	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 7:12:21 PM								
5	From File			EPC_013Surf_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	22677				95% Bootstrap-t UCL		23802
73					95% Hall's Bootstrap UCL	24278				95% Percentile Bootstrap UCL		22815
74					95% BCA Bootstrap UCL	23024						
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	1152				95% Bootstrap-t UCL		2388
149					95% Hall's Bootstrap UCL	3224				95% Percentile Bootstrap UCL		1221
150					95% BCA Bootstrap UCL	1367						
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	**Silver**											
169												
170	**General Statistics**											
171	Total Number of Observations					11	Number of Distinct Observations					3
172							Number of Missing Observations					0
173	Minimum					2.5	Mean					52.41
174	Maximum					124	Median					50
175	SD					27.69	Std. Error of Mean					8.349
176	Coefficient of Variation					0.528	Skewness					1.396
177												
178	**Normal GOF Test**											
179	Shapiro Wilk Test Statistic					0.604	**Shapiro Wilk GOF Test**					
180	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
181	Lilliefors Test Statistic					0.444	**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					67.54	95% Adjusted-CLT UCL (Chen-1995)					69.9
188							95% Modified-t UCL (Johnson-1978)					68.13
189												
190	**Gamma GOF Test**											
191	A-D Test Statistic					2.538	**Anderson-Darling Gamma GOF Test**					
192	5% A-D Critical Value					0.737	Data Not Gamma Distributed at 5% Significance Level					
193	K-S Test Statistic					0.47	**Kolmogrov-Smirnoff Gamma GOF Test**					
194	5% K-S Critical Value					0.258	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)					2.264	k star (bias corrected MLE)					1.707
199	Theta hat (MLE)					23.15	Theta star (bias corrected MLE)					30.7
200	nu hat (MLE)					49.81	nu star (bias corrected)					37.56
201	MLE Mean (bias corrected)					52.41	MLE Sd (bias corrected)					40.11
202							Approximate Chi Square Value (0.05)					24.52
203	Adjusted Level of Significance					0.0278	Adjusted Chi Square Value					22.82
204												
205	**Assuming Gamma Distribution**											
206	95% Approximate Gamma UCL (use when n>=50))					80.26	95% Adjusted Gamma UCL (use when n<50)					86.25
207												
208	**Lognormal GOF Test**											

	A	B	C	D	E	F	G	H	I	J	K	L
209					Shapiro Wilk Test Statistic	0.508	**Shapiro Wilk Lognormal GOF Test**					
210					5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level					
211					Lilliefors Test Statistic	0.487	**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	0.916	Mean of logged Data					3.722
217					Maximum of Logged Data	4.82	SD of logged Data					0.97
218												
219	**Assuming Lognormal Distribution**											
220					95% H-UCL	163	90% Chebyshev (MVUE) UCL					120.5
221					95% Chebyshev (MVUE) UCL	146.8	97.5% Chebyshev (MVUE) UCL					183.3
222					99% Chebyshev (MVUE) UCL	254.9						
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	66.14	95% Jackknife UCL					67.54
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	77.46	95% Chebyshev(Mean, Sd) UCL					88.8
233					97.5% Chebyshev(Mean, Sd) UCL	104.6	99% Chebyshev(Mean, Sd) UCL					135.5
234												
235	**Suggested UCL to Use**											
236					95% Chebyshev (Mean, Sd) UCL	88.8						
237												
238	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
239	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
240	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
241	For additional insight the user may want to consult a statistician.											
242												
243												
244	**Vanadium**											
245												
246	**General Statistics**											
247					Total Number of Observations	11	Number of Distinct Observations					10
248							Number of Missing Observations					0
249					Minimum	71	Mean					103.1
250					Maximum	151	Median					106
251					SD	23.95	Std. Error of Mean					7.222
252					Coefficient of Variation	0.232	Skewness					0.364
253												
254	**Normal GOF Test**											
255					Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**					
256					5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level					
257					Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**					
258					5% Lilliefors Critical Value	0.267	Data appear Normal at 5% Significance Level					
259	**Data appear Normal at 5% Significance Level**											
260												

	A	B	C	D	E	F	G	H	I	J	K	L
261	**Assuming Normal Distribution**											
262	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
263					95% Student's-t UCL	116.2				95% Adjusted-CLT UCL (Chen-1995)		115.8
264										95% Modified-t UCL (Johnson-1978)		116.3
265												
266	**Gamma GOF Test**											
267					A-D Test Statistic	0.369	**Anderson-Darling Gamma GOF Test**					
268					5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level					
269					K-S Test Statistic	0.182	**Kolmogrov-Smirnoff Gamma GOF Test**					
270					5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level					
271	**Detected data appear Gamma Distributed at 5% Significance Level**											
272												
273	**Gamma Statistics**											
274					k hat (MLE)	20.3				k star (bias corrected MLE)		14.82
275					Theta hat (MLE)	5.079				Theta star (bias corrected MLE)		6.955
276					nu hat (MLE)	446.6				nu star (bias corrected)		326.1
277					MLE Mean (bias corrected)	103.1				MLE Sd (bias corrected)		26.78
278										Approximate Chi Square Value (0.05)		285.3
279					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		279
280												
281	**Assuming Gamma Distribution**											
282				95% Approximate Gamma UCL (use when n>=50))		117.8				95% Adjusted Gamma UCL (use when n<50)		120.5
283												
284	**Lognormal GOF Test**											
285					Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**					
286					5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level					
287					Lilliefors Test Statistic	0.193	**Lilliefors Lognormal GOF Test**					
288					5% Lilliefors Critical Value	0.267	Data appear Lognormal at 5% Significance Level					
289	**Data appear Lognormal at 5% Significance Level**											
290												
291	**Lognormal Statistics**											
292					Minimum of Logged Data	4.263				Mean of logged Data		4.611
293					Maximum of Logged Data	5.017				SD of logged Data		0.235
294												
295	**Assuming Lognormal Distribution**											
296					95% H-UCL	119				90% Chebyshev (MVUE) UCL		125.2
297					95% Chebyshev (MVUE) UCL	135.2				97.5% Chebyshev (MVUE) UCL		149
298					99% Chebyshev (MVUE) UCL	176.2						
299												
300	**Nonparametric Distribution Free UCL Statistics**											
301	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
302												
303	**Nonparametric Distribution Free UCLs**											
304					95% CLT UCL	115				95% Jackknife UCL		116.2
305					95% Standard Bootstrap UCL	114.3				95% Bootstrap-t UCL		116.6
306					95% Hall's Bootstrap UCL	117.5				95% Percentile Bootstrap UCL		114.2
307					95% BCA Bootstrap UCL	115.4						
308					90% Chebyshev(Mean, Sd) UCL	124.8				95% Chebyshev(Mean, Sd) UCL		134.6
309					97.5% Chebyshev(Mean, Sd) UCL	148.2				99% Chebyshev(Mean, Sd) UCL		174.9
310												
311	**Suggested UCL to Use**											
312					95% Student's-t UCL	116.2						

	A	B	C	D	E	F	G	H	I	J	K	L
313												
314	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
315	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
316	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
317	For additional insight the user may want to consult a statistician.											
318												