	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Uncensored Full Data Sets**											
2												
3	User Selected Options											
4	Date/Time of Computation			3/2/2015 7:20:49 PM								
5	From File			EPC_013Sub_EU14.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	**Manganese**											
12												
13	**General Statistics**											
14	Total Number of Observations					11	Number of Distinct Observations					11
15							Number of Missing Observations					0
16	Minimum					196	Mean					458.9
17	Maximum					835	Median					495
18	SD					177.1	Std. Error of Mean					53.4
19	Coefficient of Variation					0.386	Skewness					0.624
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic					0.955	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk Critical Value					0.85	Data appear Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.138	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.267	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					555.7	95% Adjusted-CLT UCL (Chen-1995)					557.5
31							95% Modified-t UCL (Johnson-1978)					557.4
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					0.238	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.731	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.175	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.256	Detected 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)					7.197	k star (bias corrected MLE)					5.294
42	Theta hat (MLE)					63.77	Theta star (bias corrected MLE)					86.68
43	nu hat (MLE)					158.3	nu star (bias corrected)					116.5
44	MLE Mean (bias corrected)					458.9	MLE Sd (bias corrected)					199.4
45							Approximate Chi Square Value (0.05)					92.56
46	Adjusted Level of Significance					0.0278	Adjusted Chi Square Value					89.09
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50))					577.5	95% Adjusted Gamma UCL (use when n<50)					600
50												
51	**Lognormal GOF Test**											
52	Shapiro Wilk Test Statistic					0.968	**Shapiro Wilk Lognormal GOF Test**					

	A	B	C	D	E	F	G	H	I	J	K	L
53					5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**					
55					5% Lilliefors Critical Value	0.267	Data appear Lognormal at 5% Significance Level					
56	**Data appear Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59					Minimum of Logged Data	5.278	Mean of logged Data					6.058
60					Maximum of Logged Data	6.727	SD of logged Data					0.405
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	604.3	90% Chebyshev (MVUE) UCL					631.6
64					95% Chebyshev (MVUE) UCL	709.2	97.5% Chebyshev (MVUE) UCL					816.9
65					99% Chebyshev (MVUE) UCL	1028						
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	546.7	95% Jackknife UCL					555.7
72					95% Standard Bootstrap UCL	543.7	95% Bootstrap-t UCL					564.4
73					95% Hall's Bootstrap UCL	585.8	95% Percentile Bootstrap UCL					545.9
74					95% BCA Bootstrap UCL	557.4						
75					90% Chebyshev(Mean, Sd) UCL	619.1	95% Chebyshev(Mean, Sd) UCL					691.7
76					97.5% Chebyshev(Mean, Sd) UCL	792.4	99% Chebyshev(Mean, Sd) UCL					990.2
77												
78	**Suggested UCL to Use**											
79					95% Student's-t UCL	555.7						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												
86												
87	**PAH, Total**											
88												
89	**General Statistics**											
90					Total Number of Observations	11	Number of Distinct Observations					4
91							Number of Missing Observations					0
92					Minimum	0.0327	Mean					0.376
93					Maximum	0.5	Median					0.376
94					SD	0.125	Std. Error of Mean					0.0378
95					Coefficient of Variation	0.334	Skewness					-2.206
96												
97	**Normal GOF Test**											
98					Shapiro Wilk Test Statistic	0.668	**Shapiro Wilk GOF Test**					
99					5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level					
100					Lilliefors Test Statistic	0.409	**Lilliefors GOF Test**					
101					5% Lilliefors Critical Value	0.267	Data Not Normal at 5% Significance Level					
102	**Data Not Normal at 5% Significance Level**											
103												
104	**Assuming Normal Distribution**											

	A	B	C	D	E	F	G	H	I	J	K	L
105	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
106					95% Student's-t UCL	0.444				95% Adjusted-CLT UCL (Chen-1995)		0.411
107										95% Modified-t UCL (Johnson-1978)		0.44
108												
109	Gamma GOF Test											
110					A-D Test Statistic	2.405	Anderson-Darling Gamma GOF Test					
111					5% A-D Critical Value	0.733	Data Not Gamma Distributed at 5% Significance Level					
112					K-S Test Statistic	0.48	Kolmogrov-Smirnoff Gamma GOF Test					
113					5% K-S Critical Value	0.257	Data Not Gamma Distributed at 5% Significance Level					
114	Data Not Gamma Distributed at 5% Significance Level											
115												
116	Gamma Statistics											
117					k hat (MLE)	3.5				k star (bias corrected MLE)		2.606
118					Theta hat (MLE)	0.107				Theta star (bias corrected MLE)		0.144
119					nu hat (MLE)	77				nu star (bias corrected)		57.34
120					MLE Mean (bias corrected)	0.376				MLE Sd (bias corrected)		0.233
121										Approximate Chi Square Value (0.05)		40.93
122					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		38.68
123												
124	Assuming Gamma Distribution											
125					95% Approximate Gamma UCL (use when n>=50))	0.526				95% Adjusted Gamma UCL (use when n<50)		0.557
126												
127	Lognormal GOF Test											
128					Shapiro Wilk Test Statistic	0.472	Shapiro Wilk Lognormal GOF Test					
129					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
130					Lilliefors Test Statistic	0.486	Lilliefors Lognormal GOF Test					
131					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
132	Data Not Lognormal at 5% Significance Level											
133												
134	Lognormal Statistics											
135					Minimum of Logged Data	-3.42				Mean of logged Data		-1.129
136					Maximum of Logged Data	-0.693				SD of logged Data		0.77
137												
138	Assuming Lognormal Distribution											
139					95% H-UCL	0.815				90% Chebyshev (MVUE) UCL		0.727
140					95% Chebyshev (MVUE) UCL	0.865				97.5% Chebyshev (MVUE) UCL		1.057
141					99% Chebyshev (MVUE) UCL	1.435						
142												
143	Nonparametric Distribution Free UCL Statistics											
144	Data do not follow a Discernible Distribution (0.05)											
145												
146	Nonparametric Distribution Free UCLs											
147					95% CLT UCL	0.438				95% Jackknife UCL		0.444
148					95% Standard Bootstrap UCL	N/A				95% Bootstrap-t UCL		N/A
149					95% Hall's Bootstrap UCL	N/A				95% Percentile Bootstrap UCL		N/A
150					95% BCA Bootstrap UCL	N/A						
151					90% Chebyshev(Mean, Sd) UCL	0.489				95% Chebyshev(Mean, Sd) UCL		0.541
152					97.5% Chebyshev(Mean, Sd) UCL	0.612				99% Chebyshev(Mean, Sd) UCL		0.752
153												
154	Suggested UCL to Use											
155					95% Chebyshev (Mean, Sd) UCL	0.541						
156												

	A	B	C	D	E	F	G	H	I	J	K	L
157	**Recommended UCL exceeds the maximum observation**											
158												
159	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
160	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
161	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
162	For additional insight the user may want to consult a statistician.											
163												
164	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
165	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
166												
167												
168	**PCB, Total**											
169												
170	**General Statistics**											
171	Total Number of Observations					11	Number of Distinct Observations					4
172							Number of Missing Observations					0
173	Minimum					0.1	Mean					3.235
174	Maximum					5	Median					5
175	SD					2.45	Std. Error of Mean					0.739
176	Coefficient of Variation					0.757	Skewness					-0.661
177												
178	**Normal GOF Test**											
179	Shapiro Wilk Test Statistic					0.629	**Shapiro Wilk GOF Test**					
180	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
181	Lilliefors Test Statistic					0.401	**Lilliefors GOF Test**					
182	5% Lilliefors Critical Value					0.267	Data Not Normal at 5% Significance Level					
183	**Data Not Normal at 5% Significance Level**											
184												
185	**Assuming Normal Distribution**											
186	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
187	95% Student's-t UCL					4.573	95% Adjusted-CLT UCL (Chen-1995)					4.292
188							95% Modified-t UCL (Johnson-1978)					4.549
189												
190	**Gamma GOF Test**											
191	A-D Test Statistic					2.079	**Anderson-Darling Gamma GOF Test**					
192	5% A-D Critical Value					0.766	Data Not Gamma Distributed at 5% Significance Level					
193	K-S Test Statistic					0.42	**Kolmogrov-Smirnoff Gamma GOF Test**					
194	5% K-S Critical Value					0.266	Data Not Gamma Distributed at 5% Significance Level					
195	**Data Not Gamma Distributed at 5% Significance Level**											
196												
197	**Gamma Statistics**											
198	k hat (MLE)					0.697	k star (bias corrected MLE)					0.567
199	Theta hat (MLE)					4.641	Theta star (bias corrected MLE)					5.7
200	nu hat (MLE)					15.33	nu star (bias corrected)					12.48
201	MLE Mean (bias corrected)					3.235	MLE Sd (bias corrected)					4.294
202							Approximate Chi Square Value (0.05)					5.548
203	Adjusted Level of Significance					0.0278	Adjusted Chi Square Value					4.815
204												
205	**Assuming Gamma Distribution**											
206	95% Approximate Gamma UCL (use when n>=50))					7.279	95% Adjusted Gamma UCL (use when n<50)					8.386
207												
208	**Lognormal GOF Test**											

	A	B	C	D	E	F	G	H	I	J	K	L
209					Shapiro Wilk Test Statistic	0.661	**Shapiro Wilk Lognormal GOF Test**					
210					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
211					Lilliefors Test Statistic	0.4	**Lilliefors Lognormal GOF Test**					
212					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
213	**Data Not Lognormal at 5% Significance Level**											
214												
215	**Lognormal Statistics**											
216					Minimum of Logged Data	-2.303				Mean of logged Data		0.306
217					Maximum of Logged Data	1.609				SD of logged Data		1.817
218												
219	**Assuming Lognormal Distribution**											
220					95% H-UCL	107.8				90% Chebyshev (MVUE) UCL		14.48
221					95% Chebyshev (MVUE) UCL	18.66				97.5% Chebyshev (MVUE) UCL		24.46
222					99% Chebyshev (MVUE) UCL	35.85						
223												
224	**Nonparametric Distribution Free UCL Statistics**											
225	**Data do not follow a Discernible Distribution (0.05)**											
226												
227	**Nonparametric Distribution Free UCLs**											
228					95% CLT UCL	4.449				95% Jackknife UCL		4.573
229					95% Standard Bootstrap UCL	N/A				95% Bootstrap-t UCL		N/A
230					95% Hall's Bootstrap UCL	N/A				95% Percentile Bootstrap UCL		N/A
231					95% BCA Bootstrap UCL	N/A						
232					90% Chebyshev(Mean, Sd) UCL	5.45				95% Chebyshev(Mean, Sd) UCL		6.454
233					97.5% Chebyshev(Mean, Sd) UCL	7.847				99% Chebyshev(Mean, Sd) UCL		10.58
234												
235	**Suggested UCL to Use**											
236					99% Chebyshev (Mean, Sd) UCL	10.58						
237												
238	**Recommended UCL exceeds the maximum observation**											
239												
240	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
241	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
242	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
243	For additional insight the user may want to consult a statistician.											
244												
245	**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
246	**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**											
247												
248												
249	**Uranium-238**											
250												
251	**General Statistics**											
252					Total Number of Observations	11				Number of Distinct Observations		5
253										Number of Missing Observations		0
254					Minimum	0.274				Mean		2.079
255					Maximum	5.55				Median		2.079
256					SD	1.344				Std. Error of Mean		0.405
257					Coefficient of Variation	0.646				Skewness		1.582
258												
259	**Normal GOF Test**											
260					Shapiro Wilk Test Statistic	0.681	**Shapiro Wilk GOF Test**					

	A	B	C	D	E	F	G	H	I	J	K	L
261					5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level					
262					Lilliefors Test Statistic	0.409	**Lilliefors GOF Test**					
263					5% Lilliefors Critical Value	0.267	Data Not Normal at 5% Significance Level					
264	**Data Not Normal at 5% Significance Level**											
265												
266	**Assuming Normal Distribution**											
267	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
268					95% Student's-t UCL	2.813	95% Adjusted-CLT UCL (Chen-1995)					2.952
269							95% Modified-t UCL (Johnson-1978)					2.845
270												
271	**Gamma GOF Test**											
272					A-D Test Statistic	1.758	**Anderson-Darling Gamma GOF Test**					
273					5% A-D Critical Value	0.738	Data Not Gamma Distributed at 5% Significance Level					
274					K-S Test Statistic	0.405	**Kolmogrov-Smirnoff Gamma GOF Test**					
275					5% K-S Critical Value	0.258	Data Not Gamma Distributed at 5% Significance Level					
276	**Data Not Gamma Distributed at 5% Significance Level**											
277												
278	**Gamma Statistics**											
279					k hat (MLE)	2.233	k star (bias corrected MLE)					1.685
280					Theta hat (MLE)	0.931	Theta star (bias corrected MLE)					1.234
281					nu hat (MLE)	49.12	nu star (bias corrected)					37.06
282					MLE Mean (bias corrected)	2.079	MLE Sd (bias corrected)					1.602
283							Approximate Chi Square Value (0.05)					24.12
284					Adjusted Level of Significance	0.0278	Adjusted Chi Square Value					22.43
285												
286	**Assuming Gamma Distribution**											
287			95% Approximate Gamma UCL (use when n>=50))			3.194	95% Adjusted Gamma UCL (use when n<50)					3.434
288												
289	**Lognormal GOF Test**											
290					Shapiro Wilk Test Statistic	0.703	**Shapiro Wilk Lognormal GOF Test**					
291					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
292					Lilliefors Test Statistic	0.429	**Lilliefors Lognormal GOF Test**					
293					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
294	**Data Not Lognormal at 5% Significance Level**											
295												
296	**Lognormal Statistics**											
297					Minimum of Logged Data	-1.295	Mean of logged Data					0.492
298					Maximum of Logged Data	1.714	SD of logged Data					0.835
299												
300	**Assuming Lognormal Distribution**											
301					95% H-UCL	4.721	90% Chebyshev (MVUE) UCL					3.991
302					95% Chebyshev (MVUE) UCL	4.79	97.5% Chebyshev (MVUE) UCL					5.898
303					99% Chebyshev (MVUE) UCL	8.076						
304												
305	**Nonparametric Distribution Free UCL Statistics**											
306	**Data do not follow a Discernible Distribution (0.05)**											
307												
308	**Nonparametric Distribution Free UCLs**											
309					95% CLT UCL	2.745	95% Jackknife UCL					2.813
310					95% Standard Bootstrap UCL	2.718	95% Bootstrap-t UCL					3.046
311					95% Hall's Bootstrap UCL	6.191	95% Percentile Bootstrap UCL					2.711
312					95% BCA Bootstrap UCL	2.873						

	A	B	C	D	E	F	G	H	I	J	K	L
313					90% Chebyshev(Mean, Sd) UCL	3.294				95% Chebyshev(Mean, Sd) UCL		3.845
314					97.5% Chebyshev(Mean, Sd) UCL	4.609				99% Chebyshev(Mean, Sd) UCL		6.11
315												
316					**Suggested UCL to Use**							
317					95% Chebyshev (Mean, Sd) UCL	3.845						
318												
319					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
320					These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)							
321					and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.							
322					For additional insight the user may want to consult a statistician.							
323												
324												
325	**Vanadium**											
326												
327					**General Statistics**							
328					Total Number of Observations	11				Number of Distinct Observations		11
329										Number of Missing Observations		0
330					Minimum	75				Mean		108.7
331					Maximum	158				Median		105
332					SD	24.99				Std. Error of Mean		7.534
333					Coefficient of Variation	0.23				Skewness		0.551
334												
335					**Normal GOF Test**							
336					Shapiro Wilk Test Statistic	0.958				**Shapiro Wilk GOF Test**		
337					5% Shapiro Wilk Critical Value	0.85				Data appear Normal at 5% Significance Level		
338					Lilliefors Test Statistic	0.144				**Lilliefors GOF Test**		
339					5% Lilliefors Critical Value	0.267				Data appear Normal at 5% Significance Level		
340					**Data appear Normal at 5% Significance Level**							
341												
342					**Assuming Normal Distribution**							
343					**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**		
344					95% Student's-t UCL	122.4				95% Adjusted-CLT UCL (Chen-1995)		122.5
345										95% Modified-t UCL (Johnson-1978)		122.6
346												
347					**Gamma GOF Test**							
348					A-D Test Statistic	0.193				**Anderson-Darling Gamma GOF Test**		
349					5% A-D Critical Value	0.729				Detected data appear Gamma Distributed at 5% Significance Level		
350					K-S Test Statistic	0.115				**Kolmogrov-Smirnoff Gamma GOF Test**		
351					5% K-S Critical Value	0.255				Detected data appear Gamma Distributed at 5% Significance Level		
352					**Detected data appear Gamma Distributed at 5% Significance Level**							
353												
354					**Gamma Statistics**							
355					k hat (MLE)	21.25				k star (bias corrected MLE)		15.51
356					Theta hat (MLE)	5.117				Theta star (bias corrected MLE)		7.008
357					nu hat (MLE)	467.5				nu star (bias corrected)		341.3
358					MLE Mean (bias corrected)	108.7				MLE Sd (bias corrected)		27.6
359										Approximate Chi Square Value (0.05)		299.5
360					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		293.1
361												
362					**Assuming Gamma Distribution**							
363					95% Approximate Gamma UCL (use when n>=50))	123.9				95% Adjusted Gamma UCL (use when n<50)		126.6
364												

	A	B	C	D	E	F	G	H	I	J	K	L
365						**Lognormal GOF Test**						
366					Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**					
367					5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level					
368					Lilliefors Test Statistic	0.114	**Lilliefors Lognormal GOF Test**					
369					5% Lilliefors Critical Value	0.267	Data appear Lognormal at 5% Significance Level					
370					**Data appear Lognormal at 5% Significance Level**							
371												
372					**Lognormal Statistics**							
373					Minimum of Logged Data	4.317				Mean of logged Data		4.665
374					Maximum of Logged Data	5.063				SD of logged Data		0.228
375												
376					**Assuming Lognormal Distribution**							
377					95% H-UCL	124.9				90% Chebyshev (MVUE) UCL		131.3
378					95% Chebyshev (MVUE) UCL	141.5				97.5% Chebyshev (MVUE) UCL		155.7
379					99% Chebyshev (MVUE) UCL	183.6						
380												
381					**Nonparametric Distribution Free UCL Statistics**							
382					**Data appear to follow a Discernible Distribution at 5% Significance Level**							
383												
384					**Nonparametric Distribution Free UCLs**							
385					95% CLT UCL	121.1				95% Jackknife UCL		122.4
386					95% Standard Bootstrap UCL	121.1				95% Bootstrap-t UCL		124.2
387					95% Hall's Bootstrap UCL	127.3				95% Percentile Bootstrap UCL		120.8
388					95% BCA Bootstrap UCL	121.7						
389					90% Chebyshev(Mean, Sd) UCL	131.3				95% Chebyshev(Mean, Sd) UCL		141.6
390					97.5% Chebyshev(Mean, Sd) UCL	155.8				99% Chebyshev(Mean, Sd) UCL		183.7
391												
392					**Suggested UCL to Use**							
393					95% Student's-t UCL	122.4						
394												
395	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
396	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
397	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
398	For additional insight the user may want to consult a statistician.											
399												