	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 7:11:42 PM								
5	From File			EPC_013Surf_EU13.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					14554	Mean					23190
17	Maximum					47830	Median					18471
18	SD					10514	Std. Error of Mean					3170
19	Coefficient of Variation					0.453	Skewness					1.623
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.743	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.348	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.267	Data Not Normal at 5% Significance Level					
26	Data Not 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					28936	95% Adjusted-CLT UCL (Chen-1995)					30063
31							95% Modified-t UCL (Johnson-1978)					29195
32												
33	Gamma GOF Test											
34	A-D Test Statistic					1.177	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.731	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.328	Kolmogrov-Smirnoff Gamma GOF Test					
37	5% K-S Critical Value					0.256	Data Not Gamma Distributed at 5% Significance Level					
38	Data Not Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					6.877	k star (bias corrected MLE)					5.062
42	Theta hat (MLE)					3372	Theta star (bias corrected MLE)					4581
43	nu hat (MLE)					151.3	nu star (bias corrected)					111.4
44	MLE Mean (bias corrected)					23190	MLE Sd (bias corrected)					10307
45							Approximate Chi Square Value (0.05)					88.01
46	Adjusted Level of Significance					0.0278	Adjusted Chi Square Value					84.63
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50))					29346	95% Adjusted Gamma UCL (use when n<50)					30518
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.81	Shapiro Wilk Lognormal GOF Test					
53	5% Shapiro Wilk Critical Value					0.85	Data Not Lognormal at 5% Significance Level					

54					Lilliefors Test Statistic	0.306			**Lilliefors Lognormal GOF Test**			
55					5% Lilliefors Critical Value	0.267			Data Not Lognormal at 5% Significance Level			
56					**Data Not Lognormal at 5% Significance Level**							
57												
58					**Lognormal Statistics**							
59					Minimum of Logged Data	9.586			Mean of logged Data			9.977
60					Maximum of Logged Data	10.78			SD of logged Data			0.382
61												
62					**Assuming Lognormal Distribution**							
63					95% H-UCL	29614			90% Chebyshev (MVUE) UCL			31051
64					95% Chebyshev (MVUE) UCL	34699			97.5% Chebyshev (MVUE) UCL			39763
65					99% Chebyshev (MVUE) UCL	49710						
66												
67					**Nonparametric Distribution Free UCL Statistics**							
68					**Data do not follow a Discernible Distribution (0.05)**							
69												
70					**Nonparametric Distribution Free UCLs**							
71					95% CLT UCL	28405			95% Jackknife UCL			28936
72					95% Standard Bootstrap UCL	28189			95% Bootstrap-t UCL			32410
73					95% Hall's Bootstrap UCL	28123			95% Percentile Bootstrap UCL			28337
74					95% BCA Bootstrap UCL	29075						
75					90% Chebyshev(Mean, Sd) UCL	32701			95% Chebyshev(Mean, Sd) UCL			37009
76					97.5% Chebyshev(Mean, Sd) UCL	42988			99% Chebyshev(Mean, Sd) UCL			54733
77												
78					**Suggested UCL to Use**							
79					95% Student's-t UCL	28936			or 95% Modified-t UCL			29195
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	119			Mean			466.6
93					Maximum	1951			Median			348
94					SD	502.3			Std. Error of Mean			151.5
95					Coefficient of Variation	1.077			Skewness			3.073
96												
97					**Normal GOF Test**							
98					Shapiro Wilk Test Statistic	0.541			**Shapiro Wilk GOF Test**			
99					5% Shapiro Wilk Critical Value	0.85			Data Not Normal at 5% Significance Level			
100					Lilliefors Test Statistic	0.427			**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**							
105					**95% Normal UCL**				**95% UCLs (Adjusted for Skewness)**			
106					95% Student's-t UCL	741.2			95% Adjusted-CLT UCL (Chen-1995)			865.7

	A	B	C	D	E	F	G	H	I	J	K	L
107										95% Modified-t UCL (Johnson-1978)		764.6
108												
109						Gamma GOF Test						
110					A-D Test Statistic	1.156	Anderson-Darling Gamma GOF Test					
111					5% A-D Critical Value	0.739	Data Not Gamma Distributed at 5% Significance Level					
112					K-S Test Statistic	0.341	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)	1.956				k star (bias corrected MLE)		1.483
118					Theta hat (MLE)	238.6				Theta star (bias corrected MLE)		314.6
119					nu hat (MLE)	43.03				nu star (bias corrected)		32.63
120					MLE Mean (bias corrected)	466.6				MLE Sd (bias corrected)		383.2
121										Approximate Chi Square Value (0.05)		20.57
122					Adjusted Level of Significance	0.0278				Adjusted Chi Square Value		19.02
123												
124						Assuming Gamma Distribution						
125					95% Approximate Gamma UCL (use when n>=50))	740.2				95% Adjusted Gamma UCL (use when n<50)		800.4
126												
127						Lognormal GOF Test						
128					Shapiro Wilk Test Statistic	0.859	Shapiro Wilk Lognormal GOF Test					
129					5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level					
130					Lilliefors Test Statistic	0.28	Lilliefors Lognormal GOF Test					
131					5% Lilliefors Critical Value	0.267	Data Not Lognormal at 5% Significance Level					
132						Data appear Approximate Lognormal at 5% Significance Level						
133												
134						Lognormal Statistics						
135					Minimum of Logged Data	4.779				Mean of logged Data		5.869
136					Maximum of Logged Data	7.576				SD of logged Data		0.687
137												
138						Assuming Lognormal Distribution						
139					95% H-UCL	761.8				90% Chebyshev (MVUE) UCL		717.9
140					95% Chebyshev (MVUE) UCL	845.2				97.5% Chebyshev (MVUE) UCL		1022
141					99% Chebyshev (MVUE) UCL	1369						
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	715.8				95% Jackknife UCL		741.2
148					95% Standard Bootstrap UCL	697.8				95% Bootstrap-t UCL		1435
149					95% Hall's Bootstrap UCL	1878				95% Percentile Bootstrap UCL		752.7
150					95% BCA Bootstrap UCL	831						
151					90% Chebyshev(Mean, Sd) UCL	921				95% Chebyshev(Mean, Sd) UCL		1127
152					97.5% Chebyshev(Mean, Sd) UCL	1413				99% Chebyshev(Mean, Sd) UCL		1974
153												
154						Suggested UCL to Use						
155					95% Chebyshev (Mean, Sd) UCL	1127						
156												
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.							

	A	B	C	D	E	F	G	H	I	J	K	L
160	For additional insight the user may want to consult a statistician.											
161												
162												
163	**Molybdenum**											
164												
165	**General Statistics**											
166	Total Number of Observations					11	Number of Distinct Observations					4
167							Number of Missing Observations					0
168	Minimum					0.31	Mean					8.846
169	Maximum					43	Median					3
170	SD					14	Std. Error of Mean					4.221
171	Coefficient of Variation					1.583	Skewness					2.097
172												
173	**Normal GOF Test**											
174	Shapiro Wilk Test Statistic					0.551	**Shapiro Wilk GOF Test**					
175	5% Shapiro Wilk Critical Value					0.85	Data Not Normal at 5% Significance Level					
176	Lilliefors Test Statistic					0.48	**Lilliefors GOF Test**					
177	5% Lilliefors Critical Value					0.267	Data Not Normal at 5% Significance Level					
178	**Data Not Normal at 5% Significance Level**											
179												
180	**Assuming Normal Distribution**											
181	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
182	95% Student's-t UCL					16.5	95% Adjusted-CLT UCL (Chen-1995)					18.64
183							95% Modified-t UCL (Johnson-1978)					16.94
184												
185	**Gamma GOF Test**											
186	A-D Test Statistic					2.03	**Anderson-Darling Gamma GOF Test**					
187	5% A-D Critical Value					0.765	Data Not Gamma Distributed at 5% Significance Level					
188	K-S Test Statistic					0.459	**Kolmogrov-Smirnoff Gamma GOF Test**					
189	5% K-S Critical Value					0.265	Data Not Gamma Distributed at 5% Significance Level					
190	**Data Not Gamma Distributed at 5% Significance Level**											
191												
192	**Gamma Statistics**											
193	k hat (MLE)					0.72	k star (bias corrected MLE)					0.584
194	Theta hat (MLE)					12.29	Theta star (bias corrected MLE)					15.15
195	nu hat (MLE)					15.84	nu star (bias corrected)					12.85
196	MLE Mean (bias corrected)					8.846	MLE Sd (bias corrected)					11.58
197							Approximate Chi Square Value (0.05)					5.792
198	Adjusted Level of Significance					0.0278	Adjusted Chi Square Value					5.04
199												
200	**Assuming Gamma Distribution**											
201	95% Approximate Gamma UCL (use when n>=50))					19.63	95% Adjusted Gamma UCL (use when n<50)					22.55
202												
203	**Lognormal GOF Test**											
204	Shapiro Wilk Test Statistic					0.736	**Shapiro Wilk Lognormal GOF Test**					
205	5% Shapiro Wilk Critical Value					0.85	Data Not Lognormal at 5% Significance Level					
206	Lilliefors Test Statistic					0.393	**Lilliefors Lognormal GOF Test**					
207	5% Lilliefors Critical Value					0.267	Data Not Lognormal at 5% Significance Level					
208	**Data Not Lognormal at 5% Significance Level**											
209												
210	**Lognormal Statistics**											
211	Minimum of Logged Data					-1.171	Mean of logged Data					1.344
212	Maximum of Logged Data					3.761	SD of logged Data					1.299

	A	B	C	D	E	F	G	H	I	J	K	L
213												
214					Assuming Lognormal Distribution							
215					95% H-UCL	39.18				90% Chebyshev (MVUE) UCL		17.89
216					95% Chebyshev (MVUE) UCL	22.42				97.5% Chebyshev (MVUE) UCL		28.69
217					99% Chebyshev (MVUE) UCL	41.02						
218												
219					Nonparametric Distribution Free UCL Statistics							
220					Data do not follow a Discernible Distribution (0.05)							
221												
222					Nonparametric Distribution Free UCLs							
223					95% CLT UCL	15.79				95% Jackknife UCL		16.5
224					95% Standard Bootstrap UCL	N/A				95% Bootstrap-t UCL		N/A
225					95% Hall's Bootstrap UCL	N/A				95% Percentile Bootstrap UCL		N/A
226					95% BCA Bootstrap UCL	N/A						
227					90% Chebyshev(Mean, Sd) UCL	21.51				95% Chebyshev(Mean, Sd) UCL		27.25
228					97.5% Chebyshev(Mean, Sd) UCL	35.21				99% Chebyshev(Mean, Sd) UCL		50.85
229												
230					Suggested UCL to Use							
231					95% Chebyshev (Mean, Sd) UCL	27.25						
232												
233					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
234					These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)							
235					and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.							
236					For additional insight the user may want to consult a statistician.							
237												
238												
239	Vanadium											
240												
241					General Statistics							
242					Total Number of Observations	11				Number of Distinct Observations		11
243										Number of Missing Observations		0
244					Minimum	70				Mean		105.6
245					Maximum	145				Median		108
246					SD	23.56				Std. Error of Mean		7.105
247					Coefficient of Variation	0.223				Skewness		0.229
248												
249					Normal GOF Test							
250					Shapiro Wilk Test Statistic	0.967				Shapiro Wilk GOF Test		
251					5% Shapiro Wilk Critical Value	0.85				Data appear Normal at 5% Significance Level		
252					Lilliefors Test Statistic	0.133				Lilliefors GOF Test		
253					5% Lilliefors Critical Value	0.267				Data appear Normal at 5% Significance Level		
254					Data appear Normal at 5% Significance Level							
255												
256					Assuming Normal Distribution							
257					95% Normal UCL					95% UCLs (Adjusted for Skewness)		
258					95% Student's-t UCL	118.5				95% Adjusted-CLT UCL (Chen-1995)		117.8
259										95% Modified-t UCL (Johnson-1978)		118.6
260												

	A	B	C	D	E	F	G	H	I	J	K	L
261	**Gamma GOF Test**											
262					A-D Test Statistic	0.186	**Anderson-Darling Gamma GOF Test**					
263					5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level					
264					K-S Test Statistic	0.115	**Kolmogrov-Smirnoff Gamma GOF Test**					
265					5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level					
266	**Detected data appear Gamma Distributed at 5% Significance Level**											
267												
268	**Gamma Statistics**											
269					k hat (MLE)	21.83	k star (bias corrected MLE)					15.93
270					Theta hat (MLE)	4.84	Theta star (bias corrected MLE)					6.629
271					nu hat (MLE)	480.2	nu star (bias corrected)					350.6
272					MLE Mean (bias corrected)	105.6	MLE Sd (bias corrected)					26.46
273							Approximate Chi Square Value (0.05)					308.2
274					Adjusted Level of Significance	0.0278	Adjusted Chi Square Value					301.7
275												
276	**Assuming Gamma Distribution**											
277					95% Approximate Gamma UCL (use when n>=50))	120.2	95% Adjusted Gamma UCL (use when n<50)					122.7
278												
279	**Lognormal GOF Test**											
280					Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**					
281					5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level					
282					Lilliefors Test Statistic	0.124	**Lilliefors Lognormal GOF Test**					
283					5% Lilliefors Critical Value	0.267	Data appear Lognormal at 5% Significance Level					
284	**Data appear Lognormal at 5% Significance Level**											
285												
286	**Lognormal Statistics**											
287					Minimum of Logged Data	4.248	Mean of logged Data					4.637
288					Maximum of Logged Data	4.977	SD of logged Data					0.227
289												
290	**Assuming Lognormal Distribution**											
291					95% H-UCL	121.2	90% Chebyshev (MVUE) UCL					127.5
292					95% Chebyshev (MVUE) UCL	137.3	97.5% Chebyshev (MVUE) UCL					151.1
293					99% Chebyshev (MVUE) UCL	178						
294												
295	**Nonparametric Distribution Free UCL Statistics**											
296	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
297												
298	**Nonparametric Distribution Free UCLs**											
299					95% CLT UCL	117.3	95% Jackknife UCL					118.5
300					95% Standard Bootstrap UCL	116.7	95% Bootstrap-t UCL					119.8
301					95% Hall's Bootstrap UCL	119	95% Percentile Bootstrap UCL					117.4
302					95% BCA Bootstrap UCL	117.1						
303					90% Chebyshev(Mean, Sd) UCL	127	95% Chebyshev(Mean, Sd) UCL					136.6
304					97.5% Chebyshev(Mean, Sd) UCL	150	99% Chebyshev(Mean, Sd) UCL					176.3
305												
306	**Suggested UCL to Use**											
307					95% Student's-t UCL	118.5						
308												
309	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
310	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
311	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
312	For additional insight the user may want to consult a statistician.											
313												