On-Site Environmental, Inc.

Consulting Assessment Remediation

July 5, 2022 Sent Via email

Mr. Trifunovic
New Jersey Department of Environmental Protection (NJDEP)
Bureau of Environmental Evaluation and Risk Assessment (BEERA)
Mail Code 401-05W
P.O. Box 420
Trenton, New Jersey 08625

RE: North Brunswick Gulf - 95% ProUCL Component Review of Remedial Investigation Report (RIR)
1696 Georges Road/RT 130
North Brunswick, NJ
NJDEP PI #: 010180
NJDEP Case #: 01-08-301546-07

Dear Mr. Trifunovic:

The following comments respond to your Compliance Review of the above referenced report:

1. (p.57) 8.3 Compliance Averaging - The bullets at the end of this section should not have compared the calculated averages to the Residential Direct Contact Soil Remediation Standards (RDCSRS). This is a non-residential site and a deed notice will eventually be used to restrict the site to non-residential use. Therefore the calculated averages should have only been compared to the non-residential standards in the bullets in the RIR. Compliance to residential standards are not planned for this site.

2. (p57) 8.3 Compliance Averaging - Per your request attached is an alternative version of Figure 23, which shows which soil samples were included in the compliance averaging calculation for lead. Also attached is an updated Table that lists the samples used in the calculation. Note that the table submitted in the RIR inadvertently omitted sample F 24, which was used in the calculation for lead. The concentration of lead in that sample was 1,490 mg/kg.

3. (p. 57) 8.3 Compliance Averaging - An Order of Magnitude Evaluation will be conducted and presented in the next remedial phase document report.

4. (e-page 1056) Appendix Q Compliance Averaging - I determined the reason why there is a discrepancy between the calculated averages BEERA calculated and the ones On-Site Environmental, Inc. calculated. The reason why there is a difference for the average related to manganese and vanadium was because On-Site used version 5.0 verses version 5.1 of the software. For some unknown reason when you run the same samples in the two versions the software calculates different averages for the mean. Since version 5.1 is the newest version I concur with BEERA that the 95% UCL for manganese should be 2,223 mg/kg, which is compliant to the 2021 Non-Residential Ingestion/Dermal Soil Remediation Standard (NRIDSRS) of 31,000 mg/kg and the 95% UCL for vanadium should be 44.25 mg/kg, which is complaint to the 2021 NRIDSRS of 6,500 mg/kg. Updated software printouts using version 5.1 are attached along with Tables that list the samples used in the calculations.

The reason for the discrepancy in the calculated averavere for lead is twofold. Fist the table that listed the samples used in the calculation inadvertently omitted sample F 24, which had a concentration of 1,490 mg/kg. The second reason was because version 5.0 was used as mentioned above. An updated 95% UCL printout for lead is attached along with a table that list the samples used in the calculation. The 95% UCL for lead using version 5.1 and the F 24 sample is 353.9 mg/kg, which is complaint to the 2021 Non-Residential Ingestion/Dermal Soil Remediation Standard of 800 mg/kg.

Also please note that the input data in the original table provided in the RIR listed sample P 16 with a concentration of 1.49 m/kg, which was not a typographical error. The error was in the input data table, which inadvertently omitted sample F24, which had a concentration of 1,490 mg/kg as mentioned above.

If you have any questions please feel free to contact me.

Sincerely,
On-Site Environmental, Inc.

Frank Jasiulewicz, PG, SSE, LSRP
President

Cc: Judy Lapp
Ruth Frey
Tracey Chierepko: Resolute Management
Jennifer L. Galoski: Resolute Management

2001 - 2009 Samples

Sample ID	Concentration (mg/kg)	Depth (ft)
Test pit 1	72	2'
	5	8'
Test pit 2	34	2'
	8	7'
TB 1	21.2	8-9'
TB 2	7.4	6-7'
TB 3	66	3-4'
TB 4	12.9	13-14'
TB 5	15.7	2-2½' dug out
TB 6	6.3	10-11'
TB 7	13	4-5'
TB 7	7	10-11'
TB 8	675	3-4' dug to 3'
N 1	13	8-9½'
N 2	14	8-9'
N 3	29	4-5'
N 4	7	10-12'
N 5	6	4-5'
N 6	9	8-9'
N 7	2	8-9'
N 8	9	8-9½'
N 9	3	11-12'
N 10	2	8-10'
N 11	<1	10-12'
N 12	3	6-8'
N 13	8	9-10'
N 14	19	8-9'
N 15	7	2-3'
N 16	10	4-7'
F 17	6.97	4-5'
F 17	7.19	13-14'
F 18	2.87	10-11'
F 19	1.34	10-12'
F 20	11.1	5-6'
F 20	3.97	10-11'
F 23	5.83	9-10'
F 23	16.8	13-14'
F 24	1,490	3-4'
	5.42	9-10'

2018 Samples Analyzed for Lead

Sample ID	Concentration (mg/kg)	Depth (ft)
P 77	19.2	0-0.5'
P 77	9.7	1.5-2'
P 82	40.4	0-0.5'
P 82	22	1.5-2'
P 82	16.9	5.5-6'
P 85	24.7	0-0.5'
P 85	18.6	1.5-2'
P 85	<7	3.4-4'
P 86	25.7	0-0.5'
P 86	3.7	1.5-2'
P 87	147	6-6.5'
P 89	8.2	3.5-4'
P 90	15.4	3.5-4'
P 90	10.7	5.5-6'
P 90	5.3	10-10.5'
P 92	16.7	0-0.5'
P 92	5.5	1.5-2'
P 92	15.4	6-6.5'
P 93	85.8	1'
P 93	209	2.5-3'
P 95	<6.5	0.5-1'
P 95	9.8	5.5-6'
P 99	17.5	Storm Drain
P 100	20.1	Storm Drain
P 102	108	0-0.5'
P 102	69.2	1-2'
P 102	9	5-6'
P 103	37.4	0-0.5'
P 103	28.4	1-2'
P 106	57.3	0-0.5'
P 106	6.3	1.5-2'
P 108	61.9	0-0.5'
P 110	233	0-0.5'
P 110	94	0.5-1'
P 111	193	0-0.5'
P 111	152	0.5-1'
P 112	84.4	0-0.5'
P 112	11	0.5-1'
P 113	57.2	0-0.5'
P 113	18.5	0.5-1'

2017 Samples Analyzed for Lead

Sample ID	Concentration (mg/kg)	Depth (ft)
P 8	6.8	6'
P 8	10.5	12'
P 10	241	0-1'
P 10	190	3'
P 12	50.9	0-6"
P 12	25.5	5'
P 12	9.5	6.5'
P 13	14.6	0-6"
P 13	529	4'
P 13	49.9	6'
P 14	7.8	0-6"
P 14	55	5'
P 15	112	0-6"
P 15	11.2	5'
P 16	6.2	0-6"
P 16	14.9	4'
P 17	27	4'
P 17	11.7	9'
P 20	16.2	5'
P 22	54.4	0-6"
P 25	13.6	5-5.5'
P 26	220	3.5'
P 27	7.7	3.5'
P 28	39.3	3.5'
P 29	46.3	3.5'
P 30	11.5	6.5-7'
P 30	8	8'
P 30	36.8	17-18'
P 30	18.9	21'
P 31	20.3	6.5'
P 31	10.7	9'
P 32	5.7	4.5'
P 32	2.5	15'
P 33	10.8	4.5'
P 33	32	15'
P 34	15.1	16'
P 35	8.1	5.5-6'
P 35	5.8	7-7.5'
P 36	9.6	6'
P 36	8.9	12'
P 37	8.6	3'
P 37	3	7'
P 38	11.3	3'
P 38	14.2	8'
P 38	13.7	13'
P 38	19.8	18'
P 39	2.3	15'
P 40	8.9	6'
p 40	5.5	15
P 41	15.7	5'
P 41	9.3	10'
P 42	10.7	6'
P 42	5.2	8'
P 43	37.7	1'
P 43	19.6	2'
P 43	8.8	6'
P 44	78.6	3'
P 44	6.6	7-7.5'
P 45	23.3	5.5-6'
P 45	12.3	12-12.5'
P 46	12.9	6-6.5'
P 54	45.4	0-0.5'
P 54	68.6	0.5-1'
P 55	56.8	0-4"
P 58	343	0-0.5'
P 58	9	6-6.5'
P 59	44.1	0-0.5'
P 59	337	1.5-2'
P 59	469	4.5-5'
P 61	79.9	0-0.5'
P 61	88.7	1.5-2'
P 62	13.7	0-0.5'
P 65	165	1'
P 65	13.9	3.5'
P 65	20.6	6.5'
P 66	33.8	0-0.5'
P 66	226	1.5-2'
P 66	9	6-6.5'
P 67	35.6	0-0.5'
P 67	19.2	1.5-2'
P 68	15.7	0-0.5'
P 69	63.9	0.5-1'
P 69	99.4	1-1.5'
P 72	555	3.5-4'
P 73	13.2	3'
P 74	9.2	6-6.5'
P 76	31	0-1'
P 76	39.8	4-4.5'

2018 Samples Analyzed for Lead

Sample ID	Concentration (mg/kg)	Depth (ft)
P 114	104	0-0.5'
P 114	113	0.5-1'
P 114	8.8	6-6.5'
P 115	6.6	0-0.5'
P 115	37.2	0.5-1'
P 115	8.4	6-6.5'
P 116	34.1	0-0.5'
P 116	115	0.5-1'
P 117	52.1	0-0.5'
P 117	151	0.5-1'
P 118	15.7	0-0.5'
P 118	17.5	0.5-1'
P 119	40	0-0.5'
P 119	88.4	0.5-1'
P 119	64.2	1.5-2'
P 120	63.6	0-0.5'
P 120	51.4	0.5-1'
P 120	86.6	1.5-2'
MW 18	2.5	5-5.5'

Inferred extent of lead that exceeds residential direct contact standard of 400 mg/kg

Inferred extent of lead that exceeds non-residential direct contact standard of 800 mg/kg @ F24

Key

- Existing Groundwater Monitoring Well
- F24 ● Soil Boring Installed by RedHawk 2008 & 2009
- N12 ▲ Soil Boring Installed by RedHawk in 2001 & 2002
- ◑ UST Closure Sample 2002
- Soil Boring Installed by On-Site in April & May 2017
- Soil Boring Installed by On-Site in October 2017
- Soil Boring Installed by On-Site in February 2018
- Soil Boring Installed by On-Site in May 2018
- Soil boring installed by On-Site in September 2018
- (37.7) Lead concentration in 2017 & 2018 samples: mg/kg
- (66) Lead concentration in 2001/2009 samples: mg/kg/
- 400 400 ppm contour line
- Tree
- Extent of Excavation in 2001/2002
- HL Former hydraulic lift
- FD Former floor drain

Note: 1) Sample depths at TB 5, TB8, Test pit 4, and NW Corner were removed by excations in 2001/2002.
2) Concentrations shown are the highest value reported in a boring.
3) Lead residential direct contact standard is 400 mg/kg.
4) Lead non-residential direct contact standard is 800 mg/kg.

Sample used in Compliance Averaging

ON-SITE ENVIRONMENTAL
119 Stevenson Way • Gaithersville, PA 19320
Phone: (610) 384-2719 • Fax (610) 384-2709

Drawing #: File : Soillead2.drw compliance averaging
Date 12/2/18

Figure 23 A LEAD in Soil Used for Compliance Averaging

North Brunswick Gulf
1696 Georges Road RT 130
North Brunswick, New Jersey 08902

LEAD DIRECT CONTACT SAMPLES 2 feet and Deeper						
Contaminant	**Sample I.D.**	**Depth (ft bgs)**	**Vertical Zone 2 ft and Deeper**	**Functional Area**	**Concentration (mg/kg)**	**MDL (NDs only) (mg/kg)**
Lead	P 16	4'	subsurface	FA1 subsurface	14.9	
Lead	P 13	4'	subsurface	FA1 subsurface	529	
Lead	P 13	6'	subsurface	FA1 subsurface	49.9	
Lead	P 14	5'	subsurface	FA1 subsurface	55	
Lead	P 15	5'	subsurface	FA1 subsurface	11.2	
Lead	P 90	3.5-4'	subsurface	FA1 subsurface	15.4	
Lead	P 90	5.5-6'	subsurface	FA1 subsurface	10.7	
Lead	P 90	10-10.5'	subsurface	FA1 subsurface	5.3	
Lead	P 89	3.5-4'	subsurface	FA1 subsurface	8.2	
Lead	P 10	3'	subsurface	FA1 subsurface	190	
Lead	P 72	3.5-4'	subsurface	FA1 subsurface	555	
Lead	P 58	6-6.5'	subsurface	FA1 subsurface	9	
Lead	P 59	4.5-5'	subsurface	FA1 subsurface	469	
Lead	P 87	6-6.5'	subsurface	FA1 subsurface	147	
Lead	P 8	6'	subsurface	FA1 subsurface	6.8	
Lead	P 8	12'	subsurface	FA1 subsurface	10.5	
Lead	P 85	3.5-4'	subsurface	FA1 subsurface	ND	7
Lead	P 30	6.5-7'	subsurface	FA1 subsurface	11.5	
Lead	P 30	8'	subsurface	FA1 subsurface	8	
Lead	P 30	17-18'	subsurface	FA1 subsurface	36.8	
Lead	P 30	21'	subsurface	FA1 subsurface	18.9	
Lead	P 66	6-6.5'	subsurface	FA1 subsurface	9	
Lead	P 41	5'	subsurface	FA1 subsurface	15.7	
Lead	P 41	10'	subsurface	FA1 subsurface	9.3	
Lead	P 42	6'	subsurface	FA1 subsurface	10.7	
Lead	P 42	8'	subsurface	FA1 subsurface	5.2	
Lead	P 92	6-6.5'	subsurface	FA1 subsurface	15.4	
Lead	P 17	4'	subsurface	FA1 subsurface	27	
Lead	P 17	9'	subsurface	FA1 subsurface	11.7	
Lead	P 95	5.5-6'	subsurface	FA1 subsurface	9.8	
Lead	**F 24**	**3-4'**	**subsurface**	**FA1 subsurface**	**1490**	

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.16/30/2022 4:33:21 PM
From File	manganese 0 to 2ft DC worksheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

manganese 0to2ft DC

General Statistics

Total Number of Observations	35	Number of Distinct Observations	35
Number of Detects	34	Number of Non-Detects	1
Number of Distinct Detects	34	Number of Distinct Non-Detects	1
Minimum Detect	16.6	Minimum Non-Detect	570
Maximum Detect	12500	Maximum Non-Detect	570
Variance Detects	4534924	Percent Non-Detects	2.857%
Mean Detects	689.7	SD Detects	2130
Median Detects	237	CV Detects	3.088
Skewness Detects	5.486	Kurtosis Detects	31.11
Mean of Logged Detects	5.153	SD of Logged Detects	1.555

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.306	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.39	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	675.4	KM Standard Error of Mean	355.1
KM SD	2070	95% KM (BCA) UCL	1345
95% KM (t) UCL	1276	95% KM (Percentile Bootstrap) UCL	1367
95% KM (z) UCL	1260	95% KM Bootstrap t UCL	3835
90% KM Chebyshev UCL	1741	95% KM Chebyshev UCL	2223
97.5% KM Chebyshev UCL	2893	99% KM Chebyshev UCL	4209

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.046	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.819	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.209	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.16	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.465	k star (bias corrected MLE)	0.443
Theta hat (MLE)	1485	Theta star (bias corrected MLE)	1556
nu hat (MLE)	31.59	nu star (bias corrected)	30.14
Mean (detects)	689.7		

52	**Gamma ROS Statistics using Imputed Non-Detects**											
53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
56	This is especially true when the sample size is small.											
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
58				Minimum	0.01			Mean	670			
59				Maximum	12500			Median	232			
60				SD	2101			CV	3.136			
61				k hat (MLE)	0.403			k star (bias corrected MLE)	0.387			
62				Theta hat (MLE)	1664			Theta star (bias corrected MLE)	1731			
63				nu hat (MLE)	28.18			nu star (bias corrected)	27.1			
64				Adjusted Level of Significance (β)	0.0425							
65				Approximate Chi Square Value (27.10, α)	16.23			Adjusted Chi Square Value (27.10, β)	15.83			
66				95% Gamma Approximate UCL (use when n>=50)	1119			95% Gamma Adjusted UCL (use when n<50)	1147			
67												
68	**Estimates of Gamma Parameters using KM Estimates**											
69				Mean (KM)	675.4			SD (KM)	2070			
70				Variance (KM)	4283521			SE of Mean (KM)	355.1			
71				k hat (KM)	0.106			k star (KM)	0.116			
72				nu hat (KM)	7.454			nu star (KM)	8.149			
73				theta hat (KM)	6342			theta star (KM)	5802			
74				80% gamma percentile (KM)	571.9			90% gamma percentile (KM)	1897			
75				95% gamma percentile (KM)	3868			99% gamma percentile (KM)	9931			
76												
77	**Gamma Kaplan-Meier (KM) Statistics**											
78				Approximate Chi Square Value (8.15, α)	2.821			Adjusted Chi Square Value (8.15, β)	2.674			
79				95% Gamma Approximate KM-UCL (use when n>=50)	1951			95% Gamma Adjusted KM-UCL (use when n<50)	2058			
80												
81	**Lognormal GOF Test on Detected Observations Only**											
82				Shapiro Wilk Test Statistic	0.949			**Shapiro Wilk GOF Test**				
83				5% Shapiro Wilk Critical Value	0.933			Detected Data appear Lognormal at 5% Significance Level				
84				Lilliefors Test Statistic	0.104			**Lilliefors GOF Test**				
85				5% Lilliefors Critical Value	0.15			Detected Data appear Lognormal at 5% Significance Level				
86	**Detected Data appear Lognormal at 5% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89				Mean in Original Scale	673.4			Mean in Log Scale	5.143			
90				SD in Original Scale	2100			SD in Log Scale	1.534			
91				95% t UCL (assumes normality of ROS data)	1274			95% Percentile Bootstrap UCL	1337			
92				95% BCA Bootstrap UCL	1914			95% Bootstrap t UCL	3976			
93				95% H-UCL (Log ROS)	1281							
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96				KM Mean (logged)	5.14			KM Geo Mean	170.7			
97				KM SD (logged)	1.525			95% Critical H Value (KM-Log)	3.169			
98				KM Standard Error of Mean (logged)	0.264			95% H-UCL (KM -Log)	1251			
99				KM SD (logged)	1.525			95% Critical H Value (KM-Log)	3.169			
100				KM Standard Error of Mean (logged)	0.264							
101												
102	**DL/2 Statistics**											

	A	B	C	D	E	F	G	H	I	J	K	L
103	**DL/2 Normal**						**DL/2 Log-Transformed**					
104					Mean in Original Scale	678.2					Mean in Log Scale	5.168
105					SD in Original Scale	2099					SD in Log Scale	1.535
106					95% t UCL (Assumes normality)	1278					95% H-Stat UCL	1316
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Detected Data appear Lognormal Distributed at 5% Significance Level**											
111												
112	**Suggested UCL to Use**											
113					95% KM (Chebyshev) UCL	2223						
114												
115	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
116	Recommendations are based upon data size, data distribution, and skewness.											
117	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
118	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

MANGANESE DIRECT CONTACT SAMPLES 0 TO 2 feet						
Contaminant	Sample I.D	Depth (ft bgs)	Vertical Zone 0 to 2 ft	Functional Area	Concentration (mg/kg)	MDL (NDs only) (mg/kg)
Manganese	P 10	0 - 1	Surface	FA1 Surface	393	
Manganese	P 22	0 - 0.5	Surface	FA1 Surface	242	
Manganese	P 54	0 - 0.5	Surface	FA1 Surface	90.1	
Manganese	P 54	0.5 - 1	Surface	FA1 Surface	162	
Manganese	P 55	0 - 0.33	Surface	FA1 Surface	168	
Manganese	P 59	0 - 0.5	Surface	FA1 Surface	351	
Manganese	P 59	1.5 - 2	Surface	FA1 Surface	372	
Manganese	P 61	0 - 0.5	Surface	FA1 Surface	277	
Manganese	P 61	1.5 - 2	Surface	FA1 Surface	17.6	
Manganese	P 66	0 - 0.5	Surface	FA1 Surface	381	
Manganese	P 66	1.5 - 2	Surface	FA1 Surface	1380	
Manganese	P 68	0 - 0.5	Surface	FA1 Surface	415	
Manganese	P 68	1.5 - 2	Surface	FA1 Surface	31.9	
Manganese	P 69	0.5 - 1	Surface	FA1 Surface	508	
Manganese	P 69	1 - 1.5	Surface	FA1 Surface	650	
Manganese	P 80	0 - 0.5	Surface	FA1 Surface	29.8	
Manganese	P 82	0 - 0.5	Surface	FA1 Surface	55.6	
Manganese	P 82	1.5 - 2	Surface	FA1 Surface	16.6	
Manganese	P 85	0 - 0.5	Surface	FA1 Surface	2040	
Manganese	P 85	1.5 - 2	Surface	FA1 Surface	56.9	
Manganese	P 92	0 - 0.5	Surface	FA1 Surface	12500	
Manganese	P 92	1.5 - 2	Surface	FA1 Surface	ND	570
Manganese	P 102	0 - 0.5	Surface	FA1 Surface	319	
Manganese	P 102	1 - 2	Surface	FA1 Surface	980	
Manganese	P 103	0 - 0.5	Surface	FA1 Surface	392	
Manganese	P 103	1 - 2	Surface	FA1 Surface	438	
Manganese	P 106	0 - 0.5	Surface	FA1 Surface	35	
Manganese	P 106	1.5 - 2	Surface	FA1 Surface	18.4	
Manganese	P 108	1 - 1.5	Surface	FA1 Surface	17.5	
Manganese	P 119	0 - 0.5	Surface	FA1 Surface	32.8	
Manganese	P 119	0.5 - 1	Surface	FA1 Surface	55.5	
Manganese	P 119	1.5 - 2	Surface	FA1 Surface	61.4	
Manganese	P 120	0 - 0.5	Surface	FA1 Surface	641	
Manganese	P 120	0.5 - 1	Surface	FA1 Surface	232	
Manganese	P 120	1.5 - 2	Surface	FA1 Surface	90.6	

UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.16/30/2022 4:28:13 PM
From File	vanadium 0 to 2ft DC worksheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

vanadium 0to2ft DC

General Statistics

Total Number of Observations	33	Number of Distinct Observations	33
		Number of Missing Observations	0
Minimum	11.8	Mean	37.82
Maximum	80	Median	35
SD	18.9	Std. Error of Mean	3.29
Coefficient of Variation	0.5	Skewness	0.83

Normal GOF Test

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	43.4	95% Adjusted-CLT UCL (Chen-1995)	43.74
		95% Modified-t UCL (Johnson-1978)	43.48

Gamma GOF Test

A-D Test Statistic	0.467	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.134	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.154	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.39	k star (bias corrected MLE)	4.011
Theta hat (MLE)	8.616	Theta star (bias corrected MLE)	9.429
nu hat (MLE)	289.8	nu star (bias corrected)	264.7
MLE Mean (bias corrected)	37.82	MLE Sd (bias corrected)	18.89
		Approximate Chi Square Value (0.05)	228.1
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	226.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	43.91	95% Adjusted Gamma UCL (use when n<50)	44.25

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.114	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.468	Mean of logged Data	3.515
Maximum of Logged Data	4.382	SD of logged Data	0.496

Assuming Lognormal Distribution

95% H-UCL	45.03	90% Chebyshev (MVUE) UCL	48.1
95% Chebyshev (MVUE) UCL	52.74	97.5% Chebyshev (MVUE) UCL	59.18
99% Chebyshev (MVUE) UCL	71.83		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	43.24	95% Jackknife UCL	43.4
95% Standard Bootstrap UCL	43.19	95% Bootstrap-t UCL	44.28
95% Hall's Bootstrap UCL	43.79	95% Percentile Bootstrap UCL	43.3
95% BCA Bootstrap UCL	43.78		
90% Chebyshev(Mean, Sd) UCL	47.69	95% Chebyshev(Mean, Sd) UCL	52.16
97.5% Chebyshev(Mean, Sd) UCL	58.37	99% Chebyshev(Mean, Sd) UCL	70.56

Suggested UCL to Use

95% Adjusted Gamma UCL	44.25		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Vanadium DIRECT CONTACT SAMPLES 0 TO 2 feet						
Contaminant	**Sample I.D.**	**Depth (ft bgs)**	**Vertical Zone 0 to 2 ft**	**Functional Area**	**Concentration (mg/kg)**	**MDL (NDs only) (mg/kg)**
Vanadium	P 10	0 - 1	Surface	FA1 Surface	73.9	
Vanadium	P 22	0 - 0.5	Surface	FA1 Surface	26.3	
Vanadium	P 54	0 - 0.5	Surface	FA1 Surface	20.8	
Vanadium	P 54	0.5 - 1	Surface	FA1 Surface	30	
Vanadium	P 55	0 - 0.33	Surface	FA1 Surface	23.9	
Vanadium	P 59	0 - 0.5	Surface	FA1 Surface	53.2	
Vanadium	P 59	1.5 - 2	Surface	FA1 Surface	45.9	
Vanadium	P 61	0 - 0.5	Surface	FA1 Surface	59.8	
Vanadium	P 61	1.5 - 2	Surface	FA1 Surface	35	
Vanadium	P 66	0 - 0.5	Surface	FA1 Surface	66.8	
Vanadium	P 66	1.5 - 2	Surface	FA1 Surface	40.7	
Vanadium	P 68	0 - 0.5	Surface	FA1 Surface	74.7	
Vanadium	P 68	1.5 - 2	Surface	FA1 Surface	19.5	
Vanadium	P 69	0.5 - 1	Surface	FA1 Surface	39.2	
Vanadium	P 69	1 - 1.5	Surface	FA1 Surface	45.3	
Vanadium	P 82	0 - 0.5	Surface	FA1 Surface	35.8	
Vanadium	P 82	1.5 - 2	Surface	FA1 Surface	15.5	
Vanadium	P 85	0 - 0.5	Surface	FA1 Surface	36.2	
Vanadium	P 85	1.5 - 2	Surface	FA1 Surface	50.2	
Vanadium	P 92	0 - 0.5	Surface	FA1 Surface	80	
Vanadium	P 92	1.5 - 2	Surface	FA1 Surface	17.9	
Vanadium	P 102	0 - 0.5	Surface	FA1 Surface	42.2	
Vanadium	P 102	1 - 2	Surface	FA1 Surface	40.1	
Vanadium	P 103	0 - 0.5	Surface	FA1 Surface	69	
Vanadium	P 103	1 - 2	Surface	FA1 Surface	31.8	
Vanadium	P 106	0 - 0.5	Surface	FA1 Surface	22.4	
Vanadium	P 106	1.5 - 2	Surface	FA1 Surface	11.8	
Vanadium	P 119	0 - 0.5	Surface	FA1 Surface	19.4	
Vanadium	P 119	0.5 - 1	Surface	FA1 Surface	25.2	
Vanadium	P 119	1.5 - 2	Surface	FA1 Surface	23.7	
Vanadium	P 120	0 - 0.5	Surface	FA1 Surface	25.3	
Vanadium	P 120	0.5 - 1	Surface	FA1 Surface	24	
Vanadium	P 120	1.5 - 2	Surface	FA1 Surface	22.7	

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.17/5/2022 11:13:04 AM
From File	lead 2ft and deeper DC worksheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

lead 2ftanddeeper DC

General Statistics

Total Number of Observations	31	Number of Distinct Observations	28
Number of Detects	30	Number of Non-Detects	1
Number of Distinct Detects	27	Number of Distinct Non-Detects	1
Minimum Detect	5.2	Minimum Non-Detect	7
Maximum Detect	1490	Maximum Non-Detect	7
Variance Detects	90452	Percent Non-Detects	3.226%
Mean Detects	125.5	SD Detects	300.8
Median Detects	13.3	CV Detects	2.396
Skewness Detects	3.658	Kurtosis Detects	15.04
Mean of Logged Detects	3.257	SD of Logged Detects	1.562

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.458	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.927	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.393	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.159	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	121.7	KM Standard Error of Mean	53.28
KM SD	291.7	95% KM (BCA) UCL	219.5
95% KM (t) UCL	212.1	95% KM (Percentile Bootstrap) UCL	213
95% KM (z) UCL	209.3	95% KM Bootstrap t UCL	328.1
90% KM Chebyshev UCL	281.5	95% KM Chebyshev UCL	353.9
97.5% KM Chebyshev UCL	454.4	99% KM Chebyshev UCL	651.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	4.108	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.828	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.316	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.171	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.415	k star (bias corrected MLE)	0.396
Theta hat (MLE)	302.4	Theta star (bias corrected MLE)	317.2
nu hat (MLE)	24.91	nu star (bias corrected)	23.75
Mean (detects)	125.5		

52	**Gamma ROS Statistics using Imputed Non-Detects**											
53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
56	This is especially true when the sample size is small.											
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
58				Minimum	0.01			Mean	121.5			
59				Maximum	1490			Median	11.7			
60				SD	296.6			CV	2.441			
61				k hat (MLE)	0.371			k star (bias corrected MLE)	0.356			
62				Theta hat (MLE)	327.6			Theta star (bias corrected MLE)	340.9			
63				nu hat (MLE)	22.99			nu star (bias corrected)	22.1			
64				Adjusted Level of Significance (β)	0.0413							
65				Approximate Chi Square Value (22.10, α)	12.41			Adjusted Chi Square Value (22.10, β)	12.01			
66				95% Gamma Approximate UCL (use when n>=50)	216.3			95% Gamma Adjusted UCL (use when n<50)	223.6			
67												
68	**Estimates of Gamma Parameters using KM Estimates**											
69				Mean (KM)	121.7			SD (KM)	291.7			
70				Variance (KM)	85064			SE of Mean (KM)	53.28			
71				k hat (KM)	0.174			k star (KM)	0.179			
72				nu hat (KM)	10.79			nu star (KM)	11.08			
73				theta hat (KM)	699.2			theta star (KM)	680.9			
74				80% gamma percentile (KM)	150.3			90% gamma percentile (KM)	366.8			
75				95% gamma percentile (KM)	644.7			99% gamma percentile (KM)	1425			
76												
77	**Gamma Kaplan-Meier (KM) Statistics**											
78				Approximate Chi Square Value (11.08, α)	4.626			Adjusted Chi Square Value (11.08, β)	4.396			
79				95% Gamma Approximate KM-UCL (use when n>=50)	291.3			95% Gamma Adjusted KM-UCL (use when n<50)	306.6			
80												
81	**Lognormal GOF Test on Detected Observations Only**											
82				Shapiro Wilk Test Statistic	0.802			**Shapiro Wilk GOF Test**				
83				5% Shapiro Wilk Critical Value	0.927			Detected Data Not Lognormal at 5% Significance Level				
84				Lilliefors Test Statistic	0.26			**Lilliefors GOF Test**				
85				5% Lilliefors Critical Value	0.159			Detected Data Not Lognormal at 5% Significance Level				
86	**Detected Data Not Lognormal at 5% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89				Mean in Original Scale	121.6			Mean in Log Scale	3.179			
90				SD in Original Scale	296.5			SD in Log Scale	1.596			
91				95% t UCL (assumes normality of ROS data)	211.9			95% Percentile Bootstrap UCL	217.6			
92				95% BCA Bootstrap UCL	258.3			95% Bootstrap t UCL	329.9			
93				95% H-UCL (Log ROS)	219							
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96				KM Mean (logged)	3.208			KM Geo Mean	24.73			
97				KM SD (logged)	1.535			95% Critical H Value (KM-Log)	3.126			
98				KM Standard Error of Mean (logged)	0.28			95% H-UCL (KM -Log)	192.8			
99				KM SD (logged)	1.535			95% Critical H Value (KM-Log)	3.126			
100				KM Standard Error of Mean (logged)	0.28							
101												
102	**DL/2 Statistics**											

	A	B	C	D	E	F	G	H	I	J	K	L
103	**DL/2 Normal**						**DL/2 Log-Transformed**					
104					Mean in Original Scale	121.6					Mean in Log Scale	3.192
105					SD in Original Scale	296.5					SD in Log Scale	1.578
106					95% t UCL (Assumes normality)	212					95% H-Stat UCL	211.6
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Data do not follow a Discernible Distribution at 5% Significance Level**											
111												
112	**Suggested UCL to Use**											
113					95% KM (Chebyshev) UCL	353.9						
114												
115	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
116	Recommendations are based upon data size, data distribution, and skewness.											
117	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
118	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											

LEAD DIRECT CONTACT SAMPLES 2 feet and Deeper						
Contaminant	**Sample I.D.**	**Depth (ft bgs)**	**Vertical Zone 2 ft and Deeper**	**Functional Area**	**Concentration (mg/kg)**	**MDL (NDs only) (mg/kg)**
Lead	P 16	4'	subsurface	FA1 subsurface	14.9	
Lead	P 13	4'	subsurface	FA1 subsurface	529	
Lead	P 13	6'	subsurface	FA1 subsurface	49.9	
Lead	P 14	5'	subsurface	FA1 subsurface	55	
Lead	P 15	5'	subsurface	FA1 subsurface	11.2	
Lead	P 90	3.5-4'	subsurface	FA1 subsurface	15.4	
Lead	P 90	5.5-6'	subsurface	FA1 subsurface	10.7	
Lead	P 90	10-10.5'	subsurface	FA1 subsurface	5.3	
Lead	P 89	3.5-4'	subsurface	FA1 subsurface	8.2	
Lead	P 10	3'	subsurface	FA1 subsurface	190	
Lead	P 72	3.5-4'	subsurface	FA1 subsurface	555	
Lead	P 58	6-6.5'	subsurface	FA1 subsurface	9	
Lead	P 59	4.5-5'	subsurface	FA1 subsurface	469	
Lead	P 87	6-6.5'	subsurface	FA1 subsurface	147	
Lead	P 8	6'	subsurface	FA1 subsurface	6.8	
Lead	P 8	12'	subsurface	FA1 subsurface	10.5	
Lead	P 85	3.5-4'	subsurface	FA1 subsurface	ND	7
Lead	P 30	6.5-7'	subsurface	FA1 subsurface	11.5	
Lead	P 30	8'	subsurface	FA1 subsurface	8	
Lead	P 30	17-18'	subsurface	FA1 subsurface	36.8	
Lead	P 30	21'	subsurface	FA1 subsurface	18.9	
Lead	P 66	6-6.5'	subsurface	FA1 subsurface	9	
Lead	P 41	5'	subsurface	FA1 subsurface	15.7	
Lead	P 41	10'	subsurface	FA1 subsurface	9.3	
Lead	P 42	6'	subsurface	FA1 subsurface	10.7	
Lead	P 42	8'	subsurface	FA1 subsurface	5.2	
Lead	P 92	6-6.5'	subsurface	FA1 subsurface	15.4	
Lead	P 17	4'	subsurface	FA1 subsurface	27	
Lead	P 17	9'	subsurface	FA1 subsurface	11.7	
Lead	P 95	5.5-6'	subsurface	FA1 subsurface	9.8	
Lead	**F 24**	**3-4'**	**subsurface**	**FA1 subsurface**	**1490**	