APPENDIX A

95TH UTL AND 95TH PERCENTILE BACKGROUND SCREENING VALUES FOR REMEDIAL INVESTIGATIONS AND EXAMPLE SITE-TO-BACKGROUND COMPARISONS

Table 1. Background Summary Statistics – Groundwater
(Concentrations in milligrams per liter)

Element	Number of Samples	Percent Nondetects	Distribution	Minimum	Maximum	Median	Arithmetic Mean	Arithmetic Std. Dev	95th UTL or Percentile
Aluminum	54	35.2	Nonparametric	41.9	9,600	343	1,231	2,068	5,950
Antimony	53	96.2	Nonparametric	< 0.6	< 60	< 1	2.68	5.72	< 10
Arsenic	56	83.9	Nonparametric	< 1.1	222	< 2.35	8.19	31.8	< 117
Barium	54	7.4	Lognormal	5.5	653	39.35	88.4	140	472
Beryllium	54	72.2	Nonparametric	< 0.2	< 5	< 1.12	0.65	0.73	< 5
Cadmium	56	64.3	Nonparametric	< 0.1	< 6.78	< 2	1.37	1.27	< 6.78
Calcium	54	14.8	Nonparametric	217	452,000	17,175	29,102	61,702	71,400
Chromium	54	100	Nonparametric	< 6.02	< 16.8	< 10	6.27	1.84	< 16.8
Cobalt	54	94.4	Nonparametric	<20	25.2	< 25	11.82	2.82	20.2
Copper	54	81.5	Nonparametric	< 5	235	8.45	19.28	49.3	207
Cyanide	29	100	Nonparametric	< 5	< 5	< 5	2.50	N/A	< 5
Hexavalent Chromium	8	100	Nonparametric	< 20	< 20	< 20	10.0	N/A	< 20
Iron	54	18.5	Nonparametric	2.51	25,800	1,034	4,284	6,481	22,000
Lead	55	60.0	Nonparametric	< 0.6	< 43.4	< 4.47	4.32	6.45	< 43.4
Magnesium	54	16.7	Nonparametric	< 100	149,000	6,710	10,261	20,277	22,000
Manganese	54	22.2	Nonparametric	< 5	5,820	96.2	316	828	4,134
Mercury	56	100	Nonparametric	< 0.1	< 2.43	< 0.2	0.10	0.15	< 0.243
Nickel	54	100	Nonparametric	< 15	<34.3	< 15	11.5	4.38	< 34.3
Potassium	54	25.9	Nonparametric	1.02	68,500	1,270	3,746	9,751	16,000
Selenium	56	100	Nonparametric	< 2.2	<97.1	< 2.53	3.78	10.75	< 97.1
Silver	54	98.2	Nonparametric	< 0.1	< 10	< 0.1	2.20	2.40	< 10
Sodium	54	7.4	Lognormal	555	64,700	3,365	8,002	11,926	49,028
Thallium	50	88.0	Nonparametric	< 0.1	< 10	< 0.1	0.89	1.36	< 10
Vanadium	54	96.3	Nonparametric	< 10	< 27.6	< 10.5	8.84	4.31	< 27.6
Zinc	54	55.6	Nonparametric	< 18	1,520	< 30	141	337	1,155

Table 2. Background Summary Statistics – Surface Water
(Concentrations in milligrams per liter)

Element	Number of Samples	Percent Nondetects	Distribution	Minimum	Maximum	Median	Arithmetic Mean	Arithmetic Std. Dev	95th UTL or Percentile
Aluminum	59	15.3	Nonparametric	< 50	47,800	299	2,864	8,400	13,700
Antimony	55	100	Nonparametric	< 1	< 10	< 1	1.03	1.42	< 10
Arsenic	57	86.0	Nonparametric	< 1.1	10.5	< 1.1	1.07	1.53	3.40
Barium	59	0	Nonparametric	10.6	200	24	38.1	36.2	115
Beryllium	50	82.0	Nonparametric	< 0.2	3.2	< 0.2	0.20	0.46	0.40
Cadmium	59	83.1	Nonparametric	0.15	< 6.78	< 0.2	0.53	0.88	< 5
Calcium	59	0	Nonparametric	179	64,100	6,810	12,889	14,016	37,800
Chromium	56	98.2	Nonparametric	< 6.02	< 16.8	< 10	5.52	1.72	< 16.8
Cobalt	56	100	Nonparametric	< 20	< 25	< 20	10.40	0.93	< 25
Copper	50	84.0	Nonparametric	< 5	71.6	< 5	6.81	14.16	50.60
Cyanide	52	100	Nonparametric	< 2.5	< 5	< 5	2.45	0.24	< 5
Hexavalent Chromium	12	100	Nonparametric	< 2.5	< 20	< 20	8.54	3.41	< 20
Iron	59	5.1	Nonparametric	< 45	232,000	502	10,916	40,347	118,000
Lead	58	46.6	Nonparametric	0.45	47.3	0.90	4.55	8.77	22.10
Magnesium	59	0	Lognormal	171	24,400	3,110	5,516	5,964	50,536
Manganese	59	5.1	Lognormal	< 5	6,060	68.1	312	891	1,829
Mercury	57	100	Nonparametric	< 0.1	< 0.243	< 0.2	0.09	0.02	< 0.243
Nickel	59	94.9	Nonparametric	< 15	70.1	< 15	11.44	11.87	40.00
Potassium	59	6.8	Lognormal	330	7,120	1130	1,333	1,212	4,251
Selenium	58	100	Nonparametric	< 2.53	< 5	< 5	2.32	0.43	< 5
Silver	50	100	Nonparametric	< 0.1	< 4.6	< 0.1	0.14	0.45	< 4.6
Sodium	58	0	Nonparametric	296	15,200	1,080	1,791	2,167	5,580
Thallium	51	98.0	Nonparametric	< 0.1	2.59	< 0.1	0.16	0.41	< 2
Vanadium	57	91.2	Nonparametric	< 10	35.6	< 10	7.59	5.81	21.10
Zinc	58	91.4	Nonparametric	< 18	182	< 30	20.54	27.62	45.60

Table 3. Background Summary Statistics – Sediment
(Concentrations in milligrams per kilogram)

Element	Number of Samples	Percent Nondetects	Distribution	Minimum	Maximum	Median	Arithmetic Mean	Arithmetic Std. Dev	95th UTL or Percentile
Aluminum	59	0	Lognormal	657	17,400	3,370	4,430	3,260	14,331
Antimony	53	28.3	Nonparametric	< 0.107	1.2	0.365	0.370	0.251	0.878
Arsenic	52	0	Lognormal	0.407	20.1	3.74	5.79	5.056	28.40
Barium	59	0	Lognormal	5.37	272	36.5	50.26	44.07	190.6
Beryllium	49	0	Lognormal	0.069	1.24	0.471	0.492	0.310	1.826
Cadmium	59	27.1	Nonparametric	< 0.02	2.37	0.070	0.232	0.409	0.787
Calcium	59	5.1	Lognormal	< 79.4	2,810	388	570	571.8	2,856
Chromium	59	0	Lognormal	1.43	63.4	10.31	15.9	14.21	63.27
Cobalt	58	6.9	Lognormal	< 0.265	21.9	4.31	5.62	4.621	29.07
Copper	55	1.8	Lognormal	0.726	58.6	7.13	8.85	9.223	36.79
Cyanide	52	100	Nonparametric	< 0.517	< 1.24	< 0.653	0.355	0.079	< 1.24
Hexavalent Chromium	10	100	Nonparametric	< 0.1	< 0.15	< 0.12	0.061	0.008	< 0.15
Iron	59	0	Lognormal	721	51,900	13,500	17,740	12,295	70,845
Lead	56	1.8	Lognormal	1.71	110	12.8	18.88	20.90	76.4
Magnesium	59	0	Nonparametric	29.9	3,270	226	485.2	712.5	2,440
Manganese	58	1.7	Lognormal	8.66	2,050	223	356	375.2	2,611
Mercury	59	42.4	Nonparametric	< 0.0255	0.277	0.056	0.058	0.043	0.137
Nickel	59	33.9	Nonparametric	< 2.11	32.7	4.7	6.73	7.189	25.8
Potassium	59	28.8	Nonparametric	< 100	4,810	228	538	877	2,300
Selenium	59	93.2	Nonparametric	< 0.25	1.88	< 0.585	0.364	0.303	1.03
Silver	59	44.1	Nonparametric	< 0.018	1.05	0.064	0.160	0.204	0.530
Sodium	59	13.6	Nonparametric	< 38.7	738	350	341	155	547
Thallium	50	0	Lognormal	0.012	0.221	0.051	0.064	0.049	0.211
Vanadium	59	0	Lognormal	2.7	66.7	16.7	20.5	13.19	67.7
Zinc	59	10.2	Lognormal	< 5.26	111	18.0	27.1	24.85	122.9

Table 4. Background Summary Statistics – Surface Soil
(Concentrations in milligrams per kilogram)

Element	Number of Samples	Percent Nondetects	Distribution	Minimum	Maximum	Median	Arithmetic Mean	Arithmetic Std. Dev	95th UTL or Percentile
Aluminum	67	0	Nonparametric	2400	39,900	6720	8,224	6,206	22,900
Antimony	66	33.3	Nonparametric	< 0.082	< 7.14	0.381	1.021	1.328	< 7.14
Arsenic	63	0	Lognormal	1.09	48.5	3.94	6.59	7.76	25.42
Barium	67	0	Lognormal	11.2	288	39.8	60.2	54.0	193.8
Beryllium	50	0	Lognormal	0.062	0.868	0.357	0.385	0.215	1.189
Cadmium	67	35.8	Nonparametric	< 0.016	< 4.01	0.059	0.172	0.281	< 1.2
Calcium	67	6.0	Lognormal	62.9	17,900	278	850	2,308	3,545
Chromium	67	0	Lognormal	1.99	134	11.3	18.4	20.5	64.4
Cobalt	67	3.0	Lognormal	0.39	70.9	3.6	7.1	11.1	32.5
Copper	67	1.5	Lognormal	1.31	23.5	5.2	6.32	4.30	22.5
Cyanide	63	100	Nonparametric	< 0.0528	< 0.92	< 0.563	0.31	0.08	< 0.92
Iron	67	0	Lognormal	2,510	56,300	13,700	17,185	11,786	55,399
Lead	67	0	Lognormal	2.89	82.8	15.9	19.4	14.5	63.8
Magnesium	67	0	Nonparametric	59.8	9,600	225.0	526	1,294	2,160
Manganese	67	0	Lognormal	8	6,850	295.0	728.1	1,157	4,658
Mercury	67	65.7	Nonparametric	< 0.023	0.322	< 0.05	0.041	0.047	0.125
Nickel	67	20.9	Nonparametric	< 1.64	21.8	4.33	5.08	4.14	19.96
Potassium	67	14.9	Nonparametric	< 82.2	6,010	193	408	967	1,830
Selenium	67	98.5	Nonparametric	< 0.25	1.28	< 0.491	0.241	0.140	< 0.563
Silver	67	41.8	Nonparametric	< 0.016	1.87	0.047	0.182	0.342	0.774
Sodium	67	6.0	Nonparametric	< 38.7	563	334	315	99	451
Thallium	63	20.6	Nonparametric	0.015	< 6.62	0.07	0.75	1.32	< 6.62
Vanadium	67	0	Lognormal	4.66	158	21.1	29.6	26.4	99.4
Zinc	67	9.0	Lognormal	< 4.91	209	14.8	20.4	26.7	73.7

Table 5. Background Summary Statistics – Subsurface Soil
(Concentrations in milligrams per kilogram)

Element	Number of Samples	Percent Nondetect	Distribution	Minimum	Maximum	Median	Arithmetic Mean	Arithmetic Std. Dev	95th UTL or Percentile
Aluminum	55	0	Lognormal	1,770	24,600	6,120	6,827	3,700	16,574
Antimony	54	25.9	Nonparametric	< 0.079	< 7.14	0.36	0.70	1.05	< 7.14
Arsenic	55	5.5	Lognormal	< 0.25	34.5	4.81	8.45	9.27	54.9
Barium	55	0	Lognormal	4.41	4,500	20.9	125	604	320
Beryllium	50	4	Lognormal	0.041	1.88	0.255	0.427	0.420	2.19
Cadmium	55	49.1	Nonparametric	< 0.015	1.28	0.037	0.114	0.212	0.620
Calcium	55	32.7	Nonparametric	< 56.5	3,650	108	314	624	1,710
Chromium	55	1.8	Lognormal	6.21	54.7	17.1	19.2	10.8	53.4
Cobalt	55	7.3	Lognormal	< 0.233	96.2	2.69	8.6	17.2	54.7
Copper	55	0	Lognormal	1.34	60.9	6.88	9.9	9.5	34.2
Cyanide	54	100	Nonparametric	< 0.487	< 0.92	< 0.57	0.303	0.059	< 0.92
Hexavalent Chromium	13	100	Nonparametric	< 0.11	< 0.514	< 0.12	0.122	0.094	< 0.514
Iron	55	0	Nonparametric	4,840	48,000	23,400	22,468	10,295	41,800
Lead	55	0	Nonparametric	0.962	500	9.8	20.0	66.3	28.8
Magnesium	55	7.3	Nonparametric	35.3	5,940	124	415	951	2,270
Manganese	55	1.8	Lognormal	7.29	19,000	104	661	2,571	3,790
Mercury	55	52.7	Nonparametric	< 0.022	0.116	< 0.05	0.034	0.025	0.094
Nickel	55	16.4	Nonparametric	< 1.58	37.7	3.75	6.48	7.85	29.2
Potassium	55	20	Lognormal	< 77.05	6,150	180	361	830	1,420
Selenium	55	98.2	Nonparametric	< 0.25	< 0.578	< 0.484	0.236	0.063	< 0.574
Silver	55	34.6	Nonparametric	< 0.016	< 1.2	0.063	0.126	0.148	0.880
Sodium	55	1.8	Nonparametric	245	643	327	355	120	588
Thallium	54	13.0	Nonparametric	< 0.009	23.5	0.05	0.81	3.29	< 6.62
Vanadium	55	0	Lognormal	9.79	98.6	25.8	32.7	20.2	91.7
Zinc	55	21.8	Nonparametric	< 3.95	89.2	11.4	17.6	17.9	85.0

Table 6. Background Summary Statistics – Combined Soil
(Concentrations in milligrams per kilogram)

Element	Number of Samples	Percent Nondetect	Distribution	Minimum	Maximum	Median	Arithmetic Mean	Arithmetic Std. Dev	95th UTL or Percentile
Aluminum	122	0	Lognormal	1,770	39,900	6,495	7,594	5,254	17,981
Antimony	120	30.0	Nonparametric	< 0.079	< 7.14	0.37	0.88	1.21	< 7.14
Arsenic	118	2.5	Lognormal	< 0.25	48.5	4.04	7.46	8.51	32.42
Barium	122	0	Lognormal	4.41	4,500	32.7	89.23	407.0	242.0
Beryllium	100	2.0	Lognormal	0.041	1.88	0.317	0.41	0.33	1.502
Cadmium	122	41.8	Nonparametric	< 0.015	< 4.01	0.053	0.15	0.25	< 1.2
Calcium	122	18.0	Nonparametric	< 56.5	17,900	165	608	1,775	5,490
Chromium	122	0.8	Lognormal	1.99	134	14.3	18.76	16.75	56.3
Cobalt	122	4.9	Lognormal	< 0.233	96.2	3.24	7.79	14.15	36.3
Copper	122	0.8	Lognormal	1.31	60.9	6.13	7.93	7.34	25.9
Cyanide	117	100	Nonparametric	< 0.053	< 0.92	< 0.568	0.31	0.07	< 0.92
Hexavalent Chromium	28	96.4	Nonparametric	< 0.11	< 0.514	< 0.128	0.13	0.10	< 0.514
Iron	122	0	Lognormal	2,510	56,300	16,900	19,567	11,404	56,312
Lead	122	0	Lognormal	0.962	500	12.05	19.71	45.57	60.5
Magnesium	122	3.3	Nonparametric	35	9,600	161	476	1,149	5,545
Manganese	122	0.8	Lognormal	7	19,000	204	698	1,919	4,120
Mercury	122	59.8	Nonparametric	< 0.022	0.322	< 0.05	0.04	0.04	0.094
Nickel	122	18.9	Nonparametric	< 1.58	37.7	4.0	5.71	6.11	16.9
Potassium	122	17.2	Nonparametric	< 77.1	6,150	185	387	904	831
Selenium	122	98.4	Nonparametric	< 0.25	1.28	< 0.485	0.24	0.11	< 0.571
Silver	122	38.5	Nonparametric	< 0.016	1.87	0.05	0.16	0.27	< 0.803
Sodium	122	4.1	Nonparametric	< 38.7	643	329.3	333.3	110.2	560.0
Thallium	117	17.1	Nonparametric	< 0.009	23.5	0.06	0.78	2.42	< 6.62
Vanadium	122	0	Lognormal	4.66	158	23.6	31.01	23.76	90.5
Zinc	122	14.8	Lognormal	< 3.95	209	13.5	19.16	23.14	71.3

ATTACHMENT A-1

EXAMPLE SITE-TO-BACKGROUND COMPARISONS

Example Site-to-Background Comparisons

Examples of the methodology applied to selected FTMC site soil data are provided below. In each case, site and background data were compared using the hot measurement test (incorporating the UTL_{95} or 95th percentile as the background screening value), the WRS test, and box-and-whisker plots. Elements that failed at least one of the statistical tests were carried on for geochemical evaluation.

Separate summary statistics for inorganic constituents in surface soil, subsurface soil, and combined (surface and subsurface) soil are provided in this appendix. Because there are no significant differences between the background distributions in surface and subsurface soil, the combined soil data set is considered the primary reference for background. Greater confidence can be placed in the combined background summary statistics because they are based on a larger data set. Accordingly, the background screening values used in the following site-to-background comparisons are based on the combined soil data set.

Evaluation of the Concentrations of Beryllium in Surface and Subsurface Soil at the Forestry Compound (Parcel 84[7]). None of the site samples exceeds the background UTL_{95} of 1.502 milligrams per kilogram (mg/kg). The WRS test p-level of 0.989 indicates excellent agreement between the site and background distributions. The minimum and 25th percentile of the site data are higher than their respective background values (Figure A-1). The site median, 75th percentile, and maximum are lower than their respective background values. The site data are within range of background, and no geochemical evaluation is necessary.

Evaluation of the Concentrations of Chromium in Surface and Subsurface Soil at the Forestry Compound (Parcel 84[7]). One of the site samples exceeds the background UTL_{95} of 56.3 mg/kg. A WRS test p-level of 0.162 indicates good agreement between the site and background distributions. The minimum, 25th percentile, and median of the site data are slightly elevated with respect to background (Figure A-2). The site 75th percentile is higher than the corresponding background value, and the site maximum is below the background maximum.

A plot of chromium versus iron reveals a strong correlation (Figure A-3); the site samples with the highest chromium concentrations also have the highest iron concentrations, and lie on the trend formed by the other samples. This indicates that the chromium is associated with iron oxide minerals in roughly constant proportions. It is concluded that chromium in the site samples is naturally occurring.

Evaluation of the Concentrations of Lead in Surface and Subsurface Soil at the Former Trap and Skeet Range (Parcel 127Q). Four site samples exceed the background UTL_{95} of 60.5 mg/kg. A WRS test p-level of <0.0001 indicates a significant difference between the site and background distributions. The minimum, 25th percentile, median, and 75th percentile of the site data are elevated with respect to background (Figure A-4). The site maximum is below the background maximum.

Manganese oxides are naturally occurring in soil and have an affinity for adsorbing trace elements, including lead (Kabata-Pendias, 2001). If a soil sample contains a high proportion of manganese oxides, then it is expected to contain high concentrations of manganese and associated trace elements. A plot of lead versus manganese reveals a linear trend for most of the samples (Figure A-5). Samples with high lead concentrations generally contain high manganese, and lie on the trend defined by the other samples. The exceptions are five site samples that have high lead concentrations but only moderate manganese concentrations; these samples do not plot on the linear trend. There may be a component of contamination in these samples.

Figure A-1. Box Plot Comparison for Beryllium in Soil, Forestry Compound, Parcel 84(7), Fort McClellan, Calhoun County, Alabama (WRS Test p-level = 0.989)

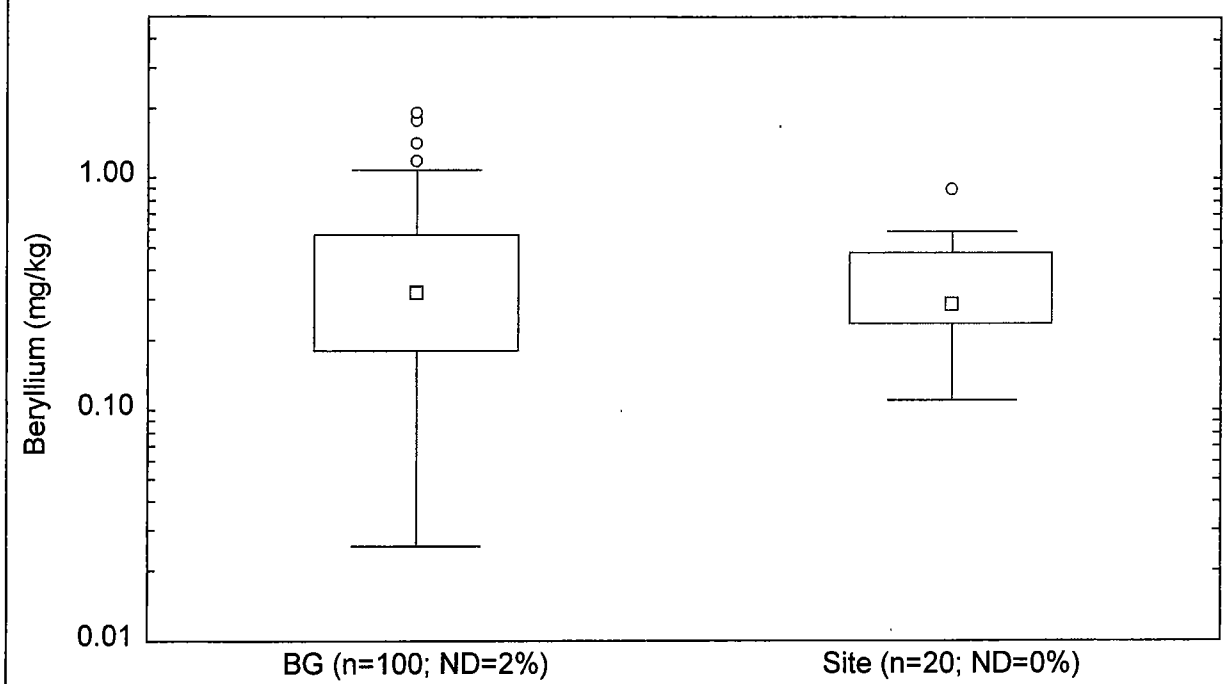

Figure A-2. Box Plot Comparison for Chromium in Soil, Forestry Compound, Parcel 84(7), Fort McClellan, Calhoun County, Alabama (WRS Test p-level = 0.162)

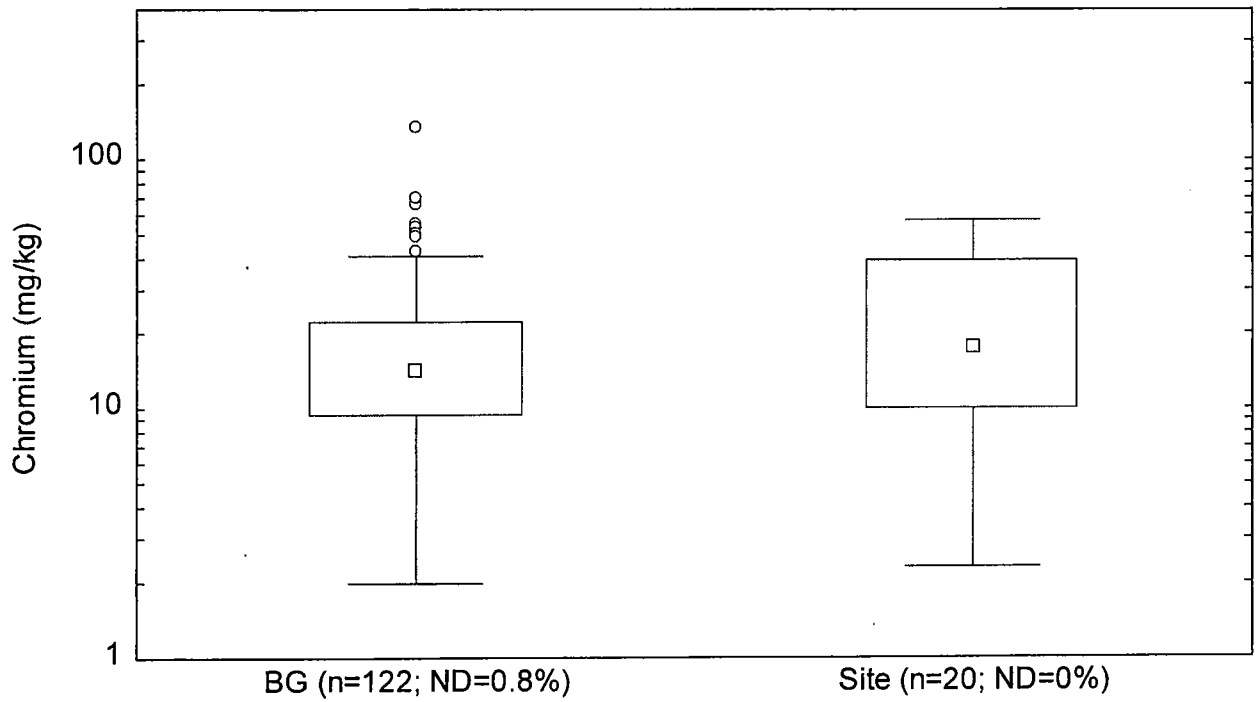

Figure A-3. Chromium vs. Iron in Soil, Forestry Compound Parcel 84(7), Fort McClellan, Calhoun County, Alabama

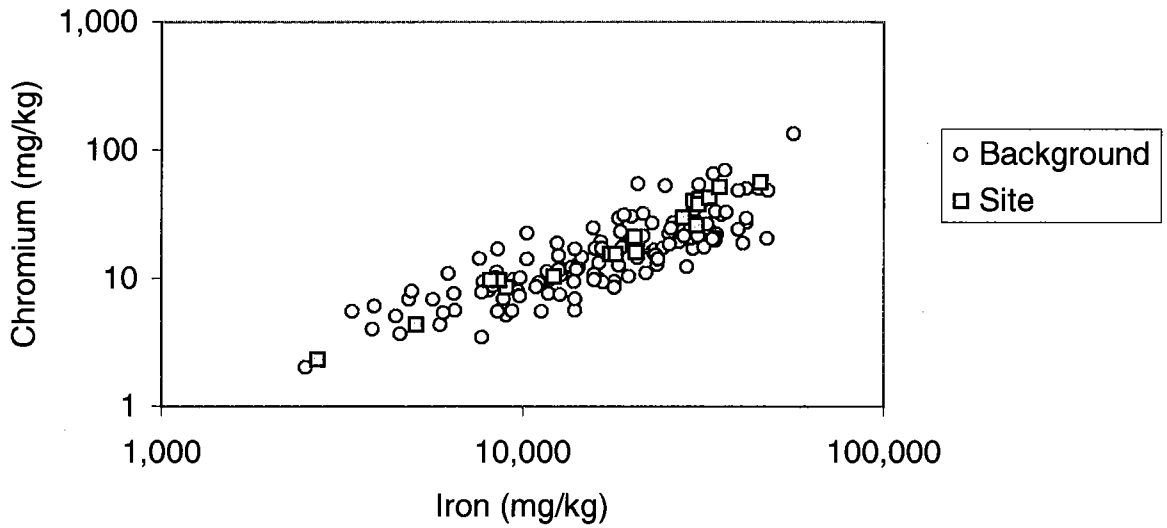

Figure A-4. Box Plot Comparison for Lead in Soil, Former Trap and Skeet Range, Parcel 127Q, Fort McClellan, Calhoun County, Alabama (WRS Test p-level = <0.0001)

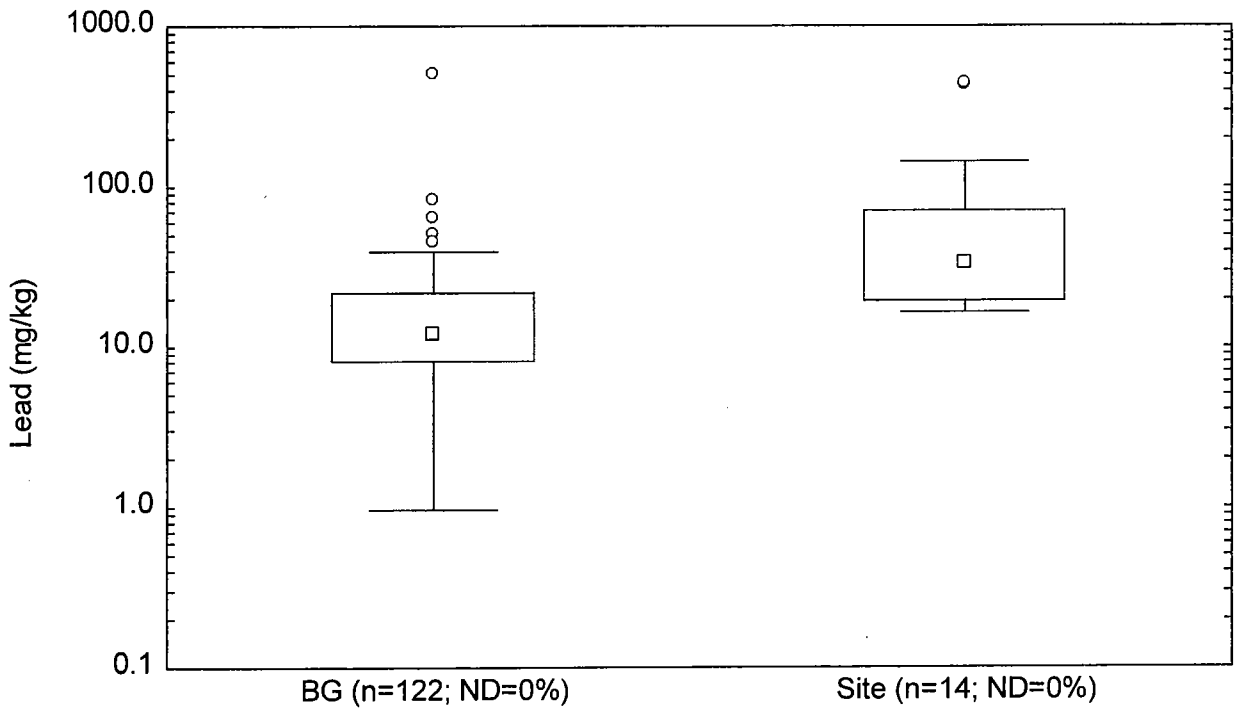
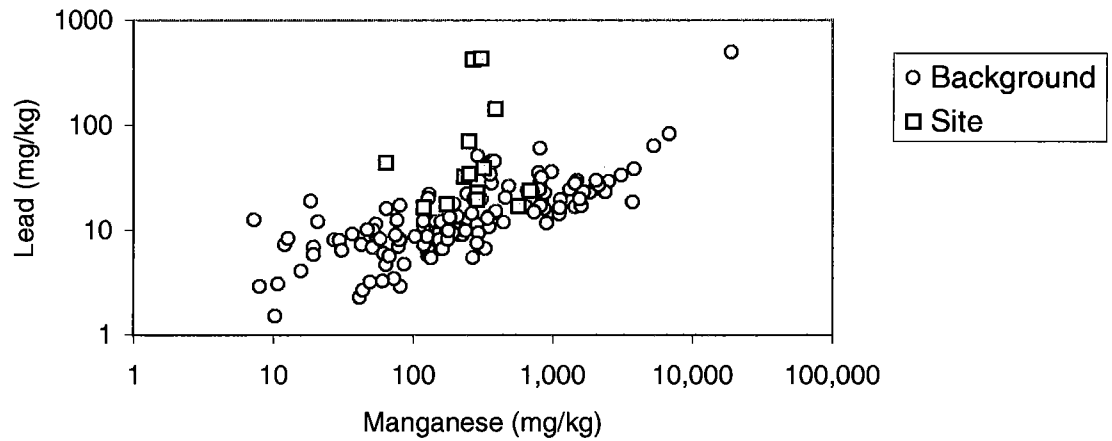
Figure A-5. Lead vs. Manganese in Soil, Former Trap and Skeet Range, Parcel 127Q, Fort McClellan, Calhoun County, Alabama