	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 7:22:17 PM								
5	From File			EPC_013Sub_EU12.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	**Iron**											
12												
13	**General Statistics**											
14	Total Number of Observations					11	Number of Distinct Observations					11
15							Number of Missing Observations					0
16	Minimum					14165	Mean					20604
17	Maximum					30409	Median					18769
18	SD					4399	Std. Error of Mean					1326
19	Coefficient of Variation					0.213	Skewness					1.01
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic					0.928	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk Critical Value					0.85	Data appear Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.207	**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					23008	95% Adjusted-CLT UCL (Chen-1995)					23217
31							95% Modified-t UCL (Johnson-1978)					23075
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					0.321	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.729	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.201	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.255	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)					25.82	k star (bias corrected MLE)					18.84
42	Theta hat (MLE)					798.1	Theta star (bias corrected MLE)					1094
43	nu hat (MLE)					567.9	nu star (bias corrected)					414.4
44	MLE Mean (bias corrected)					20604	MLE Sd (bias corrected)					4748
45							Approximate Chi Square Value (0.05)					368.2
46	Adjusted Level of Significance					0.0278	Adjusted Chi Square Value					361.1
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50))					23189	95% Adjusted Gamma UCL (use when n<50)					23645
50												
51	**Lognormal GOF Test**											
52	Shapiro Wilk Test Statistic					0.965	**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	0.186	**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	9.559				Mean of logged Data		9.914
60					Maximum of Logged Data	10.32				SD of logged Data		0.205
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	23281				90% Chebyshev (MVUE) UCL		24423
64					95% Chebyshev (MVUE) UCL	26158				97.5% Chebyshev (MVUE) UCL		28565
65					99% Chebyshev (MVUE) UCL	33294						
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	22786				95% Jackknife UCL		23008
72					95% Standard Bootstrap UCL	22641				95% Bootstrap-t UCL		23675
73					95% Hall's Bootstrap UCL	24466				95% Percentile Bootstrap UCL		22760
74					95% BCA Bootstrap UCL	23079						
75					90% Chebyshev(Mean, Sd) UCL	24583				95% Chebyshev(Mean, Sd) UCL		26385
76					97.5% Chebyshev(Mean, Sd) UCL	28887				99% Chebyshev(Mean, Sd) UCL		33801
77												
78	**Suggested UCL to Use**											
79					95% Student's-t UCL	23008						
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	**Manganese**											
88												
89	**General Statistics**											
90					Total Number of Observations	11				Number of Distinct Observations		11
91										Number of Missing Observations		0
92					Minimum	231				Mean		762.9
93					Maximum	3114				Median		541
94					SD	825.5				Std. Error of Mean		248.9
95					Coefficient of Variation	1.082				Skewness		2.736
96												
97	**Normal GOF Test**											
98					Shapiro Wilk Test Statistic	0.621	**Shapiro Wilk GOF Test**					
99					5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level					
100					Lilliefors Test Statistic	0.374	**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	1214				95% Adjusted-CLT UCL (Chen-1995)		1392
107										95% Modified-t UCL (Johnson-1978)		1248
108												
109	**Gamma GOF Test**											
110					A-D Test Statistic	0.793	**Anderson-Darling Gamma GOF Test**					
111					5% A-D Critical Value	0.741	Data Not Gamma Distributed at 5% Significance Level					
112					K-S Test Statistic	0.299	**Kolmogrov-Smirnoff Gamma GOF Test**					
113					5% K-S Critical Value	0.259	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)	1.727				k star (bias corrected MLE)		1.316
118					Theta hat (MLE)	441.9				Theta star (bias corrected MLE)		579.6
119					nu hat (MLE)	37.98				nu star (bias corrected)		28.96
120					MLE Mean (bias corrected)	762.9				MLE Sd (bias corrected)		665
121										Approximate Chi Square Value (0.05)		17.68
122					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		16.25
123												
124	**Assuming Gamma Distribution**											
125					95% Approximate Gamma UCL (use when n>=50))	1250				95% Adjusted Gamma UCL (use when n<50)		1359
126												
127	**Lognormal GOF Test**											
128					Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk Lognormal GOF Test**					
129					5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level					
130					Lilliefors Test Statistic	0.238	**Lilliefors Lognormal GOF Test**					
131					5% Lilliefors Critical Value	0.267	Data appear Lognormal at 5% Significance Level					
132	**Data appear Lognormal at 5% Significance Level**											
133												
134	**Lognormal Statistics**											
135					Minimum of Logged Data	5.442				Mean of logged Data		6.32
136					Maximum of Logged Data	8.044				SD of logged Data		0.752
137												
138	**Assuming Lognormal Distribution**											
139					95% H-UCL	1353				90% Chebyshev (MVUE) UCL		1222
140					95% Chebyshev (MVUE) UCL	1451				97.5% Chebyshev (MVUE) UCL		1770
141					99% Chebyshev (MVUE) UCL	2396						
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	1172				95% Jackknife UCL		1214
148					95% Standard Bootstrap UCL	1159				95% Bootstrap-t UCL		2375
149					95% Hall's Bootstrap UCL	3194				95% Percentile Bootstrap UCL		1203
150					95% BCA Bootstrap UCL	1484						
151					90% Chebyshev(Mean, Sd) UCL	1510				95% Chebyshev(Mean, Sd) UCL		1848
152					97.5% Chebyshev(Mean, Sd) UCL	2317				99% Chebyshev(Mean, Sd) UCL		3239
153												
154	**Suggested UCL to Use**											
155					95% H-UCL	1353						
156												

	A	B	C	D	E	F	G	H	I	J	K	L
157	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
158	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
159	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
160	For additional insight the user may want to consult a statistician.											
161												
162	**ProUCL computes and outputs H-statistic based UCLs for historical reasons only.**											
163	**H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.**											
164	**It is therefore recommended to avoid the use of H-statistic based 95% UCLs.**											
165	**Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.**											
166												
167												
168	**PCB, Total**											
169												
170	**General Statistics**											
171					Total Number of Observations	11			Number of Distinct Observations			5
172									Number of Missing Observations			0
173					Minimum	0.05			Mean			2.851
174					Maximum	5			Median			5
175					SD	2.482			Std. Error of Mean			0.748
176					Coefficient of Variation	0.871			Skewness			-0.247
177												
178	**Normal GOF Test**											
179					Shapiro Wilk Test Statistic	0.682			**Shapiro Wilk GOF Test**			
180					5% Shapiro Wilk Critical Value	0.85			Data Not Normal at 5% Significance Level			
181					Lilliefors Test Statistic	0.352			**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	4.207			95% Adjusted-CLT UCL (Chen-1995)			4.022
188									95% Modified-t UCL (Johnson-1978)			4.198
189												
190	**Gamma GOF Test**											
191					A-D Test Statistic	1.524			**Anderson-Darling Gamma GOF Test**			
192					5% A-D Critical Value	0.775			Data Not Gamma Distributed at 5% Significance Level			
193					K-S Test Statistic	0.36			**Kolmogrov-Smirnoff Gamma GOF Test**			
194					5% K-S Critical Value	0.268			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)	0.588			k star (bias corrected MLE)			0.488
199					Theta hat (MLE)	4.85			Theta star (bias corrected MLE)			5.841
200					nu hat (MLE)	12.93			nu star (bias corrected)			10.74
201					MLE Mean (bias corrected)	2.851			MLE Sd (bias corrected)			4.081
202									Approximate Chi Square Value (0.05)			4.408
203					Adjusted Level of Significance	0.0278			Adjusted Chi Square Value			3.769
204												
205	**Assuming Gamma Distribution**											
206					95% Approximate Gamma UCL (use when n>=50))	6.945			95% Adjusted Gamma UCL (use when n<50)			8.121
207												
208	**Lognormal GOF Test**											

	A	B	C	D	E	F	G	H	I	J	K	L
209					Shapiro Wilk Test Statistic	0.738	**Shapiro Wilk Lognormal GOF Test**					
210					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
211					Lilliefors Test Statistic	0.337	**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	-2.996				Mean of logged Data		-0.00678
217					Maximum of Logged Data	1.609				SD of logged Data		1.99
218												
219					**Assuming Lognormal Distribution**							
220					95% H-UCL	182				90% Chebyshev (MVUE) UCL		14.22
221					95% Chebyshev (MVUE) UCL	18.45				97.5% Chebyshev (MVUE) UCL		24.31
222					99% Chebyshev (MVUE) UCL	35.83						
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	4.082				95% Jackknife UCL		4.207
229					95% Standard Bootstrap UCL	4.02				95% Bootstrap-t UCL		4.199
230					95% Hall's Bootstrap UCL	3.902				95% Percentile Bootstrap UCL		4.105
231					95% BCA Bootstrap UCL	4.105						
232					90% Chebyshev(Mean, Sd) UCL	5.096				95% Chebyshev(Mean, Sd) UCL		6.113
233					97.5% Chebyshev(Mean, Sd) UCL	7.525				99% Chebyshev(Mean, Sd) UCL		10.3
234												
235					**Suggested UCL to Use**							
236					99% Chebyshev (Mean, Sd) UCL	10.3						
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	**Silver**											
250												
251					**General Statistics**							
252					Total Number of Observations	11				Number of Distinct Observations		6
253										Number of Missing Observations		0
254					Minimum	2.01				Mean		39.38
255					Maximum	124				Median		50
256					SD	36.52				Std. Error of Mean		11.01
257					Coefficient of Variation	0.927				Skewness		1.026
258												
259					**Normal GOF Test**							
260					Shapiro Wilk Test Statistic	0.775	**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	0.295	**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	59.34	95% Adjusted-CLT UCL (Chen-1995)					61.13
269							95% Modified-t UCL (Johnson-1978)					59.91
270												
271	**Gamma GOF Test**											
272					A-D Test Statistic	1.431	**Anderson-Darling Gamma GOF Test**					
273					5% A-D Critical Value	0.763	Data Not Gamma Distributed at 5% Significance Level					
274					K-S Test Statistic	0.362	**Kolmogrov-Smirnoff Gamma GOF Test**					
275					5% K-S Critical Value	0.265	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)	0.748	k star (bias corrected MLE)					0.604
280					Theta hat (MLE)	52.66	Theta star (bias corrected MLE)					65.15
281					nu hat (MLE)	16.45	nu star (bias corrected)					13.3
282					MLE Mean (bias corrected)	39.38	MLE Sd (bias corrected)					50.65
283							Approximate Chi Square Value (0.05)					6.093
284					Adjusted Level of Significance	0.0278	Adjusted Chi Square Value					5.319
285												
286	**Assuming Gamma Distribution**											
287			95% Approximate Gamma UCL (use when n>=50))			85.94	95% Adjusted Gamma UCL (use when n<50)					98.45
288												
289	**Lognormal GOF Test**											
290					Shapiro Wilk Test Statistic	0.733	**Shapiro Wilk Lognormal GOF Test**					
291					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
292					Lilliefors Test Statistic	0.373	**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	0.698	Mean of logged Data					2.872
298					Maximum of Logged Data	4.82	SD of logged Data					1.645
299												
300	**Assuming Lognormal Distribution**											
301					95% H-UCL	658.4	90% Chebyshev (MVUE) UCL					141.8
302			95% Chebyshev (MVUE) UCL			181.4	97.5% Chebyshev (MVUE) UCL					236.2
303			99% Chebyshev (MVUE) UCL			344						
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	57.49	95% Jackknife UCL					59.34
310			95% Standard Bootstrap UCL			56.55	95% Bootstrap-t UCL					61.97
311			95% Hall's Bootstrap UCL			68.8	95% Percentile Bootstrap UCL					57.2
312			95% BCA Bootstrap UCL			59.13						

	A	B	C	D	E	F	G	H	I	J	K	L
313					90% Chebyshev(Mean, Sd) UCL	72.42				95% Chebyshev(Mean, Sd) UCL		87.38
314					97.5% Chebyshev(Mean, Sd) UCL	108.1				99% Chebyshev(Mean, Sd) UCL		148.9
315												
316					**Suggested UCL to Use**							
317					99% Chebyshev (Mean, Sd) UCL	148.9						
318												
319					**Recommended UCL exceeds the maximum observation**							
320												
321					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
322					These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)							
323					and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.							
324					For additional insight the user may want to consult a statistician.							
325												
326												
327	**Vanadium**											
328												
329					**General Statistics**							
330					Total Number of Observations	11				Number of Distinct Observations		10
331										Number of Missing Observations		0
332					Minimum	71				Mean		103.1
333					Maximum	151				Median		106
334					SD	23.95				Std. Error of Mean		7.222
335					Coefficient of Variation	0.232				Skewness		0.364
336												
337					**Normal GOF Test**							
338					Shapiro Wilk Test Statistic	0.936				**Shapiro Wilk GOF Test**		
339					5% Shapiro Wilk Critical Value	0.85				Data appear Normal at 5% Significance Level		
340					Lilliefors Test Statistic	0.152				**Lilliefors GOF Test**		
341					5% Lilliefors Critical Value	0.267				Data appear Normal at 5% Significance Level		
342					**Data appear Normal at 5% Significance Level**							
343												
344					**Assuming Normal Distribution**							
345					**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**		
346					95% Student's-t UCL	116.2				95% Adjusted-CLT UCL (Chen-1995)		115.8
347										95% Modified-t UCL (Johnson-1978)		116.3
348												
349					**Gamma GOF Test**							
350					A-D Test Statistic	0.369				**Anderson-Darling Gamma GOF Test**		
351					5% A-D Critical Value	0.729				Detected data appear Gamma Distributed at 5% Significance Level		
352					K-S Test Statistic	0.182				**Kolmogrov-Smirnoff Gamma GOF Test**		
353					5% K-S Critical Value	0.255				Detected data appear Gamma Distributed at 5% Significance Level		
354					**Detected data appear Gamma Distributed at 5% Significance Level**							
355												
356					**Gamma Statistics**							
357					k hat (MLE)	20.3				k star (bias corrected MLE)		14.82
358					Theta hat (MLE)	5.079				Theta star (bias corrected MLE)		6.955
359					nu hat (MLE)	446.6				nu star (bias corrected)		326.1
360					MLE Mean (bias corrected)	103.1				MLE Sd (bias corrected)		26.78
361										Approximate Chi Square Value (0.05)		285.3
362					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		279
363												
364					**Assuming Gamma Distribution**							

	A	B	C	D	E	F	G	H	I	J	K	L
365	95% Approximate Gamma UCL (use when n>=50))					117.8	95% Adjusted Gamma UCL (use when n<50)					120.5
366												
367	**Lognormal GOF Test**											
368	Shapiro Wilk Test Statistic					0.935	**Shapiro Wilk Lognormal GOF Test**					
369	5% Shapiro Wilk Critical Value					0.85	Data appear Lognormal at 5% Significance Level					
370	Lilliefors Test Statistic					0.193	**Lilliefors Lognormal GOF Test**					
371	5% Lilliefors Critical Value					0.267	Data appear Lognormal at 5% Significance Level					
372	**Data appear Lognormal at 5% Significance Level**											
373												
374	**Lognormal Statistics**											
375	Minimum of Logged Data					4.263	Mean of logged Data					4.611
376	Maximum of Logged Data					5.017	SD of logged Data					0.235
377												
378	**Assuming Lognormal Distribution**											
379	95% H-UCL					119	90% Chebyshev (MVUE) UCL					125.2
380	95% Chebyshev (MVUE) UCL					135.2	97.5% Chebyshev (MVUE) UCL					149
381	99% Chebyshev (MVUE) UCL					176.2						
382												
383	**Nonparametric Distribution Free UCL Statistics**											
384	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
385												
386	**Nonparametric Distribution Free UCLs**											
387	95% CLT UCL					115	95% Jackknife UCL					116.2
388	95% Standard Bootstrap UCL					114.3	95% Bootstrap-t UCL					117.3
389	95% Hall's Bootstrap UCL					116.6	95% Percentile Bootstrap UCL					114.5
390	95% BCA Bootstrap UCL					115						
391	90% Chebyshev(Mean, Sd) UCL					124.8	95% Chebyshev(Mean, Sd) UCL					134.6
392	97.5% Chebyshev(Mean, Sd) UCL					148.2	99% Chebyshev(Mean, Sd) UCL					174.9
393												
394	**Suggested UCL to Use**											
395	95% Student's-t UCL					116.2						
396												
397	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
398	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
399	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
400	For additional insight the user may want to consult a statistician.											
401												