4185
149	95% Hall's Bootstrap UCL				6432	95% Percentile Bootstrap UCL						2941
150	95% BCA Bootstrap UCL				3352							
151	90% Chebyshev(Mean, Sd) UCL				3616	95% Chebyshev(Mean, Sd) UCL						4325
152	97.5% Chebyshev(Mean, Sd) UCL				5310	99% Chebyshev(Mean, Sd) UCL						7245
153												
154	Suggested UCL to Use											
155	95% Student's-t UCL				2995							
156												
157	Instructions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
158	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
159	Singh and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
160	For additional insight the user may want to consult a statistician.											
161												
162	Cesium-137											
163												
164	General Statistics											
165	Total Number of Observations				11	Number of Distinct Observations						11
166	Number of Detects				7	Number of Non-Detects						4
167	Number of Distinct Detects				7	Number of Distinct Non-Detects						4
168	Minimum Detect				0.095	Minimum Non-Detect						-0.037
169	Maximum Detect				2.54	Maximum Non-Detect						0.03
170	Variance Detects				0.77	Percent Non-Detects						36.3
171	Mean Detects				0.56	SD Detects						0.87
172	Median Detects				0.22	CV Detects						1.54
173	Skewness Detects				2.52	Kurtosis Detects						6.49
174												
175	Normal GOF Test on Detects Only											
176	Shapiro Wilk Test Statistic				0.58	Shapiro Wilk GOF Test						
177	5% Shapiro Wilk Critical Value				0.80	Detected Data Not Normal at 5% Significance Level						
178	Lilliefors Test Statistic				0.39	Lilliefors GOF Test						
179	5% Lilliefors Critical Value				0.33	Detected Data Not Normal at 5% Significance Level						
180	Detected Data Not Normal at 5% Significance Level											
181												
182	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
183	Mean				0.34	Standard Error of Mean						0.23
184	SD				0.71	95% KM (BCA) UCL						0.83
185	95% KM (t) UCL				0.76	95% KM (Percentile Bootstrap) UCL						0.78
186	95% KM (z) UCL				0.72	95% KM Bootstrap t UCL						1.89
187	90% KM Chebyshev UCL				1.04	95% KM Chebyshev UCL						1.35
188	97.5% KM Chebyshev UCL				1.79	99% KM Chebyshev UCL						2.65
189												

	A	B	C	D	E	F	G	H	I	J	K	L
190	Gamma GOF Tests on Detected Observations Only											
191	A-D Test Statistic				0.8	Anderson-Darling GOF Test						
192	5% A-D Critical Value				0.73	Detected Data Not Gamma Distributed at 5% Significance Level						
193	K-S Test Statistic				0.28	Kolmogorov-Smirnov GOF						
194	5% K-S Critical Value				0.32	Data appear Gamma Distributed at 5% Significance Level						
195	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
196												
197	Gamma Statistics on Detected Data Only											
198	k hat (MLE)				0.90	k star (bias corrected MLE)				0.61		
199	Theta hat (MLE)				0.62	Theta star (bias corrected MLE)				0.92		
200	nu hat (MLE)				12.6	nu star (bias corrected)				8.57		
201	MLE Mean (bias corrected)				0.56	MLE Sd (bias corrected)				0.72		
202												
203	Gamma Kaplan-Meier (KM) Statistics											
204	k hat (KM)				0.23	nu hat (KM)				5.25		
205						Adjusted Level of Significance (β)				0.02		
206	Approximate Chi Square Value (5.25, α)				1.27	Adjusted Chi Square Value (5.25, β)				0.98		
207	Approximate KM-UCL (use when n>=50)				1.43	Gamma Adjusted KM-UCL (use when n<50)				1.86		
208												
209	DL/2 Statistics											
210	Mean in Original Scale				0.36	SD in Original Scale				0.73		
211	95% t UCL (Assumes normality)				0.76							
212	DL/2 is not a recommended method, provided for comparisons and historical reasons											
213												
214	Nonparametric Distribution Free UCL Statistics											
215	Detected Data appear Approximate Gamma Distributed at 5% Significance Level											
216												
217	Suggested UCL to Use											
218	95% KM (BCA) UCL				0.83	95% GROS Adjusted Gamma UCL				N/A		
219	95% Adjusted Gamma KM-UCL				1.86							
220												
221	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate UCL.											
222	Recommendations are based upon data size, data distribution, and skewness.											
223	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Singh (2019).											
224	Recommendations results will not cover all Real World data sets; for additional insight the user may want to consult with a statistician.											
225												
226												
227	Chromium											
228												
229	General Statistics											
230	Total Number of Observations				11	Number of Distinct Observations				11		
231						Number of Missing Observations				0		
232	Minimum				2.16	Mean				7.83		
233	Maximum				19.1	Median				6.87		
234	SD				4.95	Std. Error of Mean				1.49		
235	Coefficient of Variation				0.63	Skewness				1.30		
236												
237	Normal GOF Test											
238	Shapiro Wilk Test Statistic				0.88	Shapiro Wilk GOF Test						
239	5% Shapiro Wilk Critical Value				0.85	Data appear Normal at 5% Significance Level						
240	Lilliefors Test Statistic				0.24	Lilliefors GOF Test						
241	5% Lilliefors Critical Value				0.26	Data appear Normal at 5% Significance Level						
242	Data appear Normal at 5% Significance Level											
243												
244	Assuming Normal Distribution											
245	95% Normal UCL					95% UCLs (Adjusted for Skewness)						
246	95% Student's-t UCL				10.54	95% Adjusted-CLT UCL (Chen-1995)				10.92		
247						95% Modified-t UCL (Johnson-1978)				10.61		
248												
249	Gamma GOF Test											
250	A-D Test Statistic				0.21	Anderson-Darling Gamma GOF Test						
251	5% A-D Critical Value				0.73	Data appear Gamma Distributed at 5% Significance Level						
252	K-S Test Statistic				0.16	Kolmogorov-Smirnov Gamma GOF Test						

	A	B	C	D	E	F	G	H	I	J	K	L	
253	5% K-S Critical Value					0.251	data appear Gamma Distributed at 5% Significance Level						
254	Detected data appear Gamma Distributed at 5% Significance Level												
255													
256	Gamma Statistics												
257	k hat (MLE)					2.98	k star (bias corrected MLE)					2.23	
258	Theta hat (MLE)					2.62	Theta star (bias corrected MLE)					3.51	
259	nu hat (MLE)					65.61	nu star (bias corrected)					49.01	
260	MLE Mean (bias corrected)					7.83	MLE Sd (bias corrected)					5.24	
261							Approximate Chi Square Value (0.05)					33.91	
262	Adjusted Level of Significance					0.02	Adjusted Chi Square Value					31.91	
263													
264	Assuming Gamma Distribution												
265	Approximate Gamma UCL (use when n>=50)					11.31	Adjusted Gamma UCL (use when n<50)					12.01	
266													
267	Lognormal GOF Test												
268	Shapiro Wilk Test Statistic					0.97	Shapiro Wilk Lognormal GOF Test						
269	5% Shapiro Wilk Critical Value					0.85	Data appear Lognormal at 5% Significance Level						
270	Lilliefors Test Statistic					0.15	Lilliefors Lognormal GOF Test						
271	5% Lilliefors Critical Value					0.26	Data appear Lognormal at 5% Significance Level						
272	Data appear Lognormal at 5% Significance Level												
273													
274	Lognormal Statistics												
275	Minimum of Logged Data					0.77	Mean of logged Data					1.88	
276	Maximum of Logged Data					2.95	SD of logged Data					0.63	
277													
278	Assuming Lognormal Distribution												
279	95% H-UCL					12.91	90% Chebyshev (MVUE) UCL					12.51	
280	95% Chebyshev (MVUE) UCL					14.61	97.5% Chebyshev (MVUE) UCL					17.51	
281	99% Chebyshev (MVUE) UCL					23.31							
282													
283	Nonparametric Distribution Free UCL Statistics												
284	Data appear to follow a Discernible Distribution at 5% Significance Level												
285													
286	Nonparametric Distribution Free UCLs												
287	95% CLT UCL					10.21	95% Jackknife UCL					10.51	
288	95% Standard Bootstrap UCL					10.11	95% Bootstrap-t UCL					11.91	
289	95% Hall's Bootstrap UCL					25.51	95% Percentile Bootstrap UCL					10.21	
290	95% BCA Bootstrap UCL					10.71							
291	90% Chebyshev(Mean, Sd) UCL					12.31	95% Chebyshev(Mean, Sd) UCL					14.31	
292	97.5% Chebyshev(Mean, Sd) UCL					17.11	99% Chebyshev(Mean, Sd) UCL					22.71	
293													
294	Suggested UCL to Use												
295	95% Student's-t UCL					10.51							
296													
297	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
298	recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Singh												
299	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets												
300	For additional insight the user may want to consult a statistician.												
301													
302	Copper												
303													
304	General Statistics												
305	Total Number of Observations					11	Number of Distinct Observations					11	
306	Number of Detects					10	Number of Non-Detects					1	
307	Number of Distinct Detects					10	Number of Distinct Non-Detects					1	
308	Minimum Detect					2.3	Minimum Non-Detect					2.73	
309	Maximum Detect					17.8	Maximum Non-Detect					2.73	
310	Variance Detects					21.11	Percent Non-Detects					9.09	
311	Mean Detects					6.86	SD Detects					4.59	
312	Median Detects					5.1	CV Detects					0.66	
313	Skewness Detects					1.68	Kurtosis Detects					3.07	
314	Mean of Logged Detects					1.75	SD of Logged Detects					0.59	
315													

	A	B	C	D	E	F	G	H	I	J	K	L
316	Normal GOF Test on Detects Only											
317	Shapiro Wilk Test Statistic				0.83	Shapiro Wilk GOF Test						
318	5% Shapiro Wilk Critical Value				0.84	Detected Data Not Normal at 5% Significance Level						
319	Lilliefors Test Statistic				0.21	Lilliefors GOF Test						
320	5% Lilliefors Critical Value				0.28	Detected Data appear Normal at 5% Significance Level						
321	Detected Data appear Approximate Normal at 5% Significance Level											
322												
323	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
324	Mean				6.45	Standard Error of Mean				1.38		
325	SD				4.36	95% KM (BCA) UCL				9.06		
326	95% KM (t) UCL				8.96	95% KM (Percentile Bootstrap) UCL				8.84		
327	95% KM (z) UCL				8.73	95% KM Bootstrap t UCL				10.7		
328	90% KM Chebyshev UCL				10.6	95% KM Chebyshev UCL				12.5		
329	97.5% KM Chebyshev UCL				15.1	99% KM Chebyshev UCL				20.2		
330												
331	Gamma GOF Tests on Detected Observations Only											
332	A-D Test Statistic				0.31	Anderson-Darling GOF Test						
333	5% A-D Critical Value				0.73	data appear Gamma Distributed at 5% Significance Level						
334	K-S Test Statistic				0.17	Kolmogorov-Smirnov GOF						
335	5% K-S Critical Value				0.26	data appear Gamma Distributed at 5% Significance Level						
336	Detected data appear Gamma Distributed at 5% Significance Level											
337												
338	Gamma Statistics on Detected Data Only											
339	k hat (MLE)				3.11	k star (bias corrected MLE)				2.24		
340	Theta hat (MLE)				2.20	Theta star (bias corrected MLE)				3.06		
341	nu hat (MLE)				62.2	nu star (bias corrected)				44.8		
342	MLE Mean (bias corrected)				6.86	MLE Sd (bias corrected)				4.58		
343												
344	Gamma Kaplan-Meier (KM) Statistics											
345	k hat (KM)				2.19	nu hat (KM)				48.1		
346	Approximate Chi Square Value (48.17, $\alpha$ )				33.2	Adjusted Chi Square Value (48.17, $\beta$ )				31.2		
347	Approximate KM-UCL (use when $n \geq 50$ )				9.35	Gamma Adjusted KM-UCL (use when $n < 50$ )				9.95		
348												
349	Gamma ROS Statistics using Imputed Non-Detects											
350	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
351	GROS may not be used when kstar of detected data is small such as < 0.1											
352	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
353	Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimate											
354	Minimum				0.43	Mean				6.28		
355	Maximum				17.8	Median				4.68		
356	SD				4.77	CV				0.76		
357	k hat (MLE)				1.73	k star (bias corrected MLE)				1.32		
358	Theta hat (MLE)				3.62	Theta star (bias corrected MLE)				4.75		
359	nu hat (MLE)				38.1	nu star (bias corrected)				29.1		
360	MLE Mean (bias corrected)				6.28	MLE Sd (bias corrected)				5.46		
361						Adjusted Level of Significance ( $\beta$ )				0.02		
362	Approximate Chi Square Value (29.11, $\alpha$ )				17.7	Adjusted Chi Square Value (29.11, $\beta$ )				16.3		
363	Gamma Approximate UCL (use when $n \geq 50$ )				10.2	Gamma Adjusted UCL (use when $n < 50$ )				11.1		
364												
365	Lognormal GOF Test on Detected Observations Only											
366	Shapiro Wilk Test Statistic				0.97	Shapiro Wilk GOF Test						
367	5% Shapiro Wilk Critical Value				0.84	Detected Data appear Lognormal at 5% Significance Level						
368	Lilliefors Test Statistic				0.14	Lilliefors GOF Test						
369	5% Lilliefors Critical Value				0.28	Detected Data appear Lognormal at 5% Significance Level						
370	Detected Data appear Lognormal at 5% Significance Level											
371												
372	Lognormal ROS Statistics Using Imputed Non-Detects											
373	Mean in Original Scale				6.42	Mean in Log Scale				1.66		
374	SD in Original Scale				4.60	SD in Log Scale				0.65		
375	95% t UCL (assumes normality of ROS data)				8.94	95% Percentile Bootstrap UCL				8.69		
376	95% BCA Bootstrap UCL				9.39	95% Bootstrap t UCL				10.5		
377	95% H-UCL (Log ROS)				10.6							
378												

	A	B	C	D	E	F	G	H	I	J	K	L	
379	UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed												
380	KM Mean (logged)					1.67	95% H-UCL (KM -Log)					9.93	
381	KM SD (logged)					0.60	95% Critical H Value (KM-Log)					2.31	
382	KM Standard Error of Mean (logged)					0.19							
383													
384	DL/2 Statistics												
385	DL/2 Normal					DL/2 Log-Transformed							
386	Mean in Original Scale					6.36	Mean in Log Scale					1.62	
387	SD in Original Scale					4.66	SD in Log Scale					0.71	
388	95% t UCL (Assumes normality)					8.91	95% H-Stat UCL					11.5	
389	DL/2 is not a recommended method, provided for comparisons and historical reasons												
390													
391	Nonparametric Distribution Free UCL Statistics												
392	Detected Data appear Approximate Normal Distributed at 5% Significance Level												
393													
394	Suggested UCL to Use												
395	95% KM (t) UCL					8.96	95% KM (Percentile Bootstrap) UCL					8.84	
396													
397	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
398	Recommendations are based upon data size, data distribution, and skewness.												
399	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and												
400	Recommendations results will not cover all Real World data sets; for additional insight the user may want to consult												
401													
402	Isopropyltoluene[4-]												
403													
404	General Statistics												
405	Total Number of Observations					11	Number of Distinct Observations					11	
406	Number of Detects					6	Number of Non-Detects					5	
407	Number of Distinct Detects					6	Number of Distinct Non-Detects					5	
408	Minimum Detect					4.27008	Minimum Non-Detect					0.001	
409	Maximum Detect					0.016	Maximum Non-Detect					0.001	
410	Variance Detects					3.71418	Percent Non-Detects					45.4	
411	Mean Detects					0.005	SD Detects					0.006	
412	Median Detects					0.004	CV Detects					1.01	
413	Skewness Detects					1.22	Kurtosis Detects					1.31	
414	Mean of Logged Detects					-5.74	SD of Logged Detects					1.39	
415													
416	Normal GOF Test on Detects Only												
417	Shapiro Wilk Test Statistic					0.89	Shapiro Wilk GOF Test						
418	5% Shapiro Wilk Critical Value					0.78	Detected Data appear Normal at 5% Significance Level						
419	Lilliefors Test Statistic					0.18	Lilliefors GOF Test						
420	5% Lilliefors Critical Value					0.36	Detected Data appear Normal at 5% Significance Level						
421	Detected Data appear Normal at 5% Significance Level												
422													
423	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs												
424	Mean					0.003	Standard Error of Mean					0.001	
425	SD					0.004	95% KM (BCA) UCL					0.006	
426	95% KM (t) UCL					0.006	95% KM (Percentile Bootstrap) UCL					0.006	
427	95% KM (z) UCL					0.006	95% KM Bootstrap t UCL					0.008	
428	90% KM Chebyshev UCL					0.008	95% KM Chebyshev UCL					0.01	
429	97.5% KM Chebyshev UCL					0.01	99% KM Chebyshev UCL					0.01	
430													
431	Gamma GOF Tests on Detected Observations Only												
432	A-D Test Statistic					0.19	Anderson-Darling GOF Test						
433	5% A-D Critical Value					0.71	Detected data appear Gamma Distributed at 5% Significance Level						
434	K-S Test Statistic					0.17	Kolmogorov-Smirnov GOF						
435	5% K-S Critical Value					0.34	Detected data appear Gamma Distributed at 5% Significance Level						
436	Detected data appear Gamma Distributed at 5% Significance Level												
437													
438	Gamma Statistics on Detected Data Only												
439	k hat (MLE)					0.93	k star (bias corrected MLE)					0.58	
440	Theta hat (MLE)					0.006	Theta star (bias corrected MLE)					0.01	
441	nu hat (MLE)					11.2	nu star (bias corrected)					6.96	

A	B	C	D	E	F	G	H	I	J	K	L
442	MLE Mean (bias corrected)				0.005	MLE Sd (bias corrected)				0.007	
443											
444	<b>Gamma Kaplan-Meier (KM) Statistics</b>										
445	k hat (KM)				0.53	nu hat (KM)				11.7	
446	Approximate Chi Square Value (11.77, $\alpha$ )				5.07	Adjusted Chi Square Value (11.77, $\beta$ )				4.38	
447	Approximate KM-UCL (use when $n \geq 50$ )				0.008	Gamma Adjusted KM-UCL (use when $n < 50$ )				0.009	
448											
449	<b>Gamma ROS Statistics using Imputed Non-Detects</b>										
450	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs										
451	GROS may not be used when kstar of detected data is small such as < 0.1										
452	For such situations, GROS method tends to yield inflated values of UCLs and BTVs										
453	Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates										
454	Minimum				4.2700E	Mean				0.007	
455	Maximum				0.014	Median				0.014	
456	SD				0.004	CV				0.61	
457	k hat (MLE)				1.49	k star (bias corrected MLE)				1.14	
458	Theta hat (MLE)				0.005	Theta star (bias corrected MLE)				0.006	
459	nu hat (MLE)				32.8	nu star (bias corrected)				25.2	
460	MLE Mean (bias corrected)				0.007	MLE Sd (bias corrected)				0.007	
461						Adjusted Level of Significance ( $\beta$ )				0.02	
462	Approximate Chi Square Value (25.20, $\alpha$ )				14.7	Adjusted Chi Square Value (25.20, $\beta$ )				13.4	
463	Gamma Approximate UCL (use when $n \geq 50$ )				0.014	Gamma Adjusted UCL (use when $n < 50$ )				0.014	
464											
465	<b>Lognormal GOF Test on Detected Observations Only</b>										
466	Shapiro Wilk Test Statistic				0.95	Shapiro Wilk GOF Test					
467	5% Shapiro Wilk Critical Value				0.78	Detected Data appear Lognormal at 5% Significance Level					
468	Lilliefors Test Statistic				0.17	Lilliefors GOF Test					
469	5% Lilliefors Critical Value				0.36	Detected Data appear Lognormal at 5% Significance Level					
470	<b>Detected Data appear Lognormal at 5% Significance Level</b>										
471											
472	<b>Lognormal ROS Statistics Using Imputed Non-Detects</b>										
473	Mean in Original Scale				0.003	Mean in Log Scale				-6.45	
474	SD in Original Scale				0.005	SD in Log Scale				1.28	
475	95% t UCL (assumes normality of ROS data)				0.006	95% Percentile Bootstrap UCL				0.006	
476	95% BCA Bootstrap UCL				0.007	95% Bootstrap t UCL				0.011	
477	95% H-UCL (Log ROS)				0.014						
478											
479	<b>UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed</b>										
480	KM Mean (logged)				-6.47	95% H-UCL (KM -Log)				0.014	
481	KM SD (logged)				1.26	95% Critical H Value (KM-Log)				3.53	
482	KM Standard Error of Mean (logged)				0.45						
483											
484	<b>DL/2 Statistics</b>										
485	<b>DL/2 Normal</b>					<b>DL/2 Log-Transformed</b>					
486	Mean in Original Scale				0.003	Mean in Log Scale				-6.51	
487	SD in Original Scale				0.005	SD in Log Scale				1.32	
488	95% t UCL (Assumes normality)				0.006	95% H-Stat UCL				0.011	
489	<b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>										
490											
491	<b>Nonparametric Distribution Free UCL Statistics</b>										
492	<b>Detected Data appear Normal Distributed at 5% Significance Level</b>										
493											
494	<b>Suggested UCL to Use</b>										
495	95% KM (t) UCL				0.006	95% KM (Percentile Bootstrap) UCL				0.006	
496											
497	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate										
498	Recommendations are based upon data size, data distribution, and skewness.										
499	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and										
500	Recommendations results will not cover all Real World data sets; for additional insight the user may want to consult										
501											
502											
503	<b>Lead</b>										
504											



	A	B	C	D	E	F	G	H	I	J	K	L
505	General Statistics											
506	Total Number of Observations					11	Number of Distinct Observations					11
507							Number of Missing Observations					0
508	Minimum					2.74	Mean					10.4
509	Maximum					28.2	Median					9.49
510	SD					6.71	Std. Error of Mean					2.02
511	Coefficient of Variation					0.64	Skewness					1.94
512												
513	Normal GOF Test											
514	Shapiro Wilk Test Statistic					0.80	Shapiro Wilk GOF Test					
515	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
516	Lilliefors Test Statistic					0.29	Lilliefors GOF Test					
517	5% Lilliefors Critical Value					0.26	Data Not Normal at 5% Significance Level					
518	Data Not Normal at 5% Significance Level											
519												
520	Assuming Normal Distribution											
521	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
522	95% Student's-t UCL					14.14	95% Adjusted-CLT UCL (Chen-1995)					15.0
523							95% Modified-t UCL (Johnson-1978)					14.34
524												
525	Gamma GOF Test											
526	A-D Test Statistic					0.36	Anderson-Darling Gamma GOF Test					
527	5% A-D Critical Value					0.73	data appear Gamma Distributed at 5% Significance Level					
528	K-S Test Statistic					0.21	Kolmogrov-Smirnoff Gamma GOF Test					
529	5% K-S Critical Value					0.25	data appear Gamma Distributed at 5% Significance Level					
530	Detected data appear Gamma Distributed at 5% Significance Level											
531												
532	Gamma Statistics											
533	k hat (MLE)					3.21	k star (bias corrected MLE)					2.39
534	Theta hat (MLE)					3.26	Theta star (bias corrected MLE)					4.36
535	nu hat (MLE)					70.64	nu star (bias corrected)					52.71
536	MLE Mean (bias corrected)					10.47	MLE Sd (bias corrected)					6.76
537							Approximate Chi Square Value (0.05)					37.04
538	Adjusted Level of Significance					0.02	Adjusted Chi Square Value					34.9
539												
540	Assuming Gamma Distribution											
541	Approximate Gamma UCL (use when n>=50)					14.95	Adjusted Gamma UCL (use when n<50)					15.8
542												
543	Lognormal GOF Test											
544	Shapiro Wilk Test Statistic					0.95	Shapiro Wilk Lognormal GOF Test					
545	5% Shapiro Wilk Critical Value					0.85	Data appear Lognormal at 5% Significance Level					
546	Lilliefors Test Statistic					0.19	Lilliefors Lognormal GOF Test					
547	5% Lilliefors Critical Value					0.26	Data appear Lognormal at 5% Significance Level					
548	Data appear Lognormal at 5% Significance Level											
549												
550	Lognormal Statistics											
551	Minimum of Logged Data					1.00	Mean of logged Data					2.18
552	Maximum of Logged Data					3.33	SD of logged Data					0.60
553												
554	Assuming Lognormal Distribution											
555	95% H-UCL					16.64	90% Chebyshev (MVUE) UCL					16.4
556	95% Chebyshev (MVUE) UCL					19.04	97.5% Chebyshev (MVUE) UCL					22.8
557	99% Chebyshev (MVUE) UCL					30.1						
558												
559	Nonparametric Distribution Free UCL Statistics											
560	Data appear to follow a Discernible Distribution at 5% Significance Level											
561												
562	Nonparametric Distribution Free UCLs											
563	95% CLT UCL					13.8	95% Jackknife UCL					14.14
564	95% Standard Bootstrap UCL					13.6	95% Bootstrap-t UCL					16.11
565	95% Hall's Bootstrap UCL					29.8	95% Percentile Bootstrap UCL					13.9
566	95% BCA Bootstrap UCL					15.2						
567	90% Chebyshev(Mean, Sd) UCL					16.54	95% Chebyshev(Mean, Sd) UCL					19.2

	A	B	C	D	E	F	G	H	I	J	K	L
568	97.5% Chebyshev(Mean, Sd) UCL					23.1	99% Chebyshev(Mean, Sd) UCL					30.6
569												
570	<b>Suggested UCL to Use</b>											
571	95% Adjusted Gamma UCL					15.8						
572												
573	tions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
574	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
575	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
576	For additional insight the user may want to consult a statistician.											
577												
578	<b>Tritium</b>											
579												
580	<b>General Statistics</b>											
581	Total Number of Observations					11	Number of Distinct Observations					11
582	Number of Detects					7	Number of Non-Detects					4
583	Number of Distinct Detects					7	Number of Distinct Non-Detects					4
584	Minimum Detect					0.03	Minimum Non-Detect					0
585	Maximum Detect					0.15	Maximum Non-Detect					0.03
586	Variance Detects					0.001	Percent Non-Detects					36.3
587	Mean Detects					0.09	SD Detects					0.04
588	Median Detects					0.10	CV Detects					0.45
589	Skewness Detects					-0.34	Kurtosis Detects					-0.68
590												
591	<b>Normal GOF Test on Detects Only</b>											
592	Shapiro Wilk Test Statistic					0.92	<b>Shapiro Wilk GOF Test</b>					
593	5% Shapiro Wilk Critical Value					0.80	ected Data appear Normal at 5% Significance Level					
594	Lilliefors Test Statistic					0.23	<b>Lilliefors GOF Test</b>					
595	5% Lilliefors Critical Value					0.33	ected Data appear Normal at 5% Significance Level					
596	<b>Detected Data appear Normal at 5% Significance Level</b>											
597												
598	<b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>											
599	Mean					0.05	Standard Error of Mean					0.01
600	SD					0.05	95% KM (BCA) UCL					0.09
601	95% KM (t) UCL					0.09	95% KM (Percentile Bootstrap) UCL					0.08
602	95% KM (z) UCL					0.08	95% KM Bootstrap t UCL					0.08
603	90% KM Chebyshev UCL					0.11	95% KM Chebyshev UCL					0.13
604	97.5% KM Chebyshev UCL					0.17	99% KM Chebyshev UCL					0.23
605												
606	<b>Gamma GOF Tests on Detected Observations Only</b>											
607	A-D Test Statistic					0.51	<b>Anderson-Darling GOF Test</b>					
608	5% A-D Critical Value					0.71	data appear Gamma Distributed at 5% Significance Level					
609	K-S Test Statistic					0.29	<b>Kolmogrov-Smirnoff GOF</b>					
610	5% K-S Critical Value					0.31	data appear Gamma Distributed at 5% Significance Level					
611	<b>Detected data appear Gamma Distributed at 5% Significance Level</b>											
612												
613	<b>Gamma Statistics on Detected Data Only</b>											
614	k hat (MLE)					4.49	k star (bias corrected MLE)					2.66
615	Theta hat (MLE)					0.02	Theta star (bias corrected MLE)					0.03
616	nu hat (MLE)					62.9	nu star (bias corrected)					37.2
617	MLE Mean (bias corrected)					0.09	MLE Sd (bias corrected)					0.05
618												
619	<b>Gamma Kaplan-Meier (KM) Statistics</b>											
620	k hat (KM)					1.18	nu hat (KM)					26.0
621							Adjusted Level of Significance ( $\beta$ )					0.02
622	Approximate Chi Square Value (26.05, $\alpha$ )					15.4	Adjusted Chi Square Value (26.05, $\beta$ )					14.1
623	Approximate KM-UCL (use when $n \geq 50$ )					0.09	Gamma Adjusted KM-UCL (use when $n < 50$ )					0.10
624												
625	<b>DL/2 Statistics</b>											
626	Mean in Original Scale					0.06	SD in Original Scale					0.05
627	95% t UCL (Assumes normality)					0.09						
628	<b>DL/2 is not a recommended method, provided for comparisons and historical reasons</b>											
629												
630	<b>Nonparametric Distribution Free UCL Statistics</b>											

	A	B	C	D	E	F	G	H	I	J	K	L
631	Detected Data appear Normal Distributed at 5% Significance Level											
632												
633	Suggested UCL to Use											
634	95% KM (t) UCL					0.09	95% KM (Percentile Bootstrap) UCL					0.08
635												
636	Directions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
637	Recommendations are based upon data size, data distribution, and skewness.											
638	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and											
639	Simulation results will not cover all Real World data sets; for additional insight the user may want to consult											
640												
641												
642	Uranium											
643												
644	General Statistics											
645	Total Number of Observations					11	Number of Distinct Observations					11
646							Number of Missing Observations					0
647	Minimum					1.37	Mean					64.3
648	Maximum					615	Median					3.07
649	SD					183.2	Std. Error of Mean					55.2
650	Coefficient of Variation					2.84	Skewness					3.27
651												
652	Normal GOF Test											
653	Shapiro Wilk Test Statistic					0.39	Shapiro Wilk GOF Test					
654	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
655	Lilliefors Test Statistic					0.43	Lilliefors GOF Test					
656	5% Lilliefors Critical Value					0.26	Data Not Normal at 5% Significance Level					
657	Data Not Normal at 5% Significance Level											
658												
659	Assuming Normal Distribution											
660	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
661	95% Student's-t UCL					164.5	95% Adjusted-CLT UCL (Chen-1995)					213.6
662							95% Modified-t UCL (Johnson-1978)					173.6
663												
664	Gamma GOF Test											
665	A-D Test Statistic					1.82	Anderson-Darling Gamma GOF Test					
666	5% A-D Critical Value					0.81	Data Not Gamma Distributed at 5% Significance Level					
667	K-S Test Statistic					0.34	Kolmogorov-Smirnov Gamma GOF Test					
668	5% K-S Critical Value					0.27	Data Not Gamma Distributed at 5% Significance Level					
669	Data Not Gamma Distributed at 5% Significance Level											
670												
671	Gamma Statistics											
672	k hat (MLE)					0.30	k star (bias corrected MLE)					0.28
673	Theta hat (MLE)					210.9	Theta star (bias corrected MLE)					227.8
674	nu hat (MLE)					6.71	nu star (bias corrected)					6.21
675	MLE Mean (bias corrected)					64.3	MLE Sd (bias corrected)					121.1
676							Approximate Chi Square Value (0.05)					1.75
677	Adjusted Level of Significance					0.02	Adjusted Chi Square Value					1.39
678												
679	Assuming Gamma Distribution											
680	Approximate Gamma UCL (use when n>=50)					228.4	Adjusted Gamma UCL (use when n<50)					287
681												
682	Lognormal GOF Test											
683	Shapiro Wilk Test Statistic					0.80	Shapiro Wilk Lognormal GOF Test					
684	5% Shapiro Wilk Critical Value					0.85	Data Not Lognormal at 5% Significance Level					
685	Lilliefors Test Statistic					0.26	Lilliefors Lognormal GOF Test					
686	5% Lilliefors Critical Value					0.26	Data Not Lognormal at 5% Significance Level					
687	Data Not Lognormal at 5% Significance Level											
688												
689	Lognormal Statistics											
690	Minimum of Logged Data					0.31	Mean of logged Data					1.91
691	Maximum of Logged Data					6.42	SD of logged Data					1.85
692												
693	Assuming Lognormal Distribution											

	A	B	C	D	E	F	G	H	I	J	K	L
694	95% H-UCL					645.8	90% Chebyshev (MVUE) UCL					77.0
695	95% Chebyshev (MVUE) UCL					99.4	97.5% Chebyshev (MVUE) UCL					130.6
696	99% Chebyshev (MVUE) UCL					191.6						
697												
698	Nonparametric Distribution Free UCL Statistics											
699	Data do not follow a Discernible Distribution (0.05)											
700												
701	Nonparametric Distribution Free UCLs											
702	95% CLT UCL					155.2	95% Jackknife UCL					164.5
703	95% Standard Bootstrap UCL					149.5	95% Bootstrap-t UCL					2705
704	95% Hall's Bootstrap UCL					1909	95% Percentile Bootstrap UCL					171.8
705	95% BCA Bootstrap UCL					227.6						
706	90% Chebyshev(Mean, Sd) UCL					230.1	95% Chebyshev(Mean, Sd) UCL					305.2
707	97.5% Chebyshev(Mean, Sd) UCL					409.4	99% Chebyshev(Mean, Sd) UCL					614
708												
709	Suggested UCL to Use											
710	99% Chebyshev (Mean, Sd) UCL					614						
711												
712	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
713	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
714	Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
715	For additional insight the user may want to consult a statistician.											
716												
717												
718	Uranium-234											
719												
720	General Statistics											
721	Total Number of Observations					11	Number of Distinct Observations					11
722							Number of Missing Observations					0
723	Minimum					0.91	Mean					37.5
724	Maximum					303	Median					1.66
725	SD					91.8	Std. Error of Mean					27.6
726	Coefficient of Variation					2.44	Skewness					2.91
727												
728	Normal GOF Test											
729	Shapiro Wilk Test Statistic					0.47	Shapiro Wilk GOF Test					
730	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
731	Lilliefors Test Statistic					0.44	Lilliefors GOF Test					
732	5% Lilliefors Critical Value					0.26	Data Not Normal at 5% Significance Level					
733	Data Not Normal at 5% Significance Level											
734												
735	Assuming Normal Distribution											
736	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
737	95% Student's-t UCL					87.7	95% Adjusted-CLT UCL (Chen-1995)					109.1
738							95% Modified-t UCL (Johnson-1978)					91.8
739												
740	Gamma GOF Test											
741	A-D Test Statistic					1.88	Anderson-Darling Gamma GOF Test					
742	5% A-D Critical Value					0.81	Data Not Gamma Distributed at 5% Significance Level					
743	K-S Test Statistic					0.38	Kolmogrov-Smirnoff Gamma GOF Test					
744	5% K-S Critical Value					0.27	Data Not Gamma Distributed at 5% Significance Level					
745	Data Not Gamma Distributed at 5% Significance Level											
746												
747	Gamma Statistics											
748	k hat (MLE)					0.31	k star (bias corrected MLE)					0.28
749	Theta hat (MLE)					120.5	Theta star (bias corrected MLE)					130.8
750	nu hat (MLE)					6.86	nu star (bias corrected)					6.32
751	MLE Mean (bias corrected)					37.5	MLE Sd (bias corrected)					70.1
752							Approximate Chi Square Value (0.05)					1.80
753	Adjusted Level of Significance					0.02	Adjusted Chi Square Value					1.44
754												
755	Assuming Gamma Distribution											
756	Approximate Gamma UCL (use when n>=50))					131.5	Adjusted Gamma UCL (use when n<50)					164.8

	A	B	C	D	E	F	G	H	I	J	K	L
757												
758	<b>Lognormal GOF Test</b>											
759		Shapiro Wilk Test Statistic	0.74					Shapiro Wilk Lognormal GOF Test				
760		5% Shapiro Wilk Critical Value	0.85					Data Not Lognormal at 5% Significance Level				
761		Lilliefors Test Statistic	0.31					<b>Lilliefors Lognormal GOF Test</b>				
762		5% Lilliefors Critical Value	0.26					Data Not Lognormal at 5% Significance Level				
763	<b>Data Not Lognormal at 5% Significance Level</b>											
764												
765	<b>Lognormal Statistics</b>											
766		Minimum of Logged Data	-0.091					Mean of logged Data			1.43	
767		Maximum of Logged Data	5.71					SD of logged Data			1.93	
768												
769	<b>Assuming Lognormal Distribution</b>											
770		95% H-UCL	574.8					90% Chebyshev (MVUE) UCL			54.1	
771		95% Chebyshev (MVUE) UCL	70.1					97.5% Chebyshev (MVUE) UCL			92.2	
772		99% Chebyshev (MVUE) UCL	135.8									
773												
774	<b>Nonparametric Distribution Free UCL Statistics</b>											
775	<b>Data do not follow a Discernible Distribution (0.05)</b>											
776												
777	<b>Nonparametric Distribution Free UCLs</b>											
778		95% CLT UCL	83.1					95% Jackknife UCL			87.7	
779		95% Standard Bootstrap UCL	81.6					95% Bootstrap-t UCL			1593	
780		95% Hall's Bootstrap UCL	1526					95% Percentile Bootstrap UCL			84.4	
781		95% BCA Bootstrap UCL	115.7									
782		90% Chebyshev(Mean, Sd) UCL	120.6					95% Chebyshev(Mean, Sd) UCL			158.3	
783		97.5% Chebyshev(Mean, Sd) UCL	210.5					99% Chebyshev(Mean, Sd) UCL			313	
784												
785	<b>Suggested UCL to Use</b>											
786		99% Chebyshev (Mean, Sd) UCL	313									
787												
788	<b>Recommended UCL exceeds the maximum observation</b>											
789												
790	tions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
791	ommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
792	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
793	For additional insight the user may want to consult a statistician.											
794												
795	<b>Uranium-235/236</b>											
796												
797	<b>General Statistics</b>											
798		Total Number of Observations	11					Number of Distinct Observations			11	
799		Number of Detects	7					Number of Non-Detects			4	
800		Number of Distinct Detects	7					Number of Distinct Non-Detects			4	
801		Minimum Detect	0.07					Minimum Non-Detect			0.05	
802		Maximum Detect	20.3					Maximum Non-Detect			0.09	
803		Variance Detects	56.5					Percent Non-Detects			36.3	
804		Mean Detects	3.78					SD Detects			7.52	
805		Median Detects	0.20					CV Detects			1.98	
806		Skewness Detects	2.34					Kurtosis Detects			5.56	
807		Mean of Logged Detects	-0.71					SD of Logged Detects			2.22	
808												
809	<b>Normal GOF Test on Detects Only</b>											
810		Shapiro Wilk Test Statistic	0.59					<b>Shapiro Wilk GOF Test</b>				
811		5% Shapiro Wilk Critical Value	0.80					Detected Data Not Normal at 5% Significance Level				
812		Lilliefors Test Statistic	0.38					<b>Lilliefors GOF Test</b>				
813		5% Lilliefors Critical Value	0.33					Detected Data Not Normal at 5% Significance Level				
814	<b>Detected Data Not Normal at 5% Significance Level</b>											
815												
816	<b>Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs</b>											
817		Mean	2.43					Standard Error of Mean			1.90	
818		SD	5.83					95% KM (BCA) UCL			6.05	
819		95% KM (t) UCL	5.87					95% KM (Percentile Bootstrap) UCL			5.71	

A	B	C	D	E	F	G	H	I	J	K	L
820			95% KM (z) UCL		5.56			95% KM Bootstrap t UCL			102.2
821			90% KM Chebyshev UCL		8.13			95% KM Chebyshev UCL			10.7
822			97.5% KM Chebyshev UCL		14.3			99% KM Chebyshev UCL			21.3
823											
824			Gamma GOF Tests on Detected Observations Only								
825			A-D Test Statistic		0.79			Anderson-Darling GOF Test			
826			5% A-D Critical Value		0.77			ed Data Not Gamma Distributed at 5% Significance			
827			K-S Test Statistic		0.31			Kolmogrov-Smirnoff GOF			
828			5% K-S Critical Value		0.33			data appear Gamma Distributed at 5% Significance			
829			Detected data follow Appr. Gamma Distribution at 5% Significance Level								
830											
831			Gamma Statistics on Detected Data Only								
832			k hat (MLE)		0.33			k star (bias corrected MLE)			0.28
833			Theta hat (MLE)		11.4			Theta star (bias corrected MLE)			13.3
834			nu hat (MLE)		4.63			nu star (bias corrected)			3.98
835			MLE Mean (bias corrected)		3.78			MLE Sd (bias corrected)			7.10
836											
837			Gamma Kaplan-Meier (KM) Statistics								
838			k hat (KM)		0.17			nu hat (KM)			3.82
839			Approximate Chi Square Value (3.82, $\alpha$ )		0.65			Adjusted Chi Square Value (3.82, $\beta$ )			0.47
840			Approximate KM-UCL (use when n>=50)		14.2			Gamma Adjusted KM-UCL (use when n<50)			19.5
841											
842			Gamma ROS Statistics using Imputed Non-Detects								
843			GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs								
844			GROS may not be used when kstar of detected data is small such as < 0.1								
845			For such situations, GROS method tends to yield inflated values of UCLs and BTVs								
846			Gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates								
847			Minimum		0.01			Mean			2.41
848			Maximum		20.3			Median			0.07
849			SD		6.13			CV			2.53
850			k hat (MLE)		0.23			k star (bias corrected MLE)			0.23
851			Theta hat (MLE)		10.1			Theta star (bias corrected MLE)			10.3
852			nu hat (MLE)		5.22			nu star (bias corrected)			5.13
853			MLE Mean (bias corrected)		2.41			MLE Sd (bias corrected)			4.99
854								Adjusted Level of Significance ( $\beta$ )			0.02
855			Approximate Chi Square Value (5.14, $\alpha$ )		1.21			Adjusted Chi Square Value (5.14, $\beta$ )			0.93
856			Gamma Approximate UCL (use when n>=50)		10.2			Gamma Adjusted UCL (use when n<50)			13.2
857											
858			Lognormal GOF Test on Detected Observations Only								
859			Shapiro Wilk Test Statistic		0.83			Shapiro Wilk GOF Test			
860			5% Shapiro Wilk Critical Value		0.80			ected Data appear Lognormal at 5% Significance Level			
861			Lilliefors Test Statistic		0.22			Lilliefors GOF Test			
862			5% Lilliefors Critical Value		0.33			ected Data appear Lognormal at 5% Significance Level			
863			Detected Data appear Lognormal at 5% Significance Level								
864											
865			Lognormal ROS Statistics Using Imputed Non-Detects								
866			Mean in Original Scale		2.41			Mean in Log Scale			-2.25
867			SD in Original Scale		6.13			SD in Log Scale			2.80
868			5% t UCL (assumes normality of ROS data)		5.76			95% Percentile Bootstrap UCL			5.64
869			95% BCA Bootstrap UCL		7.91			95% Bootstrap t UCL			96.2
870			95% H-UCL (Log ROS)		2676						
871											
872			DLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed								
873			KM Mean (logged)		-1.47			95% H-UCL (KM -Log)			30.5
874			KM SD (logged)		1.92			95% Critical H Value (KM-Log)			4.98
875			KM Standard Error of Mean (logged)		0.62						
876											
877			DL/2 Statistics								
878			DL/2 Normal				DL/2 Log-Transformed				
879			Mean in Original Scale		2.42			Mean in Log Scale			-1.66
880			SD in Original Scale		6.12			SD in Log Scale			2.17
881			95% t UCL (Assumes normality)		5.77			95% H-Stat UCL			91.2
882			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
883												
884	<b>Nonparametric Distribution Free UCL Statistics</b>											
885	<b>Detected Data appear Approximate Gamma Distributed at 5% Significance Level</b>											
886												
887	<b>Suggested UCL to Use</b>											
888	95% KM (BCA) UCL				6.05	95% GROS Adjusted Gamma UCL				13.2		
889	95% Adjusted Gamma KM-UCL				19.5							
890												
891	ations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
892	Recommendations are based upon data size, data distribution, and skewness.											
893	Recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and											
894	Recommendations results will not cover all Real World data sets; for additional insight the user may want to consult											
895												
896												
897	<b>Uranium-238</b>											
898												
899	<b>General Statistics</b>											
900	Total Number of Observations				11	Number of Distinct Observations				11		
901						Number of Missing Observations				0		
902	Minimum				0.86	Mean				39.0		
903	Maximum				311	Median				1.65		
904	SD				94.1	Std. Error of Mean				28.3		
905	Coefficient of Variation				2.40	Skewness				2.90		
906												
907	<b>Normal GOF Test</b>											
908	Shapiro Wilk Test Statistic				0.48	<b>Shapiro Wilk GOF Test</b>						
909	5% Shapiro Wilk Critical Value				0.85	Data Not Normal at 5% Significance Level						
910	Lilliefors Test Statistic				0.43	<b>Lilliefors GOF Test</b>						
911	5% Lilliefors Critical Value				0.26	Data Not Normal at 5% Significance Level						
912	<b>Data Not Normal at 5% Significance Level</b>											
913												
914	<b>Assuming Normal Distribution</b>											
915	<b>95% Normal UCL</b>					<b>95% UCLs (Adjusted for Skewness)</b>						
916	95% Student's-t UCL				90.5	95% Adjusted-CLT UCL (Chen-1995)				112.3		
917						95% Modified-t UCL (Johnson-1978)				94.6		
918												
919	<b>Gamma GOF Test</b>											
920	A-D Test Statistic				1.74	<b>Anderson-Darling Gamma GOF Test</b>						
921	5% A-D Critical Value				0.81	Data Not Gamma Distributed at 5% Significance Level						
922	K-S Test Statistic				0.32	<b>Kolmogorov-Smirnov Gamma GOF Test</b>						
923	5% K-S Critical Value				0.27	Data Not Gamma Distributed at 5% Significance Level						
924	<b>Data Not Gamma Distributed at 5% Significance Level</b>											
925												
926	<b>Gamma Statistics</b>											
927	k hat (MLE)				0.32	k star (bias corrected MLE)				0.29		
928	Theta hat (MLE)				120.7	Theta star (bias corrected MLE)				132		
929	nu hat (MLE)				7.12	nu star (bias corrected)				6.51		
930	MLE Mean (bias corrected)				39.0	MLE Sd (bias corrected)				71.8		
931						Approximate Chi Square Value (0.05)				1.90		
932	Adjusted Level of Significance				0.02	Adjusted Chi Square Value				1.53		
933												
934	<b>Assuming Gamma Distribution</b>											
935	Approximate Gamma UCL (use when n>=50)				133.4	Adjusted Gamma UCL (use when n<50)				166.4		
936												
937	<b>Lognormal GOF Test</b>											
938	Shapiro Wilk Test Statistic				0.78	<b>Shapiro Wilk Lognormal GOF Test</b>						
939	5% Shapiro Wilk Critical Value				0.85	Data Not Lognormal at 5% Significance Level						
940	Lilliefors Test Statistic				0.25	<b>Lilliefors Lognormal GOF Test</b>						
941	5% Lilliefors Critical Value				0.26	Data appear Lognormal at 5% Significance Level						
942	<b>Data appear Approximate Lognormal at 5% Significance Level</b>											
943												
944	<b>Lognormal Statistics</b>											
945	Minimum of Logged Data				-0.14	Mean of logged Data				1.56		

	A	B	C	D	E	F	G	H	I	J	K	L
946	Maximum of Logged Data					5.74	SD of logged Data					1.91
947												
948	Assuming Lognormal Distribution											
949	95% H-UCL					595	90% Chebyshev (MVUE) UCL					59.7
950	95% Chebyshev (MVUE) UCL					77.3	97.5% Chebyshev (MVUE) UCL					101.7
951	99% Chebyshev (MVUE) UCL					149.5						
952												
953	Nonparametric Distribution Free UCL Statistics											
954	Data appear to follow a Discernible Distribution at 5% Significance Level											
955												
956	Nonparametric Distribution Free UCLs											
957	95% CLT UCL					85.74	95% Jackknife UCL					90.5
958	95% Standard Bootstrap UCL					83.44	95% Bootstrap-t UCL					1302
959	95% Hall's Bootstrap UCL					998.7	95% Percentile Bootstrap UCL					94.2
960	95% BCA Bootstrap UCL					119.8						
961	90% Chebyshev(Mean, Sd) UCL					124.2	95% Chebyshev(Mean, Sd) UCL					162.8
962	97.5% Chebyshev(Mean, Sd) UCL					216.3	99% Chebyshev(Mean, Sd) UCL					321.4
963												
964	Suggested UCL to Use											
965	99% Chebyshev (Mean, Sd) UCL					321.4						
966												
967	Recommended UCL exceeds the maximum observation											
968												
969	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate											
970	recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and											
971	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets											
972	For additional insight the user may want to consult a statistician.											
973												
974												
975	Zinc											
976												
977	General Statistics											
978	Total Number of Observations					11	Number of Distinct Observations					10
979							Number of Missing Observations					0
980	Minimum					31	Mean					46.4
981	Maximum					114	Median					34.8
982	SD					26.1	Std. Error of Mean					7.89
983	Coefficient of Variation					0.56	Skewness					2.16
984												
985	Normal GOF Test											
986	Shapiro Wilk Test Statistic					0.64	Shapiro Wilk GOF Test					
987	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
988	Lilliefors Test Statistic					0.35	Lilliefors GOF Test					
989	5% Lilliefors Critical Value					0.26	Data Not Normal at 5% Significance Level					
990	Data Not Normal at 5% Significance Level											
991												
992	Assuming Normal Distribution											
993	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
994	95% Student's-t UCL					60.7	95% Adjusted-CLT UCL (Chen-1995)					64.8
995							95% Modified-t UCL (Johnson-1978)					61.5
996												
997	Gamma GOF Test											
998	A-D Test Statistic					1.52	Anderson-Darling Gamma GOF Test					
999	5% A-D Critical Value					0.73	Data Not Gamma Distributed at 5% Significance Level					
1000	K-S Test Statistic					0.34	Kolmogrov-Smirnoff Gamma GOF Test					
1001	5% K-S Critical Value					0.25	Data Not Gamma Distributed at 5% Significance Level					
1002	Data Not Gamma Distributed at 5% Significance Level											
1003												
1004	Gamma Statistics											
1005	k hat (MLE)					5.14	k star (bias corrected MLE)					3.79
1006	Theta hat (MLE)					9.02	Theta star (bias corrected MLE)					12.2
1007	nu hat (MLE)					113.1	nu star (bias corrected)					83.5
1008	MLE Mean (bias corrected)					46.4	MLE Sd (bias corrected)					23.8



	A	B	C	D	E	F	G	H	I	J	K	L	
1009							Approximate Chi Square Value (0.05)					63.5	
1010	Adjusted Level of Significance					0.02	Adjusted Chi Square Value					60.6	
1011													
1012	Assuming Gamma Distribution												
1013	Approximate Gamma UCL (use when n>=50))					61.0	Adjusted Gamma UCL (use when n<50)					63.9	
1014													
1015	Lognormal GOF Test												
1016	Shapiro Wilk Test Statistic					0.72	Shapiro Wilk Lognormal GOF Test						
1017	5% Shapiro Wilk Critical Value					0.85	Data Not Lognormal at 5% Significance Level						
1018	Lilliefors Test Statistic					0.31	Lilliefors Lognormal GOF Test						
1019	5% Lilliefors Critical Value					0.26	Data Not Lognormal at 5% Significance Level						
1020	Data Not Lognormal at 5% Significance Level												
1021													
1022	Lognormal Statistics												
1023	Minimum of Logged Data					3.43	Mean of logged Data					3.73	
1024	Maximum of Logged Data					4.73	SD of logged Data					0.42	
1025													
1026	Assuming Lognormal Distribution												
1027	95% H-UCL					61.0	90% Chebyshev (MVUE) UCL					63.5	
1028	95% Chebyshev (MVUE) UCL					71.7	97.5% Chebyshev (MVUE) UCL					82.9	
1029	99% Chebyshev (MVUE) UCL					105.2							
1030													
1031	Nonparametric Distribution Free UCL Statistics												
1032	Data do not follow a Discernible Distribution (0.05)												
1033													
1034	Nonparametric Distribution Free UCLs												
1035	95% CLT UCL					59.3	95% Jackknife UCL					60.7	
1036	95% Standard Bootstrap UCL					58.6	95% Bootstrap-t UCL					96.3	
1037	95% Hall's Bootstrap UCL					110.7	95% Percentile Bootstrap UCL					60.0	
1038	95% BCA Bootstrap UCL					65.4							
1039	90% Chebyshev(Mean, Sd) UCL					70.0	95% Chebyshev(Mean, Sd) UCL					80.8	
1040	97.5% Chebyshev(Mean, Sd) UCL					95.6	99% Chebyshev(Mean, Sd) UCL					124.9	
1041													
1042	Suggested UCL to Use												
1043	95% Student's-t UCL					60.7	or 95% Modified-t UCL					61.5	
1044													
1045	Recommendations regarding the selection of a 95% UCL are provided to help the user to select the most appropriate												
1046	Recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Singh												
1047	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets												
1048	For additional insight the user may want to consult a statistician.												
1049													