ALTERNATE SOURCE DEMONSTRATION
2nd Semi-annual 2014 Event
Macon County MSW Landfill, Permit No. 57-03
Macon County, North Carolina

Prepared for:

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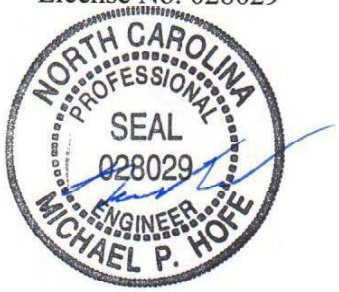

Date: 1-19-2015

1.0 EXCEEDANCE DESCRIPTION

REI Consultants of North Carolina, PLLC (REIC of NC), on behalf of Macon County, is submitting this Alternate Source Demonstration (ASD) for the Macon County Municipal Solid Waste Landfill, Permit No. 57-03 (MSW Landfill), pursuant to North Carolina waste management regulations 15 NCAC 13B .1633, due to exceedances of North Carolina groundwater protection standards for metals during the 2nd semi-annual monitoring period of 2014. North Carolina groundwater protection standards include both groundwater standards and interim maximum allowable concentrations (IMACs) given in 15A NCAC 2L .0202, effective April 1, 2013. The following metals exceeded groundwater protection standards in the indicated wells:

Parameter	Monitoring Well
Barium	MW-22
Chromium	MW-1D, MW-17, MW-19, MW-22
Cobalt	MW-1A, MW-1D, MW-2, MW-5D, MW-17, MW-19, MW-21, MW-22
Lead	MW-19
Vanadium	MW-1D, MW-19, MW-22

2.0 DATA EVALUATION

Statistical analysis of background data from upgradient wells at the facility indicates that all of the above exceedances are lower than background statistical limits with the exception of barium, chromium, cobalt, and vanadium in well MW-22. Statistical analysis of groundwater data was conducted by constructing prediction limits from available upgradient background data. Data from upgradient wells MW-10, MW-17, and MW-18 were pooled and utilized for comparison to data from compliance wells associated with the MSW Landfill. The pooled upgradient data provides a characterization of spatial variability. The statistical analysis was conducted in general accordance with the guidelines of "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance" (U.S. EPA Office of Resource Conservation and Recovery, March 2009). Prediction intervals were constructed as follows. For constituents where more than 15 but less than 50 percent of the data were below

laboratory practical quantitation limits (PQLs)/Solid Waste Section Limits (SWSLs), data was tested for normality or log-normality using the Shapiro-Wilk test. For constituents where 50 percent or more of the data were below PQLs/SWSLs or where transformation failed to bring about normality, a non-parametric prediction limit was constructed using the maximum historical background measurement. The statistical analysis is included in this report. The following table summarizes, for those wells and parameters for which groundwater protection standards were exceeded during the 2nd semiannual 2014 event, the sample results above groundwater protection standards, the applicable groundwater protection standards, and background statistical limits:

	SWSL	*GPS*	*UPL*	MW-1A	MW-1D	MW-2	MW-5D	MW-17	MW-19	MW-21	MW-22
Barium	0.100	0.7	1.24	-	-	-	-	-	-	-	**2.17**
Chromium	0.010	0.010	0.140	-	0.0103	-	-	0.0103	0.0225	-	**0.156**
Cobalt	0.010	0.001	0.056	0.0162	0.0118	0.0294	0.0133	0.0138	0.0131	0.0101	**0.110**
Lead	0.010	0.015	0.044	-	-	-	-	-	0.0352	-	-
Vanadium	0.025	0.0003	0.180	-	0.0257	-	-	-	0.0438	-	**0.315**

Notes:

All values in mg/L
SWSL – Solid Waste Section Limit
GPS – 15A NCAC 2L .0202 groundwater protection standard
UPL – upper prediction limit
"-" – not quantified above GPS
Bold – exceeds statistical background

Note that of the above results, only the metals elevations in well MW-22 exceeded the statistical background limits. However, appreciable suspended solids were present in the sample collected from well MW-22. In addition, analysis of the sample for dissolved metals yielded no detections above SWSLs of barium, chromium, cobalt, and vanadium. Due to the presence of solids in the sample and the lack of elevated dissolved metals, it is likely that the total metals elevations were the result of naturally occurring material associated with sediments in well MW-22.

All other exceedances of the groundwater standards were below background statistical limits. This indicates that the metals exceedances in wells MW-1A, MW-1D, MW-2, MW-5D, MW-15, MW-17, MW-19, and MW-21 are due to natural variation, as chromium, cobalt, lead, and vanadium have been observed in the upgradient background wells at the facility at higher levels than those exhibited in compliance wells.

3.0 CONCLUSIONS

It is the professional opinion of REIC of NC that the groundwater protection standard exceedances of chromium in wells MW-1D, MW-17, and MW-19; cobalt in wells MW-1A, MW-1D, MW-2, MW-5D, MW-17, MW-19, and MW-21; lead in well MW-19; and vanadium in wells MW-1D and MW-19 were not the result of a release from the landfill, but rather are due to natural variation. This conclusion is based upon the available data collected from background and compliance wells at the facility, and application of statistical procedures to compare data upgradient and downgradient of the waste areas. Chromium, cobalt, lead, and vanadium have been observed in samples collected from background wells at the facility, which indicates that these metals are present naturally in areas of the facility upgradient of waste units. In addition, the statistical limits derived from upgradient data are considerably higher than concentrations of chromium, cobalt, lead, and vanadium observed during the 2nd semiannual 2014 monitoring event. Since chromium, cobalt, lead, and vanadium in the affected wells do not exceed background, the presence of the metals is attributed to natural variation.

In addition, it is the professional opinion of REIC of NC that the groundwater protection standard exceedances of barium, chromium, cobalt, and vanadium in well MW-22 were not the result of a release from the landfill, but rather are due to excessive suspended solids in the sample collected from this well. This conclusion is based upon that fact that appreciable suspended solids were present in the samples, and analysis of the samples for dissolved metals yielded no detections above SWSLs of barium, chromium, cobalt, and vanadium. Due to the presence of solids in the sample and the lack of elevated dissolved metals, it is likely that the total metals elevations were the result of naturally occurring material associated with sediments in well MW-22.

MSW Landfill

Well	Date	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Selenium	Vanadium	Zinc
MW-10	Oct-99	0.0050	0.673	0.001	0.0005	0.040	0.005	0.100	0.005	0.010	0.070	0.120
MW-10	Apr-00	0.0050	0.652	0.001	0.0005	0.031	0.005	0.100	0.005	0.010	0.055	0.086
MW-10	Oct-00	0.018	0.750	0.001	0.0005	0.026	0.016	0.100	0.005	0.010	0.020	0.064
MW-10	Apr-01	0.0050	0.790	0.001	0.0005	0.024	0.015	0.100	0.011	0.010	0.020	0.025
MW-10	Oct-01	0.0050	0.570	0.001	0.0005	0.005	0.011	0.100	0.022	0.010	0.020	0.025
MW-10	Apr-03	0.0050	1.30	0.001	0.0005	0.100	0.042	0.100	0.029	0.010	0.020	0.26
MW-10	Oct-03	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-10	Apr-04	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-17	Oct-99	0.0050	0.250	0.001	0.0005	0.017	0.005	0.100	0.005	0.010	0.020	0.065
MW-17	Apr-00	0.0050	0.250	0.001	0.0005	0.025	0.005	0.100	0.005	0.010	0.020	0.061
MW-17	Oct-00	0.0050	0.250	0.001	0.0005	0.011	0.005	0.100	0.005	0.010	0.020	0.025
MW-17	Apr-01	0.0050	0.250	0.001	0.0005	0.025	0.005	0.100	0.018	0.010	0.020	0.071
MW-17	Oct-01	0.0050	0.250	0.001	0.0005	0.031	0.018	0.100	0.020	0.010	0.020	0.140
MW-17	Apr-03	0.0050	0.670	0.001	0.0005	0.140	0.056	0.100	0.044	0.010	0.180	0.260
MW-17	Oct-03	0.0050	0.250	0.001	0.0005	0.005	0.011	0.100	0.005	0.010	0.020	0.025
MW-17	Apr-04	0.0050	0.250	0.001	0.0039	0.065	0.026	0.100	0.024	0.010	0.020	0.100
MW-18	Oct-99	0.0050	0.250	0.001	0.0005	0.013	0.005	0.100	0.005	0.010	0.020	0.050
MW-18	Apr-00	0.0050	0.250	0.001	0.0005	0.005	0.022	0.100	0.005	0.010	0.020	0.025
MW-18	Oct-00	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-18	Apr-01	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.071
MW-18	Oct-01	0.0050	0.250	0.001	0.0005	0.005	0.005		0.014	0.010	0.020	0.025
MW-18	Apr-03	0.0050	0.250	0.001	0.0005	0.011	0.005	0.100	0.005	0.010	0.020	0.025
MW-18	Oct-03	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-18	Apr-04	0.0050	0.620	0.001	0.0018	0.048	0.014	0.100	0.016	0.010	0.057	0.082
MW-10	Dec-04	0.0050	0.766	0.001	0.0005	0.005	0.0118	0.100	0.005	0.010	0.020	0.025
MW-17	Dec-04	0.0050	0.250	0.001	0.0005	0.0286	0.0133	0.100	0.0122	0.010	0.020	0.0848
MW-18	Dec-04	0.0050	0.250	0.001	0.0005	0.0190	0.005	0.100	0.005	0.010	0.020	0.025
MW-10	Apr-05	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-17	Apr-05	0.0050	0.250	0.001	0.0005	0.0230	0.0125	0.100	0.005	0.010	0.020	0.0556
MW-18	Apr-05	0.0050	0.250	0.001	0.0005	0.0147	0.005	0.100	0.005	0.010	0.020	0.025
MW-10	Oct-05	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-17	Oct-05	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-18	Oct-05	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-10	Apr-06	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-17	Apr-06	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-18	Apr-06	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-10	Oct-06	0.0050	0.250	0.001	0.0005	0.005	0.005	0.100	0.005	0.010	0.020	0.025
MW-17	Oct-06	0.0050	0.250	0.001	0.0005	0.0103	0.0102	0.100	0.005	0.010	0.020	0.0529
MW-18	Oct-06	0.0050	0.250	0.001	0.0005	0.0139	0.005	0.100	0.005	0.010	0.020	0.0681
MW-10	Apr-07	0.0050	0.248	0.0005	0.0005	0.0050	0.005	0.005	0.005	0.005	0.010	0.0110
MW-17	Apr-07	0.0050	0.217	0.0005	0.0005	0.0050	0.0155	0.0121	0.005	0.005	0.010	0.0540
MW-18	Apr-07	0.0050	0.213	0.0005	0.0005	0.0050	0.005	0.005	0.005	0.005	0.010	0.0246
MW-10	Oct-07	0.0050	0.226	0.0005	0.0005	0.0050	0.005	0.005	0.005	0.005	0.010	0.005
MW-17	Oct-07	0.0050	0.125	0.0005	0.0005	0.0050	0.005	0.005	0.005	0.005	0.010	0.0230
MW-18	Oct-07	0.0050	0.146	0.0005	0.0005	0.0050	0.005	0.005	0.005	0.005	0.010	0.0294
MW-10	Apr-08	0.0050	0.235	0.0005	0.0005	0.0050	0.005	0.005	0.005	0.005	0.010	0.005
MW-17	Apr-08	0.0050	0.152	0.0005	0.0005	0.0050	0.005	0.005	0.005	0.005	0.010	0.0241
MW-18	Apr-08	0.0050	0.133	0.0005	0.0005	0.0050	0.005	0.005	0.005	0.005	0.010	0.005
MW-10	Oct-08	0.0050	0.369	0.0005	0.0005	0.0103	0.005	0.005	0.005	0.005	0.010	0.0315
MW-17	Oct-08	0.0050	0.220	0.0005	0.0005	0.0133	0.0131	0.0147	0.005	0.005	0.010	0.0654
MW-18	Oct-08	0.0050	0.237	0.0005	0.0005	0.0111	0.005	0.005	0.005	0.005	0.010	0.0278
MW-10	Apr-09	0.0050	0.315	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0173
MW-17	Apr-09	0.0050	0.105	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0285
MW-18	Apr-09	0.0050	0.175	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0130
MW-10	Oct-09	0.0050	0.254	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.005
MW-17	Oct-09	0.0050	0.112	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0242
MW-18	Oct-09	0.0050	0.177	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0152
MW-10	Apr-10	0.0050	0.408	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0145
MW-17	Apr-10	0.0050	0.114	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0299
MW-18	Apr-10	0.0050	0.115	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0118
MW-10	Oct-10	0.0050	0.840	0.0005	0.0005	0.0250	0.0112	0.0163	0.005	0.0101	0.0359	0.106
MW-17	Oct-10	0.0050	0.170	0.0005	0.0005	0.005	0.0119	0.0109	0.005	0.005	0.0125	0.0463
MW-18	Oct-10	0.0050	0.366	0.0005	0.0005	0.0212	0.005	0.005	0.005	0.005	0.0125	0.0453
MW-10	Apr-11	0.0050	1.51	0.0013	0.0005	0.0422	0.0248	0.0253	0.0164	0.0254	0.0721	0.165
MW-17	Apr-11	0.0050	0.218	0.0005	0.0005	0.0130	0.0116	0.0129	0.005	0.005	0.010	0.0578
MW-18	Apr-11	0.0050	0.183	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0165
MW-10	Oct-11	0.0050	0.434	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0124
MW-17	Oct-11	0.0050	0.116	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0309
MW-18	Oct-11	0.0050	0.050	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0104
MW-10	Apr-12	0.0050	0.394	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0309
MW-17	Apr-12	0.0050	0.120	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0334
MW-18	Apr-12	0.0050	0.110	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.005
MW-10	Oct-12	0.0050	0.308	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0250
MW-17	Oct-12	0.0050	0.151	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0362
MW-18	Oct-12	0.0050	0.110	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0133
MW-10	Apr-13	0.0050	0.407	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0387
MW-17	Apr-13	0.0050	0.151	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0444
MW-18	Apr-13	0.0050	0.115	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0319
MW-10	Oct-13	0.0050	0.197	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.005
MW-17	Oct-13	0.0050	0.105	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0386
MW-18	Oct-13	0.0050	0.050	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0266
MW-10	Apr-14	0.0050	0.216	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0109
MW-17	Apr-14	0.0050	0.175	0.0005	0.0005	0.005	0.0120	0.0131	0.005	0.005	0.010	0.0491
MW-18	Apr-14	0.0050	0.050	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0143
MW-10	Oct-14	0.0050	0.184	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.005
MW-17	Oct-14	0.0050	0.193	0.0005	0.0005	0.0103	0.0138	0.0144	0.005	0.005	0.010	0.0499
MW-18	Oct-14	0.0050	0.124	0.0005	0.0005	0.005	0.005	0.005	0.005	0.005	0.010	0.0149

PQL	0.010	0.500	0.002	0.001	0.010	0.010	0.200	0.010	0.020	0.040	0.050
SWSL	0.010	0.100	0.001	0.001	0.010	0.010	0.010	0.010	0.010	0.020	0.010
# Obs.	87	87	87	87	87	87	86	87	87	87	87
# NDs	86	33	86	85	58	65	78	76	85	58	29
% NDs	99%	38%	99%	98%	67%	75%	91%	87%	98%	67%	33%
Method	Nonpara-metric	Para-metric	Nonpara-metric	Nonpara-metric	Nonpara-metric	Nonpara-metric	Nonpara-metric	Nonpara-metric	Nonpara-metric	Nonpara-metric	Para-metric
Limit	0.018	1.24	0.0013	0.0039	0.140	0.056	0.0253	0.044	0.0254	0.180	0.266

87 available background measurements
12 compliance wells
13 constituents for which statistical comparisons are made (COCs):

1,4-Dichlorobenzene
Arsenic
Barium
Beryllium
Cadmium
Chlorobenzene
Chromium
Cobalt
Copper
Lead
Selenium
Vanadium
Zinc

From Table 19-1, EPA Unified Guidance:

#COCs	ln(#COCs)	κ
1	0	1.55
2	0.693147	1.73
5	1.609438	1.96
10	2.302585	2.12
13	2.564949	**2.18**
20	2.995732	2.27
40	3.688879	2.42

Barium (excluding data points censored at 0.5)

1	0.05	0.0175	-2.107	-0.1054	4.4409
2	0.05	0.0351	-1.811	-0.0905	3.2789
3	0.105	0.0526	-1.620	-0.1701	2.6239
4	0.105	0.0702	-1.474	-0.1548	2.1741
5	0.110	0.0877	-1.355	-0.1490	1.8358
6	0.110	0.1053	-1.252	-0.1377	1.5678
7	0.112	0.1228	-1.161	-0.1300	1.3481
8	0.114	0.1404	-1.079	-0.1230	1.1637
9	0.115	0.1579	-1.003	-0.1154	1.0063
10	0.115	0.1754	-0.933	-0.1073	0.8703
11	0.116	0.1930	-0.867	-0.1006	0.7516
12	0.120	0.2105	-0.805	-0.0966	0.6474
13	0.124	0.2281	-0.745	-0.0924	0.5553
14	0.125	0.2456	-0.688	-0.0860	0.4738
15	0.133	0.2632	-0.634	-0.0843	0.4015
16	0.146	0.2807	-0.581	-0.0848	0.3373
17	0.151	0.2982	-0.529	-0.0799	0.2803
18	0.151	0.3158	-0.480	-0.0724	0.2299
19	0.152	0.3333	-0.431	-0.0655	0.1855
20	0.170	0.3509	-0.383	-0.0651	0.1467
21	0.175	0.3684	-0.336	-0.0588	0.1129
22	0.175	0.3860	-0.290	-0.0507	0.0840
23	0.177	0.4035	-0.244	-0.0432	0.0597
24	0.183	0.4211	-0.199	-0.0365	0.0397
25	0.184	0.4386	-0.155	-0.0284	0.0239
26	0.193	0.4561	-0.110	-0.0213	0.0121
27	0.197	0.4737	-0.066	-0.0130	0.0044
28	0.213	0.4912	-0.022	-0.0047	0.0005
29	0.216	0.5088	0.022	0.0047	0.0005
30	0.217	0.5263	0.066	0.0143	0.0044
31	0.218	0.5439	0.110	0.0240	0.0121
32	0.220	0.5614	0.155	0.0340	0.0239
33	0.226	0.5789	0.199	0.0450	0.0397
34	0.235	0.5965	0.244	0.0574	0.0597
35	0.237	0.6140	0.290	0.0687	0.0840
36	0.248	0.6316	0.336	0.0833	0.1129
37	0.254	0.6491	0.383	0.0973	0.1467
38	0.308	0.6667	0.431	0.1327	0.1855
39	0.315	0.6842	0.480	0.1510	0.2299
40	0.366	0.7018	0.529	0.1938	0.2803
41	0.369	0.7193	0.581	0.2143	0.3373
42	0.394	0.7368	0.634	0.2497	0.4015
43	0.407	0.7544	0.688	0.2802	0.4738
44	0.408	0.7719	0.745	0.3040	0.5553
45	0.434	0.7895	0.805	0.3492	0.6474
46	0.570	0.8070	0.867	0.4942	0.7516
47	0.620	0.8246	0.933	0.5784	0.8703
48	0.652	0.8421	1.003	0.6541	1.0063
49	0.670	0.8596	1.079	0.7228	1.1637
50	0.673	0.8772	1.161	0.7814	1.3481
51	0.750	0.8947	1.252	0.9391	1.5678
52	0.766	0.9123	1.355	1.0379	1.8358
53	0.790	0.9298	1.474	1.1648	2.1741
54	0.840	0.9474	1.620	1.3607	2.6239
55	1.30	0.9649	1.811	2.3540	3.2789
56	1.51	0.9825	2.107	3.1821	4.4409
			sum	13.2056	49.3128

S.D. = 0.30

W' = 0.730 less than 0.942, normal assumption rejected

ln(Barium)

1	-2.995732	0.0175	-2.107	6.3130	4.4409
2	-2.995732	0.0351	-1.811	5.4246	3.2789
3	-2.253795	0.0526	-1.620	3.6508	2.6239
4	-2.253795	0.0702	-1.474	3.3232	2.1741
5	-2.207275	0.0877	-1.355	2.9907	1.8358
6	-2.207275	0.1053	-1.252	2.7638	1.5678
7	-2.189256	0.1228	-1.161	2.5419	1.3481
8	-2.171557	0.1404	-1.079	2.3426	1.1637
9	-2.162823	0.1579	-1.003	2.1696	1.0063
10	-2.162823	0.1754	-0.933	2.0177	0.8703
11	-2.154165	0.1930	-0.867	1.8676	0.7516
12	-2.120264	0.2105	-0.805	1.7060	0.6474
13	-2.087474	0.2281	-0.745	1.5556	0.5553
14	-2.079442	0.2456	-0.688	1.4314	0.4738
15	-2.017406	0.2632	-0.634	1.2783	0.4015
16	-1.924149	0.2807	-0.581	1.1175	0.3373
17	-1.890475	0.2982	-0.529	1.0009	0.2803
18	-1.890475	0.3158	-0.480	0.9065	0.2299
19	-1.883875	0.3333	-0.431	0.8114	0.1855
20	-1.771957	0.3509	-0.383	0.6786	0.1467
21	-1.742969	0.3684	-0.336	0.5857	0.1129
22	-1.742969	0.3860	-0.290	0.5052	0.0840
23	-1.731606	0.4035	-0.244	0.4230	0.0597
24	-1.698269	0.4211	-0.199	0.3383	0.0397
25	-1.69282	0.4386	-0.155	0.2616	0.0239
26	-1.645065	0.4561	-0.110	0.1812	0.0121
27	-1.624552	0.4737	-0.066	0.1072	0.0044
28	-1.546463	0.4912	-0.022	0.0340	0.0005
29	-1.532477	0.5088	0.022	-0.0337	0.0005
30	-1.527858	0.5263	0.066	-0.1009	0.0044
31	-1.52326	0.5439	0.110	-0.1678	0.0121
32	-1.514128	0.5614	0.155	-0.2340	0.0239
33	-1.48722	0.5789	0.199	-0.2963	0.0397
34	-1.44817	0.5965	0.244	-0.3538	0.0597
35	-1.439695	0.6140	0.290	-0.4173	0.0840
36	-1.394327	0.6316	0.336	-0.4685	0.1129
37	-1.370421	0.6491	0.383	-0.5248	0.1467
38	-1.177655	0.6667	0.431	-0.5072	0.1855
39	-1.155183	0.6842	0.480	-0.5539	0.2299
40	-1.005122	0.7018	0.529	-0.5322	0.2803
41	-0.996959	0.7193	0.581	-0.5790	0.3373
42	-0.931404	0.7368	0.634	-0.5902	0.4015
43	-0.898942	0.7544	0.688	-0.6188	0.4738
44	-0.896488	0.7719	0.745	-0.6681	0.5553
45	-0.834711	0.7895	0.805	-0.6716	0.6474
46	-0.562119	0.8070	0.867	-0.4873	0.7516
47	-0.478036	0.8246	0.933	-0.4460	0.8703
48	-0.427711	0.8421	1.003	-0.4291	1.0063
49	-0.400478	0.8596	1.079	-0.4320	1.1637
50	-0.39601	0.8772	1.161	-0.4598	1.3481
51	-0.287682	0.8947	1.252	-0.3602	1.5678
52	-0.266573	0.9123	1.355	-0.3612	1.8358
53	-0.235722	0.9298	1.474	-0.3476	2.1741
54	-0.174353	0.9474	1.620	-0.2824	2.6239
55	0.2623643	0.9649	1.811	0.4751	3.2789
56	0.4121097	0.9825	2.107	0.8685	4.4409
			sum	38.7479	49.3128

S.D. = 0.76

W' = 0.957 greater than 0.942, lognormal assumption not rejected

Mean	-1.438
Std. Dev.	0.761
K	2.18
ln(Pr. Lim.)	0.217
Pr. Lim.	1.24

Zinc (excluding data points censored at 0.05)

1	0.005	0.0159	-2.148	-0.0107	4.6122
2	0.005	0.0317	-1.856	-0.0093	3.4437
3	0.005	0.0476	-1.668	-0.0083	2.7835
4	0.005	0.0635	-1.526	-0.0076	2.3290
5	0.005	0.0794	-1.409	-0.0070	1.9863
6	0.005	0.0952	-1.309	-0.0065	1.7139
7	0.0104	0.1111	-1.221	-0.0127	1.4900
8	0.0109	0.1270	-1.141	-0.0124	1.3013
9	0.0110	0.1429	-1.068	-0.0117	1.1397
10	0.0118	0.1587	-1.000	-0.0118	0.9994
11	0.0124	0.1746	-0.936	-0.0116	0.8763
12	0.0130	0.1905	-0.876	-0.0114	0.7676
13	0.0133	0.2063	-0.819	-0.0109	0.6710
14	0.0143	0.2222	-0.765	-0.0109	0.5848
15	0.0145	0.2381	-0.712	-0.0103	0.5076
16	0.0149	0.2540	-0.662	-0.0099	0.4383
17	0.0152	0.2698	-0.613	-0.0093	0.3761
18	0.0165	0.2857	-0.566	-0.0093	0.3203
19	0.0173	0.3016	-0.520	-0.0090	0.2702
20	0.0230	0.3175	-0.475	-0.0109	0.2254
21	0.0241	0.3333	-0.431	-0.0104	0.1855
22	0.0242	0.3492	-0.387	-0.0094	0.1501
23	0.0246	0.3651	-0.345	-0.0085	0.1190
24	0.0250	0.3810	-0.303	-0.0076	0.0918
25	0.0278	0.3968	-0.262	-0.0073	0.0684
26	0.0285	0.4127	-0.221	-0.0063	0.0487
27	0.0294	0.4286	-0.180	-0.0053	0.0324
28	0.0299	0.4444	-0.140	-0.0042	0.0195
29	0.0309	0.4603	-0.100	-0.0031	0.0099
30	0.0309	0.4762	-0.060	-0.0018	0.0036
31	0.0315	0.4921	-0.020	-0.0006	0.0004
32	0.0319	0.5079	0.020	0.0006	0.0004
33	0.0334	0.5238	0.060	0.0020	0.0036
34	0.0362	0.5397	0.100	0.0036	0.0099
35	0.0387	0.5556	0.140	0.0054	0.0195
36	0.0444	0.5714	0.180	0.0080	0.0324
37	0.0453	0.5873	0.221	0.0100	0.0487
38	0.0463	0.6032	0.262	0.0121	0.0684
39	0.0491	0.6190	0.303	0.0149	0.0918
40	0.0499	0.6349	0.345	0.0172	0.1190
41	0.050	0.6508	0.387	0.0194	0.1501
42	0.0529	0.6667	0.431	0.0228	0.1855
43	0.0540	0.6825	0.475	0.0256	0.2254
44	0.0556	0.6984	0.520	0.0289	0.2702
45	0.0578	0.7143	0.566	0.0327	0.3203
46	0.061	0.7302	0.613	0.0374	0.3761
47	0.064	0.7460	0.662	0.0424	0.4383
48	0.065	0.7619	0.712	0.0463	0.5076
49	0.0654	0.7778	0.765	0.0500	0.5848
50	0.0681	0.7937	0.819	0.0558	0.6710
51	0.071	0.8095	0.876	0.0622	0.7676
52	0.071	0.8254	0.936	0.0665	0.8763
53	0.082	0.8413	1.000	0.0820	0.9994
54	0.0848	0.8571	1.068	0.0905	1.1397
55	0.086	0.8730	1.141	0.0981	1.3013
56	0.100	0.8889	1.221	0.1221	1.4900
57	0.106	0.9048	1.309	0.1388	1.7139
58	0.120	0.9206	1.409	0.1691	1.9863
59	0.140	0.9365	1.526	0.2137	2.3290
60	0.165	0.9524	1.668	0.2753	2.7835
61	0.26	0.9683	1.856	0.4825	3.4437
62	0.260	0.9841	2.148	0.5584	4.6122
			sum	2.5279	55.1322

S.D. = 0.052

W' = 0.714 ⇒ less than 0.947, normal assumption rejected

	ln(Zn)				
1	-5.298317	0.0159	-2.148	11.3786	4.6122
2	-5.298317	0.0317	-1.856	9.8322	3.4437
3	-5.298317	0.0476	-1.668	8.8397	2.7835
4	-5.298317	0.0635	-1.526	8.0858	2.3290
5	-5.298317	0.0794	-1.409	7.4672	1.9863
6	-5.298317	0.0952	-1.309	6.9364	1.7139
7	-4.565949	0.1111	-1.221	5.5734	1.4900
8	-4.518992	0.1270	-1.141	5.1551	1.3013
9	-4.50986	0.1429	-1.068	4.8146	1.1397
10	-4.439656	0.1587	-1.000	4.4383	0.9994
11	-4.390059	0.1746	-0.936	4.1097	0.8763
12	-4.342806	0.1905	-0.876	3.8049	0.7676
13	-4.319991	0.2063	-0.819	3.5387	0.6710
14	-4.247496	0.2222	-0.765	3.2481	0.5848
15	-4.233607	0.2381	-0.712	3.0162	0.5076
16	-4.206394	0.2540	-0.662	2.7849	0.4383
17	-4.18646	0.2698	-0.613	2.5675	0.3761
18	-4.104395	0.2857	-0.566	2.3229	0.3203
19	-4.057049	0.3016	-0.520	2.1090	0.2702
20	-3.772261	0.3175	-0.475	1.7911	0.2254
21	-3.725543	0.3333	-0.431	1.6047	0.1855
22	-3.721403	0.3492	-0.387	1.4419	0.1501
23	-3.705009	0.3651	-0.345	1.2779	0.1190
24	-3.688879	0.3810	-0.303	1.1177	0.0918
25	-3.582719	0.3968	-0.262	0.9371	0.0684
26	-3.557851	0.4127	-0.221	0.7849	0.0487
27	-3.526761	0.4286	-0.180	0.6349	0.0324
28	-3.509897	0.4444	-0.140	0.4904	0.0195
29	-3.476999	0.4603	-0.100	0.3464	0.0099
30	-3.476999	0.4762	-0.060	0.2076	0.0036
31	-3.457768	0.4921	-0.020	0.0688	0.0004
32	-3.445149	0.5079	0.020	-0.0685	0.0004
33	-3.399199	0.5238	0.060	-0.2030	0.0036
34	-3.318696	0.5397	0.100	-0.3307	0.0099
35	-3.251916	0.5556	0.140	-0.4543	0.0195
36	-3.114516	0.5714	0.180	-0.5607	0.0324
37	-3.094448	0.5873	0.221	-0.6827	0.0487
38	-3.072613	0.6032	0.262	-0.8037	0.0684
39	-3.013896	0.6190	0.303	-0.9132	0.0918
40	-2.997734	0.6349	0.345	-1.0340	0.1190
41	-2.995732	0.6508	0.387	-1.1607	0.1501
42	-2.939352	0.6667	0.431	-1.2661	0.1855
43	-2.918771	0.6825	0.475	-1.3859	0.2254
44	-2.889572	0.6984	0.520	-1.5021	0.2702
45	-2.850767	0.7143	0.566	-1.6134	0.3203
46	-2.796881	0.7302	0.613	-1.7153	0.3761
47	-2.748872	0.7460	0.662	-1.8199	0.4383
48	-2.733368	0.7619	0.712	-1.9474	0.5076
49	-2.727233	0.7778	0.765	-2.0855	0.5848
50	-2.686778	0.7937	0.819	-2.2009	0.6710
51	-2.645075	0.8095	0.876	-2.3175	0.7676
52	-2.645075	0.8254	0.936	-2.4761	0.8763
53	-2.501036	0.8413	1.000	-2.5003	0.9994
54	-2.46746	0.8571	1.068	-2.6342	1.1397
55	-2.453408	0.8730	1.141	-2.7988	1.3013
56	-2.302585	0.8889	1.221	-2.8106	1.4900
57	-2.244316	0.9048	1.309	-2.9382	1.7139
58	-2.120264	0.9206	1.409	-2.9882	1.9863
59	-1.966113	0.9365	1.526	-3.0005	2.3290
60	-1.80181	0.9524	1.668	-3.0061	2.7835
61	-1.347074	0.9683	1.856	-2.4998	3.4437
62	-1.347074	0.9841	2.148	-2.8930	4.6122
			sum	56.1156	55.1322

S.D. = 0.977

W' = 0.980 ⇒ greater than 0.947, lognormal assumption not rejected

Mean	-3.451
Std. Dev.	0.977
K	2.18
ln(Pr. Lim.)	-1.324
Pr. Lim.	0.266