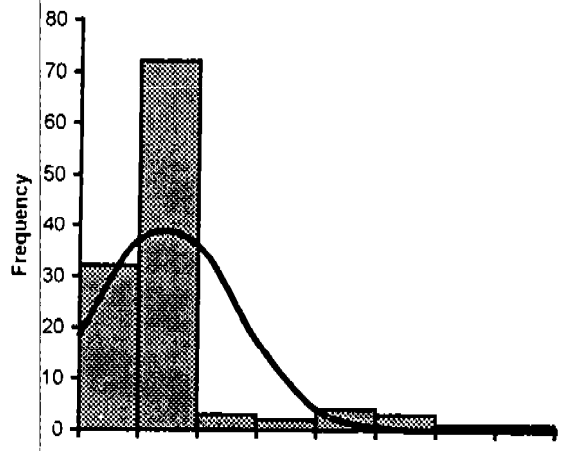
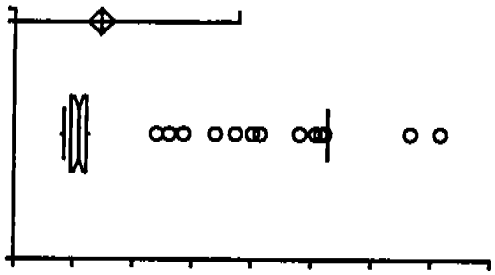
analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Nitrite as N (log-transformed)
Project	Tourtelot
Date	1 June 2001

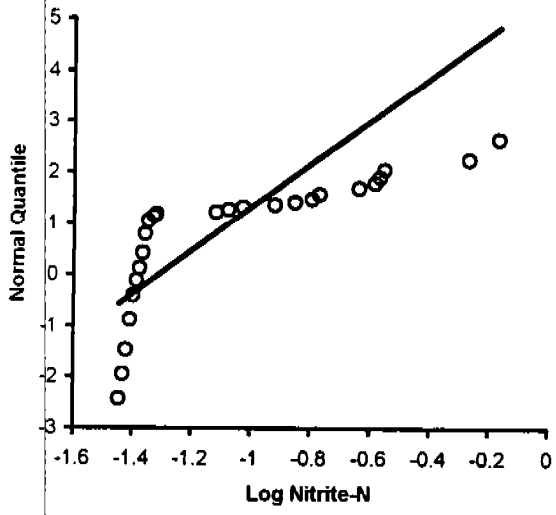


n	118 (cases excluded: 170 due to
Mean	-1.308
95% CI	-1.351 to -1.265
Variance	0.0560
SD	0.2366
SE	0.0218
CV	-18%



Median	-1.382
96.6% CI	-1.398 to -1.367
Range	1.276206412
IQR	0.052388069

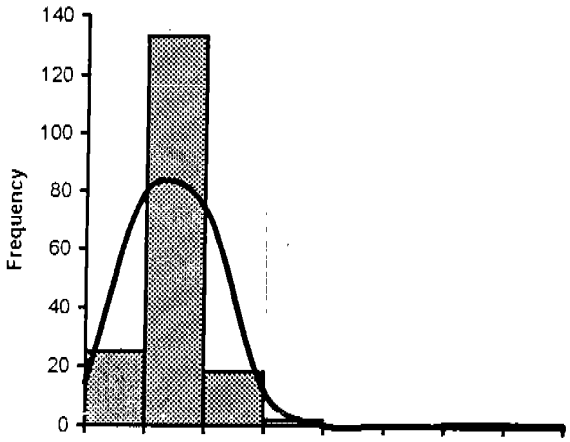
Percentile	
2.5th	-1.432
25th	-1.409
50th	-1.382
75th	-1.357
97.5th	-0.546



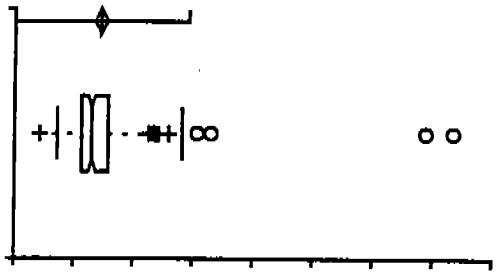
	Coefficient	p
Shapiro-Wilk	0.4775	<0.0001
Skewness	3.0822	<0.0001
Kurtosis	9.2085	<0.0001

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Phosphorus
Project	Tourtelot
Date	1 June 2001

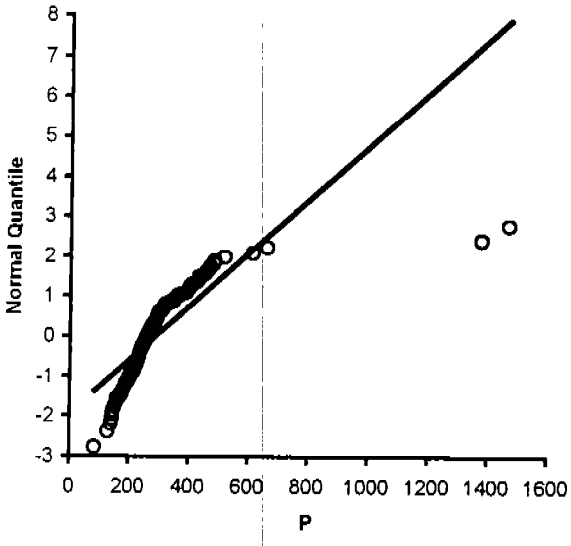


n	180 (cases excluded: 108 due to
Mean	291.259
95% CI	269.259 to 313.258
Variance	22372.1000
SD	149.5731
SE	11.1485
CV	51%



Median	261.000
95.6% CI	251.000 to 274.000
Range	1385.4
IQR	88.75

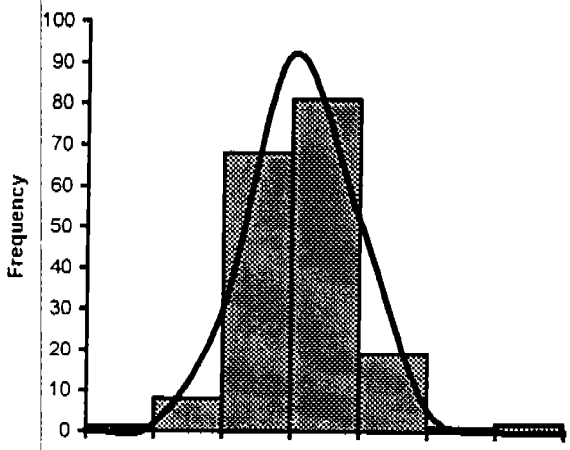
Percentile	
2.5th	144.525
25th	226.750
50th	261.000
75th	315.500
97.5th	564.125



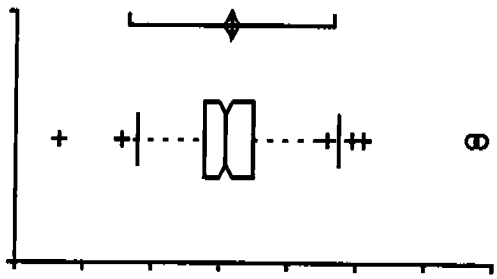
	Coefficient	p
Shapiro-Wilk	0.5866	<0.0001
Skewness	5.1043	<0.0001
Kurtosis	36.0511	<0.0001

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Phosphorus (log-transformed)
Project	Tourtelot
Date	1 June 2001

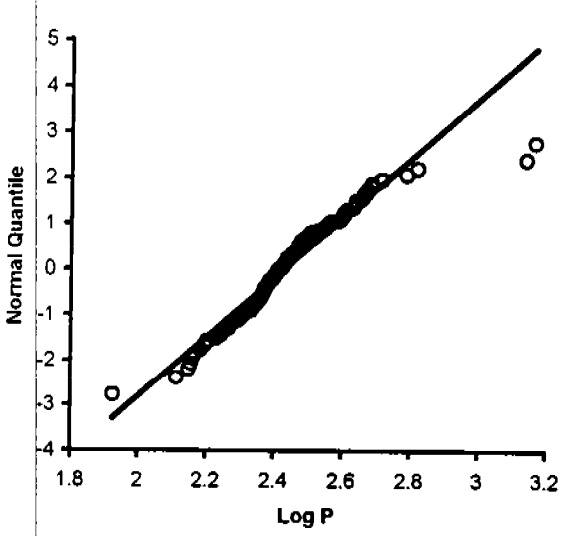


n	180 (cases excluded: 108 due to
Mean	2.433
95% CI	2.410 to 2.455
Variance	0.0234
SD	0.1529
SE	0.0114
CV	6%



Median	2.417
95.6% CI	2.400 to 2.438
Range	1.239946972
IQR	0.143438041

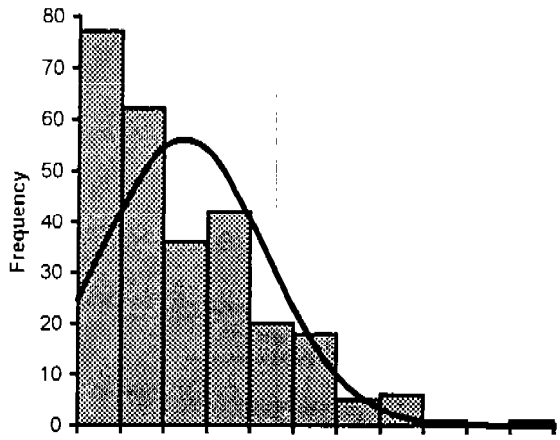
Percentile	
2.5th	2.160
25th	2.356
50th	2.417
75th	2.499
97.5th	2.750



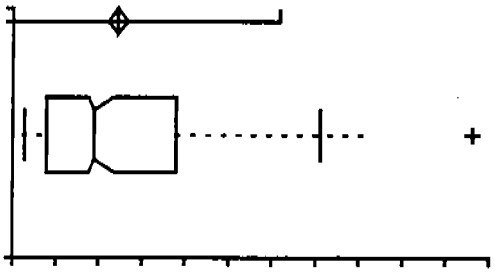
	Coefficient	p
Shapiro-Wilk	0.9266	<0.0001
Skewness	1.0652	<0.0001
Kurtosis	4.9522	<0.0001

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Selenium
Project	Tourtelot
Date	1 June 2001

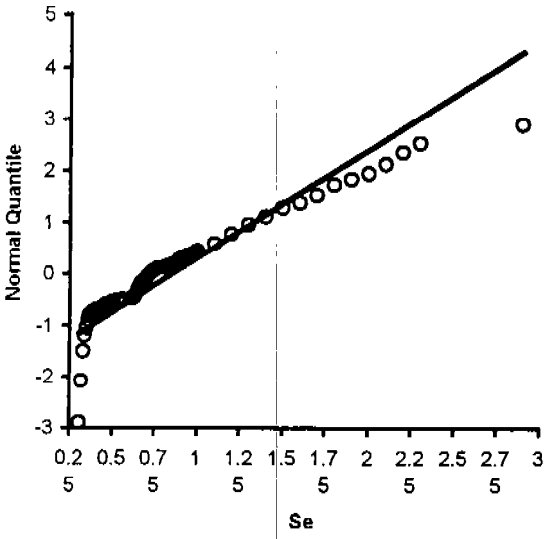


n	268 (cases excluded: 20 due to m
Mean	0.860
95% CI	0.803 to 0.917
Variance	0.2260
SD	0.4754
SE	0.0290
CV	55%



Median	0.725
95.6% CI	0.690 to 0.840
Range	2.59
IQR	0.7525

Percentile	
2.5th	0.320
25th	0.448
50th	0.725
75th	1.200
97.5th	2.028

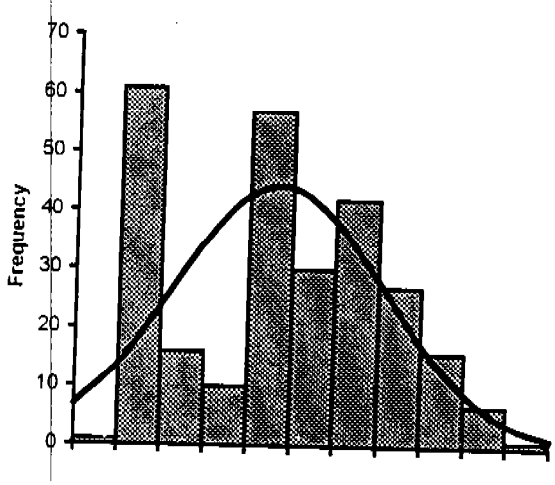


	Coefficient	p
Shapiro-Wilk	0.9088	<0.0001
Skewness	0.9967	<0.0001
Kurtosis	0.9276	0.0153

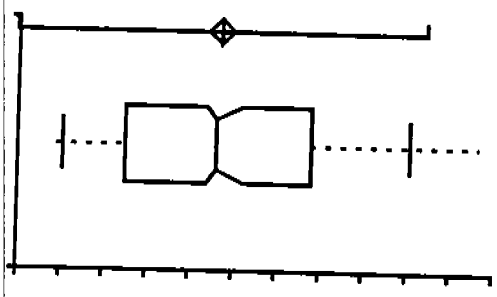
Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Selenium (log-transformed)
Project	Tourtelot

analysed with: Analyse-It + General v1.50

Date	1 June 2001

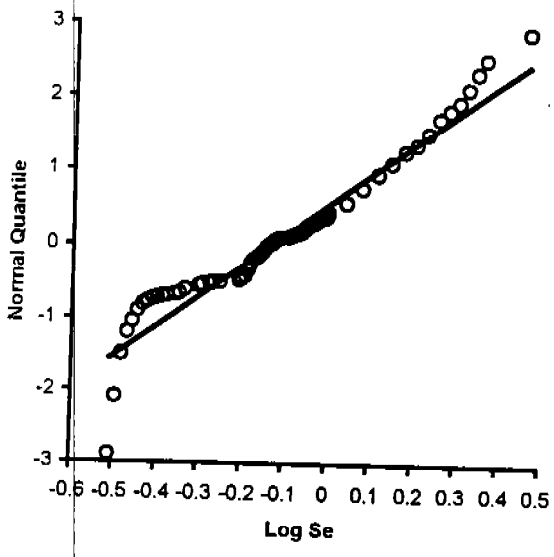


n	268 (cases excluded: 20 due to m
Mean	-0.131
95% CI	-0.160 to -0.102
Variance	0.0584
SD	0.2417
SE	0.0148
CV	-185%



Median	-0.140
95.6% CI	-0.161 to -0.076
Range	0.971036304
IQR	0.428408692

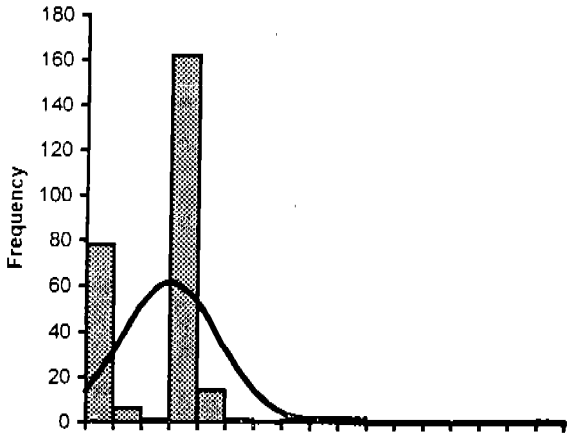
Percentile	
2.5th	-0.495
25th	-0.349
50th	-0.140
75th	0.079
97.5th	0.307



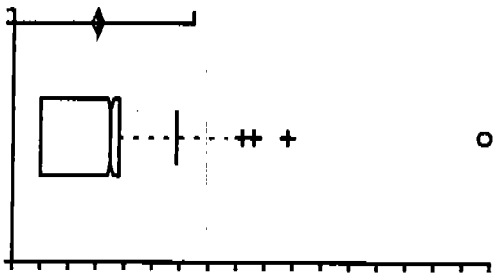
	Coefficient	p
Shapiro-Wilk	0.9475	<0.0001
Skewness	-0.0024	0.9871
Kurtosis	-1.0369	<0.0001

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Silver
Project	Tourtelot
Date	1 June 2001

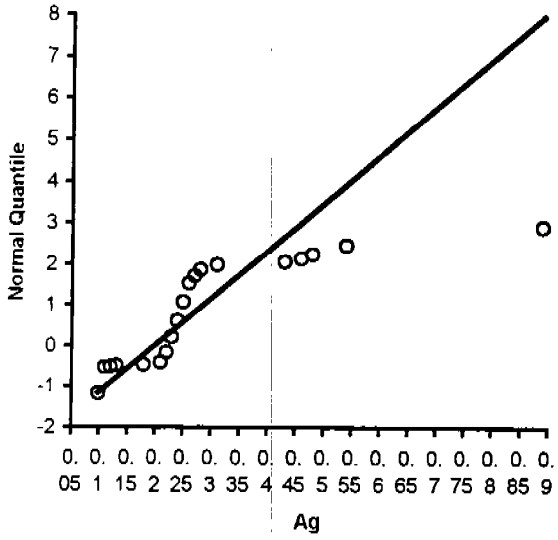


n	268 (cases excluded: 20 due to m
Mean	0.200
95% CI	0.190 to 0.211
Variance	0.0076
SD	0.0869
SE	0.0053
CV	43%



Median	0.225
95.6% CI	0.220 to 0.230
Range	0.791
IQR	0.141

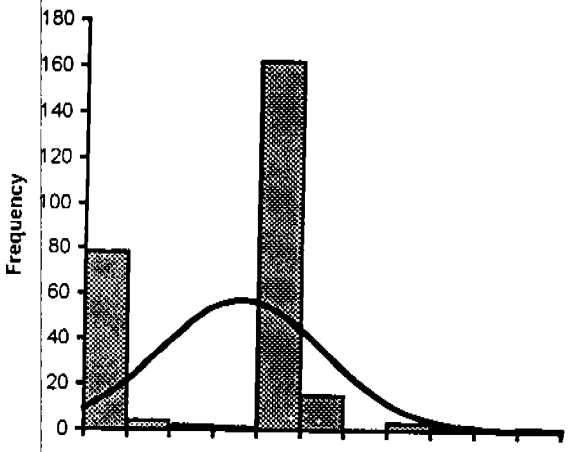
Percentile	
2.5th	0.099
25th	0.099
50th	0.225
75th	0.240
97.5th	0.343



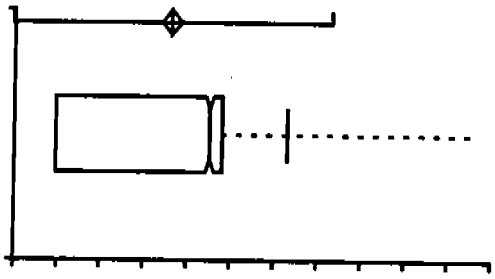
	Coefficient	p
Shapiro-Wilk	0.7066	<0.0001
Skewness	2.2224	<0.0001
Kurtosis	15.4687	<0.0001

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Silver (log-transformed)
Project	Tourtelot
Date	1 June 2001

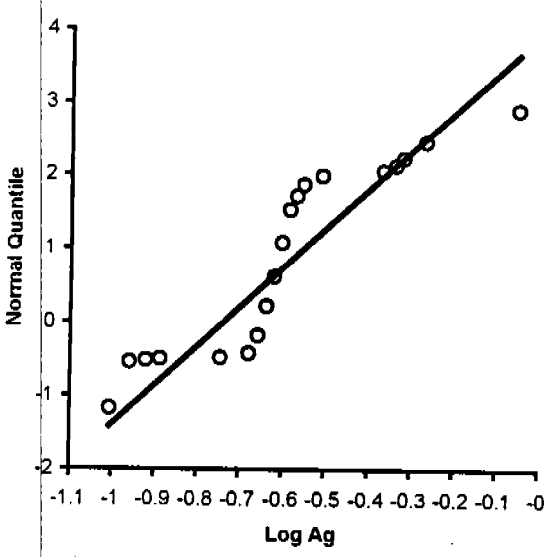


n	268 (cases excluded: 20 due to m
Mean	-0.737
95% CI	-0.759 to -0.714
Variance	0.0353
SD	0.1878
SE	0.0115
CV	-25%



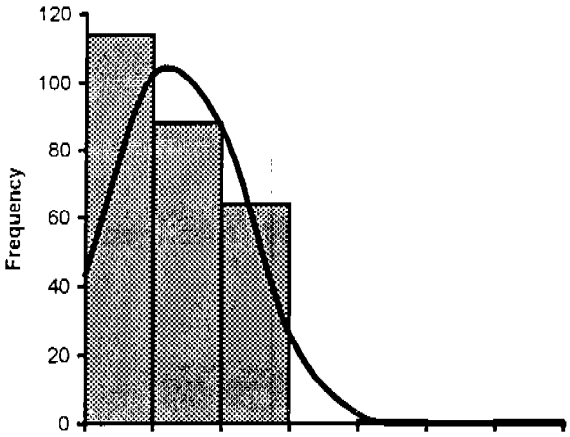
Median	-0.648
95.6% CI	-0.658 to -0.638
Range	0.953754812
IQR	0.384576047

Percentile	
2.5th	-1.004
25th	-1.004
50th	-0.648
75th	-0.620
97.5th	-0.470

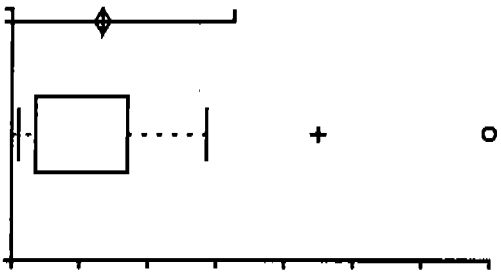


	Coefficient	p
Shapiro-Wilk	0.7647	<0.0001
Skewness	-0.3101	0.0383
Kurtosis	-0.4506	0.0635

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Thallium
Project	Tourtelot
Date	1 June 2001

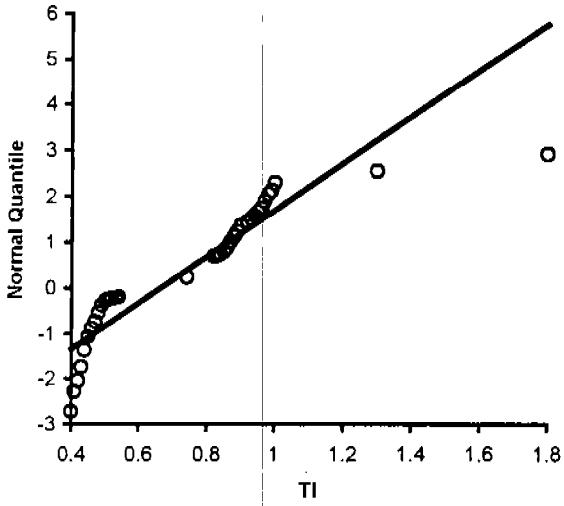


n	268 (cases excluded: 20 due to m
Mean	0.666
95% CI	0.643 to 0.690
Variance	0.0389
SD	0.1971
SE	0.0120
CV	30%



Median	0.741
95.6% CI	0.741 to 0.741
Range	1.4
IQR	0.271

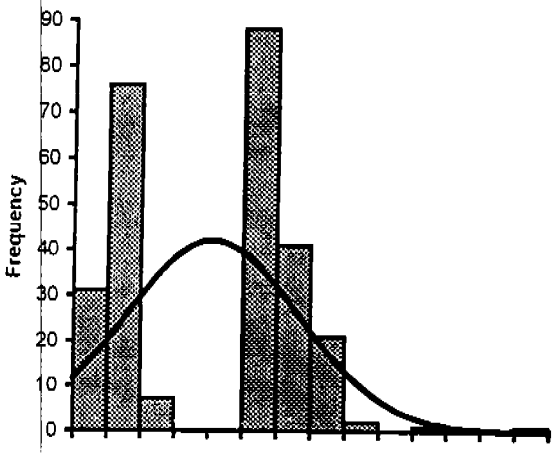
Percentile	
2.5th	0.420
25th	0.470
50th	0.741
75th	0.741
97.5th	0.973



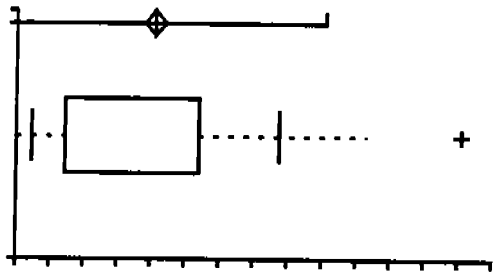
	Coefficient	p
Shapiro-Wilk	0.8534	<0.0001
Skewness	0.7990	<0.0001
Kurtosis	2.6642	<0.0001

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Thallium (log-transformed)
Project	Tourtelot
Date	1 June 2001

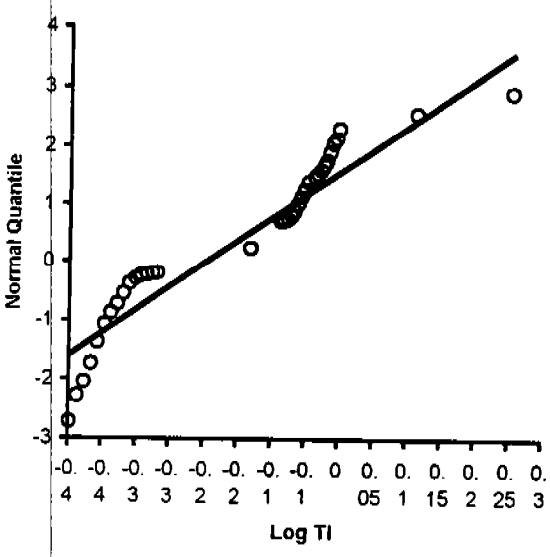


n	268 (cases excluded: 20 due to m
Mean	-0.195
95% CI	-0.210 to -0.179
Variance	0.0162
SD	0.1274
SE	0.0078
CV	-65%



Median	-0.130
95.6% CI	-0.130 to -0.130
Range	0.653212514
IQR	0.19772035

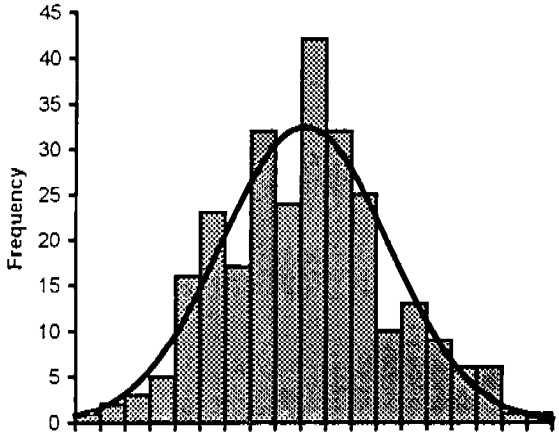
Percentile	
2.5th	-0.377
25th	-0.328
50th	-0.130
75th	-0.130
97.5th	-0.012



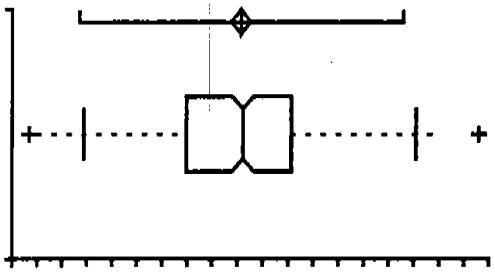
	Coefficient	p
Shapiro-Wilk	0.8690	<0.0001
Skewness	0.0396	0.7874
Kurtosis	-1.0503	<0.0001

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Vanadium
Project	Tourtelot
Date	1 June 2001

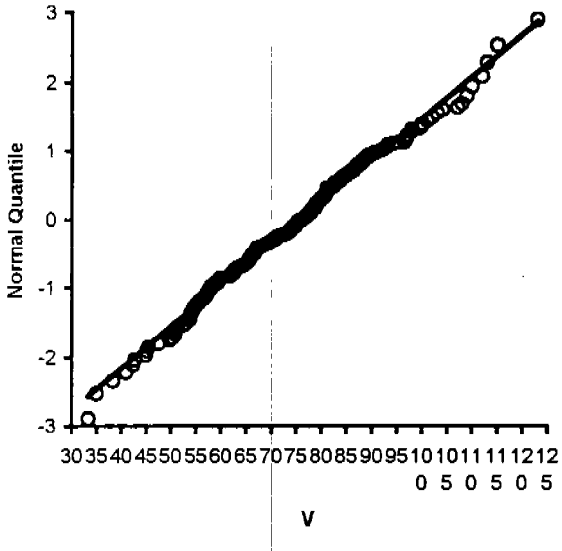


n	268 (cases excluded: 20 due to m
Mean	75.691
95% CI	73.712 to 77.671
Variance	270.9033
SD	16.4591
SE	1.0054
CV	22%



Median	76.100
95.6% CI	74.000 to 78.200
Range	89.6
IQR	20.8

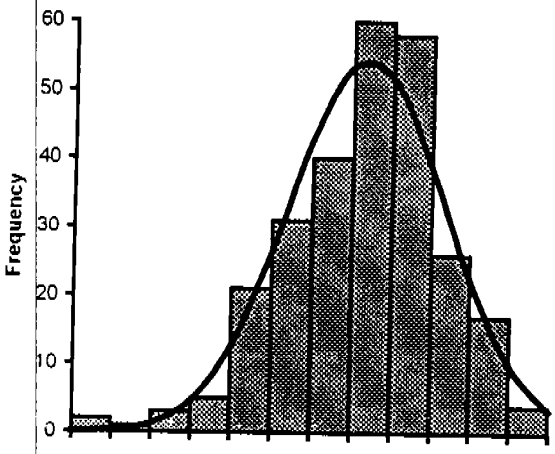
Percentile	
2.5th	44.368
25th	64.850
50th	76.100
75th	85.650
97.5th	110.550



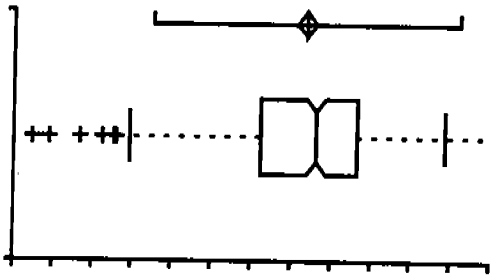
	Coefficient	p
Shapiro-Wilk	0.9930	0.2436
Skewness	0.1788	0.2259
Kurtosis	-0.1079	0.7946

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Vanadium (log-transformed)
Project	Tourtelot
Date	1 June 2001

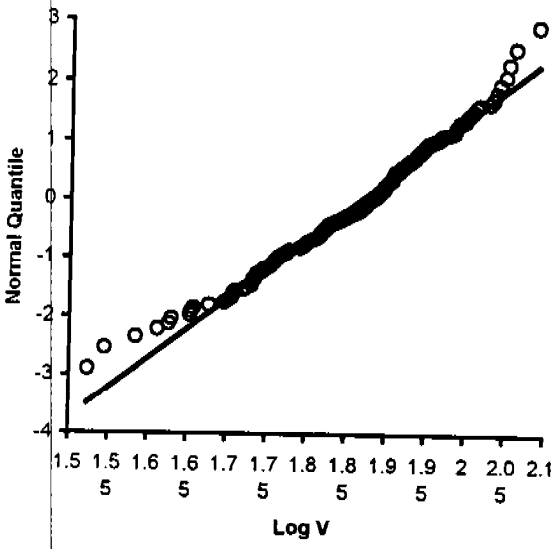


n	268 (cases excluded: 20 due to m
Mean	1.868
95% CI	1.857 to 1.880
Variance	0.0097
SD	0.0983
SE	0.0060
CV	5%



Median	1.881
95.6% CI	1.869 to 1.893
Range	0.566158645
IQR	0.12081888

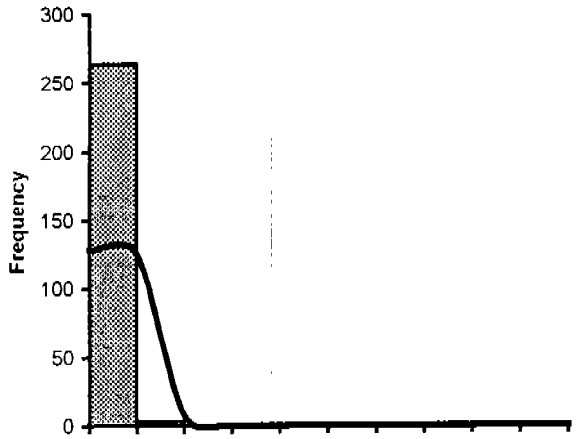
Percentile	
2.5th	1.647
25th	1.812
50th	1.881
75th	1.933
97.5th	2.044



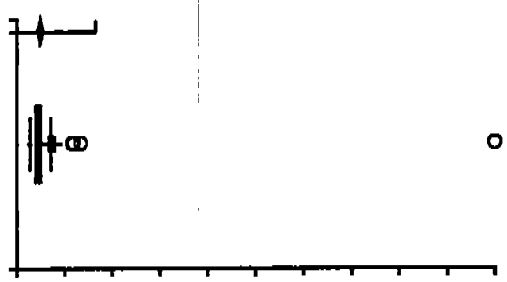
	Coefficient	p
Shapiro-Wilk	0.9827	0.0025
Skewness	-0.4901	0.0015
Kurtosis	0.4374	0.1611

analysed with: Analyse-It + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Zinc
Project	Tourtelot
Date	1 June 2001

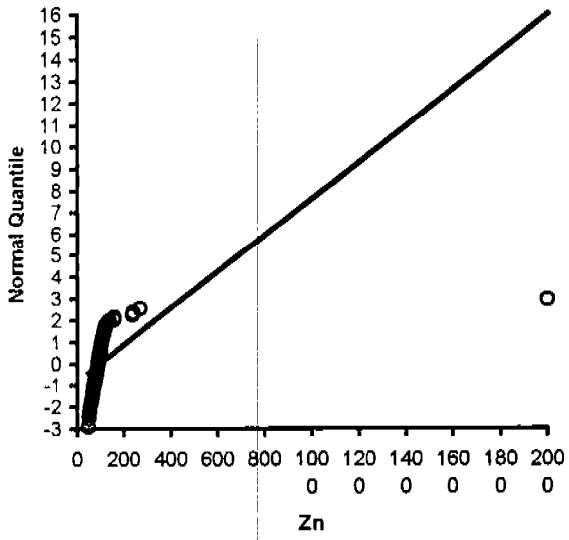


n	268 (cases excluded: 20 due to m
Mean	97.923
95% CI	83.607 to 112.238
Variance	14168.2968
SD	119.0307
SE	7.2710
CV	122%



Median	89.150
95.6% CI	87.000 to 91.300
Range	1951
IQR	20.975

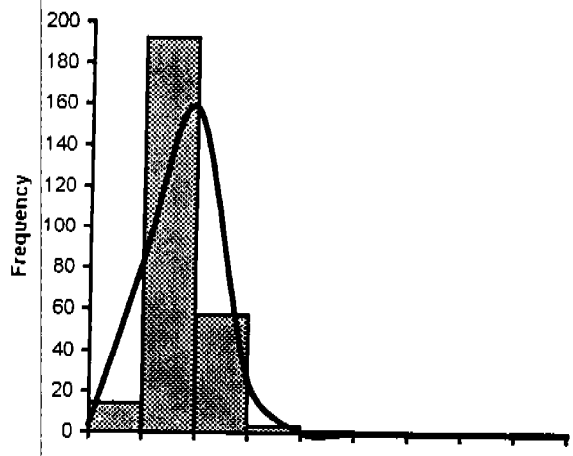
Percentile	
2.5th	56.305
25th	78.975
50th	89.150
75th	99.950
97.5th	142.050



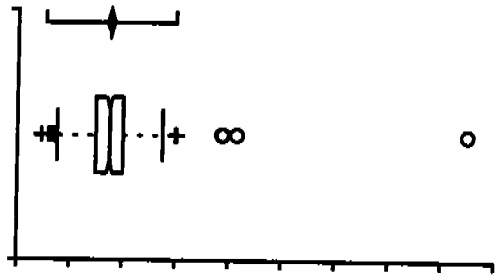
	Coefficient	p
Shapiro-Wilk	0.1223	<0.0001
Skewness	15.4179	<0.0001
Kurtosis	246.7613	<0.0001

analysed with: Analyse-it + General v1.50

Test	**Cumulative Probability and Other Statistics**
Data Set	All Soil and Sediment
Parameter	Zinc (log-transformed)
Project	Tourtelot
Date	1 June 2001

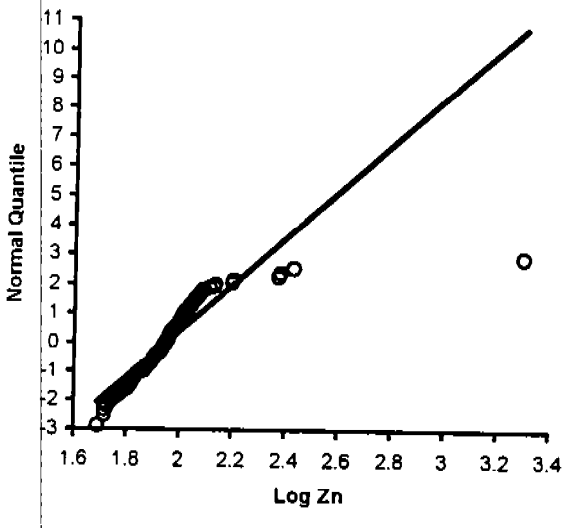


n	268 (cases excluded: 20 due to m
Mean	1.952
95% CI	1.937 to 1.967
Variance	0.0159
SD	0.1262
SE	0.0077
CV	6%



Median	1.950
95.6% CI	1.940 to 1.960
Range	1.610833916
IQR	0.102293066

Percentile	
2.5th	1.751
25th	1.897
50th	1.950
75th	2.000
97.5th	2.151



	Coefficient	p
Shapiro-Wilk	0.6934	<0.0001
Skewness	4.9414	<0.0001
Kurtosis	49.5784	<0.0001

ATTACHMENT E-5

Soil Heterogeneity Evaluation for Arsenic, Iron, and Manganese

ARSENIC DATA EVALUATION

1. Maximum As value at site = 39.1 mg/kg detected in boring TW-8 at 15.5 ft bgs. This is a bedrock sample outside the "areas of interest."
2. Minimum As value at site = 4.4 mg/kg at Demolition Area 3 (DA3-4/5.5). This is a bedrock sample.
3. As concentration in high-metal "ash" sample from Flare Site (FA-6A/1) = 9.2 mg/kg.
4. As concentration in other high-metal sample from Flare Site (FA-3/.5) = 18.0 mg/kg.
5. 95th percentile of ambient soil data set = 18.2 mg/kg.
6. Upper Tolerance Limit (UTL) based on normal distribution of 20-sample Tourtelot ambient soil data set = 21.5 mg/kg. Normal distribution selected due to higher Shapiro-Wilk coefficient for untransformed data relative to log-transformed data for ambient soil data set (see Table 1). (Note that larger data set of all site in-situ As samples is more consistent with a log-normal distribution; see item 14, below).
7. "Typical" range of As in soil = 1.0 – 40 mg/kg (Dragun, 1988).
8. Range of As in "B horizon" soil in Western US = <0.2 – 97 mg/kg (Connor and Shacklette, 1975).
9. Range of As in UC California soil study = 0.6 – 11.0 mg/kg with a log-normal distribution.
10. PRG (cancer) for As = 0.39 mg/kg; PRG (non-cancer) for As = 22 mg/kg.
11. As occurs naturally in about 245 mineral species. It is redox sensitive and can "cycle" through the environment
12. Isoconcentration contour map does not indicate "bullseye" arsenic anomalies within the "areas of interest." However, an arsenic anomaly is apparent along the northeastern border of the site unrelated to any "areas of interest." (See isoconcentration contour map).
13. Wilcoxon rank sum test comparing ambient soil data set with all available data from each area of interest shows NONE of the areas of interest have statistically significantly higher As concentrations (see Table 2 and Figure 1).
14. As histogram of all in-situ site soil data (as opposed to just the 20-sample ambient soil data set) is uniform when log-transformed (and exhibits a higher Shapiro-Wilk coefficient relative to untransformed data), with two far outliers of 39.1 mg/kg (TW-8/15.5) and 37.4 (FA-4/2.5). (See Figure 2).
15. Scatter plot shows 19 out of 243 in-situ soil samples exceed the 95th percentile ambient value of 18.2 mg/kg; this 7.8% of the data compared with the predicted 5%. (See Figure 3).
16. Scatter plot shows 14 out of 243 in-situ soil sample exceed the ambient UTL of 21.5 mg/kg; this is 5.8%of the data compared with the predicted 5%. (See Figure 3).

17. Examination of the scatter plot suggests that the highest As concentrations tend to be associated with bedrock samples. Is this an important geochemical variable that could affect the ability to identify potential impact? To test this hypothesis, we separated the data into lithologic categories and statistically compared the two categories with the most data, bedrock vs. clay, using the Wilcoxon rank sum test. Result: no statistical difference between bedrock and clay (see Table 3). We, therefore, conclude that lithology is not a significant variable. Why does this statistical result seem to contradict the observation of highest As concentrations being associated with bedrock? We examined the full data set and found that the samples with the lowest As values are also bedrock samples. Indicates a high degree of natural geochemical heterogeneity with respect to As.

18. After we statistically examined potential lithologic differences, we used the more generic approach of examining concentration variations as a function of depth. First, we performed regression and correlation analysis that showed a weak but statistically significant negative relationship between concentration and depth (See Table 3 and Figure 4). That is, concentrations actually tend to decrease with depth, contrary to the above observation (demonstrates just how anomalous those high bedrock samples are). Separated the data into two groups: 0 to 2 ft bgs and > 2ft bgs and statistically compared the groups using Wilcoxon rank sum. Result: 0 to 2 ft bgs group is statistically significantly higher than > 2ft bgs (Table 3). Suggests that only shallow data should be used for comparing areas of interest to ambient data set as inclusion of deeper data would bias low the area-of-interest mean. We re-did #13 above screening out all data from areas of interest >2 ft bgs. Result: still no significantly higher As concentrations in areas of interest versus ambient data. (see Table 2).

19. Re-examined histograms, grouping the data in two groups as above to see if better distributions resulted. Slight improvement in Shapiro-Wilk probabilities. (See Figures 5 and 6).

20. Possible explanations for higher As concentrations in shallow soil samples include: regional industrial impact and natural geochemical variability. For the latter, we researched As occurrence in soil and found that most As is derived from the weathering of sulfide minerals. As is relatively mobile under reducing conditions and immobile in oxidizing conditions. Shallow soil zone would be expected to be oxidizing. Where does As occur in the oxidized soil zone? Typically found in iron and manganese oxy-hydroxides formed from weathering of iron and manganese minerals abundant in rocks found at the site. Whatever the cause, the lack of significantly higher values in the areas of interest relative to the ambient data set supports no DOD-related impact.

21. CONCLUSION: No evidence of arsenic impact at the site but data analysis indicates high degree of heterogeneity with respect to natural As concentrations, making a "no impact" demonstration difficult.

IRON DATA EVALUATION

1. Maximum Fe value at site = 66,000 mg/kg detected in Flare Site (FA-3/.5). This is a clay sample.
2. Minimum Fe value at site = 25,000 mg/kg at TNT Strips (TNT-1C-1). This is a clay sample.
3. Fe concentration in high-metal "ash" sample from Flare Site (FA-6A/1) = 39,400 mg/kg.
4. The maximum Fe value coincides with other high-metal values in FA-3/.5.
5. 95th percentile of ambient soil data set = 43,805 mg/kg.
6. Upper Tolerance Limit (UTL) based on normal distribution of 20-sample ambient data set = 50,817 mg/kg. Normal distribution selected due to higher Shapiro-Wilk coefficient for untransformed data relative to log-transformed data for ambient soil data set (see Table 1).
7. "Typical" range of Fe in soil = 7,000 – 550,000 mg/kg (Dragun, 1988).
8. Range of Fe in "B horizon" soil in Western US = 15,000 – >100,000 mg/kg (Connor and Shacklette, 1975).
9. Range of Fe in UC California soil study = 10,000 – 87,000 mg/kg with a log-normal distribution.
10. The PRG for Iron is 23,000 mg/kg.
11. Iron is the third most abundant metallic element in the earth's crust –behind silicon and aluminum. It occurs as a major component of most rocks, particularly certain types of igneous and metamorphic rocks and the sediments derived from such rocks, such as shale. Mafic igneous rocks often contain in excess of 10% (100,000 mg/kg) iron. Iron occurs in thousands of minerals, is highly pH and redox sensitive and is largely mobilized and redistributed through the soil zone upon weathering. In the oxidized soil zone, iron commonly occurs in various particulate Fe(III) oxyhydroxides. Iron is an essential element in the metabolism of animals and plants.
12. Isoconcentration contour map does not indicate "bullseye" iron anomalies in the areas of interest. Instead, there appears to be a widespread zone of elevated Fe concentrations that extends through the areas of interest in the South Valley and the Howitzer Test Facility in the North Valley and continuing through TNT Strips. (See isoconcentration contour map).
13. Wilcoxon rank sum test comparing ambient soil data set with all available data from each area of interest shows that several of the areas of interest have statistically significantly higher Fe concentrations, including the soil samples from North Valley borings located outside of the areas of interest (see Table 2 and Figure 7).
14. Fe histogram of all in-situ site soil data (as opposed to just the 20-sample ambient soil data set) shows one far outlier of 66,000 mg/kg (FA-3/.5). (See Figure 8).

15. Scatter plot shows 103 out of 243 in-situ soil samples exceed the 95th percentile ambient value of 43,805 mg/kg; this 42% of the data compared with the predicted 5%. (See Figure 9).

16. Scatter plot shows 6 out of 243 in-situ soil sample exceed the ambient UTL of 50,817 mg/kg; this is 2.5%of the data compared with the predicted 5%. (See Figure 9).

17. Examination of the scatter plot does not indicate a systematic pattern with respect to concentration and location, depth, or lithology, with the possible exception that the two highest Fe concentrations are in the Flare Site – one clay sample and one bedrock sample. We separated the data into lithologic categories and statistically compared the two with the most data, bedrock vs. clay, using Wilcoxon rank sum. Result: no statistical difference between bedrock and clay. (See Table 3).

18. After statistically examining potential lithologic differences, we used the more generic approach of examining variation as a function of depth. First, we performed regression and correlation analysis that showed a weak but statistically significant positive relationship between concentration and depth (See Table 3 and Figure 10). That is, concentrations of Fe actually tend to increase with depth. Separated the data into two groups: 0 to 2 ft bgs and > 2ft bgs and statistically compared the groups using Wilcoxon rank sum. Result: >2-ft bgs group is statistically significantly higher than 0 to-2ft bgs. Suggests that only shallow data should be used for comparing areas of interest to ambient data set as inclusion of deeper data would bias high the area-of-interest mean (might explain the high rate of concentrations above the ambient 95th percentile). We re-did #13 above screening out all data from areas of interest >2 ft bgs. Result: still some significantly higher Fe concentrations in areas of interest versus ambient data (see Table 2) but two key observations: (1) no change to status of N. Valley borings (still significantly higher even though these samples are collected outside of the areas of interest) and (2) change of status to Flare Site (no longer significantly higher). Suggests that high Flare Site samples are not representative of significant "impact" and that a high degree of natural heterogeneity is present with respect to Fe soil concentrations.

19. Re-examined histograms, grouping the data in two groups as above to see if better distributions resulted. No improvement for 0 to 2-ft bgs data set but slight improvement for >2-ft bgs data set. (See Figures 11 and 12).

20. Examined the ratio of iron to other metals to see if we could document if a natural ratio is maintained independent of absolute Fe concentrations. Noted in UC study that a strong positive statistical correlation was apparent for Fe and V. This is likely a result of the natural relationship of these metals in mafic minerals. Is this ratio reflected at Tourtelot? We performed regression and correlation analysis and found a reasonably strong positive correlation between Fe and V (see Figures 13 and 14); however Fe:V ratio at Tourtelot is significantly higher than found in UC Study. Performed Wilcoxon rank sum comparison of ambient sample Fe:V ratio to UC Study Fe:V ratio for their 50-samples. Result: Fe:V ratio is statistically significantly higher in Tourtelot ambient samples. Indicates that Tourtelot samples are naturally enriched in Fe (not depleted in V due to examination of V concentrations) relative to literature

values. A logical next step would be to perform Wilcoxon area-of-interest comparisons using Fe:V ratios to see if and where differences occur.

21. Fe results at Tourtelot exhibit some systematically higher concentrations in areas of interest relative to ambient data set. Possible explanations for higher Fe concentrations in deeper soil samples include: natural geochemical weathering processes that cause leaching near surface and re-deposition at depth based on changes in pH and redox. Whatever the cause, finding higher Fe concentrations at depth supports an interpretation of no DOD-related impact.

22. CONCLUSION: Iron data at the site exhibits very complex relationships, making proof of no DOD-related impact difficult. However, the higher Fe concentrations at depth, the appearance of natural iron enrichment in the ambient samples, and the inconsistent area-of-interest vs. ambient Wilcoxon results support the interpretation of natural causes for the apparently elevated Fe concentrations.

MANGANESE DATA EVALUATION

1. Maximum Mn value at site = 4,340 mg/kg detected in Ammunition Renovation Area (AR-1/4.5). This is a clay sample.
2. Minimum Mn value at site = 131 mg/kg at Demo Site 3 (DA3-4/5.5). This is a bedrock sample.
3. Mn concentration in high-metal "ash" sample from Flare Site (FA-6A/1) = 564 mg/kg.
4. Mn concentration in other high-metal sample from Flare Site (FA-3/.5) = 1,100 mg/kg.
5. 95th percentile of ambient soil data set = 1,645 mg/kg.
6. UTL based on normal distribution of 20-sample ambient data set = 2,083 mg/kg. Normal distribution selected due to higher Shapiro-Wilk coefficient for untransformed data relative to log-transformed data for ambient soil data set (see Table 1). (Note that larger data set of all site in-situ Mn samples is more consistent with a log-normal distribution; see item 14, below).
7. "Typical" range of Mn in soil = 100 – 4,000 mg/kg (Dragun, 1988).
8. Range of Mn in "B horizon" soil in Western US = 30 – 5,000 mg/kg (Connor and Shacklette, 1975).
9. Range of Mn in UC California soil study = 253 – 1,687 mg/kg with a log-normal distribution.
10. The PRG for Manganese is 1,800 mg/kg.
11. Manganese geochemistry is similar to iron. However, Mn is generally significantly less abundant than Fe, the ratio in the earth's crust being about 1 part Mn to 50 parts Fe. Similar to Fe, Mn is relatively abundant in many types of igneous and metamorphic rocks, is highly pH and redox sensitive, and is largely remobilized and redistributed through the soil zone upon weathering. Also similar to Fe, Mn commonly occurs in particulate oxyhydroxide minerals in its oxidized valence states.
12. Isoconcentration contour map does not indicate significant manganese anomalies in areas of interest with the possible exception of the Ammunition Renovation Area and a relatively small portion of the TNT Strips where an area of elevated concentration is created by anomalous results at sample AR-1A and ambient sample NO-100.
13. Wilcoxon rank sum test comparing ambient soil data set with all available data from each area of interest shows that NONE of the areas of interest have statistically significantly higher Mn concentrations (see Table 2 and Figure 15).
14. Mn histogram of all site data (as opposed to just the 20-sample ambient soil data set) is relatively uniform when log-transformed (and exhibits a higher Shapiro-Wilk coefficient relative to untransformed data), with no far outliers. (See Figure 16).

15. Scatter plot shows 32 out of 243 in-situ soil samples exceed the 95th percentile ambient value of 1,645 mg/kg; this 13% of the data compared with the predicted 5%. (See Figure 17).

16. Scatter plot shows 13 out of 243 in-situ soil sample exceed the ambient UTL of 2,083 mg/kg; this is 5.3%of the data compared with the predicted 5%. (See Figure 17).

17. Examination of the scatter plot does not indicate a systematic pattern with respect to concentration and location, depth, or lithology, with the possible exception that the two highest Mn concentrations are in Ammunition Renovation Area – both are clay samples. Note, however, that Ammunition Renovation did not show significantly higher concentration relative to ambient data set using the Wilcoxon test in step 13 above. We separated the data into lithologic categories and statistically compared the two with the most data, bedrock vs. clay, using Wilcoxon rank sum. Result: statistically significant difference between bedrock and clay. (See Table 3)

18. After statistically examining potential lithologic differences, used the more generic approach of examining variation as a function of depth. First, we performed regression and correlation analysis that showed a weak but statistically significant negative relationship between concentration and depth (see Table 3 and Figure 18). That is, concentrations of Mn actually tend to decrease with depth. Separated the data into two groups: 0 to 2 ft bgs and > 2ft bgs and statistically compared the groups using Wilcoxon rank sum. Result: 0 to 2-ft bgs group is statistically significantly higher than > 2-ft bgs. Suggests that only shallow data should be used for comparing areas of interest to ambient data set as inclusion of deeper data would bias low the area-of-interest mean. Re-did #13 above screening out all data from areas of interest >2 ft bgs. Result: still no significantly higher Mn concentrations in areas of interest versus ambient data (see Table 2).

19. Re-examined histograms, grouping the data in two groups as above to see if better distributions resulted. Slight improvement for >2-ft bgs data set toward lognormal but significant improvement for shallow (i.e., 0 to 2-ft bgs) data set such that log-normal distribution for this data set is strongly supported. (See Figures 19 and 20).

20. Possible explanations for higher Mn concentration bias in shallow soil samples include: regional industrial impact and natural geochemical weathering processes. We suspect the latter as Mn commonly occurs in the highly oxidized part of the soil column as manganese oxy-hydroxides formed from weathering of manganese-bearing minerals abundant in rocks found at the site. Whatever the cause, the lack of significantly higher values in the areas of interest relative to the ambient data set supports no DOD-related impact.

21. CONCLUSION: No evidence of manganese impact at the site but data analysis indicates high degree of heterogeneity with respect to natural Mn concentrations, making "no impact" demonstration difficult.

TABLE 1

Shapiro-Wilk Test Results for Untransformed and Log-Transformed Tourtelot Ambient Soil Data Set

Element	Untransformed		Log-transformed		Distributional
	Shapiro-Wilk Coefficient	Probability	Shapiro-Wilk Coefficient	Probability	Assumption
Al	0.9846	0.9789	0.9797	0.9304	Normal
Sb	0.9535	0.4227	0.8373	0.0033	Normal
As	0.9446	0.2920	0.9021	0.0452	Normal
Ba	0.9603	0.5493	0.9741	0.8385	Log-Normal
Be	0.9778	0.9027	0.9696	0.7469	Normal
Cd	0.8356	0.0031	0.8209	0.0018	Normal
Cr	0.9528	0.4122	0.9483	0.3419	Normal
Co	0.9527	0.4098	0.9193	0.0960	Normal
Cu	0.9532	0.4181	0.9290	0.1478	Normal
Fe	0.9299	0.1535	0.9154	0.0807	Normal
Pb	0.9085	0.0597	0.9436	0.2796	Log-Normal
Mn	0.9500	0.3675	0.9330	0.1767	Normal
Hg	0.9384	0.2232	0.9541	0.4331	Log-Normal
Mo	N/A	N/A	N/A	N/A	N/A
Ni	0.9823	0.9605	0.9586	0.5167	Normal
P	0.9053	0.0518	0.9261	0.1300	Log-Normal
Se	N/A	N/A	N/A	N/A	N/A
Ag	N/A	N/A	N/A	N/A	N/A
Tl	N/A	N/A	N/A	N/A	N/A
V	0.9382	0.2216	0.9697	0.7490	Log-Normal
Zn	0.9720	0.7970	0.9751	0.8571	Log-Normal

Notes:

Non-detected values were assigned a value of 1/2 of the method detection limit (MDL); applies to Cd only

N/A: not applicable as all results were below the MDL (for Mo, Ag, and Tl) or >50% of results below the MDL (for Se)

TABLE 2
Comparison of Areas of Interest Soil Concentrations to Ambient Soil Concentrations using Wilcoxon Rank Sum Test
(two scenarios -- all depths and 0 to 2-ft bgs for As, Fe, and Mn)

Area of Interest	As (all depths)	As (0 to 2-ft bgs)	Fe (all depths)	Fe (0 to 2-ft bgs)	Mn (all depths)	Mn (0 to 2-ft bgs)
Ammunition Renovation Area	0.9959	0.9976	0.0800	0.7182	0.8268	0.3798
Demolition Site 1	0.4407	0.4340	**0.0014**	**0.0080**	0.9671	0.9488
Demolition Site 2	0.5000	0.2515	**0.0016**	**0.0008**	0.8739	0.7767
Demolition Site 3	0.9977	0.9694	**0.0007**	0.0515	0.9998	0.9668
Flare Site	0.9751	0.9985	**0.0274**	0.0593	0.9938	0.9926
Howitzer Test Facility	0.9900	0.7409	**0.0005**	**0.0359**	0.4477	0.1384
Ridge Stockpiles	0.9999	N/A	0.3142	N/A	0.9953	N/A
Stockpile 1	0.6924	N/A	**0.0112**	N/A	0.5364	N/A
Stockpile 2	0.9932	N/A	0.3575	N/A	0.9174	N/A
Stockpile 3	0.9693	N/A	0.2934	N/A	0.8761	N/A
TNT Strips	0.9978	0.9924	**0.0002**	**0.0011**	0.2273	0.1679
North Valley (outside areas of interest)	0.9999	0.9975	**0.0025**	**0.0031**	0.7862	0.7675
S. Valley Wetlands	0.9927	N/A	0.5919	N/A	0.4384	N/A
N. Valley Military Landfill	1.000	0.9994	**<0.0001**	0.0720	0.4149	0.8351

NOTES:
1. Null hypothesis for Wilcoxon rank sum test is that the "area of interest" concentrations are equal to the ambient concentrations; alternative hypothesis is that the "area of interest" concentrations are higher than the ambient concentrations. Therefore, a 1-sided test is performed and the null hypothesis is rejected when the probability value shown is below 0.05 these values shown in bold).
2. N/A = not applicable as these samples are not depth discrete and cannot, therefore, be evaluated by depth interval

TABLE 3
Results of Various Statistical Tests for As, Fe, and Mn

Statistical Test	As	Fe	Mn
1. Wilcoxon Rank Sum Test Bedrock vs. Clay Null Hypothesis = No Difference in Concentrations Alternative Hypothesis = Difference in Concentrations 2-sided test, reject null hypothesis at p <0.05	0.1307	0.4652	**<0.0001**
2. Wilcoxon Rank Sum Test 0 to 2-ft bgs vs. > 2-ft bgs Null Hypothesis = No Difference in Concentrations Alternative Hypothesis = Difference in Concentrations 2-sided test, reject null hypothesis at p <0.05	**0.0001**	**0.0479**	**0.0084**
3. Spearman Rank Correlation Concentration vs. Depth Null Hypothesis = No Correlation Alternative Hypothesis = Correlation Reject null hypothesis at p <0.05	**<0.0001**	**0.0092**	**0.0088**
4. Linear Regression Concentration vs. Depth Null Hypothesis = No Correlation Alternative Hypothesis = Correlation Reject null hypothesis at p <0.05	**0.0160**	0.5080	0.0839

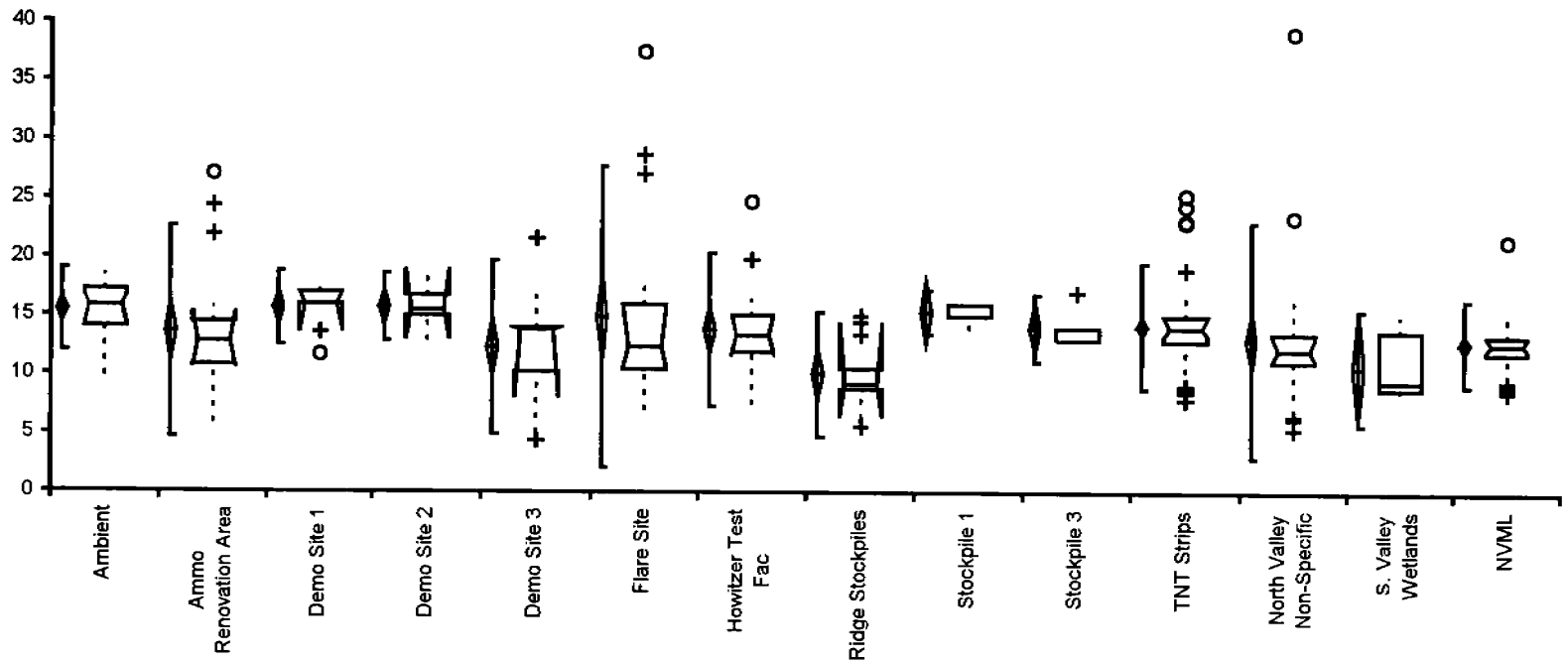
Notes:
Values in bold regarded as "statistically significant" at <0.05 level

Figu

analysed with: Analyse-It + General v1.50

Test Area Box Plots and Statistics
Parameter ARSENIC

Date 7 May 2001



Arsenic	n	Mean	SD	SE	95% CI of Mean	Median	IQR	95% CI of Median
Ambient	20	15.495	2.1375	0.4780	14.495 to 16.495	15.850	3.175	14.100 to 16.800
Ammo Renovation Area	19	13.653	5.4428	1.2487	11.029 to 16.276	12.800	3.700	10.600 to 15.400
Demo Site 1	9	15.700	1.9183	0.6394	14.225 to 17.175	16.000	1.000	13.600 to 17.000
Demo Site 2	8	15.750	1.7525	0.6196	14.285 to 17.215	15.500	1.750	13.000 to 19.000
Demo Site 3	16	12.338	4.4854	1.1213	9.947 to 14.728	13.850	3.750	8.000 to 14.000
Flare Site	20	14.920	7.7885	1.7416	11.275 to 18.565	12.400	5.575	10.500 to 16.000
Howitzer Test Fac	18	13.833	3.9549	0.9322	11.867 to 15.800	13.350	3.125	11.900 to 15.100
Ridge Stockpiles	10	10.050	3.2205	1.0184	7.746 to 12.354	9.200	1.700	6.400 to 14.500

Figure 1, Con't.

analysed with: Analyse-It + General v1.50

Test **Area Box Plots and Statistics**
Parameter ARSENIC

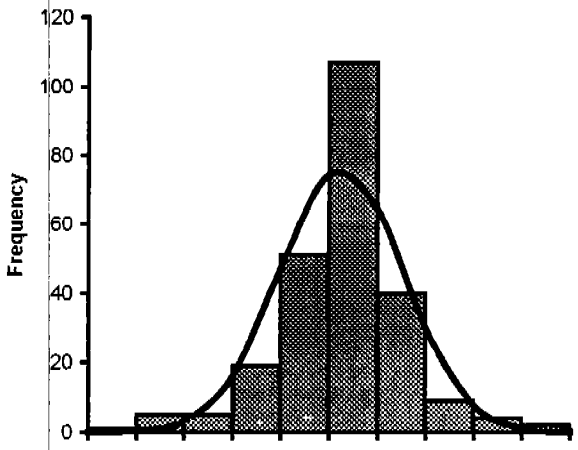
Date 7 May 2001

Stockpile 1	3	15.333	1.1547	0.6667	12.465 to 18.202	16.000	1.000	- to -
Stockpile 3	5	14.000	1.7321	0.7746	11.849 to 16.151	13.000	1.000	- to -
TNT Strips	68	14.182	3.2605	0.3954	13.393 to 14.972	14.000	2.125	13.300 to 15.000
North Valley Non-Specific	29	12.993	6.0873	1.1304	10.678 to 15.309	12.100	2.400	11.200 to 13.300
S. Valley Wetlands	4	10.625	2.9635	1.4818	5.909 to 15.341	9.400	4.875	- to -
NVML	34	12.756	2.2369	0.3836	11.975 to 13.536	12.650	1.450	12.200 to 13.300

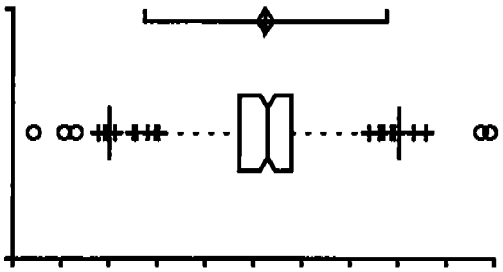
Figure 2

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples
Parameter	Arsenic (log-transformed)
Date	15 April 2001

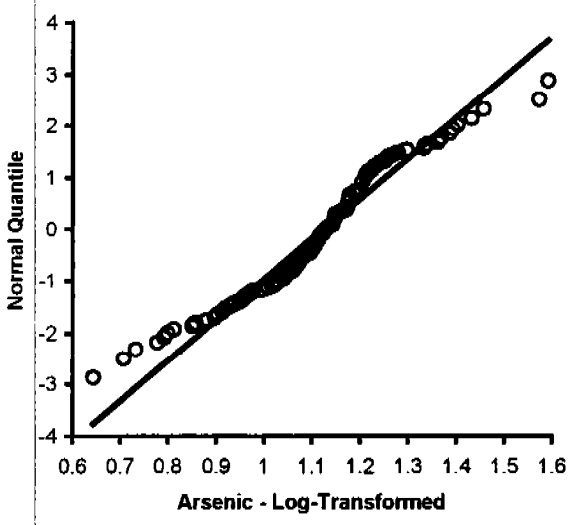


n	243
Mean	1.125
95% CI	1.109 to 1.141
Variance	0.0164
SD	0.1279
SE	0.0082
CV	11%



Median	1.130
96.0% CI	1.114 to 1.146
Range	0.948724081
IQR	0.10709494

Percentile	
2.5th	0.801
25th	1.072
50th	1.130
75th	1.179
97.5th	1.402



	Coefficient	p
Shapiro-Wilk	0.9422	<0.0001
Skewness	-0.2034	0.1897
Kurtosis	2.6048	<0.0001

Figure 3

DRAFT

Arsenic Concentration vs. Depth

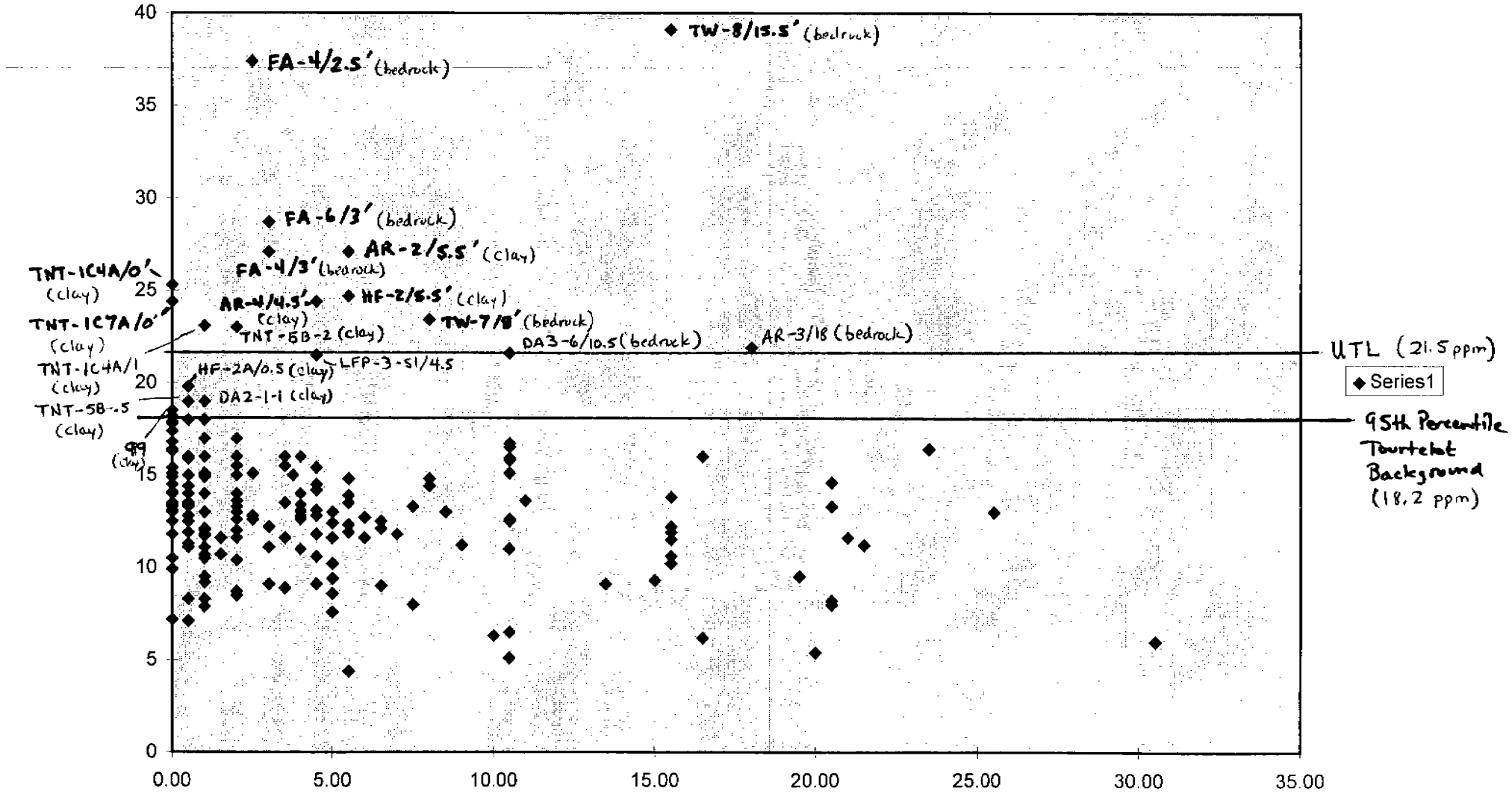


Figure 4

analysed with: Analyse-It + General v1.50

Test	**Linear regression** Arsenic: Concentration v Depth
Date	7 May 2001

n	243
R^2	0.02
Adjusted R^2	0.02
SE	4.2963

Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	14.4405	0.3476	<0.0001	13.7557 to 15.1253
Slope	-0.1209	0.0498	0.0160	-0.2191 to -0.0228

Source of variation	SSq	DF	MSq	F	p
Due to regression	108.723	1	108.723	5.89	0.0160
About regression	4448.389	241	18.458		
Total	4557.111	242			

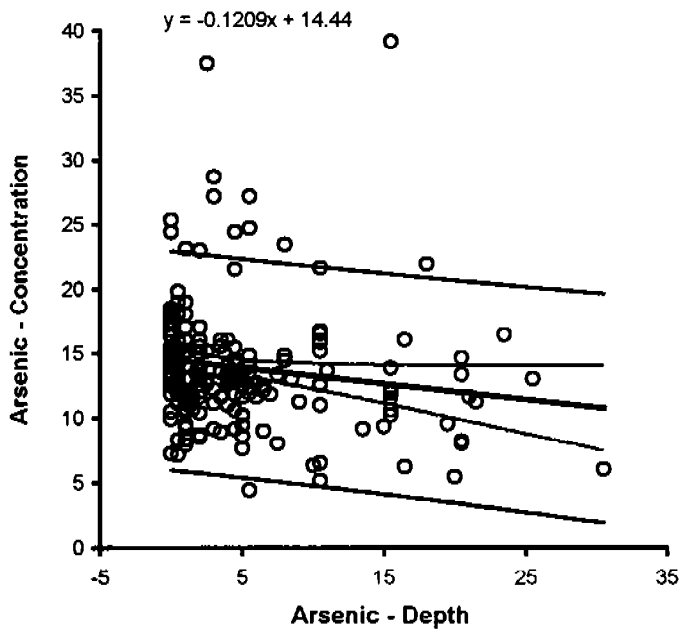


Figure 4, con't.

analysed with: Analyse-It + General v1.50

Test **Linear regression**
Arsenic: Concentration v Depth

Date 7 May 2001

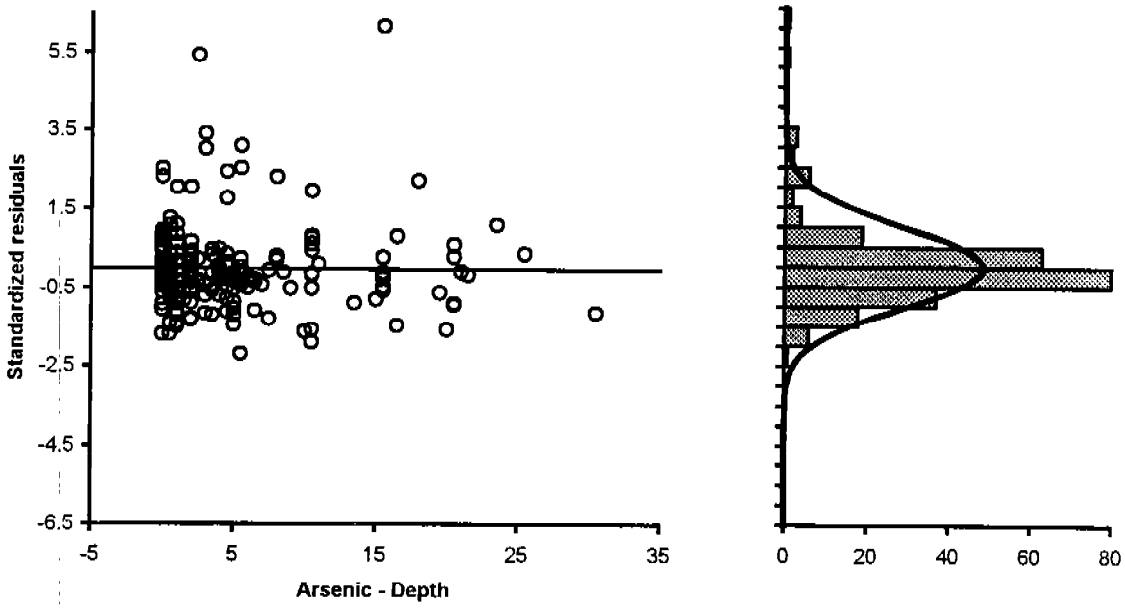
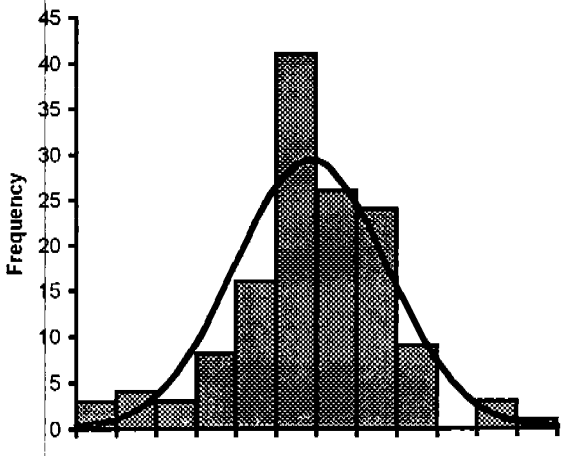


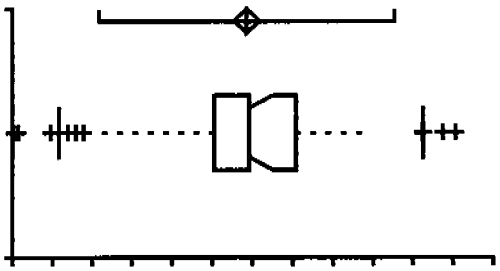
Figure 5

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples 0 to 2-ft bgs
Parameter	Arsenic (log-transformed)
Date	14 May 2001

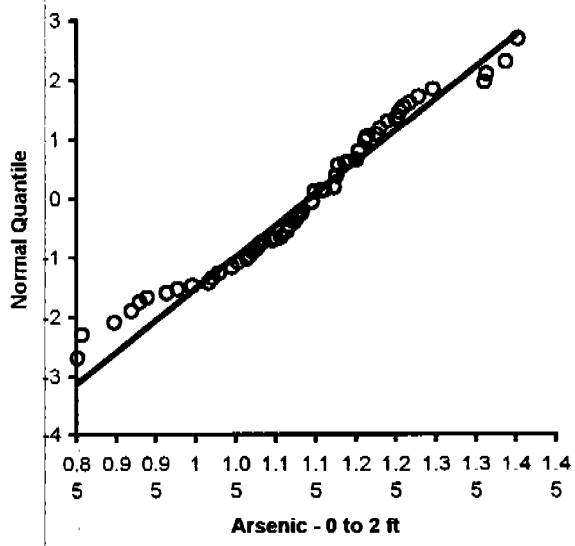


n	138
Mean	1.143
95% CI	1.127 to 1.159
Variance	0.0088
SD	0.0936
SE	0.0080
CV	8%



Median	1.146
95.0% CI	1.146 to 1.176
Range	0.551862172
IQR	0.102039581

Percentile	
2.5th	0.908
25th	1.102
50th	1.146
75th	1.204
97.5th	1.363

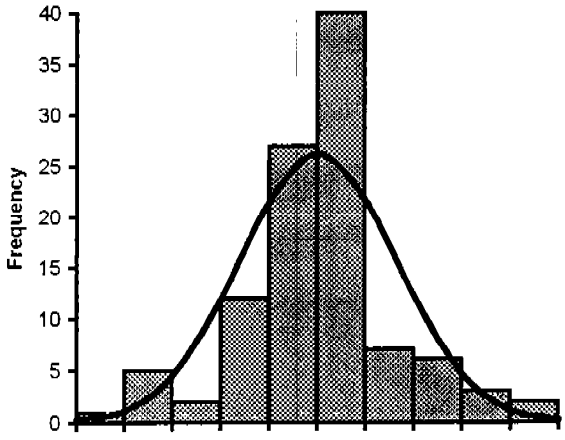


	Coefficient	p
Shapiro-Wilk	0.9560	0.0002
Skewness	-0.4753	0.0236
Kurtosis	1.5103	0.0099

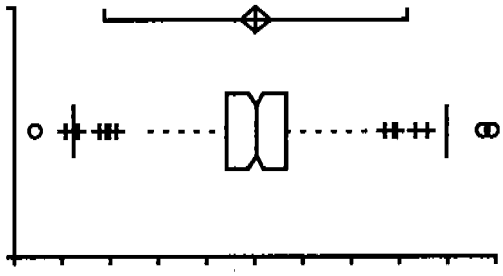
Figure 6

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples > 2-ft bgs
Parameter	Arsenic (log-transformed)
Date	14 May 2001

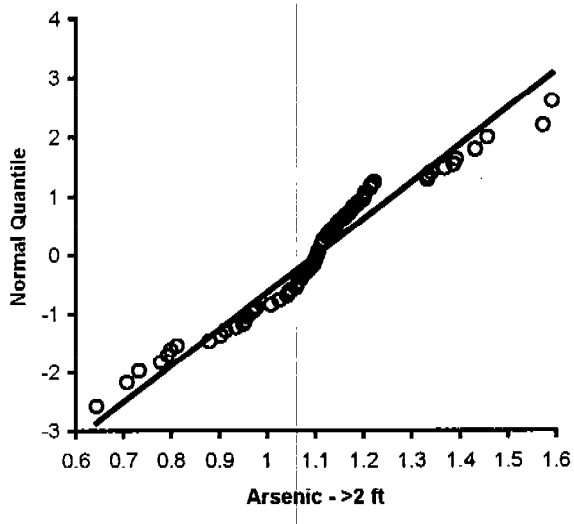


n	105 (cases excluded: 33 due to m
Mean	1.102
95% CI	1.071 to 1.133
Variance	0.0256
SD	0.1598
SE	0.0156
CV	15%



Median	1.104
96.9% CI	1.086 to 1.117
Range	0.948724081
IQR	0.122960171

Percentile	
2.5th	0.724
25th	1.041
50th	1.104
75th	1.164
97.5th	1.498



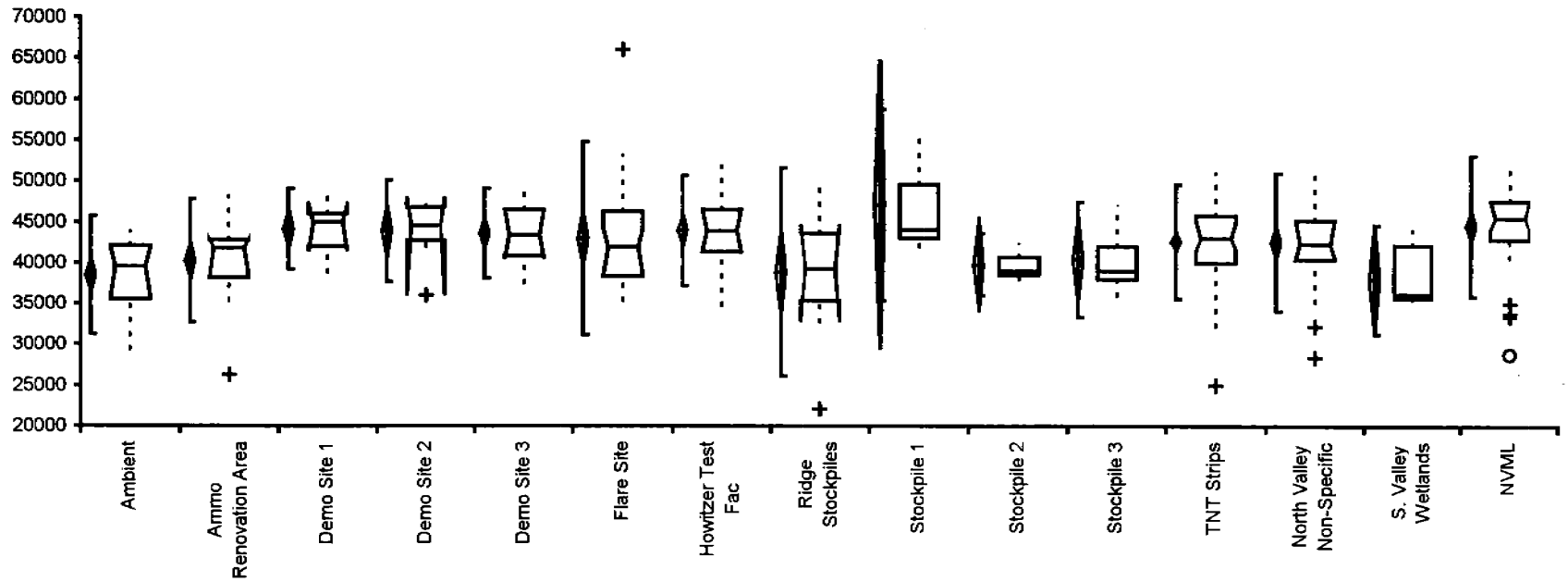
	Coefficient	p
Shapiro-Wilk	0.9406	0.0001
Skewness	0.1748	0.4468
Kurtosis	1.7454	0.0106

Figure 7

analysed with: Analyse-It + General v1.50

Test **Area Box Plots and Statistics**
Parameter IRON

Date 7 May 2001



Iron	n	Mean	SD	SE	95% CI of Mean	Median	IQR	95% CI of Median
Ambient	20	38475.000	4396.8739	983.1709	36417.20 40532.80	39550.000	6600.000	35900.00 41800.00
Ammo Renovation Area	19	40263.158	4585.8733	1052.0715	38052.84 42473.48	41800.000	4600.000	38200.00 42900.00
Demo Site 1	9	44133.333	3013.3038	1004.4346	41817.10 46449.56	45000.000	4000.000	41400.00 47000.00
Demo Site 2	8	43875.000	3758.3241	1328.7682	40732.96 47017.04	44500.000	4000.000	36000.00 48000.00
Demo Site 3	16	43606.250	3335.5597	833.8899	41828.86 45383.64	43400.000	5575.000	40500.00 46500.00
Flare Site	20	42970.000	7165.8621	1602.3355	39616.27 46323.73	41950.000	7925.000	38500.00 44100.00
Howitzer Test Fac	18	43922.222	4119.9023	971.0703	41873.44 45971.00	43900.000	5125.000	41300.00 46700.00
Ridge Stockpiles	10	38850.000	7734.9495	2446.0058	33316.75 44383.25	39300.000	8200.000	32800.00 44700.00

Figure 7, con't.

analysed with: Analyse-It + General v1.50

Test **Area Box Plots and Statistics**
Parameter IRON

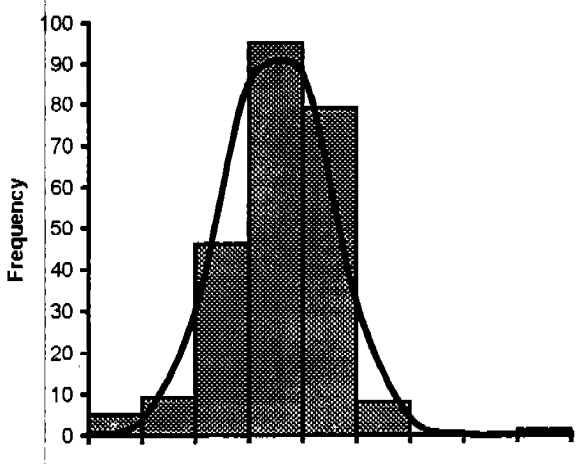
Date 7 May 2001

Stockpile 1	3	47066.667	7114.3048	4107.4458	29393.76	64739.58	44000.000	6600.000	- to -	
Stockpile 2	3	39800.000	2306.5125	1331.6656	34070.31	45529.69	39000.000	2200.000	- to -	
Stockpile 3	5	40400.000	4277.8499	1913.1126	35088.35	45711.65	39000.000	4000.000	- to -	
TNT Strips	68	42585.294	4269.1977	517.7163	41551.93	43618.66	43050.000	5775.000	41500.00	45000.00
North Valley Non-Specific	29	42500.000	5144.9004	955.3840	40542.98	44457.02	42300.000	4800.000	40500.00	45200.00
S. Valley Wetlands	4	37950.000	4061.6089	2030.8044	31487.08	44412.92	36150.000	6500.000	- to -	
NVML	34	44508.824	5231.0476	897.1173	42683.62	46334.02	45500.000	4700.000	44100.00	47500.00

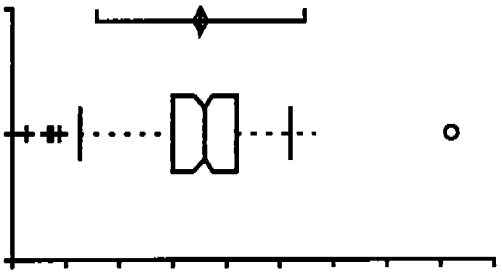
Figure 8

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples
Parameter	Iron (untransformed)
Date	7 May 2001

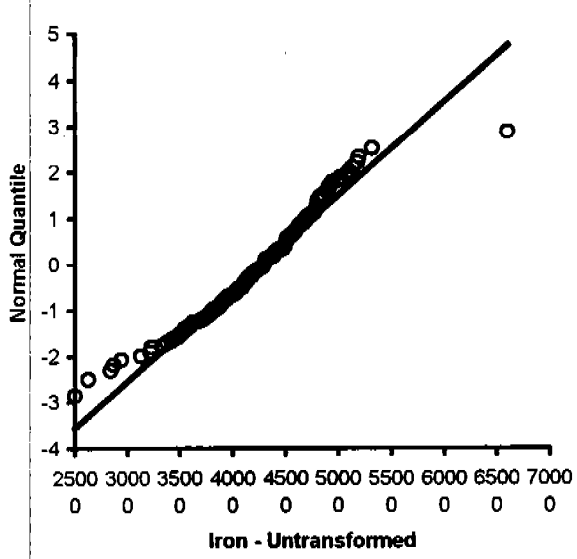


n	243
Mean	42608.230
95% CI	41985.196 to 43231.265
Variance	24309684
SD	4930.4852
SE	316.2908
CV	12%



Median	43000.000
96.0% CI	42000.000 to 43700.000
Range	41000
IQR	6000

Percentile	
2.5th	31390.000
25th	40000.000
50th	43000.000
75th	46000.000
97.5th	50980.000



	Coefficient	p
Shapiro-Wilk	0.9630	<0.0001
Skewness	-0.2456	0.1148
Kurtosis	2.5475	<0.0001

Figure 9

Iron Concentration vs. Depth

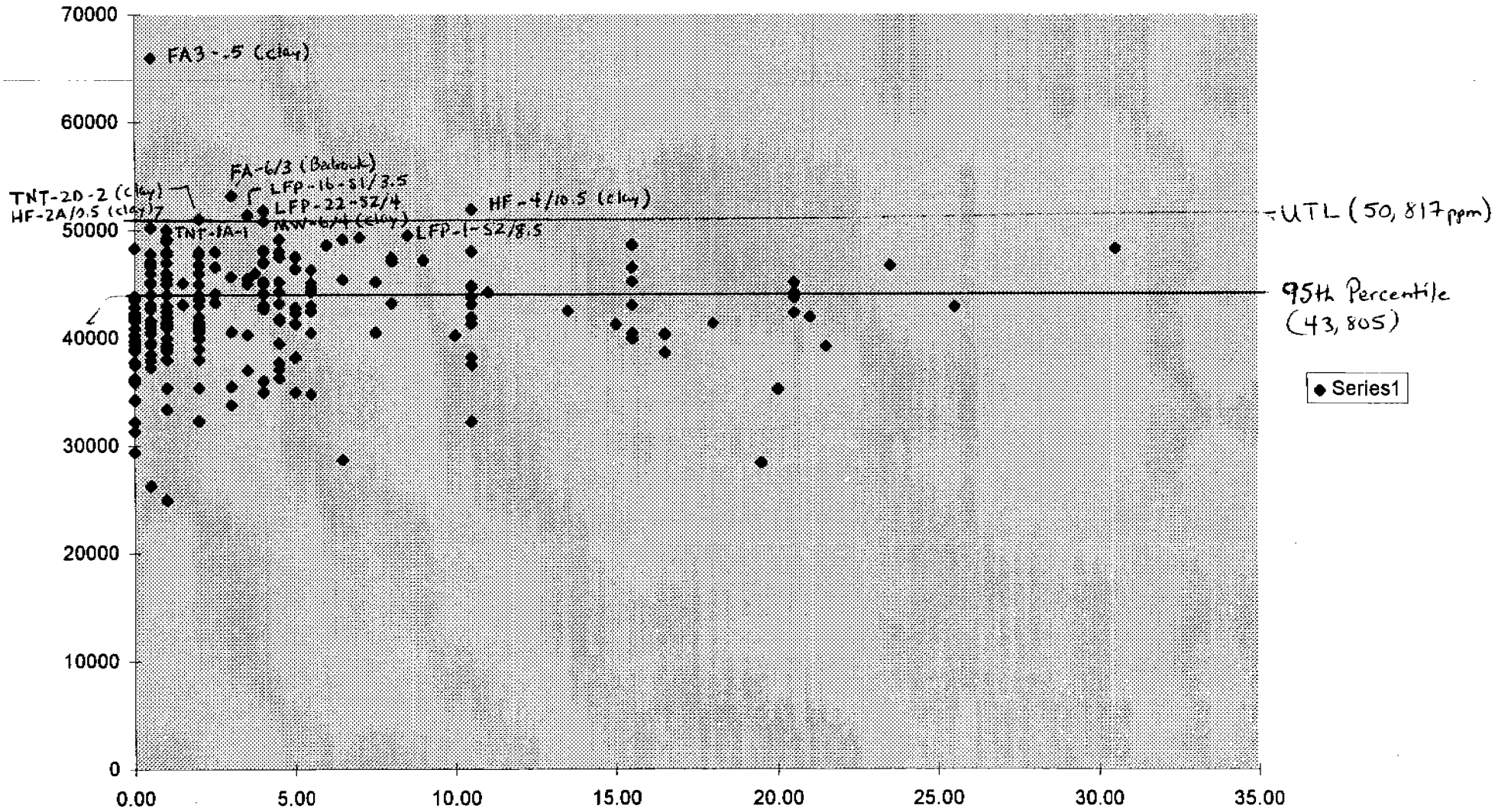


Figure 10

analysed with: Analyse-It + General v1.50

Test	**Linear regression** Iron: Concentration v Depth
Date	7 May 2001

n	243
R^2	0.00
Adjusted R^2	0.00
SE	4936.2046

Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	42446.8623	399.3960	<0.0001	41660.1096 to 43233.6150
Slope	37.9506	57.2436	0.5080	-74.8111 to 150.7123

Source of variation	SSq	DF	MSq	F	p
Due to regression	10709503	1	10709503.374	0.44	0.5080
About regression	5872234036	241	24366116.331		
Total	5882943539	242			

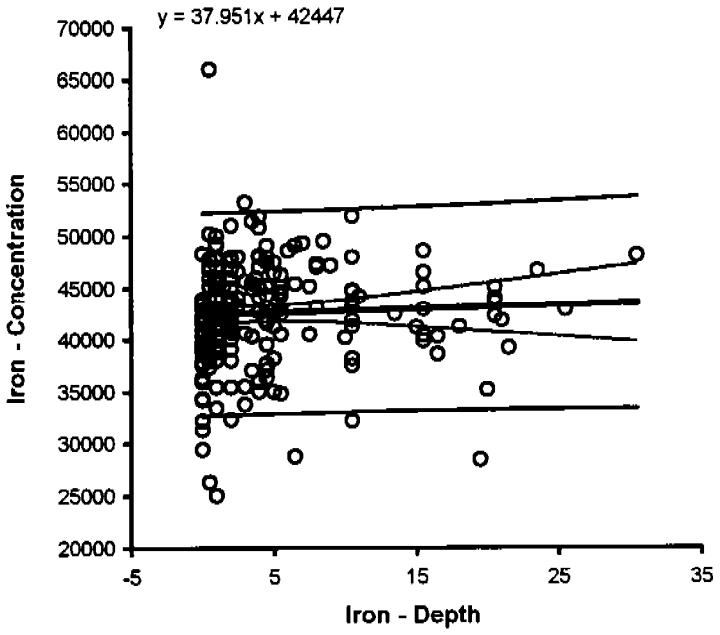


Figure 10, con't.

analysed with: Analyse-It + General v1.50

Test **Linear regression**
Iron: Concentration v Depth

Date 7 May 2001

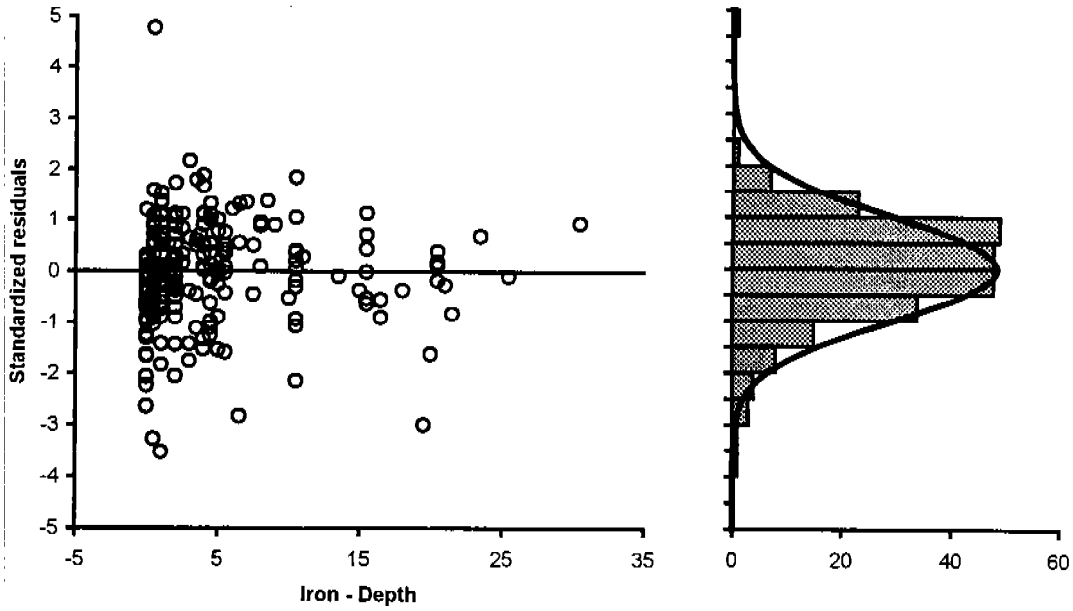
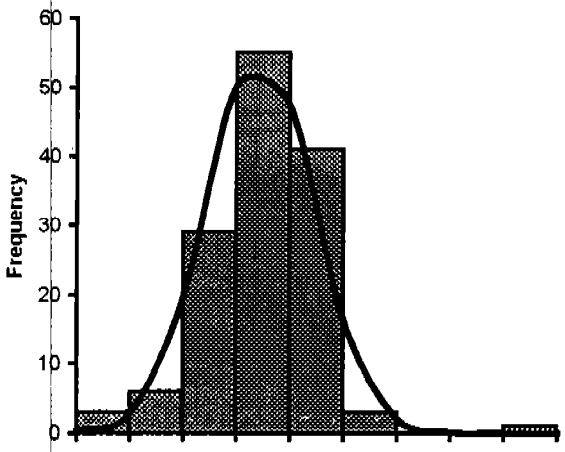


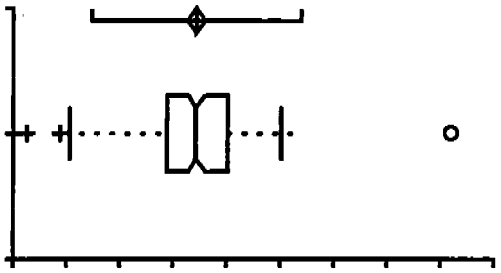
Figure 11

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples 0 to 2-ft bgs
Parameter	Iron (untransformed)
Date	7 May 2001

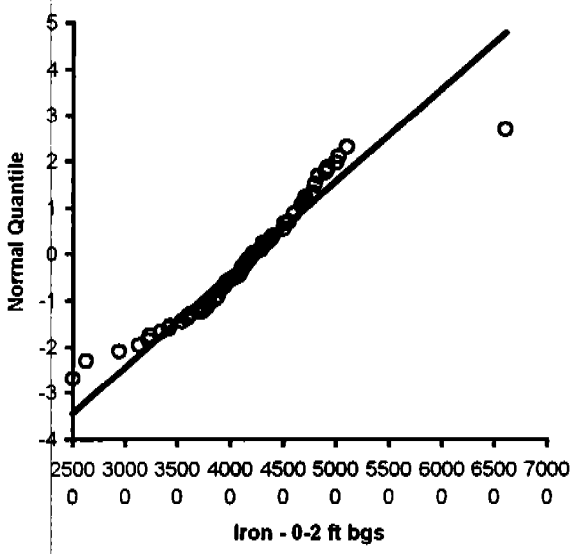


n	138
Mean	42189.130
95% CI	41350.763 to 43027.498
Variance	Fe
SD	4980.4975
SE	423.9681
CV	12%



Median	42100.000
95.0% CI	41500.000 to 43000.000
Range	41000
IQR	5700

Percentile	
2.5th	30302.500
25th	39425.000
50th	42100.000
75th	45125.000
97.5th	50105.000

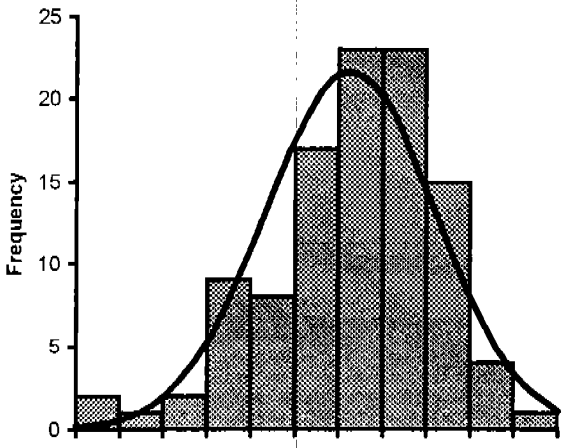


	Coefficient	p
Shapiro-Wilk	0.9359	<0.0001
Skewness	0.0312	0.8768
Kurtosis	4.3075	<0.0001

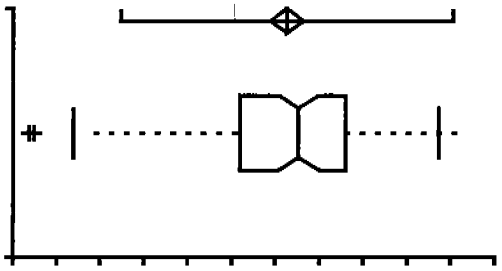
Figure 12

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples >2-ft bgs
Parameter	Iron (untransformed)
Date	7 May 2001

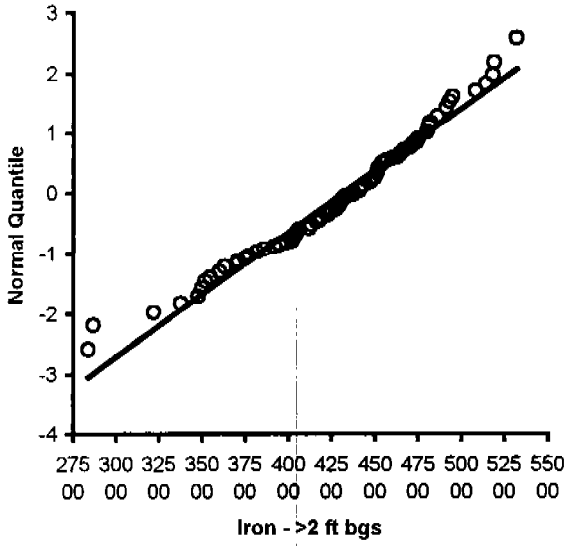


n	105 (cases excluded: 33 due to m
Mean	43159.048
95% CI	42223.879 to 44094.216
Variance	23351095
SD	4832.2971
SE	471.5839
CV	11%



Median	43800.000
96.9% CI	42700.000 to 45000.000
Range	24800
IQR	6000

Percentile	
2.5th	30975.000
25th	40500.000
50th	43800.000
75th	46500.000
97.5th	51835.000



	Coefficient	p
Shapiro-Wilk	0.9716	0.0235
Skewness	-0.6370	0.0093
Kurtosis	0.5207	0.2474

Figure 13

analysed with: Analyse-It + General v1.50

Test	**Spearman rank correlation**
Null Hypothesis	No correlation between Fe and V concentrations
Alternative Hypothesis	Correlation between Fe and V concentrations
Date	14 May 2001

n	243
rs statistic	0.54
95% CI	0.44 to 0.62
2-tailed p	<0.0001 (t approximation, corrected for ties)

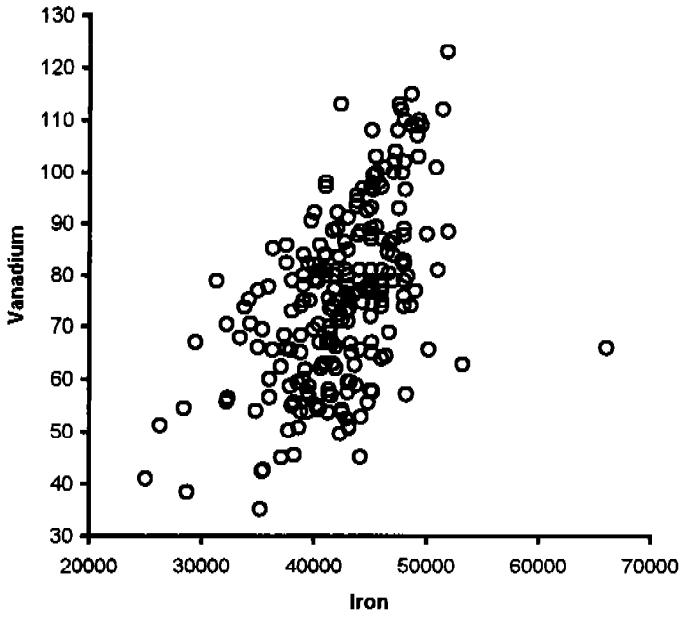


Figure 14

analysed with: Analyse-It + General v1.50

Test	**Linear regression** Vanadium v Iron
Date	14 May 2001

n	243
R^2	0.27
Adjusted R^2	0.27
SE	14.3155

Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	0.5751	8.0053	0.9428	-15.1943 to 16.3444
Slope	0.0018	0.0002	<0.0001	0.0014 to 0.0021

Source of variation	SSq	DF	MSq	F	p
Due to regression	18468.367	1	18468.367	90.12	<0.0001
About regression	49389.035	241	204.934		
Total	67857.402	242			

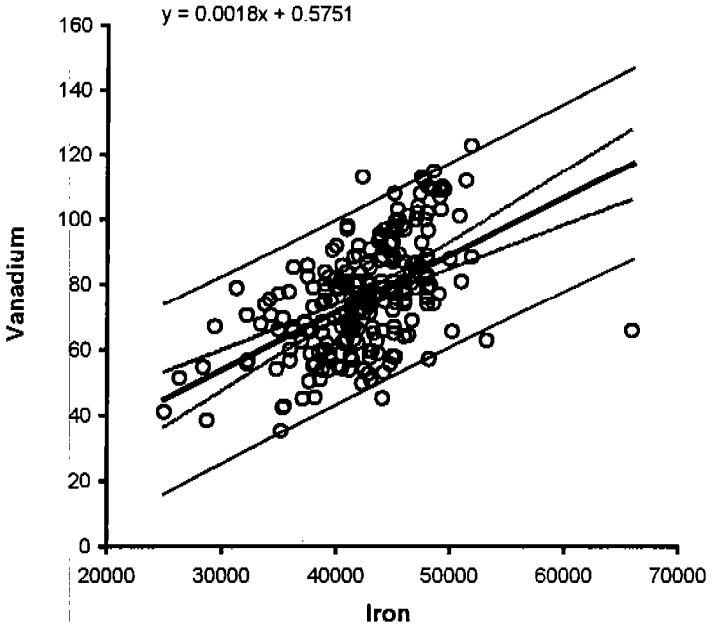


Figure 14, con't.

analysed with: Analyse-It + General v1.50

Test **Linear regression**
Vanadium v Iron

Date 14 May 2001

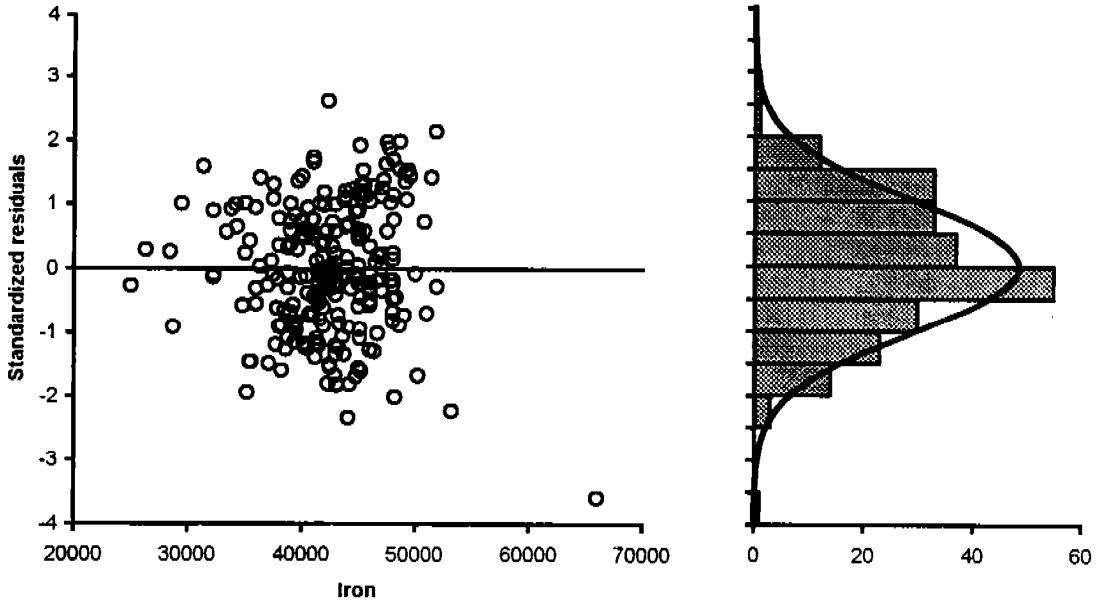
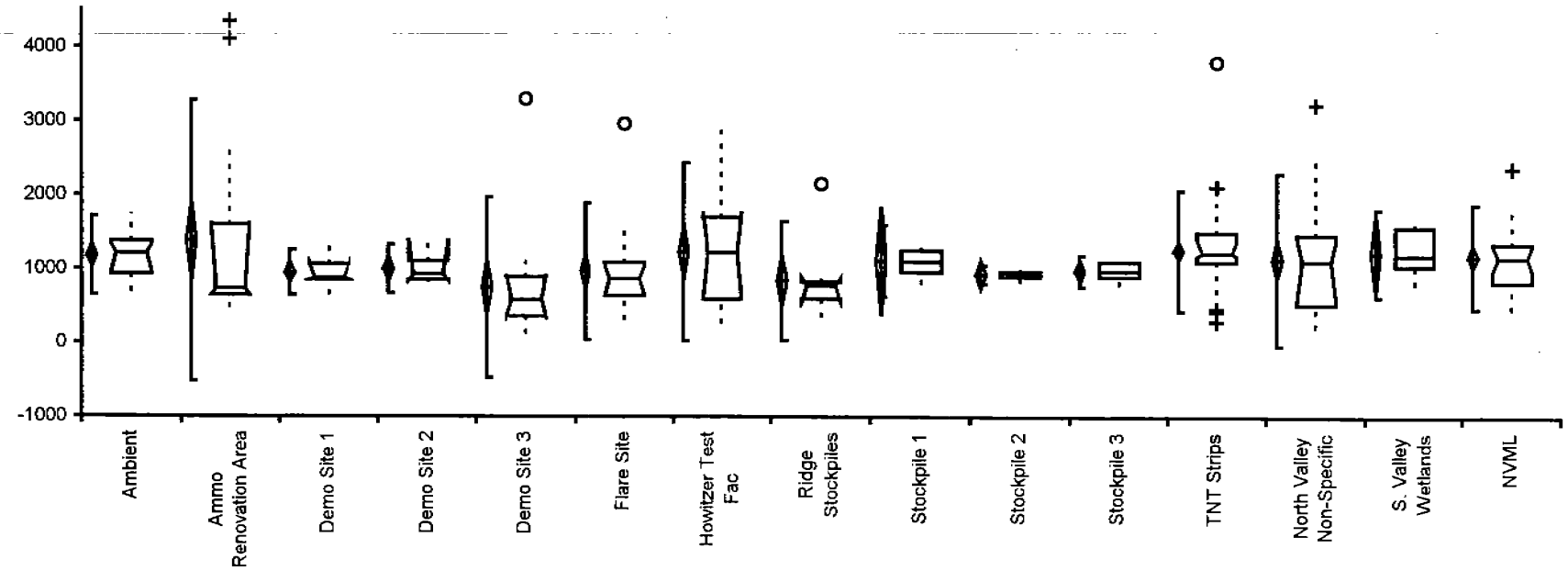


Figure 15

analysed with: Analyse-It + General v1.50

Test **Area Box Plots and Statistics**
Parameter MANGANESE

Date 7 May 2001



Manganese	n	Mean	SD	SE	95% CI of Mean	Median	IQR	95% CI of Median
Ambient	20	1176.600	323.0370	72.2333	1025.414 to 1327.786	1210.000	448.500	952.000 to 1330.000
Ammo Renovation Area	19	1378.053	1155.1779	265.0160	821.275 to 1934.831	731.000	951.500	641.000 to 1630.000
Demo Site 1	9	947.778	184.5791	61.5264	805.898 to 1089.658	870.000	210.000	850.000 to 1080.000
Demo Site 2	8	997.500	198.7640	70.2737	831.329 to 1163.671	930.000	252.500	830.000 to 1400.000
Demo Site 3	16	746.500	741.6356	185.4089	351.310 to 1141.690	580.500	535.750	350.000 to 920.000
Flare Site	20	965.200	563.5572	126.0152	701.447 to 1228.953	865.000	452.000	644.000 to 1050.000
Howitzer Test Fac	18	1228.611	732.7255	172.7050	864.235 to 1592.987	1225.000	1108.000	580.000 to 1770.000
Ridge Stockpiles	10	838.000	489.8957	154.9186	487.550 to 1188.450	770.500	232.500	543.000 to 886.000

Fig 15, con't.

analysed with: Analyse-It + General v1.50

Test **Area Box Plots and Statistics**
Parameter MANGANESE

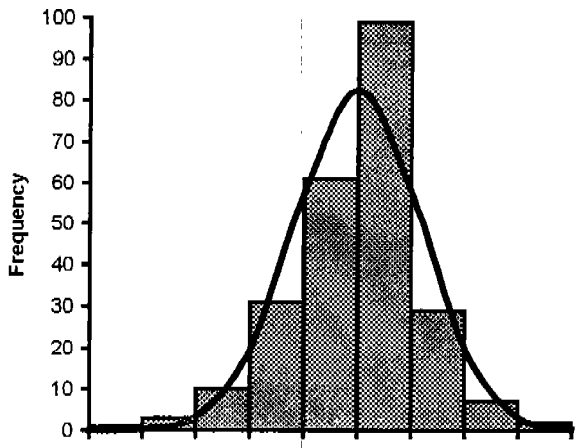
Date 7 May 2001

Stockpile 1	3	1110.000	295.1271	170.3917	376.864 to 1843.136	1100.000	295.000	- to -
Stockpile 2	3	928.000	75.4453	43.5584	740.583 to 1115.417	950.000	73.000	- to -
Stockpile 3	5	976.000	129.9231	58.1034	814.679 to 1137.321	980.000	200.000	- to -
TNT Strips	68	1255.882	496.8493	60.2518	1135.619 to 1376.145	1225.000	400.000	1180.000 to 1400.000
North Valley Non-Specific	29	1133.759	712.1060	132.2348	862.888 to 1404.629	1110.000	948.000	560.000 to 1410.000
S. Valley Wetlands	4	1217.500	359.9421	179.9711	644.752 to 1790.248	1190.000	522.500	- to -
NVML	34	1173.882	431.1810	73.9469	1023.436 to 1324.329	1160.000	520.500	975.000 to 1330.000

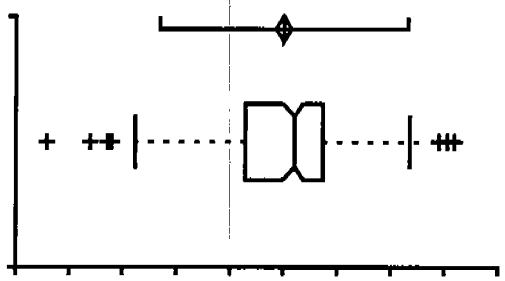
Figure 16

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples
Parameter	Manganese (log-transformed)
Date	7 May 2001

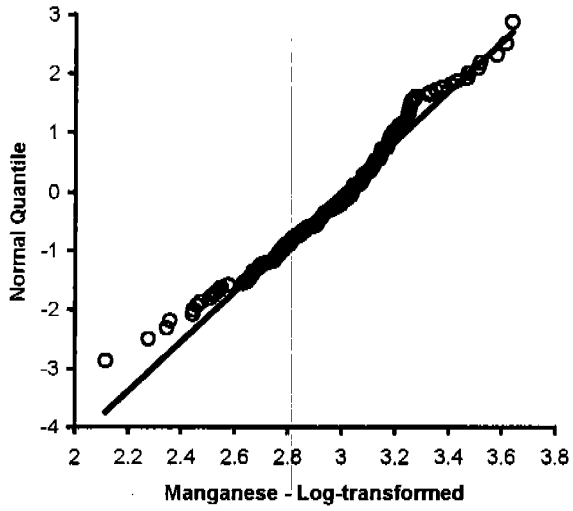


n	243
Mean	3.001
95% CI	2.971 to 3.031
Variance	0.0554
SD	0.2354
SE	0.0151
CV	8%



Median	3.041
96.0% CI	3.000 to 3.072
Range	1.520218434
IQR	0.286712836

Percentile	
2.5th	2.449
25th	2.859
50th	3.041
75th	3.146
97.5th	3.471



	Coefficient	p
Shapiro-Wilk	0.9721	0.0001
Skewness	-0.5316	0.0011
Kurtosis	1.0679	0.0103

Manganese Concentration vs. Depth

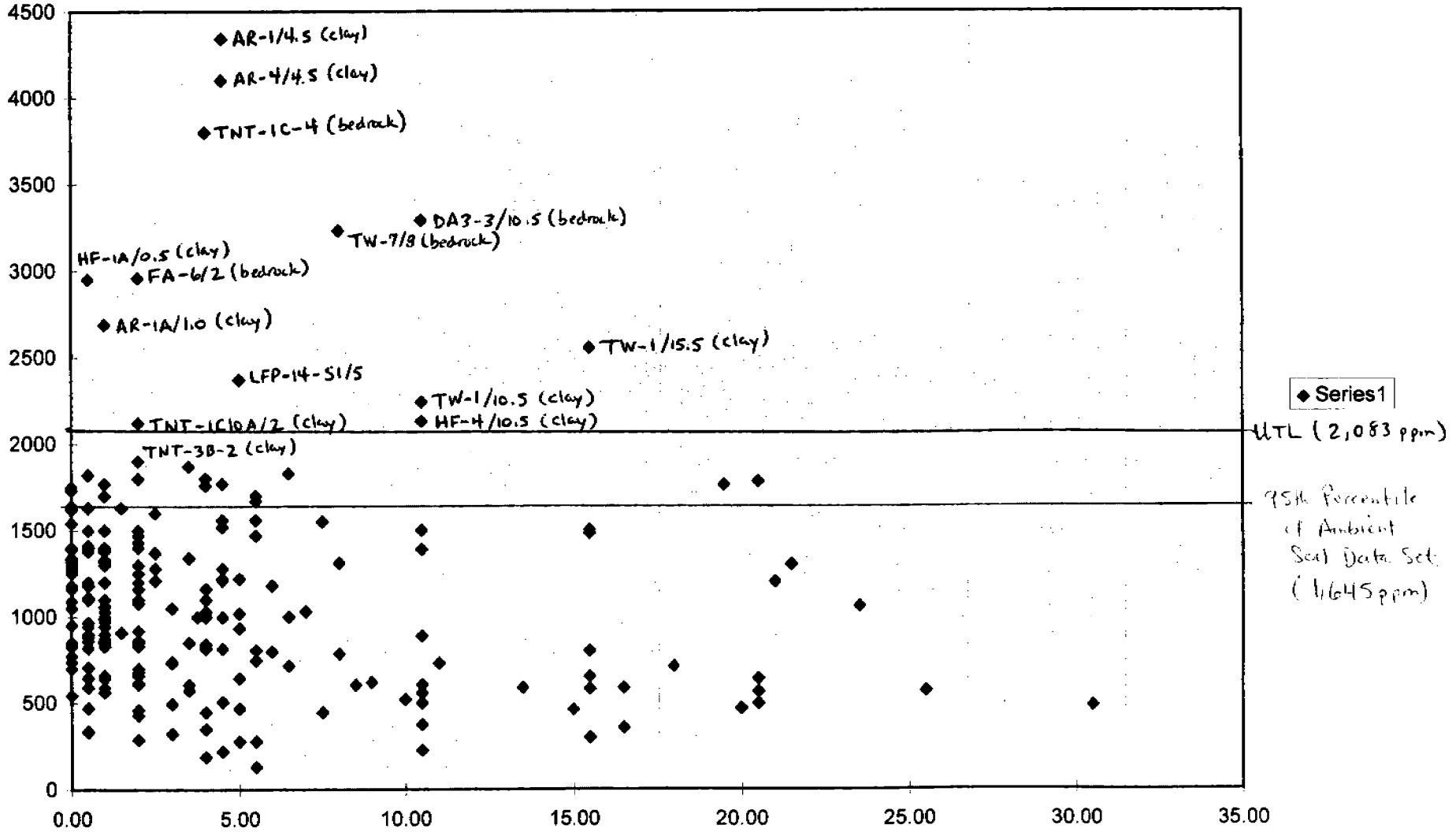


Figure 18

analysed with: Analyse-It + General v1.50

Test	**Linear regression** Manganese: Concentration v Depth
Date	7 May 2001

n	243
R^2	0.01
Adjusted R^2	0.01
SE	617.3942

Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	1201.7254	49.9543	<0.0001	1103.3225 to 1300.1282
Slope	-12.4251	7.1597	0.0839	-26.5288 to 1.6785

Source of variation	SSq	DF	MSq	F	p
Due to regression	1147978.787	1	1147978.787	3.01	0.0839
About regression	91863326.431	241	381175.628		
Total	93011305.218	242			

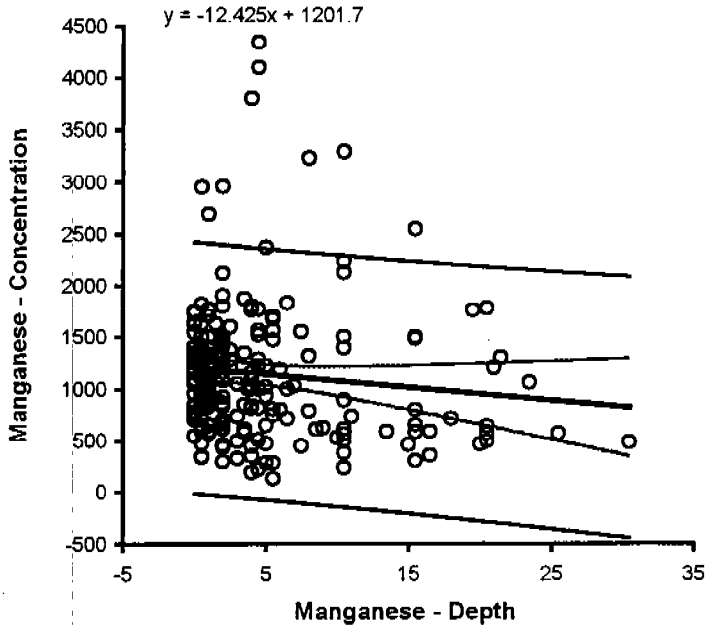


Figure 18, con't.

analysed with: Analyse-It + General v1.50

Test **Linear regression**
Manganese: Concentration v Depth

Date 7 May 2001

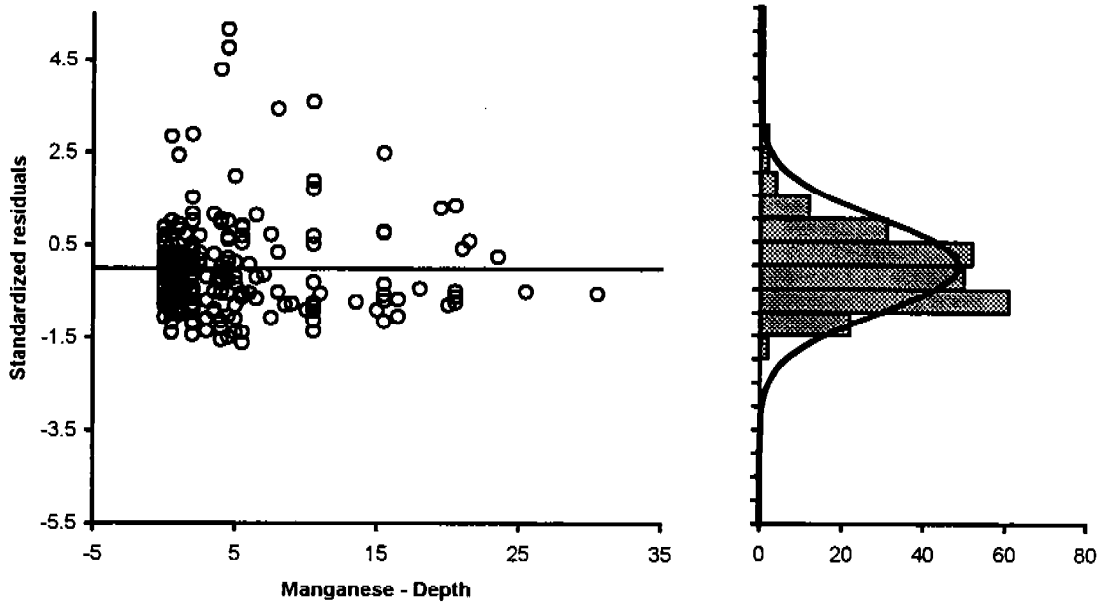
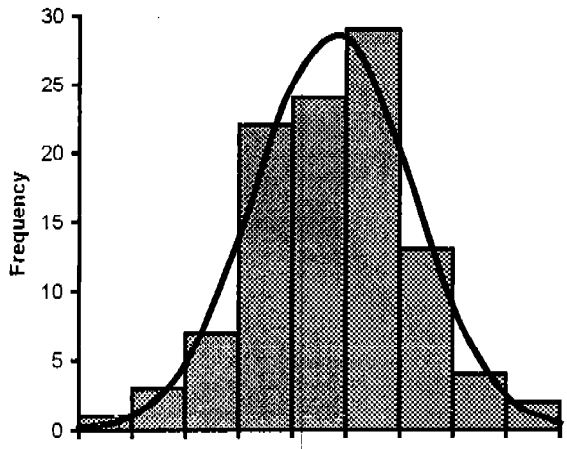


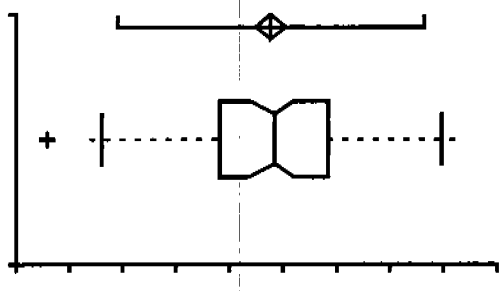
Figure 19

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples 0 to 2-ft bgs
Parameter	Manganese (log-transformed)
Date	8 May 2001

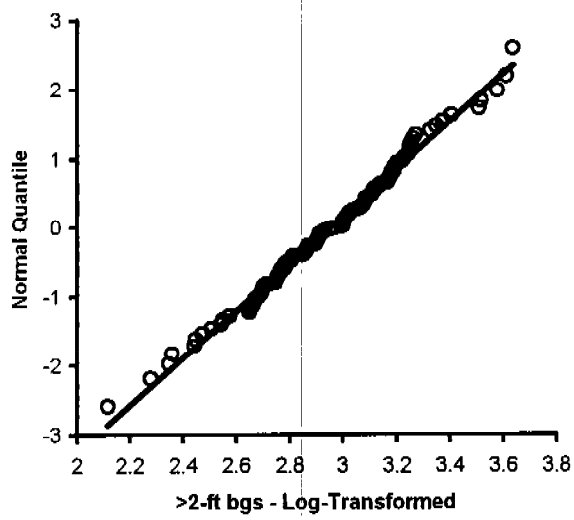


n	105 (cases excluded: 33 due to m
Mean	2.953
95% CI	2.897 to 3.010
Variance	0.0849
SD	0.2914
SE	0.0284
CV	10%



Median	2.970
96.9% CI	2.873 to 3.041
Range	1.520218434
IQR	0.403889341

Percentile	
2.5th	2.323
25th	2.763
50th	2.970
75th	3.167
97.5th	3.591

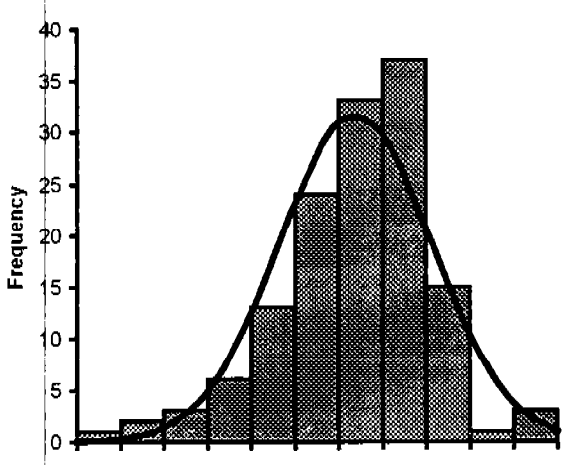


	Coefficient	p
Shapiro-Wilk	0.9917	0.7741
Skewness	-0.1579	0.4914
Kurtosis	0.1768	0.5782

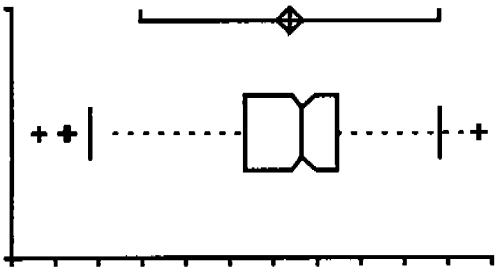
Figure 20

analysed with: Analyse-It + General v1.50

Test	**Summary Statistics**
Data Set	All Site In-Situ Soil Samples > 2-ft bgs
Parameter	Manganese (log-transformed)
Date	8 May 2001

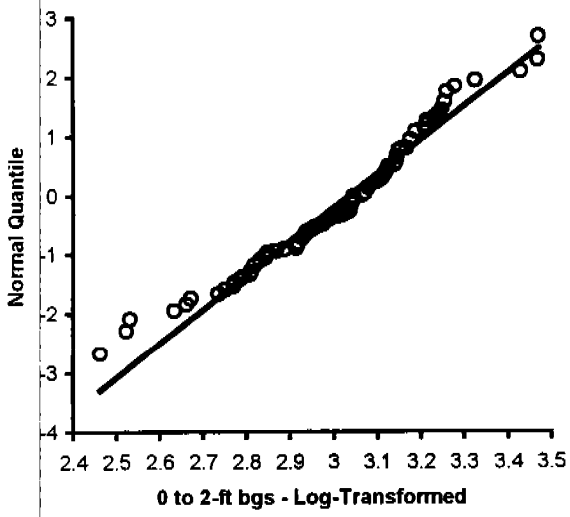


n	138
Mean	3.038
95% CI	3.008 to 3.067
Variance	0.0304
SD	0.1743
SE	0.0148
CV	6%



Median	3.064
95.0% CI	3.041 to 3.097
Range	1.008893713
IQR	0.211251498

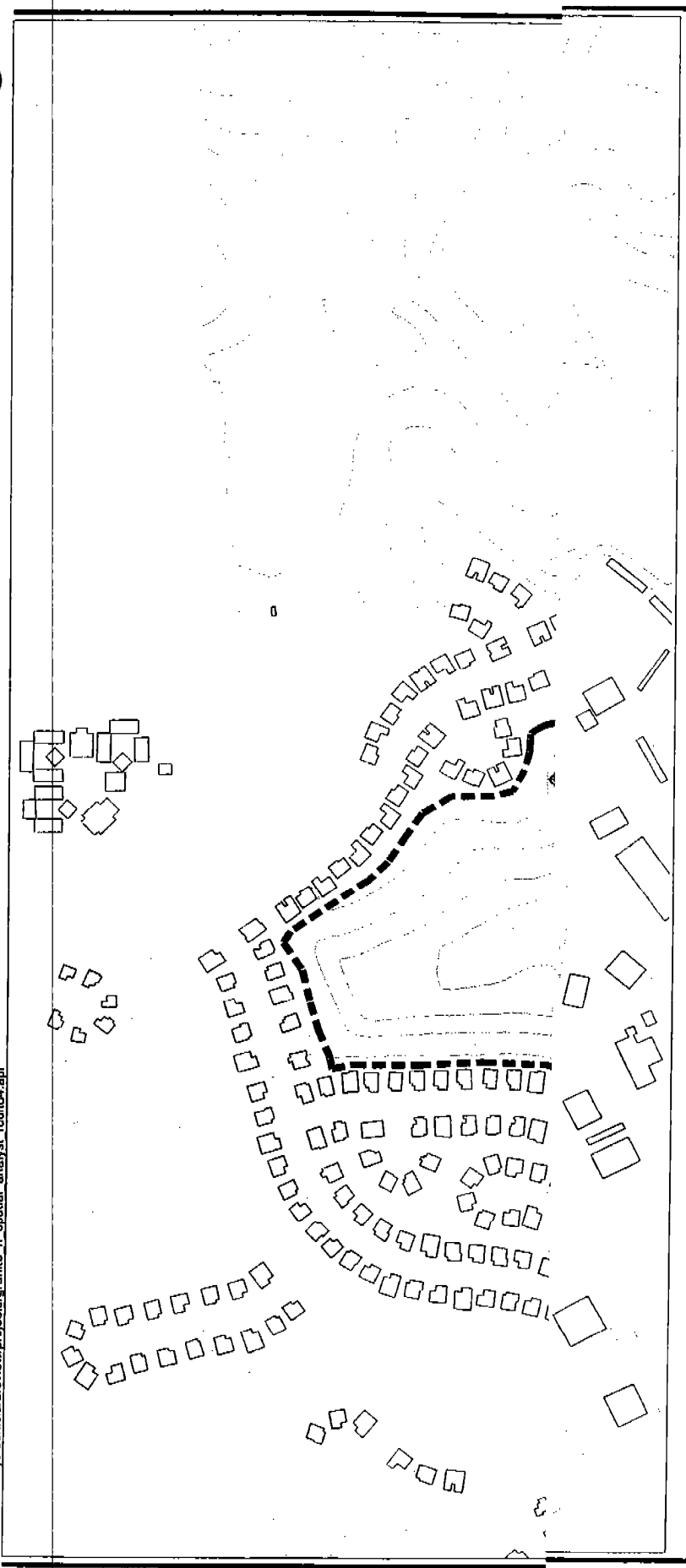
Percentile	
2.5th	2.580
25th	2.935
50th	3.064
75th	3.146
97.5th	3.381



	Coefficient	p
Shapiro-Wilk	0.9637	0.0010
Skewness	-0.6268	0.0037
Kurtosis	1.0747	0.0374

color picture

-to be scanned-



E

A

Buildings
Roads/Concrete
25 Foot Topographic Contours

Arsenic (mg/kg)
0 - 18.2
18.2 - 21.5
21.5 - 22
22 - 50

NOTES:
95th Percentile = 18.2
UTL = 21.5
PRG = 22.0 (Non-cancer value)

300 0 300 600 Feet

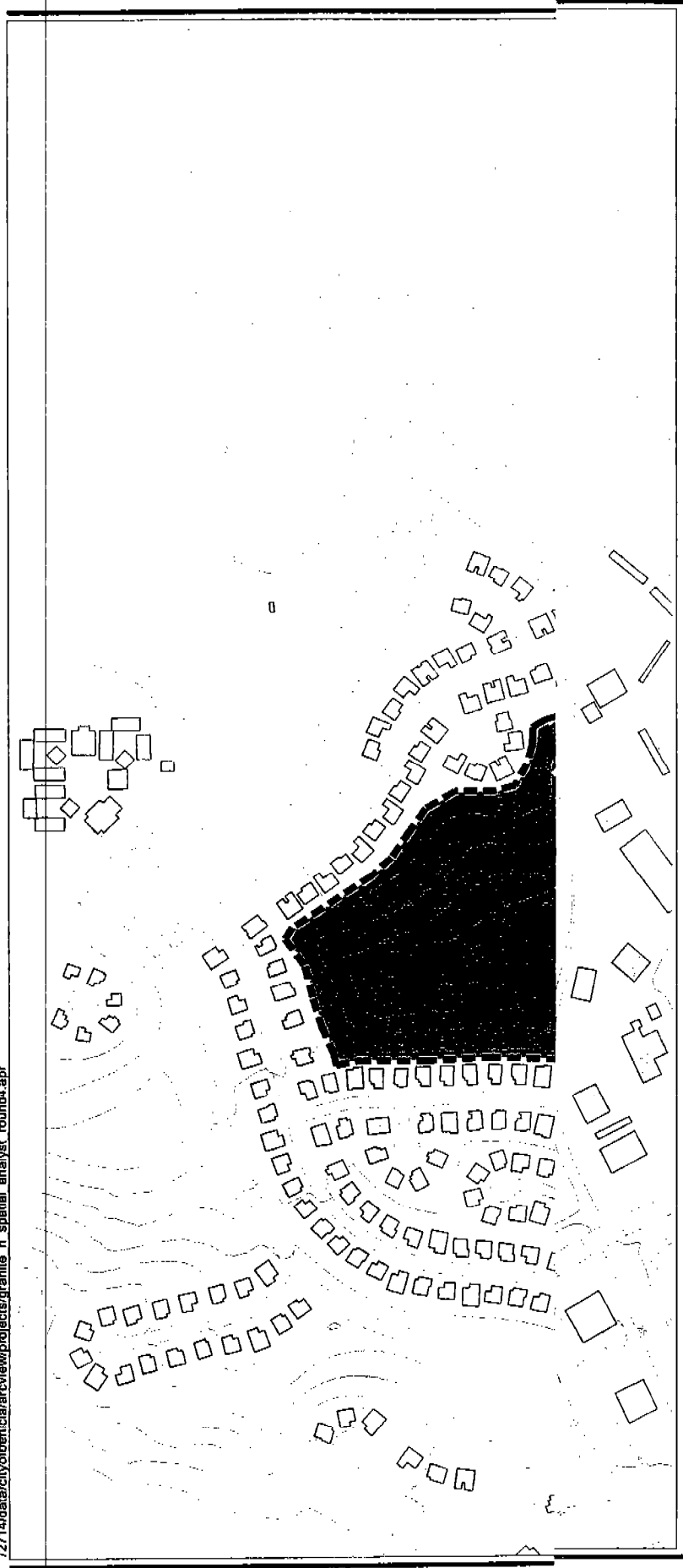
1" = 500'

Tourtelot Property
Arsenic Surface
0-2 Foot
Benicia, California

/2714/data/cityofbenicia/arcview/projects/granite_ri_spatial_analyst_round4.apr

color picture

-to be scanned-



E

Ir

Roads/Concrete
Buildings
25 Foot Topographic Contours
Iron (mg/kg)
23000 - 43805
43805 - 50817
50817 - 67000

NOTES:
95th Percentile = 43805
UTL = 50,817
PRG = 23,000

250 0 250 500 Feet

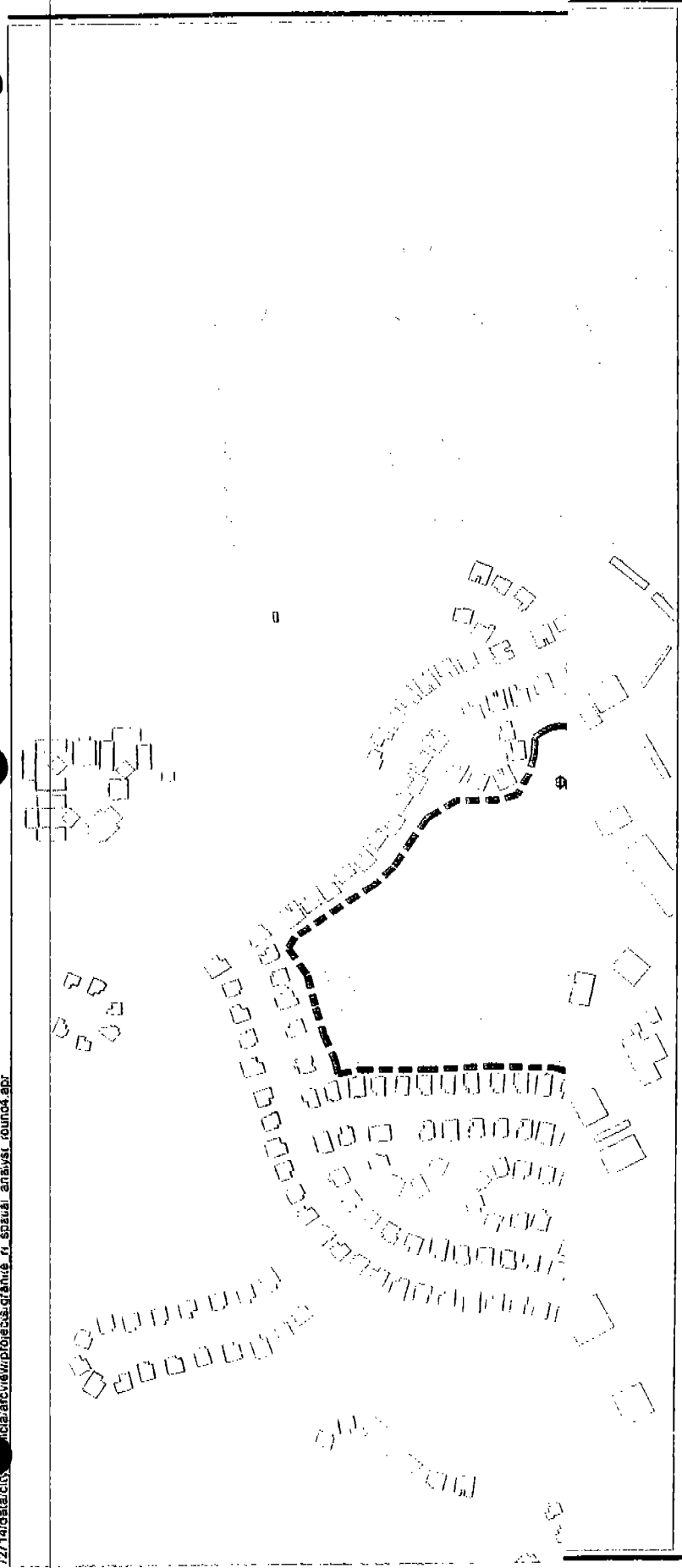
1" = 500'

Tourtelot Property
Iron Surface
0-2 Foot
Benicia, California

/2714/data/cityofbenicia/arcview/projects/granite_ri_spatial_analyst_round4.apr

color picture

-to be scanned-



EX

Mar

Buildings
25 Foot Topographic Contours
Manganese (mg/kg)
0 - 1645
1645 - 1800
1800 - 2083
2083 - 3000

NOTES:
95th Percentile = 1,645
UTL = 2,083
PRG = 1,800

250 0 250 500 Feet

1" = 500'

Tourtelot Property
Manganese Surface
0-2 Foot
Benicia, California

/2714/data/city/data/arcview/projects/granite_ri_spatial_analyst_round4.apr

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum)**
Null Hypothesis	Bedrock Concentration equals Clay Concentration
Alternative Hypothesis	Bedrock Concentration does not equal Clay Concentration
Parameter	Arsenic (in-situ site soil samples)
Date	18 April 2001

n 197

Arsenic	n	Rank sum	Mean rank	U
Bedrock	40	3474.0	86.85	3626.0
Clay	157	16029.0	102.10	2654.0

Difference between medians -1.000
95.0% CI -2.400 to 0.500 (normal approximation)

Mann-Whitney U statistic 3626
2-tailed p 0.1307 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum)**
Null Hypothesis	0-2 ft bgs Concentration equals >2 ft bgs Concentration
Alternative Hypothesis	0-2 ft bgs Concentration does not equal >2 ft bgs Concentration
Parameter	Arsenic (in-situ site soil samples)
Date	24 April 2001

n 243

Arsenic	n	Rank sum	Mean rank	U
0 to 2 ft	138	18826.5	136.42	5254.5
>2 ft	105	10819.5	103.04	9235.5

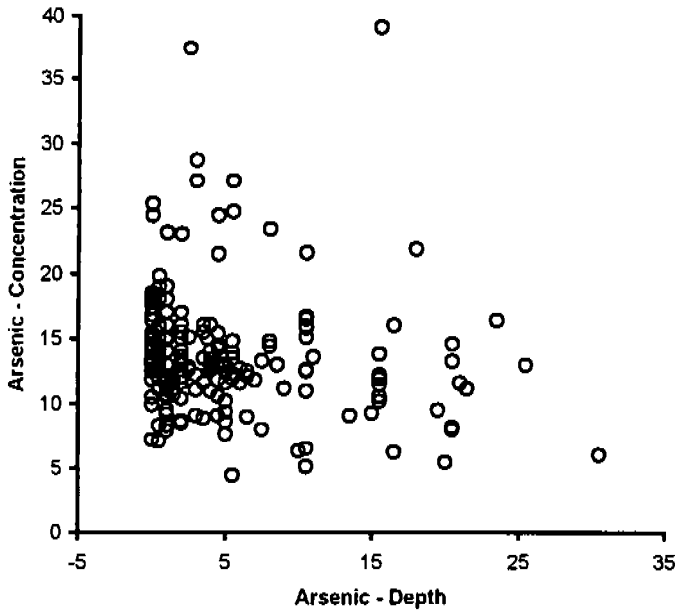
Difference between medians	1.400	
95.0% CI	0.700 to 2.200	(normal approximation)

Mann-Whitney U statistic	5254.5	
2-tailed p	0.0002	(normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Spearman rank correlation**
Null Hypothesis	No correlation between As concentration and depth
Alternative Hypothesis	Correlation between As concentration and depth
Date	7 May 2001

n	243
rs statistic	-0.27
95% CI	-0.38 to -0.14
2-tailed p	<0.0001 (t approximation, corrected for ties)



analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	16 April 2001

n	39

ARSENIC	n	Rank sum	Mean rank	U
Ammo Renovation Area	19	286.0	15.05	284.0
Background	20	494.0	24.70	96.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	284
1-tailed p	0.9959 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	16 April 2001

n	29

ARSENIC	n	Rank sum	Mean rank	U
Demo Site 1	9	138.0	15.33	87.0
Background	20	297.0	14.85	93.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	87
1-tailed p	0.4437 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	16 April 2001

n	28

ARSENIC	n	Rank sum	Mean rank	U
Demo Site 2	8	116.0	14.50	80.0
Background	20	290.0	14.50	80.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	80
1-tailed p	0.5000 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	16 April 2001

n	36

ARSENIC	n	Rank sum	Mean rank	U
Demo Site 3	16	207.0	12.94	249.0
Background	20	459.0	22.95	71.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	249
1-tailed p	0.9977 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	40

ARSENIC	n	Rank sum	Mean rank	U
Flare Site	20	337.5	16.88	272.5
Background	20	482.5	24.13	127.5

Difference between medians	-2.550	
95.1% CI	-4.600 to +∞	(normal approximation)

Mann-Whitney U statistic	272.5	
1-tailed p	0.9751	(normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	38

ARSENIC	n	Rank sum	Mean rank	U
Howitzer Test Fac	18	271.5	15.08	259.5
Background	20	469.5	23.48	100.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	259.5
1-tailed p	0.9900 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	30

ARSENIC	n	Rank sum	Mean rank	U
Ridge Stockpiles	10	72.0	7.20	183.0
Background	20	393.0	19.65	17.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	183
1-tailed p	0.9999 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	23

ARSENIC	n	Rank sum	Mean rank	U
Stockpile 1	3	30.5	10.17	35.5
Background	20	245.5	12.28	24.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	35.5
1-tailed p	0.6924 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	23

ARSENIC	n	Rank sum	Mean rank	U
Stockpile 2	3	9.0	3.00	57.0
Background	20	267.0	13.35	3.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	57
1-tailed p	0.9932 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	25

ARSENIC	n	Rank sum	Mean rank	U
Stockpile 3	5	37.5	7.50	77.5
Background	20	287.5	14.38	22.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	77.5
1-tailed p	0.9693 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	88

ARSENIC	n	Rank sum	Mean rank	U
TNT Strips	68	2741.0	40.31	965.0
Background	20	1175.0	58.75	395.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	965
1-tailed p	0.9978 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	49

ARSENIC	n	Rank sum	Mean rank	U
North Valley Non-Specific	29	539.0	18.59	476.0
Background	20	686.0	34.30	104.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	476
1-tailed p	0.9999 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	24

ARSENIC	n	Rank sum	Mean rank	U
S. Valley Wetlands	4	18.5	4.63	71.5
Background	20	281.5	14.08	8.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	71.5
1-tailed p	0.9927 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	54

ARSENIC	n	Rank sum	Mean rank	U
N. Valley Landfill	34	686.5	20.19	588.5
Background	20	798.5	39.93	91.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	588.5
1-tailed p	1.0000 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n	25	(cases excluded: 14 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
Ammo Renovation Area	5	23.5	4.70	91.5
Background	20	301.5	15.08	8.5

Difference between medians	-	
No CI	- to -	

Mann-Whitney U statistic	91.5	
1-tailed p	0.9976	(normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 27 (cases excluded: 2 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
Demo Site 1	7	101.0	14.43	67.0
Background	20	277.0	13.85	73.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	67
1-tailed p	0.4340 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 26 (cases excluded: 1 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
Demo Site 2	6	92.0	15.33	49.0
Background	20	259.0	12.95	71.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	49
1-tailed p	0.2515 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 25 (cases excluded: 1 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
Demo Site 3	5	37.5	7.50	77.5
Background	20	287.5	14.38	22.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	77.5
1-tailed p	0.9694 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n	36	(cases excluded: 4 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
Flare Site	16	202.5	12.66	253.5
Background	20	463.5	23.18	66.5

Difference between medians	-	
No CI	- to -	

Mann-Whitney U statistic	253.5	
1-tailed p	0.9985	(normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 25 (cases excluded: 13 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
Howitzer Test Fac	5	55.5	11.10	59.5
Background	20	269.5	13.48	40.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	59.5
1-tailed p	0.7409 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n	48	(cases excluded: 4 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
TNT Strips	28	570.0	20.36	396.0
Background	20	606.0	30.30	164.0

Difference between medians	-	
No CI	- to -	

Mann-Whitney U statistic	396	
1-tailed p	0.9924	(normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 26 (cases excluded: 16 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
North Valley Non-Specific	6	35.0	5.83	106.0
Background	20	316.0	15.80	14.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	106
1-tailed p	0.9975 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n	26	(cases excluded: 14 due to missing values)

ARSENIC	n	Rank sum	Mean rank	U
N. Valley Landfill	6	28.0	4.67	113.0
Background	20	323.0	16.15	7.0

Difference between medians	-	
No CI	- to -	

Mann-Whitney U statistic	113	
1-tailed p	0.9994	(normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test**
Null Hypothesis	Bedrock Concentration equals Clay Concentration
Alternative Hypothesis	Bedrock Concentration does not equal Clay Concentration
Parameter	Iron (all in-situ site soil samples)

Date 7 May 2001

n 197

Iron	n	Rank sum	Mean rank	U
Bedrock	40	4195.0	104.88	2905.0
Clay	157	15308.0	97.50	3375.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	2905
2-tailed p	0.4652 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	0-2-ft bgs Concentration equals >2-ft bgs Concentration
Alternative Hypothesis	0-2-ft bgs Concentration does not equal >2-ft bgs Concentration
Parameter	Iron (all in-situ site soil samples)
Date	7 May 2001

n	243

Iron	n	Rank sum	Mean rank	U
0-2 ft bgs	138	15762.5	114.22	8318.5
>2 ft bgs	105	13883.5	132.22	6171.5

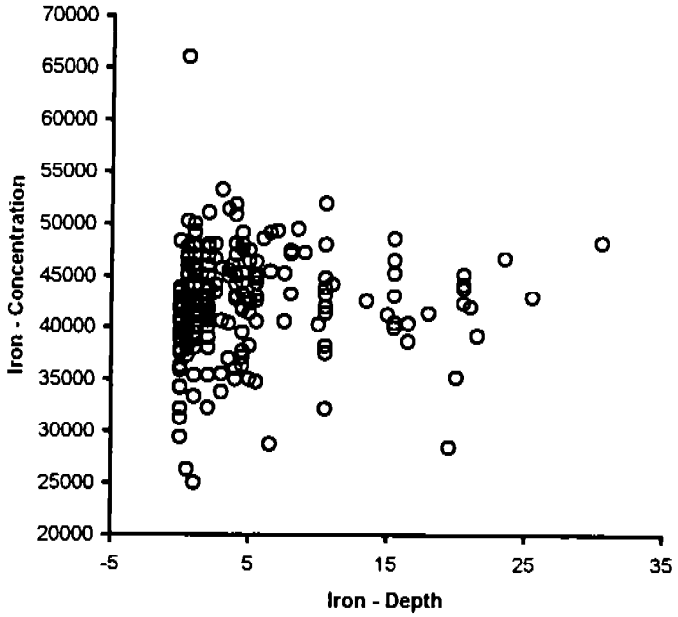
Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	8318.5
2-tailed p	0.0479 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Spearman rank correlation**
Null Hypothesis	No correlation between Fe concentration and depth
Alternative Hypothesis	Correlation between Fe concentration and depth
Date	7 May 2001

n	243
rs statistic	0.17
95% CI	0.04 to 0.29
2-tailed p	0.0092 (t approximation, corrected for ties)



Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	39

IRON	n	Rank sum	Mean rank	U
Ammo Renovation Area	19	430.0	22.63	140.0
Background	20	350.0	17.50	240.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	140
1-tailed p	0.0800 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	29

IRON	n	Rank sum	Mean rank	U
Demo Site 1	9	198.5	22.06	26.5
Background	20	236.5	11.83	153.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	26.5
1-tailed p	0.0014 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	28

IRON	n	Rank sum	Mean rank	U
Demo Site 2	8	174.0	21.75	22.0
Background	20	232.0	11.60	138.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	22
1-tailed p	0.0016 (normal approximation)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	36

IRON	n	Rank sum	Mean rank	U
Demo Site 3	16	396.5	24.78	59.5
Background	20	269.5	13.48	260.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	59.5
1-tailed p	0.0007 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	40

IRON	n	Rank sum	Mean rank	U
Flare Site	20	481.0	24.05	129.0
Background	20	339.0	16.95	271.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	129
1-tailed p	0.0274 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	38

IRON	n	Rank sum	Mean rank	U
Howitzer Test Fac	18	464.0	25.78	67.0
Background	20	277.0	13.85	293.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	67
1-tailed p	0.0005 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	30

IRON	n	Rank sum	Mean rank	U
Ridge Stockpiles	10	166.0	16.60	89.0
Background	20	299.0	14.95	111.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	89
1-tailed p	0.3142 (normal approximation, corrected for ties)

analysed with: Analyse-it + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	23

IRON	n	Rank sum	Mean rank	U
Stockpile 1	3	61.0	20.33	5.0
Background	20	215.0	10.75	55.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	5
1-tailed p	0.0112 (normal approximation)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	23

IRON	n	Rank sum	Mean rank	U
Stockpile 2	3	40.0	13.33	26.0
Background	20	236.0	11.80	34.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	26
1-tailed p	0.3575 (normal approximation)

analysed with: Analyse-it + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	25

IRON	n	Rank sum	Mean rank	U
Stockpile 3	5	73.0	14.60	42.0
Background	20	252.0	12.60	58.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	42
1-tailed p	0.2934 (normal approximation)

analysed with: Analyse-It - General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	88

IRON	n	Rank sum	Mean rank	U
TNT Strips	68	3386.5	49.80	319.5
Background	20	529.5	26.48	1040.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	319.5
1-tailed p	0.0002 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	49

IRON	n	Rank sum	Mean rank	U
North Valley Non-Specific	29	863.0	29.76	152.0
Background	20	362.0	18.10	428.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	152
1-tailed p	0.0025 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	24

IRON	n	Rank sum	Mean rank	U
S. Valley Wetlands	4	47.0	11.75	43.0
Background	20	253.0	12.65	37.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	43
1-tailed p	0.5919 (normal approximation)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	17 April 2001

n	54

IRON	n	Rank sum	Mean rank	U
NVML	34	1170.5	34.43	104.5
Background	20	314.5	15.73	575.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	104.5
1-tailed p	<0.0001 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 25 (cases excluded: 14 due to missing values)

IRON	n	Rank sum	Mean rank	U
Ammo Renovation Area	5	56.5	11.30	58.5
Background	20	268.5	13.43	41.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	58.5
1-tailed p	0.7182 (normal approximation, corrected for ties)

analysed with: Analyse-it + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 27 (cases excluded: 2 due to missing values)

IRON	n	Rank sum	Mean rank	U
Demo Site 1	7	141.5	20.21	26.5
Background	20	236.5	11.83	113.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	26.5
1-tailed p	0.0080 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 26 (cases excluded: 1 due to missing values)

IRON	n	Rank sum	Mean rank	U
Demo Site 2	6	133.0	22.17	8.0
Background	20	218.0	10.90	112.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	8
1-tailed p	0.0008 (normal approximation)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 25 (cases excluded: 1 due to missing values)

IRON	n	Rank sum	Mean rank	U
Demo Site 3	5	89.0	17.80	26.0
Background	20	236.0	11.80	74.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	26
1-tailed p	0.0515 (normal approximation, corrected for ties)

analysed with: Analyse-It - General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 36 (cases excluded: 4 due to missing values)

IRON	n	Rank sum	Mean rank	U
Flare Site	16	345.0	21.56	111.0
Background	20	321.0	16.05	209.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	111
1-tailed p	0.0593 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 25 (cases excluded: 13 due to missing values)

IRON	n	Rank sum	Mean rank	U
Howitzer Test Fac	5	91.5	18.30	23.5
Background	20	233.5	11.68	76.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	23.5
1-tailed p	0.0359 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n	48	(cases excluded: 4 due to missing values)

IRON	n	Rank sum	Mean rank	U
TNT Strips	28	832.0	29.71	134.0
Background	20	344.0	17.20	426.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	134	
1-tailed p	0.0011	(normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 26 (cases excluded: 16 due to missing values)

IRON	n	Rank sum	Mean rank	U
North Valley Non-Specific	6	126.0	21.00	15.0
Background	20	225.0	11.25	105.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	15
1-tailed p	0.0031 (normal approximation)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	7 May 2001

n 26 (cases excluded: 14 due to missing values)

IRON	n	Rank sum	Mean rank	U
NVML	6	105.0	17.50	36.0
Background	20	246.0	12.30	84.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	36
1-tailed p	0.0720 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum)**
Null Hypothesis	Bedrock Concentration equals Clay Concentration
Alternative Hypothesis	Bedrock Concentration does not equal Clay Concentration
Parameter	Manganese (in-situ site soil samples)
Date	7 May 2001

n	197

Manganese	n	Rank sum	Mean rank	U
Bedrock	40	2524.0	63.10	4576.0
Clay	157	16979.0	108.15	1704.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	4576
2-tailed p	<0.0001 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum)**
Null Hypothesis	0-2 ft bgs Concentration equals >2 ft bgs Concentration
Alternative Hypothesis	0-2 ft bgs Concentration does not equal >2 ft bgs Concentration
Parameter	Manganese (in-situ site soil samples)
Date	7 May 2001

n 243

Manganese	n	Rank sum	Mean rank	U
0 to 2-ft bgs	138	18265.5	132.36	5815.5
>2-ft bgs	105	11380.5	108.39	8674.5

Difference between medians -

No CI - to -

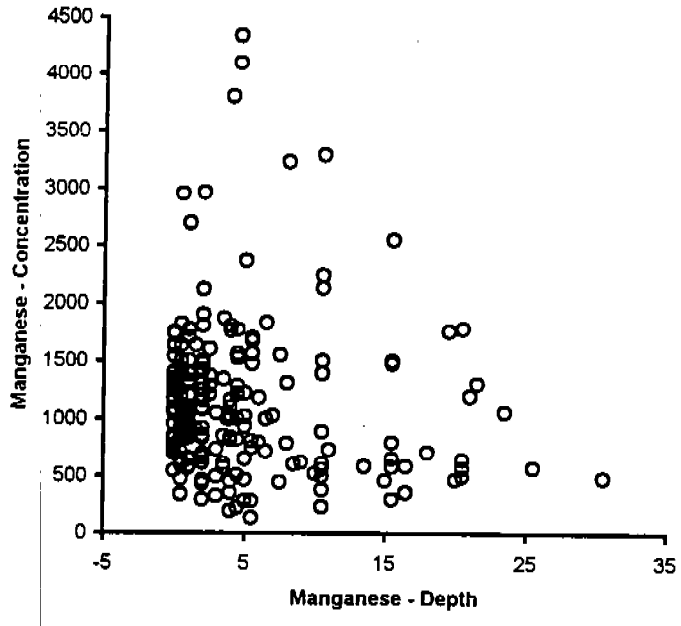
Mann-Whitney U statistic 5815.5

2-tailed p 0.0084 (normal approximation, corrected for ties)

analysed with: Analyse-it - General v1.50

Test	**Spearman rank correlation**
Null Hypothesis	No correlation between Mn concentration and depth
Alternative Hypothesis	Correlation between Mn concentration and depth
Date	7 May 2001

n	243
rs statistic	-0.17
95% CI	-0.29 to -0.04
2-tailed p	0.0088 (t approximation, corrected for ties)



analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	39

MANGANESE	n	Rank sum	Mean rank	U
Ammo Renovation Area	19	346.5	18.24	223.5
Background	20	433.5	21.68	156.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	223.5
1-tailed p	0.8268 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	29

MANGANESE	n	Rank sum	Mean rank	U
Demo Site 1	9	96.0	10.67	129.0
Background	20	339.0	16.95	51.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	129
1-tailed p	0.9671 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	28

MANGANESE	n	Rank sum	Mean rank	U
Demo Site 2	8	93.5	11.69	102.5
Background	20	312.5	15.63	57.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	102.5
1-tailed p	0.8739 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	36

MANGANESE	n	Rank sum	Mean rank	U
Demo Site 3	16	186.0	11.63	270.0
Background	20	480.0	24.00	50.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	270
1-tailed p	0.9998 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	40

MANGANESE	n	Rank sum	Mean rank	U
Flare Site	20	317.5	15.88	292.5
Background	20	502.5	25.13	107.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	292.5
1-tailed p	0.9938 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1 50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	38

MANGANESE	n	Rank sum	Mean rank	U
Howitzer Test Fac	18	355.5	19.75	175.5
Background	20	385.5	19.28	184.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	175.5
1-tailed p	0.4477 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	30

MANGANESE	n	Rank sum	Mean rank	U
Ridge Stockpiles	10	96.0	9.60	159.0
Background	20	369.0	18.45	41.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	159
1-tailed p	0.9953 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	23

MANGANESE	n	Rank sum	Mean rank	U
Stockpile 1	3	35.0	11.67	31.0
Background	20	241.0	12.05	29.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	31
1-tailed p	0.5364 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	23

MANGANESE	n	Rank sum	Mean rank	U
Stockpile 2	3	21.0	7.00	45.0
Background	20	255.0	12.75	15.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	45
1-tailed p	0.9147 (normal approximation, corrected for ties)

analysed with: Analyse-it + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	25

MANGANESE	n	Rank sum	Mean rank	U
Stockpile 3	5	48.0	9.60	67.0
Background	20	277.0	13.85	33.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	67
1-tailed p	0.8761 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	88

MANGANESE	n	Rank sum	Mean rank	U
TNT Strips	68	3101.0	45.60	605.0
Background	20	815.0	40.75	755.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	605
1-tailed p	0.2273 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	49

MANGANESE	n	Rank sum	Mean rank	U
North Valley Non-Specific	29	686.0	23.66	329.0
Background	20	539.0	26.95	251.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	329
1-tailed p	0.7862 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	24

MANGANESE	n	Rank sum	Mean rank	U
S. Valley Wetlands	4	52.0	13.00	38.0
Background	20	248.0	12.40	42.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	38
1-tailed p	0.4384 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	54

MANGANESE	n	Rank sum	Mean rank	U
Background	20	562.0	28.10	328.0
NVML	34	923.0	27.15	352.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	328
1-tailed p	0.4149 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n 25 (cases excluded: 14 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
Ammo Renovation Area	5	69.5	13.90	45.5
Background	20	255.5	12.78	54.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	45.5
1-tailed p	0.3798 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n 27 (cases excluded: 2 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
Demo Site 1	7	68.5	9.79	99.5
Background	20	309.5	15.48	40.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	99.5
1-tailed p	0.9488 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n 26 (cases excluded: 1 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
Demo Site 2	6	68.5	11.42	72.5
Background	20	282.5	14.13	47.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	72.5
1-tailed p	0.7767 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	25	(cases excluded: 1 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
Demo Site 3	5	38.0	7.60	77.0
Background	20	287.0	14.35	23.0

Difference between medians	-	
No CI	- to -	

Mann-Whitney U statistic	77	
1-tailed p	0.9668	(normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	36	(cases excluded: 4 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
Flare Site	16	219.5	13.72	236.5
Background	20	446.5	22.33	83.5

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	236.5	
1-tailed p	0.9926	(normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n	25	(cases excluded: 13 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
Howitzer Test Fac	5	81.0	16.20	34.0
Background	20	244.0	12.20	66.0

Difference between medians	-	
No CI	- to -	

Mann-Whitney U statistic	34	
1-tailed p	0.1384	(normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n 48 (cases excluded: 4 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
TNT Strips	28	732.0	26.14	234.0
Background	20	444.0	22.20	326.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	234
1-tailed p	0.1679 (normal approximation, corrected for ties)

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n 26 (cases excluded: 16 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
North Valley Non-Specific	6	69.0	11.50	72.0
Background	20	282.0	14.10	48.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	72
1-tailed p	0.7675 (normal approximation, corrected for ties)

analysed with: Analyse-It + General v1.50

Test	**Mann-Whitney test (Wilcoxon Rank Sum test)**
Null Hypothesis	Area of Interest = Ambient
Alternative Hypothesis	Area of Interest > Ambient
Date	8 May 2001

n 26 (cases excluded: 14 due to missing values)

MANGANESE	n	Rank sum	Mean rank	U
NVML	6	65.0	10.83	76.0
Background	20	286.0	14.30	44.0

Difference between medians	-
No CI	- to -

Mann-Whitney U statistic	76
1-tailed p	0.8351 (normal approximation, corrected for ties)

APPENDIX F

ECOLOGICAL SCREENINGASSESSMENT SUPPORTING DOCUMENTATION

This appendix includes seven tables that document the derivation and/or source of the criteria used in Chapter 7 of this document for the screening-level Ecological Risk Assessment. In addition, a complete copy of the Wetland Research Associates report on the assessment of vegetation within the TNT Strips is attached.

TABLE F-1	Ecological Soil Screening Levels - Plants and Invertebrates
TABLE F-2	Impact of Using BTAG Values Rather Than Assessment Values for Metals Detected in Soils
TABLE F-3	Ecological Soil Screening Levels - Hawk
TABLE F-4	Ecological Soil Screening Levels - Deer
TABLE F-5	Water Quality Criteria for the Protection of Aquatic Organisms
TABLE F-6	Sediment Quality Criteria for the Protection of Aquatic Organisms
TABLE F-7	Ecological Sediment Screening Levels - Sandpiper

ATTACHMENT F-1	Wetlands Research Associates, Inc. Report (May 2001)
ATTACHMENT F-2	Photographs of TNT Vegetation Sampling Locations

Table F-1. Ecological Soil Screening Levels - Plants and Invertebrates

Chemical	Plants (mg/kg)		Invertebrates (mg/kg)	
Explosives				
1,3,5-trinitrobenzene				
1,3-dinitrobenzene				
2,4,6-trinitrotoluene	30	(1)	140	(1)
2,4-dinitrotoluene				
2,6-dinitrotoluene				
2-amino-4,6-dinitrotoluene	80	(1)		
2-nitrotoluene				
3-nitrotoluene				
4-amino-2,6-dinitrotoluene				
4-nitrotoluene				
amino-dnts				
hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine	100	(1)	95	(2)
nitrobenzene			40	(3)
nitroglycerin				
octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine				
tetryl	25	(1)		
Dioxins and Furans				
1,2,3,4,6,7,8-HpCDD				
1,2,3,4,6,7,8-HpCDF				
1,2,3,4,7,8,9-HpCDF				
1,2,3,4,7,8-HxCDD				
1,2,3,4,7,8-HxCDF				
1,2,3,6,7,8-HxCDD				
1,2,3,6,7,8-HxCDF				
1,2,3,7,8,9-HxCDD				
1,2,3,7,8-PeCDD				
1,2,3,7,8-PeCDF				
2,3,4,6,7,8-HxCDF				
2,3,4,7,8-PeCDF				
2,3,7,8-TCDD				
2,3,7,8-TCDF				
OCDD				
OCDF				
Polynuclear Aromatic Hydrocarbons				
benzo(a)anthracene				
chrysene				
fluoranthene				
naphthalene				
phenanthrene				
pyrene				
Metals				
aluminum	50	(4)		
antimony	5	(4)		
arsenic	10	(4)	60	(3)
barium	500	(4)		
beryllium	10	(4)		
cadmium	4	(4)	20	(3)
chromium, total				
cobalt	20			
copper	100	(4)	50	(3)
iron				
lead	50	(4)	500	(3)
manganese	500	(4)		
mercury	0.3	(4)	0.1	(3)
molybdenum	2			
nickel	30	(4)	200	(3)
selenium	1	(4)	70	(3)
silver	2	(4)		
thallium	1	(4)		
vanadium	2	(4)		
zinc	50	(4)	200	(3)
Other Inorganics				
nitrogen, nitrate (as N)				
phosphorus, total (as P)				

Notes:

(1) LOEC from Talmedge et al., 1999. Nitroaromati munition compounds:environmental effects and screening values. Rev. Environ.Contam. Toxicolo. 161:1-156

(2) LOEC from Robidoux et al., 2000. Chronic Toxicity of Energetic Compounds in Soil Determined using the Earthworm Reproduction Test. Environ. Tox. 7 chem v. 19 no. 7, pp. 1764-1773

(3) Invertebrate soil toxicity values from Table 1 of "Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision." Efroymsom, R.A., M.E. Will, and G.W. Suter II, ORNL.

(4) Plant soil toxicity values from Table 1 of "Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision." Efroymsom, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten, ORNL.

Table F-2 Impact of Using BTAG Values Rather Than Assessment Values for Metals Detected in Soil

	Bird - Hawk				Mammal - Deer				Comparison				
Chemical	Assessment TRV (mg/kg-d)	BTAG TRV (mg/kg-d)	Assessment Csoil (mg/kg)	BTAG Cspoil (mg/kg)	Assessment TRV (mg/kg-d)	BTAG TRV (mg/kg-d)	Assessment Csoil (mg/kg)	BTAG Cspoil (mg/kg)	Original Screeing Criteria (mg/kg)	Basis[1]	Revised Screeing Criteria (mg/kg)	Basis[1]	Impact of Using BTAG Values?[2]
arsenic	2.5	5.5	416	915	1.25	0.32	295	75	60	I			None
cadmium	1.45	0.08	95	5	0.0252	0.06	1	3	4	P	3	M	None
cobalt	1.3	0	216	0	10.4	1.2	3136	362	220	B	362	M	None
copper	47	2.3	5293	259	12	2.67	1768	393	100	P			None
lead	1.1	0.014	169	2	8	0.0015	1866	0.35	170	B	500	I	None
manganese	977	77.6	157604	12518	88	13.7	15937	2481	16000	M	2481	M	Yes
mercury	3.25	0.039	534	6	1.01	0.027	238	6	0.3	P			None
nickel	65	1.38	9939	211	50	0.133	13736	37	200	I			None
selenium	0.5	0.23	27	12	0.076	0.05	3	2.1	3.2	M	2.1	M	None
zinc	131	17.2	4645	610	10.4	9.6	717	662	200	I			None

Notes:

(1) Basis for Ecological Screening Criteria

I = Soil Invertbrates

P = Plants

B = Bird - Hawk used in this evaluation.

M = Mammal - Deer used in this evaluation.

(2) All revised values are still below maximum detected values, except for manganese at TNT Strips, Flare Site, and Demolition Site # 3.

Table F-3. Ecological Soil Screening Levels - Hawk

Hawk assumed to eat soil and voles that have eaten plants.

HI = ADD/TRV
ADD = [FIR * Csoil * Ps] + [FIR * Csoil * BAFs-p *BAFp-v]
HI = {[FIR * Csoil * Ps] + [FIR * Csoil * BAFs-p *BAFp-v]} / TRV
Solve for Eco Soil Screening Level at HI = 1.
Csoil = TRV / {FIR * [Ps + (BAFs-p * BAFp-v)]}

BAFcalc = BCF / (dw:ww)
dw:ww 0.167

FIR	0.12	Food Ingestion Rate, kg food dw/kg BW /day
Ps	0.05	Soil Ingestion as Proportion of Diet

Chemical	BAFs-p Soil-Plant (unitless)		BAFp-v plant-vole (unitless)		TRV (mg/kg-day)		Csoil (mg/kg)	BAFcalc (kg dw soil/ kg dw mouse)	BCF Plant-vole ERAP (kg dw/ kg ww mouse)	Comments	
Explosives											
1,3,5-trinitrobenzene											
1,3-dinitrobenzene	5.32	(1)	2.8E-06	(2)	0.422	(3)	70.31	2.80E-06	4.67E-07		
2,4,6-trinitrotoluene	5.1	(4)									
2,4-dinitrotoluene	2.72	(1)	6.9E-06	(2)				6.92E-06	1.49E-06		
2,6-dinitrotoluene	3.15	(1)	6.9E-06	(2)				6.95E-06	1.16E-06		
2-amino-4,6-dinitrotoluene											
2-nitrotoluene											
3-nitrotoluene											
4-amino-2,6-dinitrotoluene											
4-nitrotoluene											
amino-dnts											
hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine											
nitrobenzene	3.38	(1)	6.2E-06	(2)				6.17E-06	1.03E-06		
nitroglycerin											
octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine											
tetryl											
Dioxins and Furans											
1,2,3,4,6,7,8-HpCDD	0.00029	(1)	0.010	(5)	0.01	(5)	1.6666	0.01	0.00166	0.001	(TEF)
1,2,3,4,6,7,8-HpCDF	0.000062	(1)	0.002	(5)	0.001	(5)	0.1667	0.00	0.000358	0.01	(TEF)
1,2,3,4,7,8,9-HpCDF	0.0022	(1)	0.076	(5)	0.001	(5)	0.1661	0.08	0.0127	0.01	(TEF)
1,2,3,4,7,8-HxCDD	0.0017	(1)	0.060	(5)	0.0002	(5)	0.0333	0.06	0.0101	0.05	(TEF)
1,2,3,4,7,8-HxCDF	0.00043	(1)	0.015	(5)	0.0001	(5)	0.0167	0.01	0.00247	0.1	(TEF)
1,2,3,6,7,8-HxCDD	0.00067	(1)	0.023	(5)	0.001	(5)	0.1666	0.02	0.00391	0.01	(TEF)
1,2,3,6,7,8-HxCDF	0.0011	(1)	0.037	(5)	0.0001	(5)	0.0167	0.04	0.00618	0.1	(TEF)
1,2,3,7,8,9-HxCDD	0.00078	(1)	0.027	(5)	0.0001	(5)	0.0167	0.03	0.00456	0.1	(TEF)
1,2,3,7,8-PeCDD	0.0052	(1)	0.179	(5)	0.00001	(5)	0.0016	0.16	0.0299	1	(TEF)
1,2,3,7,8-PeCDF	0.0011	(1)	0.043	(5)	0.0001	(5)	0.0167	0.04	0.00716	0.1	(TEF)
2,3,4,6,7,8-HxCDF	0.0038	(1)	0.131	(5)	0.0001	(5)	0.0165	0.13	0.0218	0.1	(TEF)
2,3,4,7,8-PeCDF	0.009	(1)	0.312	(5)	0.00001	(5)	0.0016	0.31	0.0521	1	(TEF)
2,3,7,8-TCDD	0.00562	(1)	0.198	(3)	0.00001	(3)	0.0016	0.20	0.033	1	(TEF)
2,3,7,8-TCDF	0.0045	(1)	0.158	(5)	0.00001	(5)	0.0016	0.16	0.026	1	(TEF)
OCDD	0.000067	(1)	0.002	(5)	0.1	(5)	16.6666	0.002	0.000391	0.0001	(TEF); use mammal
OCDF	0.00009	(1)	0.003	(5)	0.1	(5)	16.6666	0.003	0.000521	0.0001	(TEF)
Polynuclear Aromatic Hydrocarbons											
benzo(a)anthracene	0.54	(4)	0.04	(2)	0.00079	(3)	0.09	0.043	0.00719		
chrysene	0.0187	(1)	0.05	(2)	0.001	(3)	0.16	0.050	0.00827		
fluoranthene	2.5	(4)	0.12	(2)				0.12	0.02		
naphthalene	1.1	(4)									
phenanthrene	3.8	(4)	0.12	(2)				0.12	0.02		
pyrene	1.9	(4)									
Metals											
aluminum	0.004	(6)	0.00032	(2)	100	(3)	16666	0.00032	0.000054	(Used value for Zn)	
antimony	0.037	(4)	0.001	(4)	0.3	(7)	50				
arsenic	0.03752	(4)	0.0025	(4)	2.5	(3)	416				
barium	0.16	(4)	0.001	(4)	21	(3)	3489				
beryllium	0.01	(4)	0.00015	(4)							
cadmium	0.59	(4)	0.13	(4)	1.45	(3)	95				
chromium, total	0.041	(4)	0.085	(4)	1.55	(8)	242				
cobalt	0.0075	(4)	0.021	(4)	1.3	(8)	216				
copper	0.12	(4)	0.2	(4)	47	(3)	5293				
iron											
lead	0.039	(4)	0.11	(4)	1.1	(7)	169				
manganese	0.079	(4)	0.021	(4)	977	(7)	157604				
mercury	0.0375	(1)	0.019	(2)	3.25	(3)	534	0.019	0.00313		
molybdenum	0.25	(6)	0.020	(2)	3.5	(7)	531	0.020	0.0033	(Used Cr-VI value)	
nickel	0.018	(4)	0.25	(4)	65	(3)	9939				
selenium	0.67	(4)	0.16	(4)	0.5	(3)	27				
silver	0.014	(4)	0.004	(4)	178	(3)	29633				
thallium	0.00085	(6)	0.14	(2)	0.35	(3)	58	0.144	0.024		
vanadium	0.0055	(6)	0.020	(2)	11.4	(7)	1896	0.020	0.0033	(Used Cr-VI value)	
zinc	0.37	(4)	0.5	(4)	131	(3)	4645				
Other Inorganics											
nitrogen, nitrate (as N)											
phosphorus, total (as P)											

Notes:

(1) BAF = BCF from Table C-2, U.S. EPA's Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Draft, 1999.

(2) BAF converted from BCF for deer mouse from Table D-1, U.S. EPA's Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Draft, 1999.

(3) TRV for birds from Table E-8, U.S. EPA's Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Draft, 1999.

(4) Median BAF from Table 7, Appendix 4-1, Ecological Soil Screening Level Guidance - Draft, June 27, 2000.

(5) TRV = TRV for 2,3,7,8-TCDD)/(Bird TEF)

(6) BAF = Bv value from Figure 2.1, Baes, C.F. et al., A Review and Anlysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture.

(7) Toxicological Benchmarks for Wildlife: 1996 Revision, DOE, Oak Ridge National Laboratory, 1996, ES/ER/TM-86/R3.

(8) TRV from Ecological Soil Screening Level Guidance - Draft, June 27, 2000.

Table F-4. Ecological Soil Screening Levels - Deer

Deer assumed to eat soil and plants

HI = ADD/TRV
ADD = [FIR * Csoil * Ps] + [FIR * Csoil * BAF]
HI = {[FIR * Csoil * Ps] + [FIR * Csoil * BAF]} / TRV
Solve for Eco Soil Screening Level at HI = 1.
Csoil = TRV / {FIR * [Ps + BAF]}

		Source: Note i, Table 5-1, ERAP for HW Combustion Facilities
FIR	0.0308	Food Ingestion Rate, kg food dw/kg BW /day = (235/1000) * Wt^(822)/(BW in kg). Wt in grams. Body Weight = 90,000 g
Ps	0.1	Soil Ingestion as Proporbon of Diet

Chemical	BAF Soil-Plant (unitless)		TRV (mg/kg-day)		Csoil (mg/kg)	Comments	
Explosives							
1,3,5-trinitrobenzene							
1,3-dinitrobenzene	5.32	(1)	1.051	(2)	6.29		
2,4,6-trinitrotoluene	5.1	(3)	1.6	(4)	9.97		
2,4-dinitrotoluene	2.72	(1)	0.7	(2)	8.05		
2,6-dinitrotoluene	3.15	(1)	0.4	(2)	3.99		
2-amino-4,6-dinitrotoluene							
2-nitrotoluene							
3-nitrotoluene							
4-amino-2,6-dinitrotoluene							
4-nitrotoluene							
amino-dnts							
hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine							
nitrobenzene	3.38	(1)					
nitroglycerin							
octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine							
tetryl							
Dioxins and Furans							
1,2,3,4,6,7,8-HpCDD	0.00029	(1)	0.000100	(5)	0.03232	0.01	(TEF)
1,2,3,4,6,7,8-HpCDF	0.000062	(1)	0.000100	(5)	0.03240	0.01	(TEF)
1,2,3,4,7,8,9-HpCDF	0.0022	(1)	0.000100	(5)	0.03172	0.01	(TEF)
1,2,3,4,7,8-HxCDD	0.0017	(1)	0.000010	(5)	0.00319	0.1	(TEF)
1,2,3,4,7,8-HxCDF	0.00043	(1)	0.000010	(5)	0.00323	0.1	(TEF)
1,2,3,6,7,8-HxCDD	0.00067	(1)	0.000010	(5)	0.00322	0.1	(TEF)
1,2,3,6,7,8-HxCDF	0.0011	(1)	0.000010	(5)	0.00321	0.1	(TEF)
1,2,3,7,8,9-HxCDD	0.00078	(1)	0.000010	(5)	0.00322	0.1	(TEF)
1,2,3,7,8-PeCDD	0.0052	(1)	0.000001	(5)	0.00031	1	(TEF)
1,2,3,7,8-PeCDF	0.0011	(1)	0.000020	(5)	0.00641	0.05	(TEF)
2,3,4,6,7,8-HxCDF	0.0038	(1)	0.000010	(5)	0.00312	0.1	(TEF)
2,3,4,7,8-PeCDF	0.009	(1)	0.000002	(5)	0.00059	0.5	(TEF)
2,3,7,8-TCDD	0.00562	(1)	0.000001	(2)	0.00031	1	(TEF)
2,3,7,8-TCDF	0.0045	(1)	0.000010	(5)	0.00310	0.1	(TEF)
OCDD	0.000067	(1)	0.010000	(5)	3.23964	0.0001	(TEF)
OCDF	0.00009	(2)	0.010000	(5)	3.23889	0.0001	(TEF)
Polynuclear Aromatic Hydrocarbons							
benzo(a)anthracene	0.54	(3)	0.167	(2)	8		
chrysene	0.0187	(1)					
fluoranthene	2.5	(3)					
naphthalene	1.1	(3)					
phenanthrene	3.8	(3)					
pyrene	1.9	(3)					
Metals							
aluminum	0.004	(6)	1.93	(2)	602		
antimony	0.037	(3)	4.4	(7)	1041		
arsenic	0.038	(3)	1.25	(2)	295		
barium	0.16	(3)	0.51	(2)	64		
beryllium	0.01	(3)	0.66	(2)	195		
cadmium	0.59	(3)	0.0252	(2)	1.18		
chromium, total	0.041	(3)	24.5	(7)	5633		
cobalt	0.0075	(3)	10.4	(7)	3136		
copper	0.12	(3)	12	(2)	1768		
iron							
lead	0.039	(3)	8	(8)	1865.8		
manganese	0.079	(3)	88	(8)	15937		
mercury	0.0375	(1)	1.01	(2)	238.13		
molybdenum	0.25	(6)	0.26	(8)	24		
nickel	0.018	(3)	50	(2)	13736		
selenium	0.67	(3)	0.076	(2)	3.20		
silver	0.014	(3)	0.37	(2)	105		
thallium	0.00065	(6)	0.013	(2)	4		
vanadium	0.0055	(6)	0.21	(8)	65		
zinc	0.37	(3)	10.4	(2)	717		
Other Inorganics							
nitrogen, nitrate (as N)			507	(8)	164360		
phosphorus, total (as P)							

Notes:
(1) BAF = BCF from Table C-2, U.S. EPA's Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Draft, 1999.
(2) TRV for mammals from Table E-7, U.S. EPA's Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Draft, 1999.
(3) Median BAF from Table 7, Appendix 4-1, Ecological Soil Screening Level Guidance - Draft, June 27, 2000.
(4) NOEL from Talmage et al., 1999.
(5) TRV = TRV for 2,3,7,8-TCDD)/(Mammalian TEF). Mammalian TEF from Table 2-3, U.S. EPA's Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Draft, 1999.
(6) BAF = Bv value from Figure 2.1, Baes, C.F. et al., A Review and Anlysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture.
(7) TRV from Appendix 4-2, Ecological Soil Screening Level Guidance - Draft, June 27, 2000.
(8) Toxicological Benchmarks for Wildlife: 1996 Revision, DOE, Oak Ridge National Laboratory, 1999, ES/ER/TM-86/R3.

Table F-5. Water Quality Criteria for the Protection of Aquatic Organisms

Chemical	Water Quality Criterion (µg/L)	Source
Explosives		
2,4,6-trinitrotoluene	90	Talmage et. al. 1999
Metals		
aluminum	87	EPA 1999c
barium	NC	
copper	9	EPA 2000c
iron	1000	EPA 1999c
manganese	NC	
mercury	0.77	EPA 1999c
nickel	52	EPA 1999c
vanadium	NC	
zinc	120	EPA 1999c
Other Inorganics		
nitrogen, nitrate (as N)	NC	

Notes:

NC = no relevant criteria available

Table F-6. Sediment Quality Criteria for the Protection of Aquatic Organisms.

Chemical	Chronic Sediment Quality Criterion[1] (mg/kg)		Source
Explosives			
2,4,6 trinitrotoluene	55		Green et.al. 1998
Polynuclear Aromatic Hydrocarbons			
benzo(b)fluoranthene	240		Persaud et. al. 1993
Metals			
aluminum	58030	(1)	EPA 1996a
arsenic	12.1		EPA 1996a
barium	NC		
beryllium	NC		
chromium, total	56		EPA 1996a
cobalt	NC		
copper	28		EPA 1996a
iron	20000		Persaud et.al. 1993
lead	34.2		EPA 1996a
manganese	1673		EPA 1996a
mercury	0.2		Persaud et.al. 1993
methyl mercury	NC		
nickel	39.6		EPA 1996a
selenium	NC		
vanadium	NC		
zinc	159		EPA 1996a
Other Inorganics			
nitrogen, nitrate (as N)	NC		
phosphorus, total (as P)	NC		

Notes:

NC - No relevant criteria available.

NA - Not applicable

(1) Probable Effect Concentration (PEC) rather than Threshold Effect Concentration (TEC).

Table F-7. Ecological Sediment Screening Levels - Sandpiper

Sandpiper assumed to eat sediment and sediment invertebrates.

HI = ADD/TRV
ADD = [FIR * Csoil * Ps] + [FIR * Csoil * BAF]
HI = {[FIR * Csed * Ps] + [FIR * Csed * BAF]} / TRV
Solve for Eco Soil Screening Level at HI = 1.
Csed = TRV / {FIR * [Ps + BAF]}

BAF (mg/ kg dw per mg/kg dry sed) = BCF (mg/ kg ww per mg/kg dry sed) / (dw:ww)
dw:ww = 0.167

Source: Table 5-1, ERAP for HW Combustion Facilities

FIR =	0.0950	Food Ingestion Rate, kg food dw/kg BW /day (= FIR ww / dw:ww, where FIR ww = 0.569 kg ww/kg BW - day)
Ps =	0.437	Soil Ingestion as Proportion of Diet (= Sed IR/ FIR, where Sed IR = 0.0415 kg DW/kg BW-day)

Chemical	BCF Sediment-Invertebrate (unitless - ww)		BAF Sediment-Invertebrate (unitless - dw)	TRV (mg/kg-day)		Csed (mg/kg)
Methyl Mecury	0.48	(1)	2.9	0.0064	(2)	0.020
Benzo(b)fluoranthene	1.61	(1)	9.6			0.000
2,4,6-trinitrotoluene						0.000

Notes:
(1) BCFs from Table C-6, U.S. EPA's Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Draft, 1999.
(2) TRVs for birds from Table E-8, U.S. EPA's Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Draft, 1999.

ATTACHMENT F-1

Wetlands Research Associates, Inc. Report

May 2001

ATTACHMENT F-1

TNT STRIP VEGETATION ANALYSIS

TOURTELOT CLEANUP PROJECT
BENICIA, CALIFORNIA

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May 2001

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1.0 INTRODUCTION

This report describes results of a quantitative analysis of vegetation associated with ordnance disposal areas known as the TNT strips located on the Tourtelot Cleanup Project Site (Project Site), in Benicia, California. Five TNT strips are located within the Project Site on the north slope of the North Valley (Study Area). Soil within and adjacent to the TNT strips have been sampled and analyzed for 2,4,6-trinitrotoluene (TNT) concentration. The purpose of the analysis was to compare characteristics of vegetation at locations with varying levels of TNT concentration. Sampling locations were determined based on TNT data from previously collected samples. Quantitative measurements of vegetative characteristics were made which may indicate variation in growing conditions as a result of TNT concentration. Vegetative characteristics sampled include plant species composition, plant height and areal cover

2.0 DESCRIPTION OF STUDY AREA

2.1 Local Setting

The Project Site is located north of the intersection of Rose Drive and McAllister Drive in Benicia, Solano County, California. The Project Site consists of approximately 220 acres partially within the boundaries of the former Benicia Arsenal. Part of this site was used by the Army between 1945 and 1960 as an ordnance renovation and demolition area. The site has rolling topography that includes the "North Valley", and a "Ridge" that separates it from the "South Valley". The Project Site is bordered by the Southampton residential development to the west and south, undeveloped lands owned by the Valero refinery to the south, and industrial and commercial facilities to the east and open space to the north and east.

The TNT strips are located on the north slope of North Valley (Study Area) along the northern boundary of the Project Site.

2.2 Plant Communities

The vegetation within the Study Area is non-native annual grassland which is typical for a south facing slope in this area. Dominant herbaceous species include wild oats (*Avena fatua*), black mustard (*Brassica nigra*), ripgut brome (*Bromus diandrus*), and Italian ryegrass (*Lolium multiflorum*). The non-native herb fennel (*Foeniculum vulgare*) grows to 8 feet in height in dense stands over much of the slope. As is typical on other areas of the site, few native species occur on the slope. The natives narrow-leaf mule ears (*Wyethia angustifolia*) and lupine (*Lupinus* sp.) are found occasionally.

2.3 Topography and Soils

Elevations within the Study Area range from 160 to 261 feet. The Study Area is situated on a south facing slope and includes the summit a small ridge. The Study Area drains towards the west to Lake Herman.

The Solano County Soil Survey (USDA 1977) indicates one mapping unit within the Study Area, Dibble-Los Osos clay loam, 30-50% slopes, eroded, well drained. The Dibble series occurs on ridge tops and south-facing slopes and the Los Osos soil is on north-facing slopes. The Dibble component of this mapping unit is a deep well drained clay loam soil. Rooting depth is 25 to 40 inches. Available water capacity is 4 to 7 inches. Depth to bedrock is 30 inches. Runoff is rapid and erosion is a high hazard.

3.0 METHODS

Sampling of vegetation within the Study Area were conducted on May 10, 2001. Sampling was conducted by a botanist who has experience with collection of vegetation data and with the plant species found within the Study Area. All plant species were identified using nomenclature found in The Jepson Manual (Hickman 1993).

Vegetation characteristics were sampled using a 0.25 m^2 quadrat centered over the sampling point marker stake. The potential for variation in TNT concentration over short distances and the close spacing of the soil sample locations required the use of this quadrat size. The botanist was not told the TNT concentrations of a sample locations until after the field sampling was completed.

Percent canopy cover was estimated for each species present in a sample quadrat. Cover was recorded as percent absolute cover. Sampling locations with tall or dense canopies could therefore have total cover which exceeded 100%. Cover in unvegetated areas was also estimated and recorded as bareground, gopher mound or drilling mud. Maximum height of *Avena fatua* was measured. Canopy height of grasses was measured to the nearest 10 cm. Each sample quadrat was labeled and photographed using a digital camera.

Samples were place into 4 groups for analysis based on TNT concentration. Statistical analysis was not possible given the limited and unequal number of samples in each group. Mean total vegetative cover, cover of bare soil, grass canopy height, maximum height of Avena fatua and species richness (number of species) was calculated for each group.

4.0 RESULTS AND DISCUSSION

Sampling data are presented in Table 1. Vegetation samples were placed into one of five groups based on TNT concentration of the soil sample at the location. A comprehensive list of plant species identified in the Study Area is provided in Table 2.

Most samples were dominated by non-native annual grasses including *Avena fatua* (wild oats), *Bromus diandrus* (ripgut), *Lolium multiflorum* (Italian ryegrass), and *Bromus hordeaceus* (soft chess). Four samples were dominated by forbs; three samples by *Foeniculm vulgare* (fennel) and one sample by *Brassica nigra* (black mustard). At this date, *Foeniculum vulgare* was approximately equivalent in height to the associated grasses. Standing dead *Foeniculum* adjacent to many sample locations reached approximately 8 feet in height. All these are highly competitive non-native species which are typical of disturbed grassland sites.

Natural and man-made disturbance at several sample locations reduced vegetative cover. Two samples (4C1 and 4C13) were located in or adjacent to animal trails. Three samples contained gopher mounds. Drill mud and soil sampling holes were visible in 6 samples. Vegetation at one sample (4C2) was reported to have been weeded prior to soil sampling.

Two of the samples in the very high group were essentially unvegetated. However, the sample with the highest TNT concentration (1F with 44,000 mg/kg) had vegetative characteristics which were slightly reduced relative to control samples.

No difference in total vegetative cover, bare soil, total cover, grass canopy height, or max height was apparent between the control, trace, low and high groups. Vegetative characteristics of the high group were more similar to the control group than the trace or low groups. Mean bare soil was lowest and mean total vegetative cover, canopy height and max height were greatest in the high sample group. Mean cover of bare soil, grass canopy height and species richness were remarkably similar between the groups.

Vegetative characteristics of samples in the trace, low and high groups were within the range of the characteristics measured in the control group. Results of control samples indicate that composition, cover and height of vegetation exhibit normal variation across the Study Area. Mean bare soil, total cover, grass canopy height, max height of *Avena fatua* and species richness of the samples in the trace, low and high groups were within the range of samples in the control group.

Measures which indicate density of vegetation might be used to indicate effects of contaminants on plant growth. In the Study Area with high unvegetated cover as a result of disturbance (including trails, drill holes and gopher mounds), total cover which combines vegetative and unvegetated cover

should be used as a measure of density of vegetation. Total vegetative cover of several samples in the trace, low and high groups was lower than the range of total vegetative cover in the control group. This appears to be a result of the higher disturbance and the resulting higher total unvegetated cover in the samples. Total cover of samples in the trace, low and high groups is within the range of samples in the control group.

5.0 CONCLUSION

No apparent differences in vegetative characteristics were detected at both the sample and group levels between control samples and samples with TNT concentrations less than 1000 mg/kg. Mean vegetative characteristics of samples in the high group (200 and 1000 mg/kg TNT), actually indicated slightly more favorable growing conditions at these locations than at the control locations and at locations with lower TNT concentrations. Samples with TNT concentrations of 1500 mg/kg or more were unvegetated or had slightly reduced vegetative characteristics.

6.0 REFERENCES

Hickman, J.C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press.

U.S. Department of Agriculture, Soil Conservation Service. 1977. Soil Survey of Solano County, California. In cooperation with the University of California Agricultural Experiment Station. 112 pp. + appendices.

TABLE 1. TNT Strip Vegetation Analysis

Sample	1C4	4C14	1F6	4C2	5H	mean	4C13	4C1	mean	1C7	5G	1F5	mean	1C6	1C3	SS5	mean	1C	1F	5A	mean
TNT concentration (mg/kg)	0	0	0	0	0		5	8		49	140	180		260	970	738		43000	44000	1500	
TNT concentration group		control					trace				low				high				very high		
Plant Species Cover (%)																					
Avena fatua	40		90	5	15			40		20	15	80		20	80	25		1	55		
Brassica nigra										40											
Bromus diandrus	60	10	5	5	15		5	10			15	3		50	10	10			1		
Bromus hordeaceous		5			15						5					25					
Carduus pycnocephalus	3									5		3		3							
Centaurea solstitialis	3														5						
Convolvulus arevensis	10											5				5					
Foeniculum vulgare		40		10	20		5	30		1	40			30		5					
Geranium dissectum	2									2											
Lactuca serriola														1							
Lolium multiflorum		40	5	60	15		35	10				5				25			5		
Medicago polymorpha																			1		
Picris echioides																5					
Vicia benghalensis	1																				
Vulpia myuros							10								5						
Total Vegetative Cover	119	95	100	80	80	94.8	55	90	72.5	68	75	96	79.7	104	100	100	101.3	1	62	0	21.0
Unvegetated Cover (%)																					
bare soil	5	15	5	20	30	15.0	15	10	12.5	15	25	10	16.7	5	5	10	6.7	99	30	100	76.3
trail							15														
drill mud / hole								10		10	5	10			10				10		
gopher mound		15					20			10											
Total Unvegetated Cover	5	30	5	20	30		50	20		35	30	20		5	15	10		99	40	100	
Total Cover (vegetated + unvegetated cover)	124	125	105	100	110	112.8	105	110	107.5	103	105	116	108.0	109	115	110	111.3	100	102	100	100.7
Plant Height (cm)																					
grass canopy height	50	30	50	30	50	42.0	30	30	30.0	30	40	50	40.0	30	70	30	43.3	0	40	0	13.3
max height (A.fatua)	88	np	66	48	93	73.8	np	48	48.0	75	77	70	74.0	75	104	57	78.7		63		63.0
Species Richness	7	4	3	4	5	4.6	4	4	4.0	5	4	5	4.7	5	4	7	5.3	1	4	0	1.7

Note: Vegetation Analysis of the TNT Strips on the Tourtelot Property was performed on May 10, 2001

TABLE 2

Plant Species Within the TNT Strip Study Area*

Scientific Name	Common Name
Amsinckia spp.	fiddleneck
Astragalus asymmetricus	San Joaquin milkvetch
Avena fatua	wild oat
Baccharis pilularis	coyote brush
Brassica nigra	black mustard
Bromus hordeaceus	soft chess
Bromus diandrus	ripgut brome
Carduus pycnocephalus.	plumeless thistle
Centaurea solstitialis	yellow star-thistle
Convolvulus arvensis	bindweed
Eschscholzia californica	California poppy
Foeniculum vulgare	fennel
Geranium dissectum	geranium
Hordeum murinum	foxtail
Lactuca serriola	prickly lettuce
Lolium multiflorum	Italian rye grass
Lupinus spp.	lupine
Medicago polymorpha	bur clover
Nassella pulchra	purple needlegrass
Picris echioides	bristly ox-tongue
Raphanus sativus	wild radish
Toxicodendron diversilobum	poison oak
Vicia benghalensis	purple vetch
Vulpia myuros	vulpia
Wyethia angustifolia	coast mules ears

* Observed by WRA within the Tourtelot Cleanup Project Site, TNT Strip Study Area, May 10, 2001

ATTACHMENT F-2

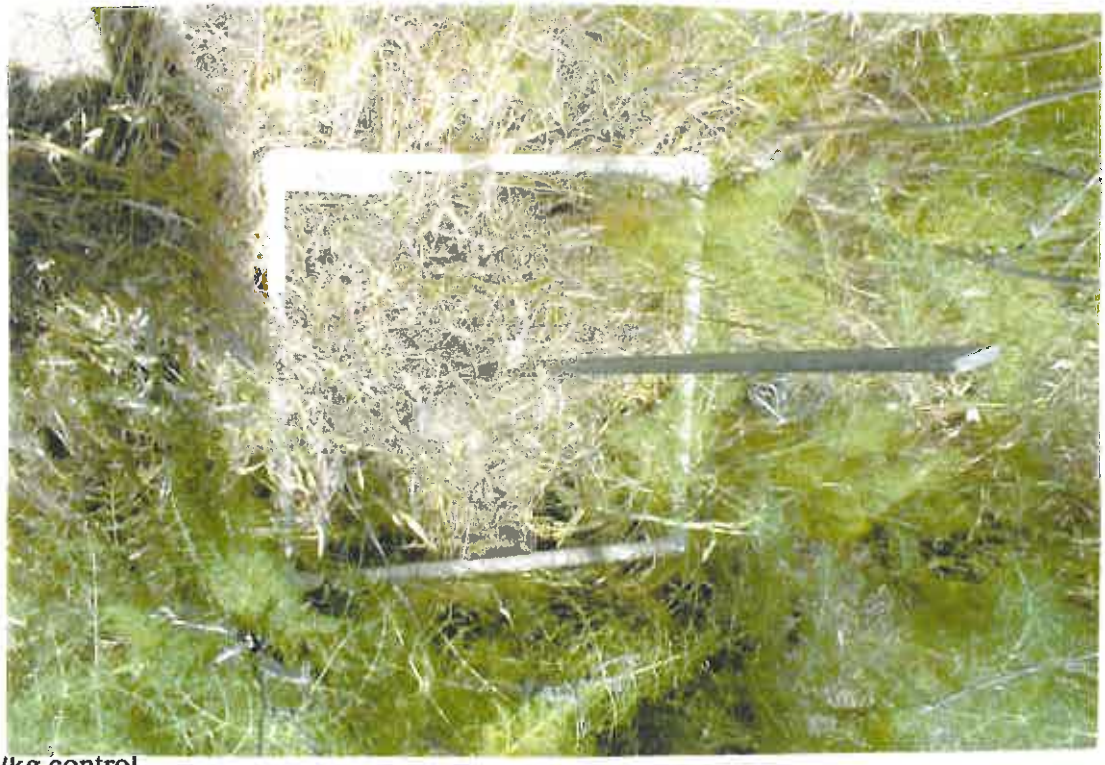
Photographs of TNT Vegetation Sampling Locations

May 2001

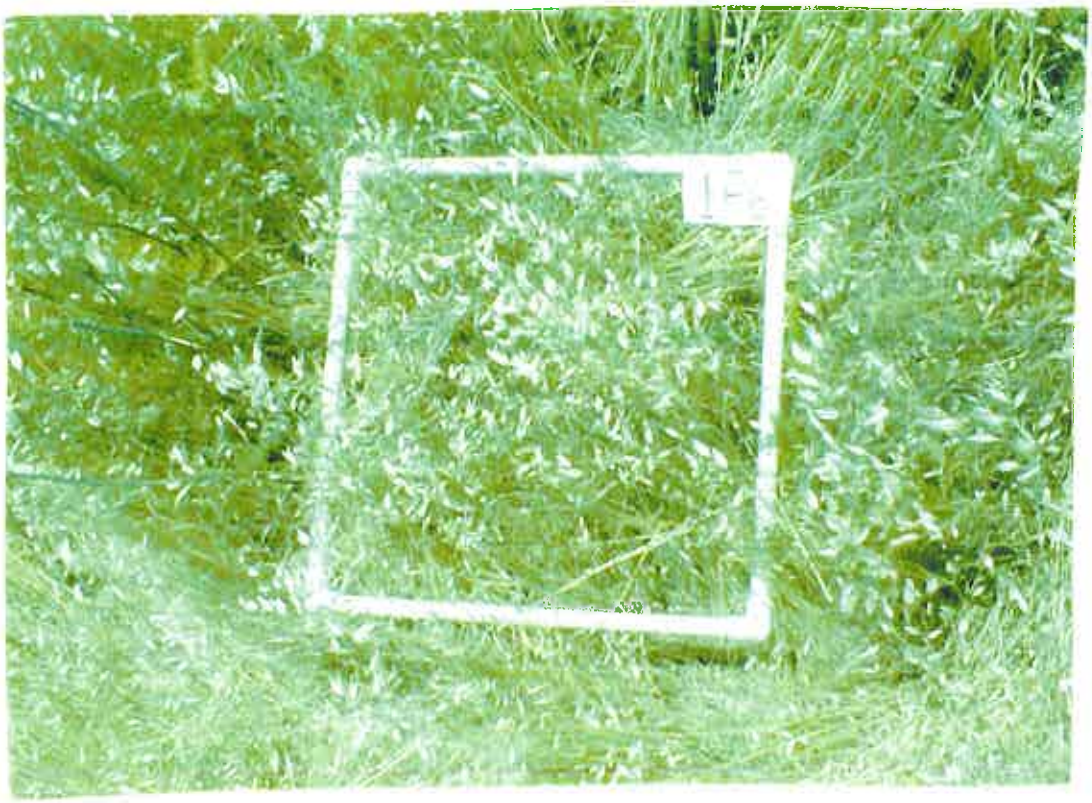
Photograph 1.
Sample 1C4 – 0 mg/kg control

Photograph 2.
Sample 4C2 – 0 mg/kg control

Photograph 3
Sample 4C14 – 0 mg/kg control



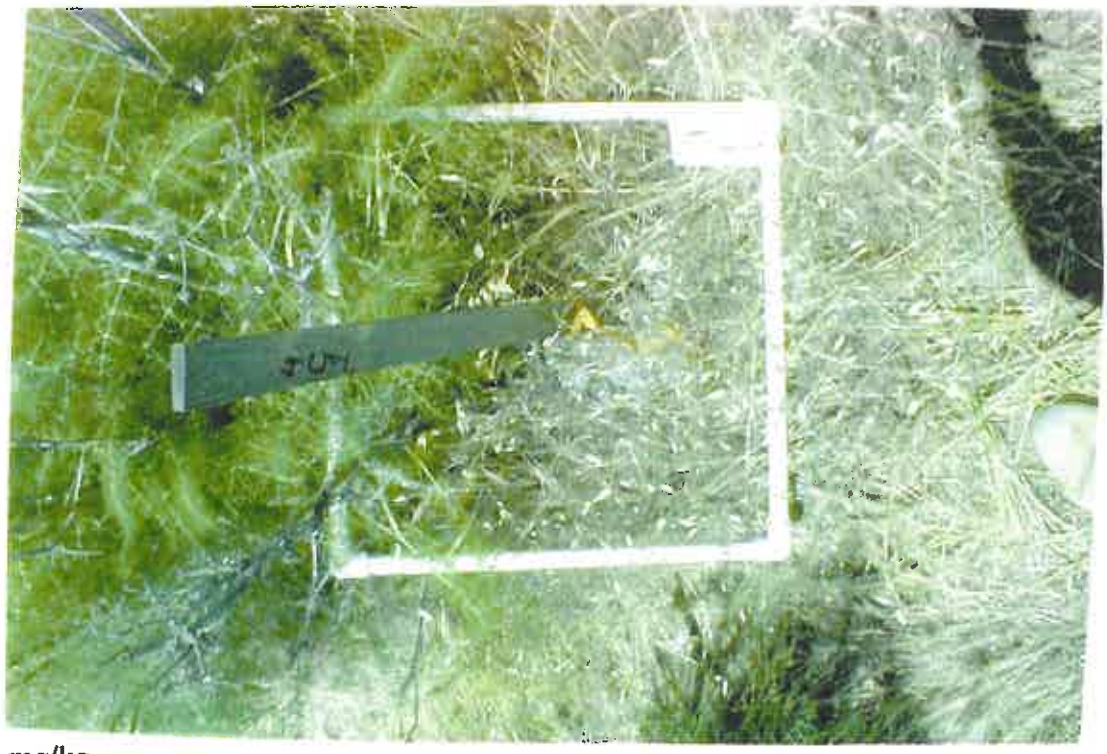
Photograph 4.
Sample 5H – 0 mg/kg control



Photograph 5.
Sample 1F6 – 0 mg/kg control

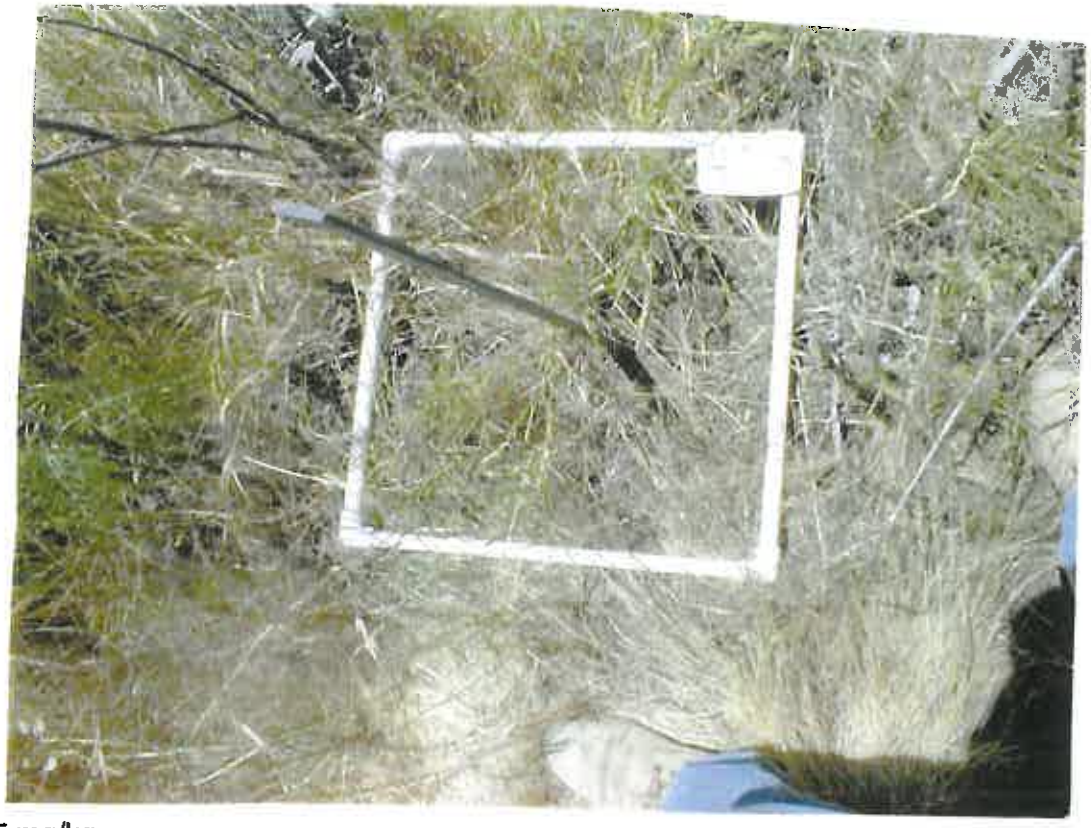
Photograph 6.
Sample 1F6 – 0 mg/kg control

Photograph 9.
Sample 4C13 – 5 mg/kg



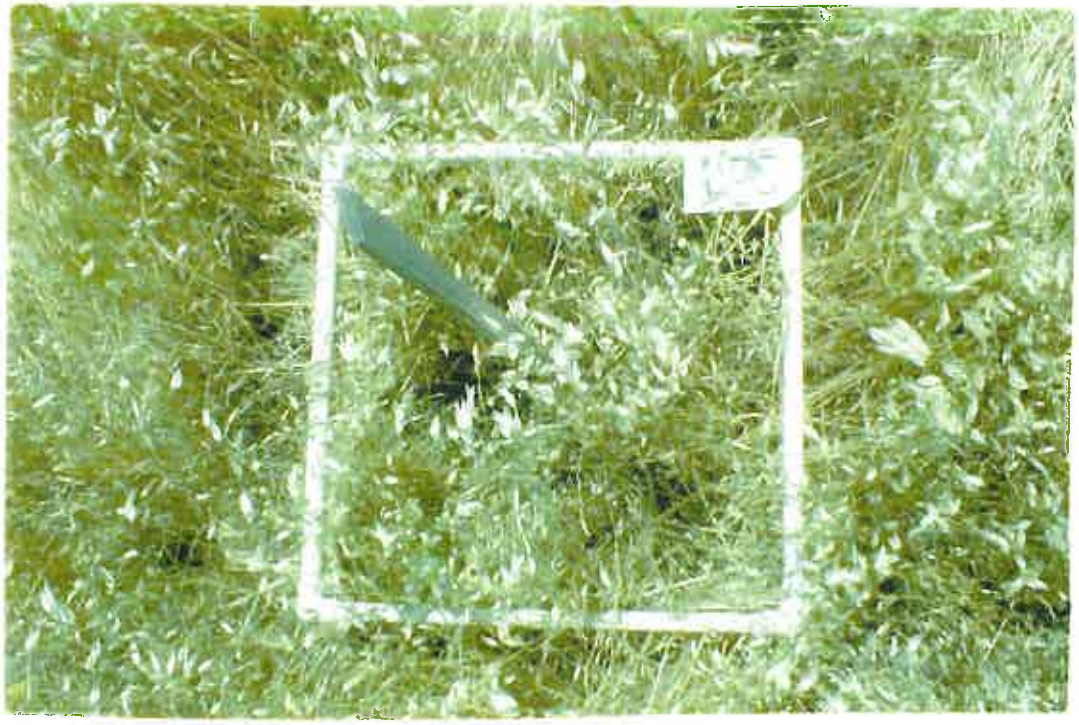
Photograph 10.
Sample 4C1 – 8 mg/kg

Photograph 7.
Sample 4C1 – 8 mg/kg



Photograph 8.
Sample 4C13 – 5 mg/kg

Photograph 11.
Sample 4C1 – 8 mg/kg



Photograph 12.
Sample 1F5 – 180 mg/kg

Photograph 13.
Sample 1C7 – 49 mg/kg

Photograph 14.
Sample 5G – 140 mg/kg

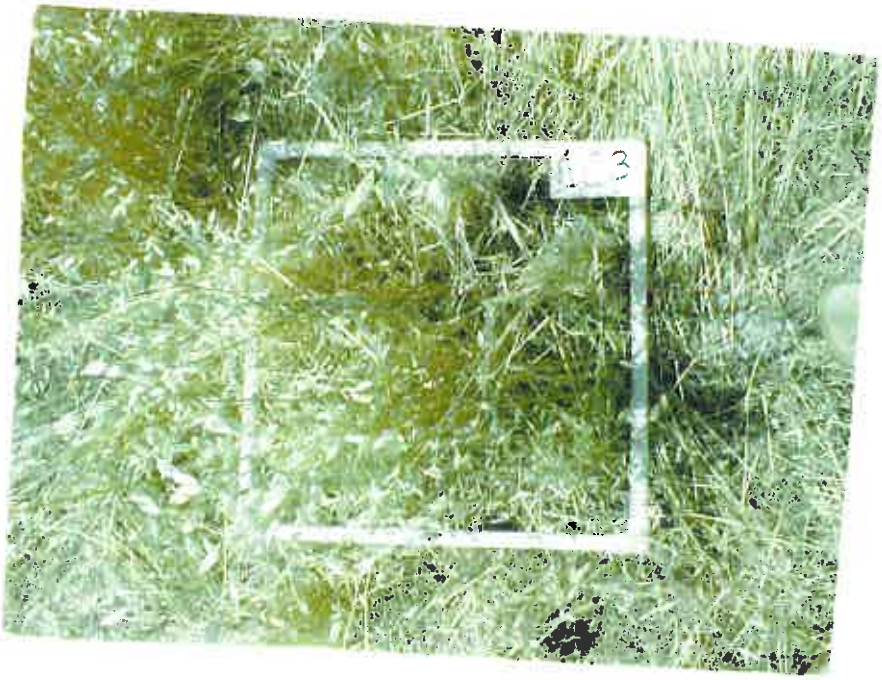
Photograph 15
Sample [redacted]
1C6 260 mg/Kg

Photograph 16.
Sample 1F5 – 180 mg/kg

Photograph 17.
Sample SS-5 – 738 mg/kg

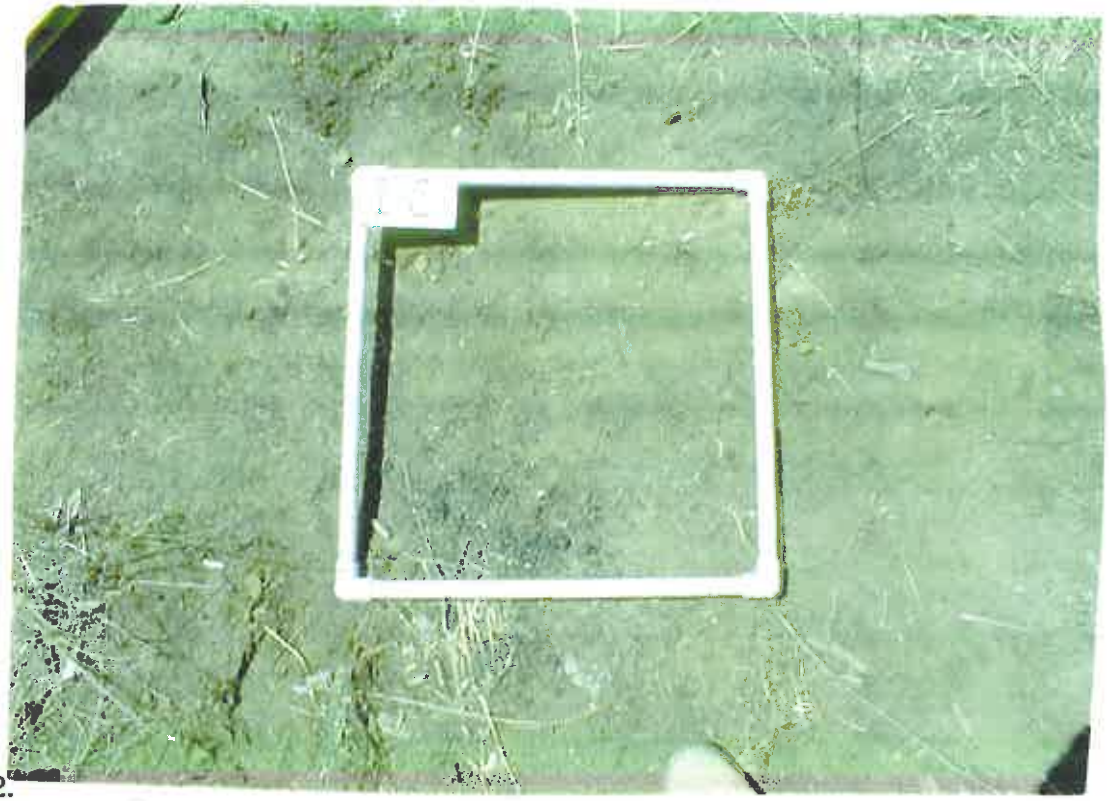
Photograph 18.
Sample SS-5 – 738 mg/kg

Photograph 19.
Sample SS-5 – 738 mg/kg

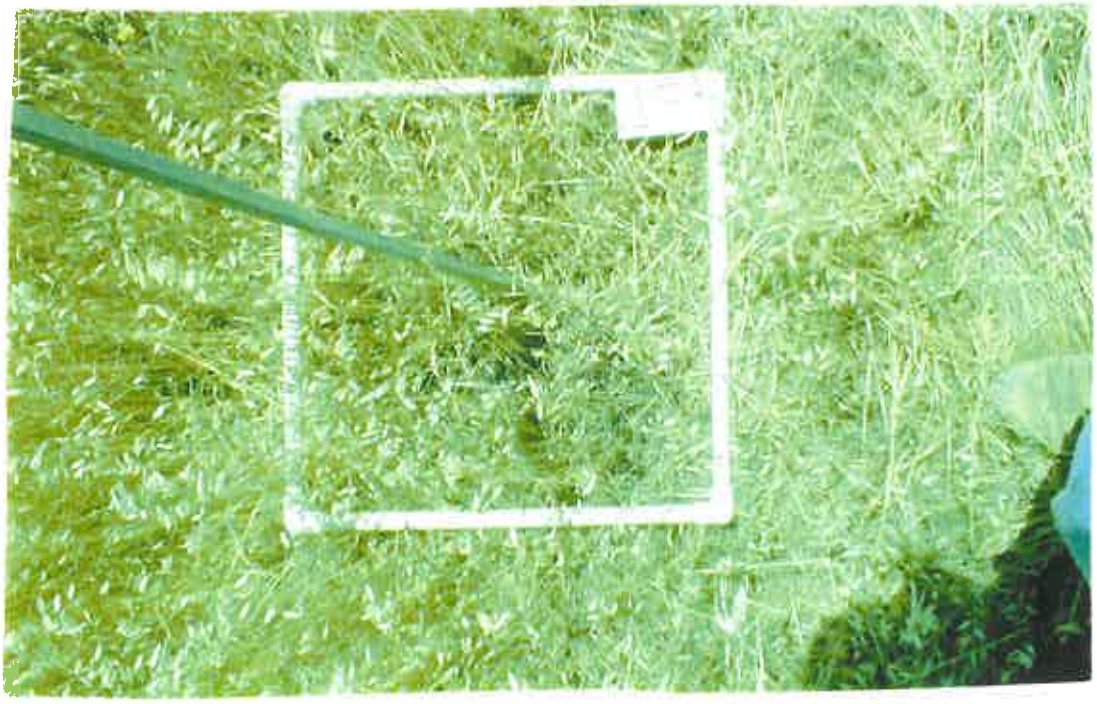


Photograph 20.
Sample 1C3 – 970 mg/kg

Photograph 21.
Sample 1C3 – [redacted] mg/kg
970



Photograph 22.
Sample 1C – 43,000 mg/kg



Photograph 23.
Sample 1F – 44,000 mg/kg

APPENDIX G
OE GEOPHYSICAL INVESTIGATIONS
EQUIPMENT AND PROCEDURES

This appendix includes detailed information concerning the geophysical equipment and procedures used during previous OE clearances and investigations at the Project Site. Information presented in this appendix was taken from the *Final Engineering Evaluation Cost Analysis Work Plan, Former Benicia Arsenal, Benicia, California* (Earth Tech, 1998), the *Final Engineering Evaluation/Cost Analysis, Former Benicia Arsenal, Benicia Arsenal, Benicia, California* (Earth Tech, 2000a), and the *Removal Action Work Plan, Tourtelot Cleanup Project, Benicia, California* (Earth Tech, 2000b). Attachments G-1 through G-4 to this appendix provide information pertaining to OE-related items recovered during previous OE clearances and investigations.

G.1 GEOPHYSICAL MAPPING EQUIPMENT

Geophysical methods were utilized at the Project Site during previous investigations and clearances because they a reliable means of detecting metallic objects, including OE items that may lie below ground level. Further, use of geophysical methods allowed a non-intrusive, controlled investigation of the subsurface, which minimized the potential for explosive hazards to personnel and the environment.

G.1.1 Geometrics G858 Cesium Vapor Magnetometer

During the survey conducted by NORCAL in Fall 1996, the data were collected using a cesium vapor magnetometer along east-west traverses spaced 5 feet apart. Measurements were recorded at (nominally) 1-foot intervals along each traverse, as interpolated from 50-foot fiducials marked along each line. The data were recorded relative to grid origins and transformed into California State Plane coordinates (North American Datum of 1927 [NAD27]) by reference to the coordinate location of the grid origin as tied to the California State Plane system by a land surveyor.

The magnetic gradiometers were deployed with a 0.5-meter sensor height above ground level. Vertical separation between the magnetometers was 1 meter. Man-portable arrays were used because they provide greater site accessibility than trailered arrays and minimize measurement noise in collected data.

G.1.2 Geonics EM61

The EM61 is a high resolution, time-domain metal detector used to detect both ferrous and nonferrous metallic objects. The system measures the electrical potential in a receiver antenna caused by the presence of a secondary field generated by currents induced by a pulsed primary signal from the system transmitter antenna. Only the secondary signal is measured because the transmitter is turned off during the measurement period. The magnitude of the secondary signal is controlled by the conductivity of the material in a half-sphere of subsurface volume investigated with each measurement and the elapsed time after current cut-off from the transmitter. All such signals decay with time. The rate at which the signals decay is related to conductivity.

As with any geophysical technique, it is the contrast between the host matrix (soil in this case) and some other body (i.e., OE) that is detected. The EM61 system parameters are such that only the effects of near-surface materials are considered, with an effective radius of investigation limited to approximately 10 feet in

any direction, laterally or vertically. The system is designed to measure the secondary signal at just one time very late in the decay process. As a consequence, the secondary signal contributions from objects with very little electrical contrast with the host soil (i.e., cobbles, boulders) are negligible, whereas the signal contribution from items with a very great contrast (i.e., metallic OE) is pronounced.

As the EM system is traversed over the ground surface, the apparent background will vary as the conductivity of the half-sphere volume of the host soil changes. These changes in conductivity are reflected as gradational increases or decreases in the amplitude of the total measured potential due to the secondary signals, and are clearly seen in the geophysical data collected at the Project Site.

The geophysical system digitally captures instrument readings in a data logger, coincident with grid coordinates. Navigation and instrument positioning were based upon the established grid corners.

EM instrumentation has consistently shown at the equipment test plot on the Project Site, at the Army's Jefferson Proving Ground evaluations, and at each geophysical prove-out conducted by Earth Tech, to have target detection capabilities equal to magnetometers for resolving large OE items in the near-surface, better capabilities for resolving small ordnance items (e.g., 20mm, 37mm, 40mm, grenades, fuzes) than cesium vapor magnetic gradiometers, and better depth detection than fluxgate gradiometers. Further, the EM response is less complex and more reliable in terms of actual targets located versus "noise-induced" or "false positive" responses from magnetometers.

Field data were collected using a 16-inch separation height between the bottom of the sensor and ground level. Geophysical data were collected at 2.5-foot transect spacings and measurements made at less than 1-foot station intervals. Navigation and instrument positioning were based upon established survey markers. Because of the steep terrain, only man-towed single trailer EM61s were deployed. Digital data were downloaded to an IBM-compatible personal computer (PC). Data were formatted in xyz American Standard Code for Information Interchange (ASCII) files, with the survey values coincident with California State Plane coordinate locations.

G.2 SURVEY DESIGN

G.2.1 EE/CA Investigation

During the EE/CA investigation, 100-foot by 100-foot grids were laid out to facilitate surveying with the origin (0,0) of each grid being the southwest corner. Grid corners were laid out with an optical laser survey system (total station). A survey tape was stretched along each boundary with an additional survey tape stretched in the center of the grid opposite the traverse direction. Twenty 5-foot-wide by 100-foot-long lanes were established within each grid. Lanes were marked by string, cones, or other suitable methods, as determined by the height and density of vegetation in the particular grid. The marking methods provided clear recognition of the search lane to ensure complete coverage of the grid.

G.2.2 Removal Action Investigation

During the removal action investigation, eight 3-foot wide by 278-foot-wide lanes were established within a 24-foot wide by 278-foot long search area centered along the northeast-southwest axis of the North Valley Military Landfill. Eleven additional 3-foot-wide lanes of varying length were established contiguous and parallel to the southeast side of the main search area. The southwest corner of the overall search area was

identified as the origin (0,0). Lanes were numbered according to the distance from the southwest corner of the lane to the origin. For example, the southwest corner of Lane 0 was at the origin, the southwest corner of the next lane, Lane 3, was three feet from the origin, and so on. Lanes were laid out with a survey tape a survey tape stretched along each boundary with an additional survey tape stretched in the center of the lane opposite the traverse direction. Lanes were marked by string and lath, providing clear recognition of the lane to ensure complete coverage of the search area.

G.3 DATA COLLECTION

The position of the instrumentation array was continuously tracked and monitored during data collection to assure complete coverage of the areas of interest. This was accomplished either by use of traverse markings, or by maintaining alignment of the instrument array relative to transect endpoints (e.g., stakes, cones, string). The procedures used were determined by the size and configuration of the area to be surveyed. The methods of monitoring survey progress were documented in the daily logbook.

Data collection during the EE/CA investigation and removal action investigation were accomplished following the procedures detailed in the Final EE/CA Work Plan (Earth Tech, 1998) and the Removal Action Work Plan (Earth Tech, 2000b), respectively. The quality of mapping data was assured by continuous tracking, adjustment, and visualization of the field data. Data quality was further assured by adherence to the quality assurance (QA)/quality control (QC) requirements also specified in the Final EE/CA Work Plan (Earth Tech, 1998) and Final Removal Action Work Plan (Earth Tech, 2000b), respectively.

G.4 DATA PROCESSING

G.4.1 EE/CA Investigation

Data processing consisted of numerous steps. Use of an encoder wheel results in some loss of positional precision whenever the surface of the survey area is uneven or if it is difficult to maintain a straight line path over the grid. Data were edited to correct the start and stop station value for each survey line. This results in extrapolating measurement position over the length (100 feet) of each line. Typical length corrections were on order of 10 to 20 percent, which equates to 0.2 feet per surveyed foot. Line numbers, sequentially recorded in the field from the southwest corner of each grid, were converted to survey distance by multiplying by line separation (nominally 2.5 feet). The result is an xyz file that provides distance east, distance north, and measured electrical potential (in millivolts).

The data were then visually inspected for extraneous, single-measurement, noise-spike anomalies. The receiver antennas are approximately 3 feet wide. The measurement interval along each line was approximately 0.6 to 0.8 feet. Anomalies caused by sources external to the EM system must contain at least three points. Accordingly, single-point anomalies were then identified as induced by EM system noise and deleted from the data set.

The remainder of the process consists of generating a contouring grid mesh and plotting the data as an isogram (contour or color) image (see Figure 10-3). A 0.6- by 0.6-foot node mesh was chosen for use as being representative of data collected. The data was then contoured using GeoSoft Oasis Software™.

G.4.2 Removal Action Investigation

Digital geophysical data (amplitude and position) were periodically downloaded each day to avoid possible data loss or corruption. The digital geophysical data was checked, edited for corrections, and processed into ASCII data files. Field processing was limited to the production of simple profiles of the data measured at the geophysical receivers. A visual inspection of the data was performed to identify any single-point anomalies, steps in response, or incoherent signal/excessive noise bandwidth. The remainder of the process consisted of generating a contouring grid mesh and plotting the data as an isogram (contour or color) image. The data was then contoured using GeoSoft Oasis Software™.

G.5 DATA QUALITY

G.5.1 EE/CA Investigation

Data quality was assured, in part, by the routine measurement across a standard underground target at the beginning and end of each survey, and monitoring these measurements over time. The standard response transects were established in areas with no EM anomalies other than those created by the buried targets.

Instrument standardization was accomplished using a test plot staked in the Project Site with multiple buried target items to establish a standard traverse. The test plot consisted of three traverse lines that were each 150 feet long oriented north to south. Each line had multiple targets buried at depths between 0.3 and 4 feet. The targets were various-sized pipe lengths and inert OE items. The minimum sized target was a 20mm projectile. The maximum sized target was a piece of pipe approximately the size of a 155mm projectile.

The standard response was the average of multiple runs over the standard target minus the average background value for each deployed EM system. The standard target was a 3-inch steel sphere. In addition, once the standard response was established, the instrument response over standard target was recorded before and after each grid was surveyed. This allowed an immediate assessment of instrument performance that was unaffected by environmental variables or measurement geometry error, and provided added QC for system response and measurement drift. No degradation of instrument response was found. All measurements were within the required acceptance range calculated for the standard response.

Complete coverage of the grids, detection performance, and reasonableness of the geophysical data were assured by daily reviews of the collected data and a comparison of processed results with the anomaly maps produced in the field for each grid investigated. The only limitations or difficulties encountered during the geophysical field effort were from dense brush and sloping terrain. Tall vegetation made it difficult to maintain precise positional control along the transects, because the data were recorded using an encoder wheel trigger. Sampling station precision requires the odometer wheel to maintain traction and continuous contact with the ground surface. However, these sources of error were limited by removing the brush prior to mapping and, where possible, traversing the grid normal to the slope of terrain.

The following items were assessed to ensure data quality was maintained:

- **Correct Survey Location** - Position of the data collection system was properly recorded
- **Properly Operating Instruments** - Daily documentation of the standardization response within acceptance range was required for each sensor system deployed

- **Complete Grid Survey** - Data were collected in such a manner that a 3-foot by 1-foot mesh could be generated for each grid

- **Geophysical Reasonableness** - Data were reviewed by experienced geophysicists to assess usefulness of data for detecting and resolving OE anomalies.

G.5.2 Removal Action Investigation

Data quality was assured, in part, by the routine measurement across a standard underground target at the beginning and end of each survey, and monitoring these measurements over time. The standard response was the average of multiple runs over the standard target minus the background value for the EM system deployed. The standard target was a 3-inch steel sphere. No degradation of instrument response was found. All measurements were within the required acceptance range calculated for the standard response.

Complete coverage, detection performance, and reasonableness of the geophysical data were assured by daily reviews of the collected data and a comparison of processed results with the anomaly maps produced in the field.

The following items were assessed to ensure data quality was maintained:

- **Precision** - A mean deviation from the standard response was calculated for each instrument used

- **Accuracy** - Discrepancies in positional or locational accuracy of data noted during field review

- **Completeness** - Data were collected in such a manner that the percentage of coverage of each investigated segment exceeded 98 percent

- **Representativeness** - Anomalies not adequately accounted for by the discovered source were reinvestigated by the OE clearance crew

- **Reasonableness** - Data were reviewed by experienced geophysicists to determine causative features that might explain any variations or results not compatible with prior results or expectations.

REFERENCES

Earth Tech, 1998. *Final Engineering Evaluation/Cost Analysis Work Plan, Former Benicia Arsenal, Benicia, California*, October.

Earth Tech 2000a. *Final Engineering Evaluation/Cost Analysis, Former Benicia Arsenal, Benicia, California*, March.

Earth Tech 2000b. *Removal Action Work Plan, Tourtelot Cleanup Project, Benicia, California*, May.

Table G-1
August 1996 OE Clearance
OE-Related Items Recovered from Tourtelot Property

Grid/Section	Anomaly ID	Item #	Category	Description	Quantity	Depth (inches)	Estimated Weight (Pounds)
A/1C	5	1	OE Scrap	Large frag piece with smaller frag pieces	NA	12	4.00
A/1C	7	1	OE Scrap	Frag	1	6	NA
A/1C	9	1	OE Scrap	Small frag mixed with gravel	NA	6	NA
A/2A	35	1	OE Scrap	Frag mixed with gravel	NA	24	0.25
A/2A	36	1	OE Scrap	Small frag mixed with gravel	NA	12	2.00
A/2B	21	1	OE Scrap	Frag mixed with gravel	NA	18	0.50
A/2B	22	1	OE Scrap	Small frag mixed with gravel	NA	24	0.50
A/2C	23	1	OE Scrap	Frag	NA	6	0.13
A/2C	38	1	OE Scrap	Frag	NA	6	0.25
B/1B	30	1	OE Scrap	Frag	2	3	0.50
B/2A	47	1	OE Scrap	Large frag mixed with gravel	NA	12	20.00
B/2A	59	1	OE Scrap	Frag mixed with gravel	NA	12	4.00
B/2B	11	1	OE Scrap	Side of 155mm	1	8	10.00
B/2B	12	1	OE Scrap	Frag	NA	8	1.00
B/2B	15	1	OE Scrap	Large frag piece	1	6	0.50
B/2B	16	1	OE Scrap	Large frag pieces	2	8	2.00
B/2B	18	1	OE Scrap	Large frag piece	1	6	1.00
B/2B	21	1	OE Scrap	Large frag piece	1	4	2.00
B/2B	24	1	OE Scrap	Large frag piece	1	8	0.50
B/2B	25	1	OE Scrap	Large frag pieces	NA	12	20.00
B/2B	26	1	OE Scrap	Large frag pieces	6	12	10.00
B/2B	27	1	OE Scrap	Large frag pieces	NA	12	10.00
B/2B	28	1	OE Scrap	Large frag pieces	NA	12	0.50
B/2B	29	1	OE Scrap	Frag	NA	12	1.00
B/2B	46	1	OE Scrap	Frag mixed with gravel	NA	6	2.00
B/2B	49	1	OE Scrap	Frag mixed with gravel	NA	6	0.25
B/2B	52	1	OE Scrap	Frag mixed with gravel	NA	12	60.00
B/2B	52x	1	OE Scrap	Frag mixed with gravel	NA	6	0.50
B/2B	53	1	OE Scrap	Frag mixed with gravel	NA	6	0.50
B/2B	56	1	OE Scrap	Small frag mixed with gravel	NA	6	1.00
B/2B	57x	1	OE Scrap	Frag mixed with gravel	NA	12	2.00
B/2B	58	1	OE Scrap	Frag mixed with gravel	NA	6	1.00
B/2B	62	1	OE Scrap	Large frag piece in gravel	1	6	10.00
B/2B	69	1	OE Scrap	Large frag pieces	5	6	10.00
B/2C	33	1	OE Scrap	Frag	NA	6	0.25
B/2C	44	1	OE Scrap	Frag mixed with gravel	NA	8	1.00
B/2C	48x	1	OE Scrap	Frag mixed with gravel	NA	6	0.06
B/2C	50	1	OE Scrap	Frag mixed with gravel	NA	6	5.00
B/2C	51x	1	OE Scrap	Frag	1	8	0.06
B/3B	7	1	OE Scrap	Large frag pieces	NA	12	10.00
B/3B	9	1	OE Scrap	Large frag pieces	NA	8	0.25
B/3B	10	1	OE Scrap	Large frag pieces	NA	8	1.00
B/3B	71	1	OE Scrap	Base section of concrete-filled 155mm w/ small frag	NA	8	20.00
C/2D	6	1	OE Scrap	Concrete-filled 90mm	1	4	15.00
C/2D	7	1	OE Scrap	Large frag piece	1	3	1.00
C/2D	9	1	OE Scrap	Frag	NA	6	NA
D/3B	1	1	OE Scrap	Large frag pieces	NA	24	NA
D/3B	8	1	OE Scrap	Frag	NA	4	NA
D/3B	9	1	OE Scrap	Frag	NA	12	20.00
D/3B	11	1	OE Scrap	Frag mixed with gravel	NA	6	1.00
D/3C	7	1	OE Scrap	Frag mixed with gravel	NA	6	NA
D/4B	28	1	OE Scrap	Frag; 60mm mortar frag	NA	18	30.00
D/4C	14	1	OE Scrap	Large frag piece	1	3	NA
D/4C	15	1	OE Scrap	Frag	NA	6	3.00
D/4C	20	1	OE Scrap	Frag	NA	12	10.00
D/4C	26	1	OE Scrap	Frag	NA	4	0.25
D/4C	30	1	OE Scrap	Frag	NA	6	NA
D/5B	32	1	OE Scrap	Base of 20mm HE round	1	2	NA
D/5B	32	2	OE Scrap	Frag	NA	8	0.13
D/5C	33	1	OE Scrap	Frag	1	6	1.00
N/1B	57	1	OE Scrap	Small frag piece (possibly from 60mm tail fin)	1	6	0.13
P/1A	67	1	OE Scrap	Frag (possibly from 75mm)	NA	1	0.50
P/1B	68	1	OE Scrap	Frag (possibly from 75mm)	NA	1	0.50
P/1B	70	1	OE Scrap	Frag (possibly from 105mm)	NA	2	0.50
P/2A	64	1	OE Scrap	Frag from 37mm HE	NA	1	0.25
P/2A	65	1	OE Scrap	Frag (possibly from 75mm)	NA	0	0.50
P/2A	66	1	OE Scrap	Frag (possibly from 105mm)	NA	1	0.50
P/2B	72	1	OE Scrap	Large frag piece	1	0	0.25
P/2B	73	1	OE Scrap	Frag	1	1	0.25
P/3B	74	1	OE Scrap	Large frag piece	1	2	0.13

Notes: NA = information was not available

Total OE recovered from Tourtelot Property: 0

Table G-2
December 1996 OE Clearance
OE-Related Items Recovered from Tourtelot Property

Grid/Section	Anomaly ID	Item #	Category	Description	Quantity	Depth (inches)	Estimated Weight (Pounds)
I-14/1	3N,42E	1	OE	40mm HE	1	12	NA
I-14/1	27N,42E	1	OE Scrap	Grenade fuze, inert (originally considered live)	1	12	NA
I-14/1	72N,53E	1	OE Scrap	40mm HE, inert (originally considered live)	1	12	NA
I-14/1	Multiple	--	OE Scrap	OE scrap (783 anomalies investigated)	1,216	NA	NA
J-14/3	NA	1	OE Scrap	OE scrap	1	NA	NA
J-14/3	NA	1	OE Scrap	OE scrap	1	NA	NA
N-15/1	NA	1	OE Scrap	Projectile fragments	1	NA	NA
N-15/1	NA	1	OE Scrap	Projectile fragments	1	NA	NA
N-15/2	NA	1	OE Scrap	40mm frag	1	NA	NA
N-15/2	NA	1	OE Scrap	Shell casing	2	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/3	NA	1	OE Scrap	OE scrap	NA	NA	NA
N-15/4	NA	1	OE Scrap	OE scrap	1	NA	NA
O-15/1	NA	1	OE Scrap	OE scrap	1	NA	NA
O-15/2	NA	1	OE Scrap	OE scrap	1	4	NA
O-15/2	NA	1	OE	60mm mortar with fuze	1	2	NA
O-15/3	NA	1	OE Scrap	OE scrap	1	NA	NA
O-15/4	NA	1	OE Scrap	OE scrap	1	NA	NA
O-15/4	NA	1	OE Scrap	OE scrap	1	NA	NA
P-14/3	92N,25E	1	OE Scrap	OE scrap	NA	3	NA
P-14/3	55N,39E	1	OE Scrap	OE scrap	NA	6	NA
P-14/3	15N,0E	1	OE Scrap	OE scrap	NA	6	NA
P-14/4	51N,49E	1	OE Scrap	OE scrap	NA	8	NA
P-14/4	73N,1E	1	OE Scrap	OE scrap	NA	2	NA
P-15/1	61N,40E	1	OE	40mm, unfired	1	8	NA
P-15/1	78N,2E	1	OE Scrap	OE scrap	NA	4	NA
P-15/3	17N,28E	1	OE Scrap	OE scrap	1	4	NA
P-15/3	31N,2E	1	OE Scrap	OE scrap	1	2	NA
P-15/3	24N,14E	1	OE Scrap	OE scrap	1	2	NA
P-15/3	34N,7E	1	OE Scrap	OE scrap	1	1	NA
P-15/3	38N,15E	1	OE Scrap	OE scrap	1	2	NA
P-15/3	51N,70E	1	OE Scrap	OE scrap	1	2	NA
P-15/3	57N,25E	1	OE Scrap	OE scrap	1	4	NA
P-15/3	65N,60E	1	OE Scrap	OE scrap	1	1	NA
P-15/3	66N,80E	1	OE Scrap	OE scrap	1	6	NA
P-15/3	85N,2E	1	OE Scrap	OE scrap	1	2	NA
Q-13/2	22N,22E	1	OE Scrap	OE scrap	NA	2	NA
Q-14/3	75N,100E	1	OE Scrap	OE scrap	NA	1	NA
Q-14/3	73N,64E	1	OE Scrap	OE scrap	NA	1	NA
Q-14/3	57N,41E	1	OE Scrap	OE scrap	NA	12	NA
Q-14/3	16N,13E	1	OE Scrap	OE scrap	NA	2	NA
Q-14/3	43N,10E	1	OE Scrap	OE scrap	NA	3	NA
Q-15/1	27N,33E	1	OE Scrap	OE scrap	NA	8	NA
Q-15/2	54N,24E	1	OE Scrap	OE scrap	NA	6	NA
R-13/1	18N,6E	1	OE Scrap	OE scrap	NA	3	NA
R-13/3	21N,60E	1	OE Scrap	OE scrap	NA	2	NA
R-13/4	48N,48E	1	OE Scrap	OE scrap	NA	2	NA
R-14/1	39N,90E	1	OE Scrap	OE scrap	NA	2	NA
R-14/1	34N,80E	1	OE Scrap	OE scrap	NA	6	NA
R-15/3	55N,5E	1	OE Scrap	OE scrap	1	6	NA

Notes: NA = information was not available

Total OE recovered from Tourtelot Property: 3

Table G-3
Former Benicia Arsenal Engineering Evaluation/Cost Analysis
OE-Related Items Recovered from Tourtelot Property

Grid	Anomaly ID	Item #	Category	Description	Quantity	Depth (Inches)	Estimated Weight (Pounds)
0301	03010001	1	OE Scrap	Frag	1	6	0.25
0301	03010008	1	OE Scrap	Frag	1	6	0.13
0301	03010009	1	OE Scrap	Frag	1	6	0.25
0301	03010013	1	OE Scrap	Frag	1	2	0.13
0301	03010014	1	OE Scrap	Frag	1	10	0.31
0301	03010015	1	OE Scrap	Frag	1	4	0.13
0301	03010023	1	OE Scrap	Frag	1	6	0.38
0301	03010028	1	OE Scrap	Frag	1	0	0.19
0301	03010031	1	OE Scrap	Frag	1	3	0.31
0301	03010035	1	OE Scrap	Frag	1	0	0.50
0301	03010036	1	OE Scrap	Frag	1	2	0.31
0301	03010037	1	OE Scrap	Frag	1	6	0.38
0301	03010039	1	OE Scrap	OE Scrap	1	8	0.13
0302	03020001	1	OE Scrap	Frag	1	6	0.50
0302	03020003	1	OE Scrap	Frag	1	4	0.63
0302	03020004	1	OE Scrap	Frag	1	4	0.19
0302	03020005	1	OE Scrap	Frag	1	6	0.63
0302	03020009	1	OE Scrap	Frag	1	4	0.13
0302	03020011	1	OE Scrap	Fuze Adaptor	1	6	0.50
0302	03020013	1	OE Scrap	Frag	1	6	0.31
0302	03020014	1	OE Scrap	Frag	1	3	0.06
0302	03020015	1	OE Scrap	Frag	1	6	1.00
0302	03020016	1	OE Scrap	Frag	1	7	1.00
0302	03020021	1	OE Scrap	OE Scrap	1	7	0.50
0306	03060003	1	OE Scrap	Frag	1	0	0.13
0306	03060010	1	OE Scrap	Frag	1	0	0.38
0306	03060022	1	OE Scrap	Frag	1	4	0.25
0306	03060023	1	OE Scrap	Frag	1	8	1.00
0306	03060024	1	OE Scrap	Frag	1	4	0.25
0306	03060026	1	OE Scrap	Frag	1	4	0.19
0306	03060026	2	OE Scrap	Frag	1	4	0.19
0306	03060029	1	OE Scrap	Frag	1	4	0.19
0306	03060039	1	OE Scrap	Frag	1	7	0.06
0306	03060040	1	OE Scrap	Frag	1	3	0.75
0306	03060042	1	OE Scrap	Frag	1	0	1.40
0306	03060043	1	OE Scrap	Frag	1	6	0.25
0306	03060044	1	OE Scrap	Frag	1	0	0.19
0306	03060045	1	OE Scrap	Frag	1	0	0.19
0306	03060046	1	OE Scrap	Frag	1	3	0.19
0306	03060046	2	OE Scrap	Frag	1	3	0.19
0306	03060047	1	OE Scrap	Frag	1	0	0.13
0306	03060049	1	OE Scrap	Frag	1	2	0.19
0306	03060051	1	OE Scrap	Frag	1	0	0.75
0306	03060052	1	OE Scrap	Frag	1	0	0.38
0306	03060052	2	OE Scrap	Frag	1	0	0.13
0306	03060053	1	OE Scrap	Frag	1	0	0.25
0306	03060054	1	OE Scrap	Frag	1	0	0.13
0306	03060054	2	OE Scrap	Frag	1	0	0.19
0307	03070001	1	OE Scrap	Frag	1	10	0.38
0307	03070002	1	OE Scrap	Frag	1	2	0.13
0307	03070003	1	OE Scrap	Frag	1	18	0.13
0307	03070004	1	OE Scrap	Frag	1	4	0.25
0307	03070005	1	OE Scrap	Frag	1	2	0.06
0307	03070006	1	OE Scrap	Frag	1	2	0.19
0307	03070012	1	OE Scrap	Frag	1	3	0.25
0307	03070013	1	OE Scrap	Frag	1	6	0.50
0307	03070013	2	OE Scrap	Frag	1	6	0.50
0307	03070017	1	OE Scrap	Frag	1	4	0.06
0307	03070018	1	OE Scrap	Frag	1	4	0.13
0307	03070019	1	OE Scrap	Frag	1	3	0.25
0307	03070020	1	OE Scrap	Frag	1	6	0.50
0307	03070022	1	OE Scrap	Frag	1	6	1.00
0307	03070023	1	OE Scrap	Frag	1	0	0.13
0307	03070024	1	OE Scrap	Frag	1	3	0.19
0307	03070025	1	OE Scrap	Frag	1	2	0.13
0307	03070026	1	OE Scrap	Frag	1	6	0.25
0307	03070026	2	OE Scrap	Frag	1	6	0.25
0307	03070029	1	OE Scrap	Frag	1	2	0.25
0308	03080003	1	OE Scrap	OE Scrap	1	6	1.00
0308	03080006	1	OE Scrap	Frag	1	6	0.38
0308	03080007	1	OE Scrap	OE Scrap	1	3	0.38
0308	03080008	1	OE Scrap	OE Scrap	1	6	0.50
0308	03080009	1	OE Scrap	OE Scrap	1	0	2.00
0308	03080010	1	OE Scrap	OE Scrap	1	6	0.50

Table G-3
Former Benicia Arsenal Engineering Evaluation/Cost Analysis
OE-Related Items Recovered from Tourtelot Property

Grid	Anomaly ID	Item #	Category	Description	Quantity	Depth (Inches)	Estimated Weight (Pounds)
0308	03080011	1	OE Scrap	OE Scrap	1	4	0.50
0308	03080012	1	OE Scrap	OE Scrap	1	6	0.19
0308	03080013	1	OE Scrap	OE Scrap	1	4	0.38
0308	03080014	1	OE Scrap	OE Scrap	1	6	0.50
0308	03080015	1	OE Scrap	Frag	1	20	0.75
0308	03080015	2	OE Scrap	Frag	1	20	0.75
0308	03080016	1	OE Scrap	OE Scrap	1	6	0.31
0308	03080017	1	OE Scrap	OE Scrap	1	6	0.19
0308	03080018	1	OE Scrap	OE Scrap	1	6	0.50
0308	03080020	1	OE Scrap	OE Scrap	1	24	0.13
0308	03080020	2	OE Scrap	OE Scrap	1	24	0.13
0308	03080021	1	OE Scrap	OE Scrap	1	22	0.38
0308	03080022	1	OE Scrap	OE Scrap	1	20	0.50
0308	03080023	1	OE Scrap	OE Scrap	1	24	0.13
0311	03110001	1	OE Scrap	Frag	1	4	0.13
0311	03110001	2	OE Scrap	Frag	1	4	0.13
0311	03110002	1	OE Scrap	Frag	1	48	0.19
0311	03110003	1	OE Scrap	Frag	1	3	0.50
0311	03110004	1	OE Scrap	Frag	1	4	0.06
0311	03110005	1	OE Scrap	Frag	1	12	1.00
0311	03110009	1	OE Scrap	Frag	1	6	0.09
0311	03110009	2	OE Scrap	Frag	1	6	0.09
0311	03110009	3	OE Scrap	Frag	1	6	0.09
0311	03110009	4	OE Scrap	Frag	1	6	0.09
0311	03110010	1	OE Scrap	Frag	1	6	0.38
0311	03110012	1	OE Scrap	Frag	1	2	0.13
0311	03110013	1	OE Scrap	Frag	1	0	0.25
0311	03110013	2	OE Scrap	Frag	1	0	0.56
0311	03110015	1	OE Scrap	Frag	1	6	1.00
0311	03110016	1	OE Scrap	Frag	1	6	0.13
0311	03110017	1	OE Scrap	Frag	1	6	0.06
0311	03110018	1	OE Scrap	Frag	1	6	0.13
0311	03110019	1	OE Scrap	Frag	1	3	0.50
0311	03110021	1	OE Scrap	Frag	1	0	0.13
0311	03110022	1	OE Scrap	Frag	1	4	0.31
0311	03110023	1	OE Scrap	Frag	1	4	0.06
0311	03110026	1	OE Scrap	Frag	1	4	0.38
0312	03120002	1	OE Scrap	OE Scrap	1	8	1.00
0312	03120010	1	OE Scrap	Frag	1	12	2.00
0312	03120016	1	OE Scrap	Frag	1	30	10.00
0312	03120017	1	OE Scrap	Frag	1	11	0.38
0312	03120017	2	OE Scrap	Frag	1	11	0.38
0312	03120018	1	OE Scrap	Frag	1	8	0.38
0312	03120019	1	OE Scrap	Frag	2	8	--
0312	03120021	1	OE Scrap	Frag	6	18	5.00
0312	03120022	1	OE Scrap	Frag	1	24	8.00
0312	03120023	1	OE Scrap	Grenade, Hand, Practice, M-21	1	8	2.00
0312	03120026	1	OE Scrap	Frag	1	2	0.50
0312	03120026	2	OE Scrap	Frag	1	2	0.50
0312	03120026	3	OE Scrap	Frag	2	2	1.00
0312	03120029	1	OE Scrap	Frag	1	18	3.00
0312	03120032	1	OE Scrap	Frag	1	4	4.00
0312	03120033	1	OE Scrap	Frag	1	24	2.00
0312	03120034	1	OE Scrap	OE Scrap	1	4	1.00
0312	03120039	1	OE Scrap	Frag	1	5	0.25
0312	03120039	2	OE Scrap	Frag	1	5	0.25
0312	03120045	1	OE Scrap	Frag	1	6	0.13
0312	03120046	1	OE Scrap	Frag	1	6	5.00
0312	03120047	1	OE Scrap	Frag	1	12	1.00
0312	03120050	1	OE Scrap	Frag	1	24	2.00
0312	03120051	1	OE Scrap	Frag	1	9	0.25
0312	03120054	1	OE Scrap	Frag	1	3	10.00
0312	03120054	2	OE Scrap	37mm	1	3	2.00
0312	03120056	1	OE Scrap	Frag	1	20	1.00
0312	03120056	2	OE Scrap	M52 Series Fuze	2	12	--
0312	03120057	1	**OE**	37mm projectile, fuzed	1	24	--
0312	03120057	2	OE Scrap	Frag	15	18	5.00
0312	03120057	3	OE Scrap	M52 Series Fuze	1	12	--
0312	03120057	4	OE Scrap	PTTF Fuze	1	12	--
0312	03120057	5	OE Scrap	Booster Adapter	1	12	--
0312	03120059	1	OE Scrap	Frag	1	0	4.00
0312	03120059	2	OE Scrap	Frag	1	0	4.00
0312	03120064	1	**OE**	75mm shrapnel projectile, unfuzed	1	6	0.50
0312	03120064	2	OE Scrap	M-21 Grenade Shell	1	6	0.50

Table G-3
Former Benicia Arsenal Engineering Evaluation/Cost Analysis
OE-Related Items Recovered from Tourtelot Property

Grid	Anomaly ID	Item #	Category	Description	Quantity	Depth (Inches)	Estimated Weight (Pounds)
0312	03120064	3	OE Scrap	Frag	1	6	0.50
0312	03120064	4	OE Scrap	Frag	1	24	0.50
0312	03120070	1	OE Scrap	75mm (No nose, empty casing)	1	3	2.00
0312	03120072	1	OE Scrap	105mm (plaster load)	1	26	20.00
0312	03120074	1	OE Scrap	Frag	1	4	0.21
0312	03120074	2	OE Scrap	Frag	1	4	0.21
0312	03120074	3	OE Scrap	Frag	1	4	0.21
0312	03120075	1	OE Scrap	Frag	1	30	2.00
0312	03120075	2	OE Scrap	Frag	1	30	2.00
0312	03120078	1	OE Scrap	Frag	1	12	10.00
0312	03120078	2	OE Scrap	Frag	1	12	10.00
0312	03120081	1	OE Scrap	Frag	1	10	0.67
0312	03120081	2	OE Scrap	Frag	1	10	0.67
0312	03120081	3	OE Scrap	Frag	1	10	0.67
0312	03120083	1	OE Scrap	Frag	1	14	6.00
0312	03120084	1	OE Scrap	Frag	1	8	1.00
0312	03120084	2	OE Scrap	Frag	1	8	1.00
0312	03120084	3	OE Scrap	Frag	1	8	1.00
0312	03120088	1	OE Scrap	Frag	1	18	5.00
0312	03120089	1	OE Scrap	75mm (no nose, empty case)	3	20	15.00
0312	03120092	1	OE Scrap	Frag	1	12	1.00
0312	03120095	1	OE Scrap	Frag	1	10	1.00
0312	03120096	1	OE Scrap	Frag	1	10	1.00
0312	03120097	1	OE Scrap	Frag	1	24	2.00
0312	03120100	1	OE Scrap	Frag	1	10	0.75
0312	03120101	1	OE Scrap	Frag	1	12	12.00
0312	03120103	1	OE Scrap	Frag	1	10	0.38
0312	03120109	1	OE Scrap	Frag	1	12	1.00
0312	03120111	1	OE Scrap	Frag	1	2	1.25
0312	03120111	2	OE Scrap	Frag	1	2	1.25
0312	03120111	3	OE Scrap	Frag	1	2	1.25
0312	03120111	4	OE Scrap	Frag	1	2	1.25
0312	03120113	1	OE Scrap	Frag	1	4	1.00
0312	03120113	2	OE Scrap	Frag	1	4	1.00
0312	03120114	1	OE Scrap	Frag	1	20	1.00
0312	03120116	1	OE Scrap	Tail Boom	1	4	0.33
0312	03120116	2	OE Scrap	37mm Base	1	4	0.33
0312	03120116	3	OE Scrap	Frag	1	4	0.33
0312	03120122	1	OE Scrap	Frag	1	8	20.00
0312	03120124	1	OE Scrap	M48 Series Fuze	1	12	1.00
0312	03120125	1	OE Scrap	Frag	1	0	0.38
0312	03120126	1	OE Scrap	Frag	1	3	1.00
0312	03120127	1	OE Scrap	Frag	1	18	0.50
0312	03120127	2	OE Scrap	Frag	1	18	0.50
0312	03120127	3	OE Scrap	Frag	1	18	0.50
0312	03120133	1	OE Scrap	Powder Train Time Fuze	1	6	1.00
0313	03130001	1	OE Scrap	Frag	1	0	0.19
0313	03130007	1	OE Scrap	Frag	1	3	0.38
0313	03130008	1	OE Scrap	Frag	1	36	0.13
0313	03130008	2	OE Scrap	Frag	1	36	0.25
0313	03130010	1	OE Scrap	Frag	1	6	0.13
0313	03130012	1	OE Scrap	Frag	1	6	0.38
0313	03130016	1	OE Scrap	Frag	1	4	0.75
0313	03130019	1	OE Scrap	Frag	1	0	0.13
0313	03130021	1	OE Scrap	Frag	1	6	0.13
0313	03130022	1	OE Scrap	Frag	1	6	0.13
0313	03130022	2	OE Scrap	Frag	1	6	0.13
0313	03130022	3	OE Scrap	Frag	1	6	0.25
0313	03130023	1	OE Scrap	Frag	1	6	0.25
0313	03130023	2	OE Scrap	Frag	1	6	0.19
0313	03130031	1	OE Scrap	Frag	1	1	0.19
0313	03130038	1	OE Scrap	Tail Boom	1	4	0.38
0313	03130039	1	OE Scrap	Frag	1	3	0.25
0313	03130042	1	OE Scrap	Tail Boom - Piece 1 of 3	1	6	0.19
0313	03130042	2	OE Scrap	Tail Boom - Piece 2 of 3	1	6	0.06
0313	03130042	3	OE Scrap	Tail Boom - Piece 3 of 3	1	6	0.13
0313	03130047	1	OE Scrap	Frag	1	2	0.38
0313	03130049	1	OE Scrap	Frag	1	6	0.38
0313	03130049	2	OE Scrap	Frag	1	6	0.13
0313	03130055	1	OE Scrap	Frag	1	4	0.19
0313	03130055	2	OE Scrap	Frag	1	4	0.25
0313	03130059	1	OE Scrap	Frag	1	12	0.19
0314	03140001	1	OE Scrap	Frag	1	3	1.00
0314	03140002	1	OE Scrap	Frag	1	0	0.13

Table G-3
Former Benicia Arsenal Engineering Evaluation/Cost Analysis
OE-Related Items Recovered from Tourtelot Property

Grid	Anomaly ID	Item #	Category	Description	Quantity	Depth (inches)	Estimated Weight (Pounds)
0314	03140006	1	OE Scrap	Frag	1	5	0.19
0314	03140008	1	OE Scrap	Frag	1	3	0.13
0314	03140009	1	OE Scrap	Frag	1	5	0.13
0314	03140011	1	OE Scrap	Fuze Adaptor	1	6	0.50
0314	03140012	1	OE Scrap	Fuze Adaptor	1	6	0.50
0314	03140027	1	OE Scrap	Frag	1	10	0.19
0314	03140031	1	OE Scrap	Frag	1	9	0.16
0314	03140031	2	OE Scrap	Frag	1	9	0.16
0314	03140032	1	OE Scrap	Frag	1	8	0.09
0314	03140032	2	OE Scrap	Frag	1	8	0.09
0314	03140035	1	OE Scrap	OE Scrap	1	10	0.50
0314	03140039	1	OE Scrap	Frag	1	8	0.13
0314	03140058	1	OE Scrap	Frag	1	4	0.13
0314	03140063	1	OE Scrap	Frag	1	8	0.50
0316	03160004	1	OE Scrap	Frag	1	6	0.06
0317	03170001	1	OE Scrap	Frag	1	10	0.19
0317	03170001	2	OE Scrap	Frag	1	10	0.19
0317	03170002	1	OE Scrap	Frag	1	6	0.50
0317	03170003	1	OE Scrap	Frag	1	20	0.06
0317	03170004	1	OE Scrap	Frag	1	6	0.33
0317	03170004	2	OE Scrap	Frag	1	6	0.33
0317	03170004	3	OE Scrap	Frag	1	6	0.33
0317	03170005	1	OE Scrap	Frag	1	6	0.16
0317	03170005	2	OE Scrap	Frag	1	6	0.16
0317	03170006	1	OE Scrap	Frag	1	8	0.09
0317	03170006	2	OE Scrap	Frag	1	8	0.09
0317	03170007	1	OE Scrap	Frag	1	8	0.20
0317	03170007	2	OE Scrap	Frag	1	8	0.20
0317	03170007	3	OE Scrap	Frag	1	8	0.20
0317	03170007	4	OE Scrap	Frag	1	8	0.20
0317	03170007	5	OE Scrap	Frag	1	8	0.20
0317	03170008	1	OE Scrap	Frag	1	6	0.38
0317	03170009	1	OE Scrap	Frag	1	6	0.06
0317	03170011	1	OE Scrap	Frag	1	6	0.06
0317	03170012	1	OE Scrap	Frag	1	4	0.13
0317	03170014	1	OE Scrap	Frag	1	8	0.13
0317	03170015	1	OE Scrap	Frag	1	18	0.25
0317	03170015	2	OE Scrap	Frag	1	18	0.25
0317	03170016	1	OE Scrap	Frag	1	12	0.67
0317	03170016	2	OE Scrap	Frag	1	12	0.67
0317	03170016	3	OE Scrap	Frag	1	12	0.67
0317	03170017	1	OE Scrap	Frag	1	24	0.19
0321	03210008	1	OE Scrap	OE Scrap	1	4	0.50
0321	03210009	1	OE Scrap	OE Scrap	1	4	0.50
0321	03210014	1	OE Scrap	OE Scrap	1	12	0.25
0321	03210015	1	OE Scrap	OE Scrap	1	8	0.50
0321	03210016	1	OE Scrap	OE Scrap	1	24	0.06
0321	03210020	1	OE Scrap	OE Scrap	1	16	0.38
0321	03210022	1	OE Scrap	OE Scrap	1	8	0.50
0321	03210024	1	OE Scrap	OE Scrap	1	10	0.75
0321	03210039	1	OE Scrap	Frag	1	6	0.33
0321	03210039	2	OE Scrap	Frag	1	6	0.33
0321	03210039	3	OE Scrap	Frag	1	6	0.33
0321	03210040	1	OE Scrap	Frag	1	6	0.25
0321	03210040	2	OE Scrap	Frag	1	6	0.25
0321	03210040	3	OE Scrap	Frag	1	6	0.25
0321	03210041	1	OE Scrap	Frag	1	6	1.00
0321	03210045	1	OE Scrap	Frag	1	2	0.25
0321	03210045	2	OE Scrap	Frag	1	2	0.25
0321	03210045	3	OE Scrap	Frag	1	2	0.25
0321	03210051	1	OE Scrap	OE Scrap	1	18	0.13
0321	03210060	1	OE Scrap	Frag	1	6	0.38
0321	03210070	1	OE Scrap	Frag	1	4	0.25
0321	03210071	1	OE Scrap	Frag	1	8	0.13
0321	03210072	1	OE Scrap	Frag	1	6	0.38
0322	03220008	1	OE Scrap	Brass Rotating Bands	2	0	0.13
0322	03220009	1	OE Scrap	Frag	1	6	0.13
0322	03220021	1	OE Scrap	OE Scrap	1	6	0.50
0322	03220024	1	OE Scrap	155mm Base Section	1	0	30.00
0322	03220026	1	OE Scrap	Frag	1	6	2.00
0322	03220029	1	OE Scrap	Frag	1	6	0.50
0322	03220032	1	OE Scrap	Frag	1	4	0.75
0322	03220036	1	OE Scrap	Frag	1	4	1.00
0322	03220067	1	OE Scrap	Frag	1	4	1.50

Table G-3
Former Benicia Arsenal Engineering Evaluation/Cost Analysis
OE-Related Items Recovered from Tourtelot Property

Grid	Anomaly ID	Item #	Category	Description	Quantity	Depth (Inches)	Estimated Weight (Pounds)
0322	03220082	1	OE Scrap	155mm concrete filled projectile	1	12	100.00
0322	03220083	1	OE Scrap	155mm concrete filled projectile	1	18	100.00
0324	03240008	1	OE Scrap	Frag	1	6	0.63
0324	03240010	1	OE Scrap	Frag	1	4	0.38
0324	03240013	1	OE Scrap	Frag	1	24	0.06
0324	03240015	1	OE Scrap	OE Scrap	1	24	0.06
0324	03240016	1	OE Scrap	Frag	1	6	0.38
0324	03240019	1	OE Scrap	Frag	1	10	0.38
0326	03260013	1	OE Scrap	Frag	1	12	3.00
0326	03260014	1	OE Scrap	Frag	1	10	0.06
0326	03260015	1	OE Scrap	Frag	1	8	2.00
0326	03260017	1	OE Scrap	155mm cement filled round - rear portion only	1	18	18.00
0326	03260017	2	OE Scrap	Frag	1	18	1.00
0326	03260017	3	OE Scrap	Frag	1	18	1.00
0326	03260028	1	OE Scrap	Frag	1	24	0.75
0326	03260032	1	OE Scrap	Frag	1	12	2.00
0326	03260034	2	OE Scrap	Frag	1	24	0.06
0326	03260035	1	OE Scrap	Frag	1	3	0.38
0326	03260036	1	OE Scrap	Frag	1	24	20.00
0326	03260037	1	OE Scrap	Frag	1	4	1.00
0326	03260040	1	OE Scrap	OE Scrap	1	2	0.25
0326	03260041	1	OE Scrap	Frag	1	0	0.13
0326	03260049	1	OE Scrap	Frag	1	10	1.00
0326	03260052	1	OE Scrap	Frag	1	11	0.75
0326	03260055	1	OE Scrap	Frag	1	6	1.00
0326	03260056	1	OE Scrap	Frag	1	0	0.38
0326	03260061	1	OE Scrap	Frag	1	0	1.00
0326	03260064	1	OE Scrap	Frag	1	3	0.17
0326	03260064	2	OE Scrap	Frag	1	3	0.17
0326	03260064	3	OE Scrap	Frag	1	3	0.17
0326	03260065	1	OE Scrap	Frag	1	3	1.00
0326	03260070	1	OE Scrap	Frag	1	6	2.00
0326	03260075	1	OE Scrap	Frag	1	8	0.13
0326	03260077	1	OE Scrap	Frag	1	6	4.00
0326	03260100	1	OE Scrap	Frag	1	8	1.00
0326	03260105	1	OE Scrap	Frag	1	24	0.13
0326	03260112	1	OE Scrap	Frag	1	6	0.75
0326	03260115	1	OE Scrap	Frag	1	14	0.38
0326	03260121	1	OE Scrap	OE Scrap	1	6	0.38
0326	03260123	1	OE Scrap	OE Scrap	1	12	1.00
0326	03260123	2	OE Scrap	OE Scrap	1	12	1.00
0326	03260124	1	OE Scrap	Frag	1	6	0.38
0326	03260124	2	OE Scrap	Base Section of 155mm	1	6	20.00
0326	03260142	1	OE Scrap	Frag	1	12	1.00
0326	03260142	2	OE Scrap	Frag	1	12	1.00
0326	03260151	1	OE Scrap	Frag	1	6	0.38
0326	03260152	1	OE Scrap	Frag	1	4	0.25
0326	03260157	1	OE Scrap	Frag	1	12	3.00
0326	03260157	2	OE Scrap	Frag	1	12	3.00
0331	03310005	1	OE Scrap	Frag	1	4	0.13
0333	03330002	1	OE Scrap	Frag	1	6	2.00
0337	03370004	1	OE Scrap	OE Scrap	1	4	0.50
0337	03370005	1	OE Scrap	OE Scrap	1	6	0.50
0337	03370007	1	OE Scrap	OE Scrap	1	4	0.50
0337	03370008	1	OE Scrap	OE Scrap	1	20	0.50
0339	03390002	1	OE Scrap	Frag	1	6	0.19

Total OE recovered from Tourtelot Property: 2
Total OE scrap recovered from Tourtelot Property: 375

Table G-4
Tourtelot Cleanup Project Removal Action Investigation
OE-Related Items Recovered from North Valley Military Landfill

Line	Anomaly ID	Item #	Category	Description	Quantity	Depth (inches)	Estimated Weight (Pounds)
0	23	1	OE Scrap	Frag	1	10	NA
0	24	1	OE Scrap	Frag	1	6	NA
3	49	1	OE Scrap	Fuze M542	1	3	NA
3	50	1	OE Scrap	Frag	1	4	NA
6	63	1	OE Scrap	Frag	1	2	NA
6	66a	1	OE Scrap	Frag	1	4	NA
6	67	1	OE Scrap	Frag	1	8	NA
6	69	1	OE Scrap	Frag	1	3	NA
9	80	1	OE Scrap	Frag	1	6	NA
9	81	1	OE Scrap	Frag	1	3	NA
9	82	1	OE Scrap	Frag	1	1	NA
9	84	1	OE Scrap	Frag	1	6	NA
9	85	1	OE Scrap	Frag	1	4	NA
9	86	1	OE Scrap	Frag	1	2	NA
9	87	1	OE Scrap	Push plate	1	3	NA
9	89	1	OE Scrap	Frag	1	3	NA
12	110	1	OE Scrap	Frag	1	4	NA
12	111	1	OE Scrap	Frag	1	1	NA
12	112	1	OE Scrap	Frag	1	12	NA
12	113	1	OE Scrap	Frag	1	8	NA
12	115	1	OE Scrap	Frag	1	2	NA
15	130	1	OE Scrap	Frag	1	1	NA
15	132	1	OE Scrap	Frag	1	8	NA
15	135	1	OE Scrap	Frag	1	0	NA
15	136	1	OE Scrap	Frag	1	3	NA
15	137	1	OE Scrap	Frag	1	2	NA
15	141	1	OE Scrap	Frag	1	4	NA
18	146	1	OE Scrap	Frag/burster tube	1	10	NA
18	157	1	OE Scrap	Frag	1	3	NA
18	158	1	OE Scrap	Frag	1	1	NA
18	160	1	OE Scrap	Frag	1	1	NA
18	161	1	OE Scrap	Frag	1	2	NA
18	163	1	OE Scrap	Frag	1	0	NA
18	165	1	OE Scrap	Frag	1	18	NA
18	166	1	OE Scrap	Frag	1	6	NA
18	168	1	OE Scrap	Frag	1	4	NA
18	169	1	OE Scrap	Frag	1	4	NA
21	188	1	OE Scrap	Frag	1	1	NA
21	191	1	OE Scrap	Frag	1	4	NA
21	194	1	OE Scrap	Fuze piece	1	10	NA
21	195	1	OE Scrap	Frag	1	4	NA
21	196	1	OE Scrap	Frag	1	0	NA
24	12	1	OE Scrap	Frag	1	0	NA
24	13	1	OE Scrap	Frag	1	0	NA
24	14	1	OE Scrap	Frag	1	4	NA
27	10	1	OE Scrap	Frag	1	12	NA
27	12	1	OE Scrap	Frag	1	6	NA
27	13	1	OE Scrap	Frag	1	4	NA
27	14	1	OE Scrap	Frag	1	4	NA
27	15	1	OE Scrap	Frag	1	2	NA
30	20	1	OE Scrap	Frag	1	2	NA
30	21	1	OE Scrap	Frag	1	8	NA
30	23	1	OE Scrap	Frag	1	2	NA
33	15	1	OE Scrap	Frag	1	2	NA
33	16	1	OE Scrap	Frag	1	2	NA
33	17	1	OE Scrap	Frag	1	2	NA
36	9	1	OE Scrap	Frag	1	2	NA
36	10	1	OE Scrap	Frag	1	8	NA
36	11	1	OE Scrap	Frag	1	2	NA

Notes: NA = information was not available

Total OE recovered from North Valley Military Landfill: 0

Total OE scrap recovered from North Valley Military Landfill: 59

ATTACHMENT H-1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Proposed Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California
(Page 1 of 8)

Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
Federal					
Resource Conservation and Recovery Act (RCRA), Subpart M (Military Munitions Rule)	40 CFR Part 266	Identifies when military munitions become a solid waste, and if these wastes are hazardous, the management standards that apply.	Chemical-specific	Relevant and Appropriate	Recovery, collection, and on-range destruction of OE and munition fragments are not subject to hazardous waste regulations or permits. Discovered OE in burial pits or trenches could be considered solid waste in accordance with this rule. However, this requirement is not applicable at California sites until the state implements the federal Military Munitions Rule as a state-implemented federal requirement.
Clean Water Act (CWA)	33 U.S.C. 1151 et seq., 1251 et seq., 40 U.S.C. 3906 et seq.	Establishes standards governing all untreated waters including marine, coastal, estuarine, fresh surface water, and groundwater; also governs discharge of dredged or fill material.	Location-specific	Applicable	OE removal and subsequent ground disturbance may be performed in areas delineated as wetlands.
	40 CFR Part 230.10, Section 404(b)(1)	Requires permit from USACE for construction activities in wetlands and alternative analysis to ensure selection of the least damaging practicable alternative.	Location-specific	Applicable	Wetlands are present within the site boundary. Coordination with USACE will be required if any wetland areas are to be disturbed by implementing a clearance action. Methods for reducing disturbance include minimizing excavation area and depth, completing in situ detonation in the least disturbing manner, and setting aside topsoil during excavation to salvage seeds and eggs.
	40 CFR Section 401	Requires permit for any activity which may result in any discharge into navigable waters, setting effluent limitations, and monitoring requirements.	Location-specific	Applicable	OE removal and subsequent ground disturbance may be performed in areas delineated as wetlands.

Proposed Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California
(Page 2 of 8)

Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
Fish & Wildlife Coordination Act	16 U.S.C. 661 et seq.	Prohibits actions from harming local fish and wildlife	Location-specific	Applicable	Implementation of any of the alternatives that may cause ground disturbance would occur in areas populated with wildlife. Provisions of this Act should be followed.
Endangered Species Act	16 U.S.C. 1531-1543	Prohibits federal actions from jeopardizing the continued existence of protected, endangered, or threatened species or modifying critical habitats.	Location-specific	Applicable	Activities may occur in areas populated with fish and wildlife. Provisions of this Act should be followed.
Floodplain Management	EO 11988	Restricts federal activities when projects are sited in floodplains.	Location-specific	Relevant and Appropriate	Activities may occur in low-lying areas designated as floodplain. Provisions of this Act should be followed.
Bald and Golden Eagle Protection Act	16 U.S.C. 668	Prohibits the transport, import, export, taking, selling, purchasing, or barter of any bald or golden eagle, including feathers or other parts, nest, eggs, or products, except as allowed by permit. "Take" includes pursuing, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, or disturbing.	Location-specific	Applicable	Although no bald eagles were observed during the field investigation, suitable habitat does exist in the study area. Provisions of this Act should be followed.
Migratory Bird Treaty Act	16 U.S.C. 703-712	Prohibits the taking, possessing, buying, selling, or bartering of any migratory bird, including feathers or other parts, nest, eggs, or products, except as allowed by regulations.	Location-specific	Applicable	The Project Site is situated along the Pacific Flyway.

Proposed Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California
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Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
Archaeological Resources Protection Act (ARPA)	16 U.S.C. 470	Prohibits unauthorized excavation of, and sets standards for protection of, archaeological resources. Prohibits disclosure of archaeological resources by federal agencies.	Location-specific	Applicable	If properties are uncovered or affected by OE clearance activities, conditions of the NHPA and the ARPA must be followed.
National Historic Preservation Act (NHPA)	16 U.S.C. 470	Requires action to be taken to locate, identify, evaluate, and protect cultural resources.	Location-specific	Applicable	If properties are uncovered or affected by OE clearance activities, conditions of the NHPA and the ARPA must be followed.
Native American Graves Protection and Repatriation Act (NAGPRA)	25 U.S.C. 3001	Prohibits disturbance of Native American remains and funerary objects. Provides a process for repatriation of remains and funerary objects.	Location-specific	Relevant and Appropriate	If any Native American remains and funerary are uncovered or affected by OE clearance activities, proper NAGPRA protocol must be followed.
Protection of Wetlands	EO 11990	Restricts federal activities when alterations of wetlands may occur.	Location-specific	Applicable	Prior to removal of OE from wetland areas, action must be taken to minimize impacts. Mitigation and habitat restoration plans include measures to minimize disturbance to wetlands. Goal of restoration plans will be to restore affected wetlands to same acreage and provide same function as before ordnance removal.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	42 U.S.C. 9601-11050	Legislation that finances remediation and creates a national policy to identify and clean up sites contaminated by the release of hazardous substances.	Action-specific	Applicable	Provides factors to be considered in determining the appropriate risk management action and specifies that public affairs must be coordinated in accordance with directives for the CERCLA response action.

Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
OE Waste Identification	Draft Department of the Army Memorandum	Adopts criterion of 10% explosive content as a measure of contaminated soil reactivity for secondary explosives.	Action-specific	TBC	Provisions should be followed.
Occupational Safety and Health Administration (OSHA)	29 CFR Part 1910.120	Defines the manner in which hazardous waste and emergency response actions must be carried out. Covers emergency response operations for the release of, or substantial threat of, hazardous substances without regard to the location of the hazard.	Action-specific	Applicable	The possibility of a fire or explosion will exist during OE clearance operations. All site personnel must be in compliance with 29 CFR Parts 1910.120, which requires workers to be 40-hour health and safety trained with an 8-hour refresher. An annual medical surveillance examination is also required.
Hazard Communication	29 CFR Part 1910.1200	Specifies that the hazards associated with all chemicals produced or imported be evaluated, and that information concerning their hazards be transmitted to employers and employees.	Action-specific	Applicable	All on-site employees and visitors will be made aware of the hazards associated with the chemicals on site and hazards associated with the OE clearance or avoidance activities.
Hazardous Substance	49 CFR Part 172.101	Details U.S. Department of Transportation (DOT) classifications of hazardous material.	Action-specific	Applicable	Transportation of explosives to be used in the detonation of OE as a means of on-site disposal must comply with DOT regulations. UXO-qualified personnel must inspect the loading and unloading of the explosives, and the transport vehicle must be properly maintained and placarded.

Proposed Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California
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Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
National Environmental Policy Act (NEPA)	40 CFR Parts 1500-1508	Requires that public officials and citizens be informed of proposed actions so informed decisions can be made (i.e., the analysis of cumulative effects and impacts on cultural/natural resources).	Action-specific	Relevant and Appropriate	Provisions of this Act should be followed.
National Contingency Plan (NCP)	40 CFR Part 300.120(c), Part 300.400(e)	Defines format for response from planning to decision making to post-removal monitoring.	Action-specific	Applicable	Permitting is not required for on-site CERCLA response actions.
Occupational Safety and Health Act	29 U.S.C. 651-678	Regulates worker health and safety.	Action-specific	Applicable	Under 40 CFR Part 300.38, requirements of the Act apply to all response activities under the NCP.
Superfund Amendments and Reauthorization Act (SARA)	Chapter 160	Established the Defense Environmental Restoration Program (DERP) that calls for "correction of environmental damage (such as detection and disposal of unexploded ordnance) that creates an imminent and substantial endangerment to public health or welfare or the environment."	Action-specific	Applicable	The contamination of the Project Site, specifically OE, was the result of past activities conducted by the U.S. Army and constitutes a hazard to human safety and the environment.
State Drinking Water Primary Standards	Title 22, Sections 64431, 64443, and 64444	Established Maximum Contaminant Levels (MCLs) for public water systems.	Chemical-specific	Relevant and Appropriate	Groundwater may be considered a potential source of drinking water. State MCLs are more stringent than federal MCLs.
California Designated level Methodology for Waste Characterization and Cleanup Level Determination	Staff Report, California Regional Water Quality Control Board	Proposes a methodology for determining cleanup levels in soil based upon impact on groundwater.	Chemical-specific	TBC	Can be used in determining cleanup levels in soil that are protective of groundwater quality.

Proposed Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California
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Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
Water Quality Objectives	Water Quality Control Plan, San Francisco Bay Basin.	The Porter-Cologne Water Quality Act established authority of state and regional Water Quality Control Boards to regulate discharges into water of the state. The Basin Plan establishes limits and procedures to protect water quality. The objective of the plan is to protect the quality of surface and groundwater in the San Francisco Bay area.	Chemical-specific	Applicable	Discharge standards for National Pollutant Discharge Elimination System (NPDES) permits and Waste Discharge Requirements (WDRs) may be applicable if discharge to surface water is proposed.
Underground Storage Tank (UST) Requirements	Title 23, Section 2672	Establishes permanent closure requirements for USTs and associated piping, including removal of residual materials, sampling, and reporting to the appropriate local agency.	Action-specific	Applicable	Will apply if UST(s) and piping are found during OE point clearance activities.
California Environmental Health Standards for the Management of Hazardous Waste[a]	Title 22, Sections 66261 and 66268.1, and 66261.23	Criteria for identifying RCRA hazardous wastes and hazardous wastes that are restricted from the landfill. Under this rule, OE is considered a hazardous waste.	Chemical-specific	Applicable	Waste munitions, munition fragments, and soil contaminated with explosives could be considered hazardous if they contain a listed waste or exhibit hazardous waste characteristics (e.g., reactivity). If found to be hazardous, they could be restricted from landfill disposal.
California Endangered Species Act (CESA)	CESA Code 2080.2081	Protects endangered species from being exported or imported. Establishes authority permitting processes and mitigation requirements to protect endangered species.	Location-specific	Relevant and Appropriate	Disturbance to riparian, wetland habitats, or vegetation will require mitigation such as contouring the ground surface to pre-project elevation and replanting of native vegetation in appropriate ratios.

Proposed Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California
(Page 7 of 8)

Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
California Clean Air Act (CCAA)[b]	AB 2595	Establishes primary and secondary air quality standards necessary to protect human health, welfare, plant and animal life, buildings, materials, and visibility.	Location-specific	Relevant and Appropriate	Provisions of this Act should be followed.
Bay Area Air Quality Management District (BAAQMD) Air Quality Rules and Regulations	BAAQMD 5-401.14	Establishes the permitting requirements for the disposal of explosives through open burning.	Action-specific	Relevant and Appropriate	A variance permit is required as of January 1, 1997, to conduct combustion-related disposal within BAAQMD districts that produces PM pollution that is visible for more than 3 minutes.
California Health and Safety Code (HSC)	HSC, Division 20 Chapter 6.5, 6.8	Establishes regulations and incentives to ensure generators of hazardous wastes to employ safe handling practices, treatment, recycling, and destruction of hazardous waste prior to disposal. Also establishes a program for response authority for release, spills, disposal sites, and compensation for medical expenses resulting from injuries caused by exposure to releases of hazardous substances.	Action-specific	Applicable	Under Title 22, Section 66261.23, UXO is considered a hazardous waste. Provisions of this Act should be followed.

Proposed Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California
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Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments

Notes: (a) Title 22 is more stringent than the federal RCRA.
(b) CCAA is more stringent than the federal Clean Air Act.

AB	=	Assembly Bill
ARPA	=	Archaeological Resources Protection Act
CCAA	=	California Clean Air Act
CERCLA	=	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	=	Code of Federal Regulations
CWA	=	Clean Water Act
DERP	=	Defense Environmental Restoration Program
DOT	=	Department of Transportation
EO	=	Executive Order
MCLs	=	Maximum Contaminant Levels
NAGPRA	=	Native American Graves Protection and Repatriation Act
NCP	=	National Contingency Plan
NEPA	=	National Environmental Policy Act
NHPA	=	National Historic Preservation Act
NPDES	=	National Pollutant Discharge Elimination System
OE	=	ordnance and explosives
OSHA	=	Occupational Safety and Health Administration
RCRA	=	Resource Conservation and Recovery Act
SARA	=	Superfund Amendments and Reauthorization Act
TBC	=	to be considered
USACE	=	U.S. Army Corps of Engineers
U.S.C.	=	U.S. Code
UST	=	underground storage tank
UXO	=	unexploded ordnance
WDRs	=	Waste Discharge Requirements

ATTACHMENT H-2

REMEDIAL COST ESTIMATES

Table H-1: ESTIMATED COST FOR ALTERNATIVE 2
Tourtelot Site, Benicia, California

Alternative 2 description: Institutional Controls and Monitoring

Components		Estimated Cost	Comments
I.	Access Controls	461,000	
II.	Monitoring (Surface Water & Ground Water)	70,000	Assumes 5-yr present worth($10,450 /yr and 5%) See Table 9
Total Estimated Cost for Alternative 2		530,000	

Table H 2 : ESTIMATED COST FOR ALTERNATIVE 5A
Tourtelot Site, Benicia, California

Description: Includes OE point clearance for entire Site and area-wide clearance in North Valley, Ridge, and D-1 areas; Excavation and disposal of non-OE affected soil for entire site; Excavated soil would be placed in North Valley and scanned for OE during placement and would be capped; Institutional controls on South Valley wetlands, South Valley open space, Kickout zone, and McAllister Drive Land Bridge.

Components		Estimated Cost		Comments
I.	**Point Clearance of OE and OE Scrap over Entire Site**	**$**	**3,516,000**	see Table No. 8
II.	**Mechanical Removal / Disposal of Affected Soil**			
	Non-OE affected soil:			
	excavation and disposal of TNT affected soil	$	2,830,000	See Table No.10
	excavation and disposal of affected soil in North Valley Military Landfill	$	207,000	see Table No. 12
	excavation and disposal of affected soil in Flare Site	$	85,000	see Table No. 13
	excavation and disposal of affected soil in Demolition Site #3	$	455,000	see Table No. 14
	OE affected soil:			
	excavation of overburden soil in North Valley Ridge, and D-1 Lots in South Valley; and placement in North Valley.	$	3,872,000	see Table No. 15
	Subtotal	**$**	**7,449,000**	
III.	**Capping**	**$**	**2,723,000**	see Table No. 18
IV.	**Run-on/Run-off Control**	**$**	**100,000**	
Total Estimated Cost for Alternative 5A		**$**	**13,800,000**	

Table H-3 : ESTIMATED COST FOR ALTERNATIVE 5B

Tourtelot Site, Benicia, California

Description: Includes OE point clearance for entire Site and area-wide clearance in North Valley, Ridge, and D-1 areas; Excavation, treatment, and disposal of non-OE affected soil for entire Site (including composting of soil with TNT concentrations greater than approximately 5%); Excavated soil would be placed in North Valley and scanned for OE during placement and would be capped; Institutional controls on South Valley wetlands, South Valley open space, Kickout zone, and McAllister Drive Land Bridge.

Components		Estimated Cost		Comments
I.	**Point Clearance of OE and OE Scrap over Entire Site**	$	**3,516,000**	see Table No. 8
II.	**Mechanical Removal / Treatment of Affected Soil**			
	Non-OE affected soil:			
	excavation, treatment and disposal of TNT affected soil	$	3,641,000	See Table No. 11
	excavation and disposal of affected soil in North Valley Military Landfill	$	207,000	see Table No. 12
	excavation and disposal of affected soil in Flare Site	$	85,000	see Table No. 13
	excavation and disposal of affected soil in Demolition Site #3	$	455,000	see Table No. 14
	OE affected soil:			
	excavation of overburden soil in North Valley Ridge, and D-1 Lots in South Valley; and placement in North Valley.	$	3,872,000	see Table No. 15
	Subtotal	$	**8,260,000**	
III.	**Capping**	$	**2,723,000**	see Table No. 18
IV.	**Run-on/Run-off Control**	$	**100,000**	
Total Estimated Cost for Alternative 5B		$	**14,600,000**	

Table H-4 : ESTIMATED COST FOR ALTERNATIVE 6A
Tourtelot Site, Benicia, California

Description: Includes OE point clearance for entire Site and area-wide clearance in North Valley, Ridge, and D-1 areas; Excavation and disposal of non-OE affected soil for entire site; Excavation of South Valley Kickout zone soil. Excavated soil would be placed in North Valley and scanned for OE during placement and would be capped; Institutional controls on South Valley wetlands, South Valley open space, and McAllister Drive Land Bridge.

Components		Estimated Cost		Comments
I.	**Point Clearance of OE and OE Scrap over Entire Site**	$	**3,516,000**	See Table No. 8
II.	**Mechanical Removal / Disposal of Affected Soil**			
	Non-OE affected soil:			
	excavation and disposal of TNT affected soil	$	2,830,000	See Table No. 10
	excavation and disposal of affected soil in North Valley Military Landfill	$	207,000	See Table No. 12
	excavation and disposal of affected soil in Flare Site	$	85,000	See Table No. 13
	excavation and disposal of affected soil in Demolition Site #3	$	455,000	See Table No. 14
	OE affected soil:			
	excavation of overburden soil in North Valley Ridge, and D-1 Lots in South Valley; and placement in North Valley.	$	3,872,000	See Table No. 15
	excavation of soil in kickout zone and placement in North Valley	$	1,904,000	See Table No. 16
	Subtotal	**$**	**9,353,000**	
III.	**Capping**	**$**	**2,723,000**	See Table No. 18
IV.	**Run-on/Run-off Control**	**$**	**100,000**	
Total Estimated Cost for Alternative 6A		**$**	**15,700,000**	

Table H-5 : ESTIMATED COST FOR ALTERNATIVE 6B
Tourtelot Site, Benicia, California

Description: Includes OE point clearance for entire Site and area-wide clearance in North Valley, Ridge, and D-1 areas; Excavation, treatment, and disposal of non-OE affected soil for entire Site (including composting of soil with TNT concentrations greater than approximately 5%); Excavation of South Valley Kickout zone soil. Excavated soil would be placed in North Valley and scanned for OE during placement and would be capped; Institutional controls on South Valley wetlands, South Valley open space, and McAllister Drive Land Bridge.

Components		Estimated Cost		Comments
I.	**Point Clearance of OE and OE Scrap over Entire Site**	**$**	**3,516,000**	see Table No. 8
II.	**Mechanical Removal / Treatment of Affected Soil**			
	Non-OE affected soil:			
	excavation, treatment and disposal of TNT affected soil	$	3,641,000	see Table No. 11
	excavation and disposal of affected soil in North Valley Military Landfill	$	207,000	see Table No. 12
	excavation and disposal of affected soil in Flare Site	$	85,000	see Table No. 13
	excavation and disposal of affected soil in Demolition Site #3	$	455,000	see Table No. 14
	OE affected soil:			
	excavation of overburden soil in North Valley Ridge, and D-1 Lots in South Valley; and placement in North Valley.	$	3,872,000	see Table No. 15
	excavation of affected soil in kickout zone and placement in North Valley	$	1,904,000	see Table No. 16
	Subtotal	**$**	**10,164,000**	
III.	**Capping**	**$**	**2,723,000**	see Table No. 18
IV.	**Run-on/Run-off Control**	**$**	**100,000**	
Total Estimated Cost for Alternative 6B		**$**	**16,500,000**	

Table H-6 : ESTIMATED COST FOR ALTERNATIVE 8A
Tourtelot Site, Benicia, California

Description: Includes OE point clearance for entire Site and area-wide clearance in North Valley, Ridge, and D-1 areas; Excavation and disposal of non-OE affected soil for entire site; Excavated soil would be placed in North Valley and scanned for OE during placement and would be capped; Excavation of South Valley Kickout zone soil, scanning soil for OE, and replacement in South Valley; Institutional controls on South Valley wetlands, South Valley open space, and McAllister Drive Land Bridge.

Components		Estimated Cost		Comments
I.	**Point Clearance of OE and OE Scrap over Entire Site**	**$**	**3,516,000**	see Table No. 8
II.	**Mechanical Removal / Disposal of Affected Soil**			
	Non-OE affected soil:			
	excavation and disposal of TNT affected soil	$	2,830,000	see Table No. 10
	excavation and disposal of affected soil in North Valley Military Landfill	$	207,000	see Table No. 12
	excavation and disposal of affected soil in Flare Site	$	85,000	see Table No. 13
	excavation and disposal of affected soil in Demolition Site #3	$	455,000	see Table No. 14
	OE affected soil:			
	excavation of overburden soil in North Valley Ridge, and D-1 Lots in South Valley; and placement in North Valley.	$	3,872,000	see Table No. 15
	excavation of affected soil in kickout zone and placement in South Valley	$	2,702,000	see Table No. 17
	Subtotal	**$**	**10,151,000**	
III.	**Capping**	**$**	**2,723,000**	see Table No. 18
IV.	**Run-on/Run-off Control**	**$**	**100,000**	
Total Estimated Cost for Alternative 8A		**$**	**16,500,000**	

Table H-7 : ESTIMATED COST FOR ALTERNATIVE 8B
Tourtelot Site, Benicia, California

Description: Includes OE point clearance for entire Site and area-wide clearance in North Valley, Ridge, and D-1 areas; Excavation, treatment, and disposal of non-OE affected soil for entire Site (including composting of soil with TNT concentrations greater than approximately 5%); Excavated soil would be placed in North Valley and scanned for OE during placement and would be capped; Excavation of South Valley Kickout zone soil, scanning for OE, and replacement in South Valley; Institutional controls on South Valley wetlands, South Valley open space, and McAllister Drive Land Bridge.

Components		Estimated Cost		Comments
I.	**Point Clearance of OE and OE Scrap over Entire Site**	$	**3,516,000**	see Table No. 8
II.	**Mechanical Removal / Treatment of Affected Soil**			
	Non-OE affected soil:			
	excavation, treatment and disposal of TNT affected soil	$	3,641,000	see Table No. 11
	excavation and disposal of affected soil in North Valley Military Landfill	$	207,000	see Table No. 12
	excavation and disposal of affected soil in Flare Site	$	85,000	see Table No. 13
	excavation and disposal of affected soil in Demolition Site #3	$	455,000	see Table No. 14
	OE affected soil:			
	excavation of overburden soil in North Valley Ridge, and D-1 Lots in South Valley; and placement in North Valley.	$	3,872,000	see Table No. 15
	excavation of affected soil in kickout zone and placement in South Valley	$	2,702,000	see Table No. 17
	Subtotal	$	**10,962,000**	
III.	**Capping**	$	**2,723,000**	see Table No. 18
IV.	**Run-on/Run-off Control**	$	**100,000**	
Total Estimated Cost for Alternative 8B		$	**17,300,000**	

Table H-8

Estimated Cost for Point Clearance of OE and OE Scrap over Entire Site

	Item	# Units	Unit		Unit Cost	Units	Extended Price
Capital Costs							
A.	**Remedial Design Document**	1	acres	@	$ 70,000	lump	$ 70,000
	Subtotal						**$ 70,000**
B.	**Surface Preparation**						
	Vegetation Removal	220	acres	@	$ 670	/acre	$ 147,400
	Survey Staking	220	acres	@	$ 605	/acre	$ 133,100
	Surface Clearance	220	acres	@	$ 965	/acre	$ 212,300
	Subtotal						**$ 492,800**
C.	**OE Removal**						
	Geophysical Support	220	acres	@	$ 2,345	/acre	$ 515,900
	Fence Removal Replacement	12,000	Feet	@	$ 2	/Ft	$ 24,000
	Subsurface Clearance	220	acres	@	$ 8,690	/acre	$ 1,911,800
	Subtotal						**$ 2,451,700**
D.	**100% QC Check**						
	Geophysical Support	220	acres	@	$ 765	/acre	$ 168,300
	Fence Removal Replacement	12,000	acres	@	$ 2	/Ft	$ 24,000
	Subsurface Clearance	220	acres	@	$ 1,405	/acre	$ 309,100
	Subtotal						**$ 501,400**
Total Capital Costs							**$ 3,516,000**

Table H-9

Estimated Cost for Groundwater and Surface Water Monitoring

Item	# units		unit cost	units	Extended Price
I. Capital Costs					
A. Engineering Fees					
engineering design	1	@	$ 10,000	lump	$ 10,000
technician oversee drilling	3	@	$ 800		$ 2,400
report preparation	1	@	$ 1,000	lump	$ 1,000
Subtotal					**$ 10,000**
B. Well Installation					
install monitoring well	6	@	$ 1,000	/well	$ 6,000
C. Laboratory Analytical Costs					
soil analysis	6	@	$ 1,000	/well	$ 6,000
groundwater sample analysis	6	@	$ 500	/well	$ 3,000
Subtotal					**$ 15,000**
Total Capital Costs					**$ 25,000**
II. Annual Monitoring & Reporting					
A. Groundwater Monitoring					
collect sample	2	@	$ 1,000	/event	$ 2,000
groundwater analysis	2	@	$ 500	/event	$ 1,000
well maintenance	2	@	$ 100	/event	$ 200
Subtotal					**$ 3,200**
B. Surface Water Monitoring					
collect sample	2	@	$ 125	/event	$ 250
water analysis	2	@	$ 500	/event	$ 1,000
					$ 1,250
C. Monitoring Reports	2	@	$ 3,000	/report	$ 6,000
Total Annual Costs					**$ 10,450**
Net Present Worth of Future Costs					**$ 45,000**
Total Cost (Net Present Value)					**$ 70,000**

Table H-10

Estimated Cost for Excavation and Offsite Disposal of Soil containing TNT concentration > RAO

Item	# units		unit cost	units	Extended Price
Capital Costs					
A. Engineering Fees					
engineering design	1	@	$ 100,000	lump	$ 100,000
construction management	1	@	$ 167,000	lump	$ 167,000
reporting	1	@	$ 54,000	lump	$ 54,000
Subtotal					**$ 321,000**
B. Excavation					
homogenize top 3' soil beneath the strips	1,500	@	$ 15.0	/cy	$ 22,500
excavate and load soil with TNT> RAO for offsite disposal	25,000	@	$ 2.5	/cy	$ 62,500
Subtotal					**$ 85,000**
C. Transportation & Disposal					
Class I Landfill	25,000	@	$ 91	/cy	$ 2,275,000
traffic control & street sweeper	50	@	$ 2,000	/day	$ 100,000
Subtotal					**$ 2,375,000**
D. Soil sampling and analyses					
field screening samples	250	@	$ 150	/sample	$ 37,500
stockpile soil samples	75	@	$ 150	/sample	$ 11,250
excavation limit soil samples	200	@	$ 150	/sample	$ 30,000
compost soil samples	50	@	$ 150	/sample	$ 7,500
Subtotal					**$ 48,750**
Total Capital Costs					**$ 2,830,000**

Table H-11

Estimated Cost for Excavation and Treatment of Soil containing TNT concentration > 5%, and Offsite disposal of soil that exceeds RAOs

Item	# units		unit cost	units		Extended Price
	See Table G-1					
Capital Costs						
A. Engineering Fees	**See Table G-2**					
engineering design	1	@	$ 100,000	lump	$	100,000
construction management	1	@	$ 167,000	lump	$	167,000
reporting	1	@	$ 54,000	lump	$	54,000
Subtotal					**$**	**321,000**
B. Excavation						
homogenize top 3' soil beneath the strips	1,500	@	$ 15.0	/cy	$	22,500
excavate and haul to treatment area	5,000	@	$ 10.0	/cy	$	50,000
Subtotal					**$**	**72,500**
C. Treatment						
prepare treatment pad	1	@	$ 60,000	lump	$	60,000
windrow composting soil with TNT > approximately 5%	5,000	@	$ 150	/cy	$	750,000
treatment pad decommission	1	@	$ 10,000	lump	$	10,000
Subtotal					**$**	**820,000**
D. Transportation & Disposal						
Class I Landfill	25,000	@	$ 91	/cy	$	2,275,000
traffic control & street sweeper	50	@	$ 2,000	/day	$	100,000
Subtotal					**$**	**2,375,000**
E. Soil Sampling and Analyses						
field screening samples	250	@	$ 40	/sample	$	10,000
stockpile soil samples	150	@	$ 150	/sample	$	22,500
excavation limit soil samples	200	@	$ 150	/sample	$	30,000
compost soil samples	150	@	$ 150	/sample	$	22,500
Subtotal					**$**	**52,500**
Total Capital Costs					**$**	**3,641,000**

Table H-12

Estimated Cost for Excavation and Disposal of Affected Soil in North Valley Military Landfill

Item	# units		unit cost	units	Extended Price
Capital Costs					
A. Engineering Fees					
engineering design	1	@	$ 20,000	lump	$ 20,000
construction management	1	@	$ 8,000	lump	$ 8,000
reporting	1	@	$ 3,000	lump	$ 3,000
Subtotal					**$ 31,000**
B. Excavation					
excavate and load for off site disposal	4,000	@	$ 4	/cy	$ 16,000
Subtotal					**$ 16,000**
C. Transportation & Disposal					
Class II Landfill - haul & dispose	4,000	@	$ 40	/cy	$ 160,000
Subtotal					**$ 160,000**
Total Capital Costs					**$ 207,000**

Table H-13

Estimated Cost for Excavation and Disposal of Affected Soil in Flare Site

Item	# units		unit cost	units	Extended Price
Capital Costs					
A. Engineering Fees					
engineering design	1	@	$ 10,000	lump	$ 10,000
construction management	1	@	$ 6,000	lump	$ 6,000
reporting	1	@	$ 3,000	lump	$ 3,000
Subtotal					**$ 19,000**
B. Excavation					
excavate and load for off site disposal	1,500	@	$ 4	/cy	$ 6,000
Subtotal					**$ 6,000**
C. Transportation & Disposal					
Class II Landfill - haul & dispose	1,500	@	$ 40	/cy	$ 60,000
Subtotal					**$ 60,000**
Total Capital Costs					**$ 85,000**

Table H-14

Estimated Cost for Excavation and Disposal of Affected Soil in Demolition Site #3

Item	# units		unit cost	units	Extended Price
Capital Costs					
A. Engineering Fees					
engineering design	1	@	$ 80,000	lump	$ 80,000
construction management	1	@	$ 17,500	lump	$ 17,500
reporting	1	@	$ 5,500	lump	$ 5,500
Subtotal					**$ 103,000**
B. Excavation					
excavate and load for off site disposal	8,000	@	$ 4	/cy	$ 32,000
Subtotal					**$ 32,000**
C. Transportation & Disposal					
Class II Landfill - haul & dispose	8,000	@	$ 40	/cy	$ 320,000
Subtotal					**$ 320,000**
Total Capital Costs					**$ 455,000**

Table H-15

Estimated Cost for Excavation of Overburden Soil in North Valley, Ridge, and Previously Graded D-1 Lots in Soutl and Placement in the North Valley

Item	# units		unit cost	units	Extended Price
Capital Costs					
A. Engineering Fees					
engineering design	1	@	$ 100,000	lump	$ 100,000
construction management and reporting	1	@	$ 74,000	lump	$ 74,000
reporting	1	@	$ 13,000	lump	$ 13,000
Subtotal					**$ 187,000**
B. Excavation and Placement as Fill					
excavate, haul, place and compact	670,000	@	$ 2.5	/cy	$ 1,675,000
Subtotal					**$ 1,675,000**
C. Area-Wide Clearance of OE					
geophysical support	670,000	@	$ 3	/cy	$ 2,010,000
Subtotal					**$ 2,010,000**
Total Capital Costs					**$ 3,872,000**

Table H-16

Estimated Cost for Excavation of Soil in Kickout Zone, Area-Wide Clearance, and Placement in the North Valley

Item	# units		unit cost	units	Extended Price
Capital Costs					
A. Engineering Fees					
engineering design	1	@	$ 115,000	lump	$ 115,000
construction management	20	@	$ 2,000	/day	$ 40,000
reporting	1	@	$ 7,000	lump	$ 7,000
Subtotal					**$ 162,000**
B. Re-Routing Sewer Line					
temporary re-routing during construction	2,000	@	$ 10	/ft	$ 20,000
permanent re-routing	600	@	$ 120	/ft	$ 72,000
					$ 92,000
C. Excavation and Placement as Fill					
excavate and haul for placment as fill	220,000	@	$ 2.5	/cy	$ 550,000
place and compact soil	220,000	@	$ 2	/cy	$ 440,000
Subtotal					**$ 990,000**
D. Area-Wide Clearance of OE					
gephysical support	220,000	@	$ 3	/cy	$ 660,000
Subtotal					**$ 660,000**
Total Capital Costs					**$ 1,904,000**

Table H-17

Estimated Cost for Excavation of OE Affected Soil in Kickout Zone, Area-Wide Clearance, and Placement in the Sou

Item	# units		unit cost	units	Extended Price
Capital Costs					
A. Engineering Fees					
engineering design	1	@	$ 100,000	lump	$ 100,000
construction management	40	@	$ 2,000	/day	$ 80,000
reporting	1	@	$ 10,000	lump	$ 10,000
Subtotal					**$ 190,000**
B. Re-Routing Sewer Line					
temporary re-routing during construction	2,000	@	$ 10	/ft	$ 20,000
permanent re-routing	600	@	$ 120	/ft	$ 72,000
					$ 92,000
C. Excavation and Placement as Fill					
excavate and haul for placement as fill	220,000	@	$ 5	/cy	$ 1,100,000
place and compact soil	220,000	@	$ 3	/cy	$ 660,000
Subtotal					**$ 1,760,000**
D. Area-Wide Clearance of OE	220,000	@	$ 3	/cy	**$ 660,000**
Total Capital Costs					**$ 2,702,000**

Table H-18

Estimated Cost for Cutting the Bedrock on Ridge and Placement in North Valley as Engineered Cap

Item	# units		unit cost	units	Extended Price
Capital Costs					
A. Engineering Fees					
engineering design	1	@	$100,000	lump	$ 100,000
construction management	1	@	$110,000	lump	$ 110,000
reporting	1	@	$ 13,000	lump	$ 13,000
Subtotal					**$ 223,000**
B. Excavation and Placement as Fill					
excavate, haul, place and compact	1,000,000	@	$ 2.5	/cy	$ 2,500,000
Subtotal					**$ 2,500,000**
Total Capital Costs					**$ 2,723,000**

Table H-19

Estimated Cost for Slope Stability Monitoring

Tourtelot Project Site

Item	# units		unit cost	units	Extended Price
I. Annual Monitoring					
professional oversight	1	@	$ 1,200	lump	$ 1,200
Subtotal					**$ 1,200**
II. Annual Reporting and Project Management					
Coordinate inspection, review and evaluate observations and prepare report	4	@	$ 600	/report	$ 2,400
Subtotal					**$ 2,400**
Total Annual Costs					**$ 3,600**
Net Present Worth of Future Costs 5 years at 5% / yr.					**$ 16,000**

Table H-20

Estimated Wetland Mitigation Construction and Five Years of Annual Monitoring

	Item	# units		unit cost	units	Extended Price
I. Capital Costs						
A.	**Design/Engineering**					
	engineering design	1	@	$ 10,000	lump	$ 10,000
	technician oversee drilling	6	@	$ 800		$ 4,800
	report preparation	1	@	$ 2,500	lump	$ 2,500
	Subtotal					**$ 17,300**
B.	**Wetland construction**					
	Grading	1	@	$ 45,000	lump	$ 45,000
C.	**Planting/Transplanting**					
	Planting	1	@	$ 15,000	lump	$ 15,000
	Soil amendments	1	@	$ 4,000	lump	$ 4,000
	Subtotal					**$ 64,000**
				Total Capital Costs		**$ 81,300**
II. Annual Monitoring & Reporting						
A.	**Wetland monitoring**					
	field work	5	@	$ 3,300	/event	$ 16,500
	analysis	5	@	$ 2,450	/event	$ 12,250
	Subtotal					**$ 28,750**
C.	**Monitoring Reports**	5	@	$ 3,000	/report	$ 15,000
				Total Annual Costs		**$ 43,750**
Total Cost (Net Present Value, 5 yrs @ 5%/yr))						**$ 270,300**

ATTACHMENT I-1

TEPH CHROMATOGRAMS FOR TNT STRIP SAMPLES DETECTING UNKNOWN HYDROCARBONS

EARTH TECH INC

Client Sample ID: TNT-2F/1

GC Semivolatiles

Lot-Sample #...: G0C300256-012 Work Order #...: DA9GJ204 Matrix.....: SO
Date Sampled...: 03/28/00 09:40 Date Received..: 03/30/00
Prep Date.....: 04/04/00 Analysis Date..: 04/26/00
Prep Batch #...: 0119152
Dilution Factor: 50
% Moisture.....: 18 Method.....: SW846 8015 MOD

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Unknown Hydrocarbon	**180**	**61**	**mg/kg**	**0.61**
TPH (as Diesel)	ND	61	mg/kg	0.70
TPH (as Kerosene)	ND	61	mg/kg	0.61
TPH (as Motor Oil)	ND	610	mg/kg	1.9

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
o-Terphenyl	0.0 SRD	(65 - 135)

NOTE(S):

SRD The surrogate recovery was not calculated because the extract was diluted beyond the ability to quantitate a recovery.

Results and reporting limits have been adjusted for dry weight.

Elevated reporting limits. The reporting limits are elevated due to matrix interference.

The unknown from n-C10 to n-C24 was quantitated with all peaks from n-C12 to n-C36 and based on diesel fuel (n-C10 to n-C24).

Quanterra / W. Sacramento
Multiple Eluter Result Summary

Analysis ID: [APR2000] 90 70B25APR001508,22
Acquired: GC #70-B 26-APR-2000 at 01:59

Sample : DA9GJ104 0094549 Si C300356-12 50X Mult: 3.0000 Dil'n: 50.000 Div: 30.000
Comment: 50(2)/15/320(5); I:250 D:320 Flow:5(2)/2/12(EOR) 0.3min pur
Method : HP HP6890 FID-B DB5.625 30mx0.32mmx0.25um M: 21-APR-2000
Calib : 25APR00 8015 Mod DSL(10,12-24)/OTP/JP4/MOT.OIL(19,24-36)/BZA M: 26-APR-2000
Baseline Subtract File: B04APR000942 , 3

Target Analyte Results

Name	RT1	RT2	Total Area	Amount	RL	
Diesel ~C10 to ~C24/03APR00	3.90 -	14.00	11822015	2968.8	50.000	
Motor Oil ~C19 to ~C36/21APR00	10.90 -	19.20	142087	34.931	250.00	U
Kerosene ~C8 to ~C16/25APR00	2.00 -	8.90	367152	91.040	50.000	
Unknown12-36 based on DSL10-24	5.60 -	19.20	11868390	3437.9	50.000	
Unknown12-36 based on MO 19-36	5.60 -	19.20	11868390	4069.7	250.00	O

per client: subtract peaks @ 9.527, 9.689:

11868390 - ~~6909520~~ = 4958870
- 11284567 = 583823

~~unk based on DSL:~~
~~$\frac{4958870}{19911} \times \frac{3}{30} \times \frac{50}{} = 1245.26$~~

unk based on DSL:
$\frac{583823}{19911} \times \frac{3}{30} \times \frac{50}{} = 146.608$

no motor oil due to matrix.
GAS 4/28/00

Surrogate Results

Peak Name	RT Actual	RT Diff	Area	Amount Present	Amount Spiked	%Rec
O-Terphenyl (Surr)/03A	10.796	-0.056	8670	1.5461	1.3333	116 %

D.O.

✓ Unknown Hydrocarbon in the range of n-C10 to n-C24. Quantitation based on DSL 10-24 between n-C12 and n-C36 only.
Units: ug/L for aqueous samples, mg/kg for soil samples.
O = Concentration > calibration range. U = Concentration < calibration range.
Multiplier = Final Extract Volume (ml), Divisor = Initial Sample Weight (g) or Volume (l) GAS 4/28/00

Group Peak Sum Ver 3.0 Reported at: 26-APR-2000 02:23:44

Injection Report

Acquired on 26-APR-2000 at 01:59

STL-Sacramento

Analyst Name : STAFFORL
Lims Id : 2FH
Comment : 50(2)/15/320(5); I:250 D:320 Flow:5(2)/2/12(EOR) 0.3min pur
Method Title : HP6890 FID-B DB5.625 30mx0.32mmx0.25um
Sample Name : DA9GJ104 0094549 Si C300356-12 50X
Sample Id : ,S,ETB
Sample Type : Sample Amount=1.00000
Bottle No : 22

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
1	2.064	1445	2894	
2	2.131	5873	23519	
3	2.331	1036	1685	
4	2.382	3915	12604	
33	7.609	1836	3375	
34	7.660	1866	3255	
36	8.000	3667	7715	
39	8.229	205318	281625	
40	8.362	10697	19955	
50	9.538	708247	5890732	
51	9.689	258530	689497	Σ= 11284567
52	10.271	771642	3343907	
53	10.293	892244	1360431	
54	10.529	37707	117609	
56	10.796	5634	8670	O-Terphenyl (Surr)/03APR00
58	10.940	5414	13905	
61	11.253	11861	24780	
62	11.364	3938	9316	
63	11.427	2688	6120	
64	11.516	11624	26140	
86	14.038	1652	4326	
100	15.764	1034	3434	
107	16.264	1174	5795	
109	16.587	1155	2637	
110	16.656	1429	4384	
112	16.918	1394	3281	
122	17.936	1355	3660	

Totals		
Unknowns	2967617	11926071
Named	5634	8670
Grand Total	2973251	11934741

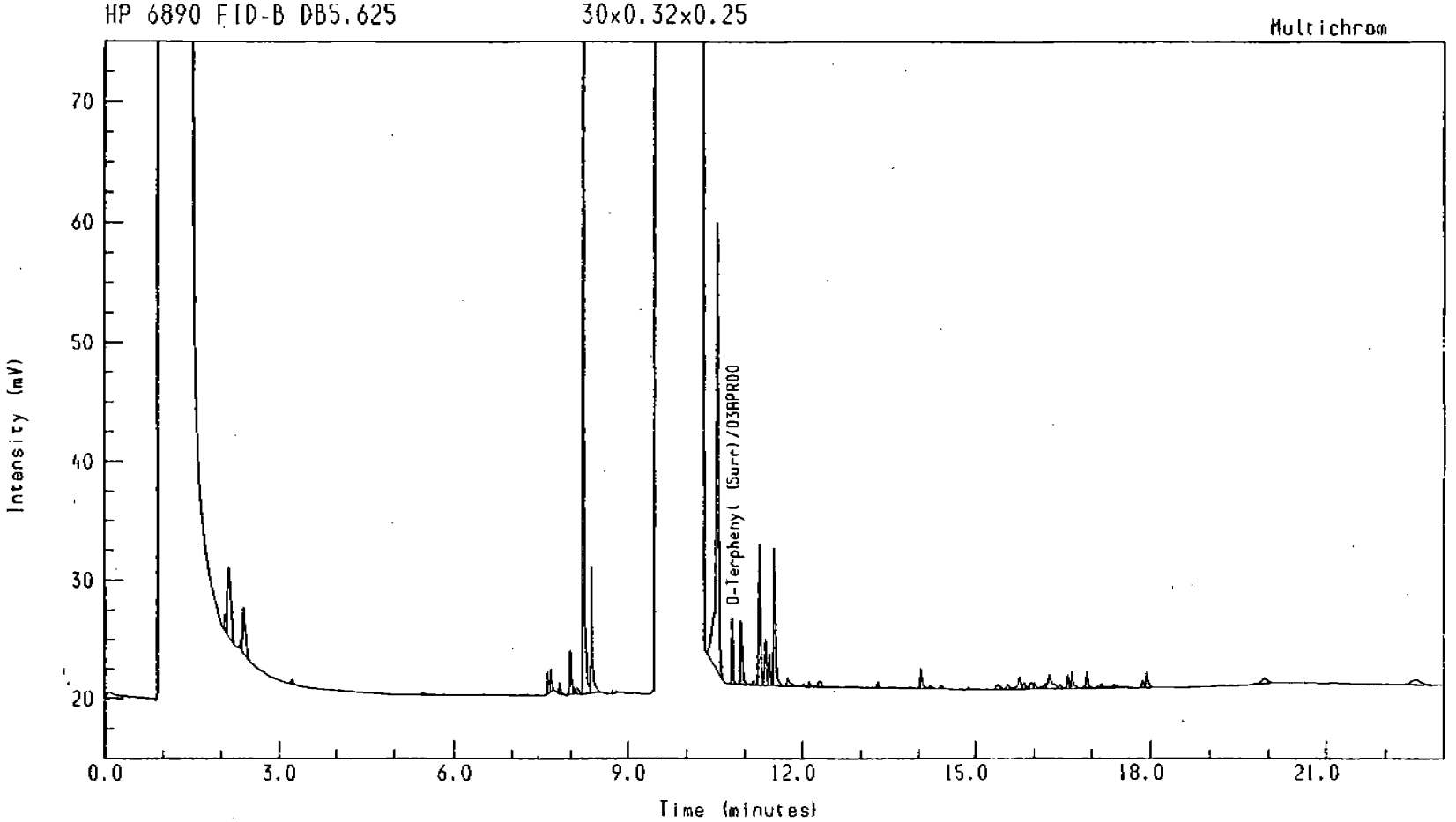
ANALYSIS SUMMARY

Method..... HP
Run sequence..... GCHP
Calibration..... 25APR00
External standard calibration using area
Calibration last modified on 26-APR-2000 at 01:53
Calibration initialised on 26-APR-1999 at 12:17
Method last modified on 21-APR-2000 at 10:33

Uncalibrated peaks use user factor (0.0000)

STL-Sacramento

Analysis Name : [APR2000] 90 70B25APR001508,22,1.
DA9GJ104 0094549 Si C300356-12 50X Amount : 1.000
HP 6890 FID-B DB5.625 30x0.32x0.25



Instrument : GC #70-B
Channel Title : HP 6890 FID-B
Lims ID : ,S,ETB
Acquired on 26-APR-2000 at 01:59
Reported on 26-APR-2000 at 02:23

Method : HP
Calibration : 25APR00
Run Sequence : GCHP

EARTH TECH INC

Client Sample ID: TNT-2F/2

GC Semivolatiles

Lot-Sample #...: G0C300256-013 **Work Order #...:** DA9GK202 **Matrix.....:** SO
Date Sampled...: 03/28/00 10:00 **Date Received..:** 03/30/00
Prep Date.....: 04/04/00 **Analysis Date..:** 04/26/00
Prep Batch #...: 0119152
Dilution Factor: 1
% Moisture.....: 16 **Method.....:** SW846 8015 MOD

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Unknown Hydrocarbon	**8.3**	**1.2**	**mg/kg**	**0.60**
TPH (as Diesel)	ND	1.2	mg/kg	0.68
TPH (as Kerosene)	ND	1.2	mg/kg	0.60
TPH (as Motor Oil)	ND	12	mg/kg	1.9

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
o-Terphenyl	0.0	(65 - 135)

NOTE(S):

Results and reporting limits have been adjusted for dry weight.

The unknown from n-C12 to n-C34 is quantitated with all peaks from n-C12 to n-C34 and based on diesel fuel (n-C10 to n-C24).

Quanterra / W. Sacramento
Multiple Eluter Result Summary

Analysis ID: [APR2000] 90 70B25APR001508,25
Acquired: GC #70-B 26-APR-2000 at 03:31

Sample : DA9GK102 0094549 Si C300356-13 Mult: 3.0000 Dil'n: 1.0000 Div: 30.000
Comment: 50(2)/15/320(5); I:250 D:320 Flow:5(2)/2/12(EOR) 0.3min pur
Method : HP HP6890 FID-B DB5.625 30mx0.32mmx0.25um M: 21-APR-2000
Calib : 25APR00 8015 Mod DSL(10,12-24)/OTP/JP4/MOT.OIL(19,24-36)/BZA M: 26-APR-2000
Baseline Subtract File: B04APR000942 , 3

Target Analyte Results

Name	RT1	RT2	Total Area	Amount	RL	
Diesel ~C10 to ~C24/03APR00	3.90 -	14.00	13345192	67.025	1.0000	
Motor Oil ~C19 to ~C36/21APR00	10.90 -	19.20	5658512	27.822	5.0000	
Kerosene ~C8 to ~C16/25APR00	2.00 -	8.90	1384460	6.8659	1.0000	
Unknown12-36 based on DSL10-24	5.60 -	19.20	13576866	78.655	1.0000	
Unknown12-36 based on MO 19-36	5.60 -	19.20	13576866	93.110	5.0000	O

per client, subtract OOR peak:

13576866 - 11508340 = 2068526

Unk based on DSL:

$\frac{2068526}{19911} \times \frac{3}{30} = 6.9156$

OTP masked by OOR Peak. GAS 4/28/00

✓ Unknown Hydrocarbon in the range of n-C12 to n-C34. Quantitation based on DSL 10-24 between n-C12 and n-C36 only.
Units: ug/L for aqueous samples, mg/kg for soil samples.
O = Concentration > calibration range. U = Concentration < calibration range.
Multiplier = Final Extract Volume (ml). Divisor = Initial Sample Weight (g) or Volume (l)

Group Peak Sum Ver 3.0 Reported at: 26-APR-2000 03:55:21

Injection Report

Acquired on 26-APR-2000 at 03:31

STL-Sacramento

Analyst Name : STAFFORL
Lims Id : 2FH
Comment : 50(2)/15/320(5); I:250 D:320 Flow:5(2)/2/12(EOR) 0.3min pur
Method Title : HP6890 FID-B DB5.625 30mx0.32mmx0.25um
Sample Name : DA9GK102 0094549 Si C300356-13
Sample Id : ,S,ETB
Sample Type : Sample Amount=1.00000
Bottle No : 25

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
2	2.011	2953	14851	
10	3.222	15452	36010	
13	3.569	1102	2398	
15	3.738	1044	2196	
16	3.820	1610	5336	
36	5.469	1783	3073	
59	7.511	1212	1459	
60	7.580	60417	82873	
61	7.649	19010	31100	
63	7.940	4536	6873	
64	7.989	23785	34895	
65	8.104	3966	6799	
66	8.249	587854	1013477	
67	8.360	75891	105951	
71	8.771	4559	8514	
78	9.540	700338	5925592	Σ= 11508340
79	9.689	257650	687150	
82	10.931	888751	4895598	
83	11.069	111236	324544	
84	11.353	9938	36611	
86	11.607	12132	34435	
87	11.680	11439	41964	
88	11.820	11381	35134	
90	12.189	1618	3077	
98	12.767	2526	4630	
105	13.327	3435	7211	
110	13.864	3724	7417	
115	14.384	5847	12610	
120	14.887	4640	9206	
125	15.371	6587	15745	
127	15.564	1032	3104	
129	15.769	3298	9994	
130	15.838	4872	10468	
132	15.947	1929	6688	Benzo(a)pyrene (Surr)/

Peak	RT mins	Hght uV	Area uVs	Peak name
135	16.189	1096	3132	
136	16.289	6175	20439	
137	16.347	1514	5574	
138	16.449	2263	5712	
139	16.578	6030	12648	
140	16.649	7506	19319	
141	16.729	1941	4145	
142	16.856	1789	4137	
143	16.907	8528	19083	
145	17.156	3086	8523	
146	17.291	1757	3543	
147	17.358	4202	14300	
152	17.853	6068	11488	
153	17.920	13150	29201	

Totals		
Unknowns	2942578	13668416
Named	1929	6688
Grand Total	2944507	13675104

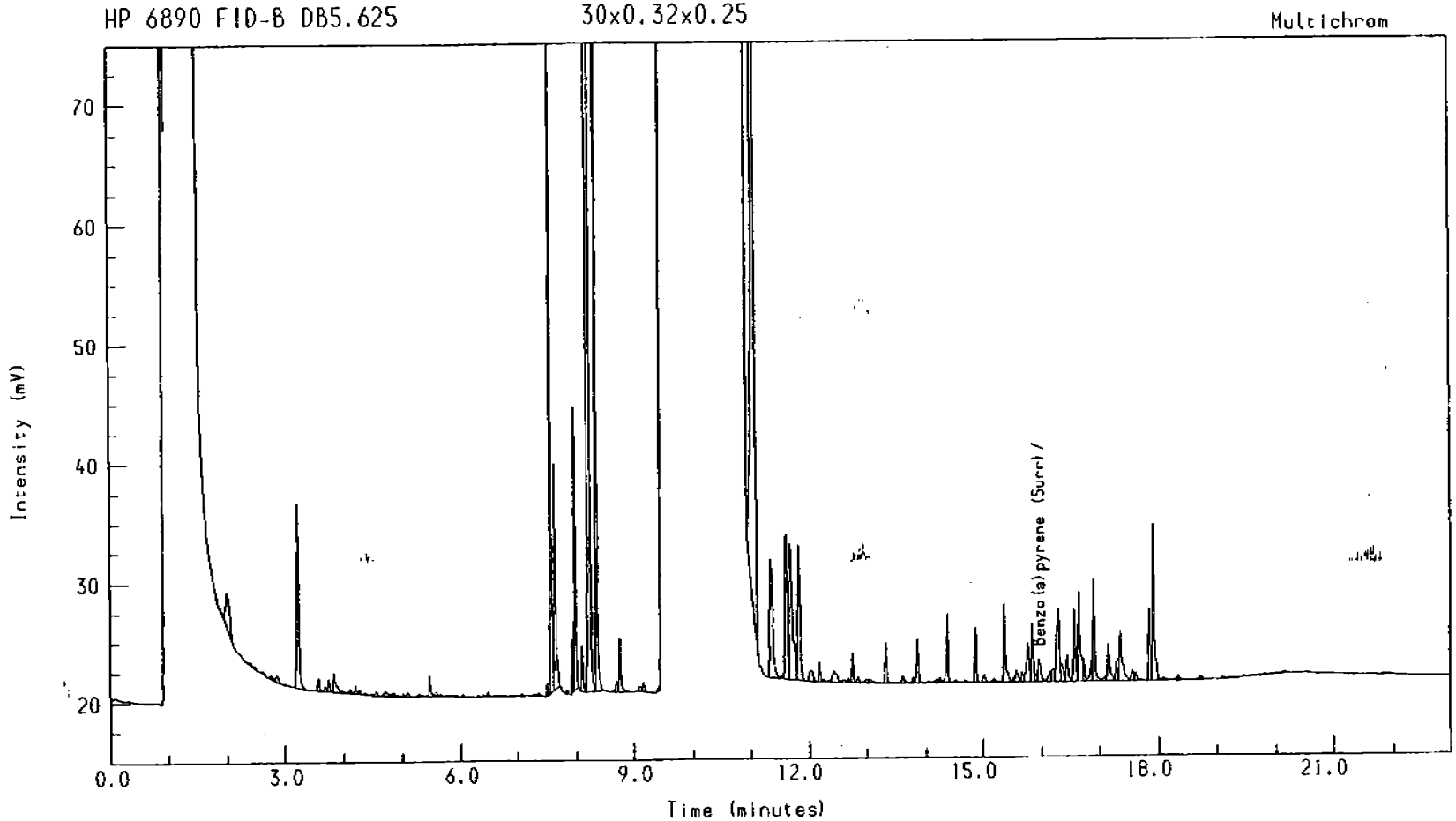
ANALYSIS SUMMARY

Method..... HP
Run sequence..... GCHP
Calibration..... 25APR00
External standard calibration using area
Calibration last modified on 26-APR-2000 at 03:24
Calibration initialised on 26-APR-1999 at 12:17
Method last modified on 21-APR-2000 at 10:33

Uncalibrated peaks use user factor (0.0000)

STL-Sacramento

Analysis Name : [APR2000] 90 70B25APR001508,25,1.
DA9GK102 0094549 Si C300356-13 Amount : 1.000
HP 6890 FID-B DB5.625 30x0.32x0.25



Instrument : GC #70-B
Channel Title : HP 6890 FID-B
Lims ID : ,S,ETB
Acquired on 26-APR-2000 at 03:31
Reported on 26-APR-2000 at 03:54

Method : HP
Calibration : 25APR00
Run Sequence : GCHP

EARTH TECH INC

Client Sample ID: TNT-1Q/0

GC Semivolatiles

Lot-Sample #...: G0C300256-014 **Work Order #...:** DA9GL202 **Matrix.....:** SO
Date Sampled...: 03/28/00 10:35 **Date Received..:** 03/30/00
Prep Date.....: 04/04/00 **Analysis Date..:** 04/26/00
Prep Batch #...: 0119152
Dilution Factor: 1
% Moisture.....: 16 **Method.....:** SW846 8015 MOD

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Unknown Hydrocarbon	**3.7**	**1.2**	**mg/kg**	**0.59**
TPH (as Diesel)	ND	1.2	mg/kg	0.68
TPH (as Kerosene)	ND	1.2	mg/kg	0.59
TPH (as Motor Oil)	ND	12	mg/kg	1.8

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
o-Terphenyl	105	(65 - 135)

NOTE(S):

Results and reporting limits have been adjusted for dry weight.

The unknown from n-C16 to n-C40 is quantitated with all peaks from n-C12 to n-C36 and based on diesel fuel (n-C10 to n-C24).

Quanterra / W. Sacramento
Multiple Eluter Result Summary

Analysis ID: [APR2000] 90 70B25APR001508,26
Acquired: GC #70-B 26-APR-2000 at 04:01

Sample : DA9GL102 0094549 Si C300356-14 Mult: 3.0000 Dil'n: 1.0000 Div: 30.000
Comment: 50(2)/15/320(5); I:250 D:320 Flow:5(2)/2/12(EOR) 0.3min pur
Method : HP HP6890 FID-B DB5.625 30mx0.32mmx0.25um M: 21-APR-2000
Calib : 25APR00 8015 Mod DSL(10,12-24)/OTP/JP4/MOT.OIL(19,24-36)/BZA M: 26-APR-2000
Baseline Subtract File: B04APR000942 , 3

Target Analyte Results

Name	RT1	RT2	Total Area	Amount	RL	
Diesel ~C10 to ~C24/03APR00	3.90 -	14.00	17480048	**87.792**	1.0000	O
Motor Oil ~C19 to ~C36/21APR00	10.90 -	19.20	537449	2.6426	5.0000	U
Kerosene ~C8 to ~C16/25APR00	2.00 -	8.90	102695	0.50929	1.0000	U
Unknown12-36 based on DSL10-24	5.60 -	19.20	17834989	**103.32**	1.0000	O
Unknown12-36 based on MO 19-36	5.60 -	19.20	17834989	122.31	5.0000	O

per client, subtract OOR peak:

17834989 - 17206063 = 628926

Unk based on DSL: $\frac{628926}{19911} \times \frac{3}{30} = 3.158686$

Surrogate Results

Peak Name	RT Actual	RT Diff	Area	Amount Present	Amount Spiked	%Rec
O-Terphenyl (Surr)/03A	10.751	-0.011	393166	1.4022	1.3333	105 %

There were 2 peaks which may be flat-topped. Check the chromatogram.

✓ Unknown Hydrocarbon in the range of n-C16 to n-C40. Quantitation based on DSL 10-24 between n-C12 and n-C36 only.
Units: ug/L for aqueous samples, mg/kg for soil samples.
O = Concentration > calibration range. U = Concentration < calibration range.
Multiplier = Final Extract Volume (ml). Divisor = Initial Sample Weight (g) or Volume (l) MS 4/28/00

Group Peak Sum Ver 3.0 Reported at: 26-APR-2000 04:25:21

Injection Report

Acquired on 26-APR-2000 at 04:01

STL-Sacramento

Analyst Name : STAFFORL
Lims Id : 2FH
Comment : 50(2)/15/320(5); I:250 D:320 Flow:5(2)/2/12(EOR) 0.3min pur
Method Title : HP6890 FID-B DB5.625 30mx0.32mmx0.25um
Sample Name : DA9GL102 0094549 Si C300356-14
Sample Id : ,S,ETB
Sample Type : Sample Amount=1.00000
Bottle No : 26

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
2	2.013	1740	9552	
8	3.227	8761	24252	
62	7.658	10823	18873	
66	8.233	10341	20110	
76	9.584	967538	10806141	Σ= 17206063
77	9.707	967528	6399922	
80	10.178	5364	22255	
85	10.751	253685	393166	O-Terphenyl (Surr)/03APR00
87	11.051	6288	13349	
90	11.260	1110	2617	
91	11.340	20516	42406	
96	12.047	1008	5543	
97	12.196	2799	12947	
102	12.762	1274	4751	
104	12.900	1072	3711	
109	13.327	2774	8076	
116	13.867	2048	10001	
120	14.389	7628	20873	
123	14.889	3244	11199	
124	15.044	1504	7456	
128	15.376	10926	26750	
129	15.533	1455	6307	
133	15.844	4216	11918	
134	16.004	12027	29330	Benzo(a)pyrene (Surr)/
135	16.129	1082	3823	
137	16.300	23005	47957	
138	16.464	1057	6743	
142	16.738	3262	9365	
143	16.904	4062	11388	
145	17.091	7463	15673	
146	17.164	25983	54513	
151	17.578	2178	5401	
152	17.749	1198	3583	
155	17.976	10810	23126	

Peak	RT mins	Hght uV	Area uVs	Peak name
159	18.364	1122	2900	
162	18.742	1831	4181	

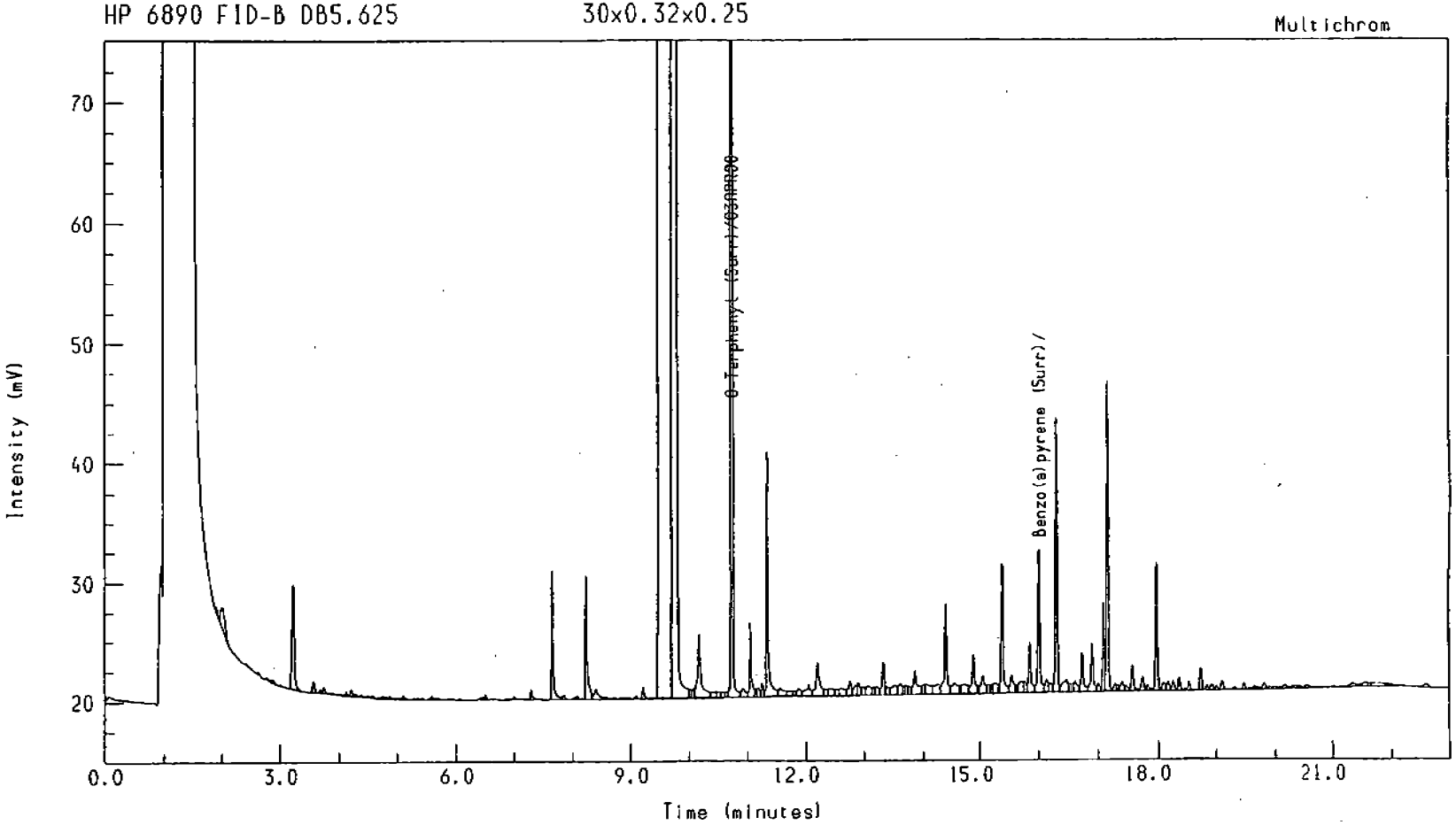
Totals		
Unknowns	2182225	17913836
Named	265712	422497
Grand Total	2447937	18336332

ANALYSIS SUMMARY

Method..... HP
Run sequence..... GCHP
Calibration..... 25APR00
External standard calibration using area
Calibration last modified on 26-APR-2000 at 03:55
Calibration initialised on 26-APR-1999 at 12:17
Method last modified on 21-APR-2000 at 10:33

Uncalibrated peaks use user factor (0.0000)

Analysis Name : [APR2000] 90 70B25APR001508,26,1.
DA9GL102 0094549 Si C300356-14 Amount : 1.000
HP 6890 FID-B DB5.625 30x0.32x0.25



Instrument : GC #70-B
Channel Title : HP 6890 FID-B
Lims ID : ,S,ETB
Acquired on 26-APR-2000 at 04:01
Reported on 26-APR-2000 at 04:24

Method : HP
Calibration : 25APR00
Run Sequence : GCHP

EARTH TECH INC

Client Sample ID: TNT-1Q/1

GC Semivolatiles

Lot-Sample #...: G0C300256-015 Work Order #...: DA9GM202 Matrix.....: SO
Date Sampled...: 03/28/00 10:55 Date Received..: 03/30/00
Prep Date.....: 04/04/00 Analysis Date..: 04/26/00
Prep Batch #...: 0119152
Dilution Factor: 1
% Moisture.....: 17 Method.....: SW846 8015 MOD

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Unknown Hydrocarbon	12	1.2	mg/kg	0.60
TPH (as Diesel)	ND	1.2	mg/kg	0.69
TPH (as Kerosene)	ND	1.2	mg/kg	0.60
TPH (as Motor Oil)	ND	12	mg/kg	1.9

SURROGATE	PERCENT RECOVERY	RECOVERY LIMITS
o-Terphenyl	0.0	(65 - 135)

NOTE(S):

Results and reporting limits have been adjusted for dry weight.

The unknown from n-C08 to n-C34 is quantitated with all peaks from n-C12 to n-C36 and based on diesel fuel (n-C10 to n-C24).

Quanterra / W. Sacramento
Multiple Eluter Result Summary

Analysis ID: [APR2000] 90 70B25APR001508,27
Acquired: GC #70-B 26-APR-2000 at 04:32

Sample : DA9GM102 0094549 Si C300356-15 Mult: 3.0000 Dil'n: 1.0000 Div: 30.000
Comment: 50(2)/15/320(5); I:250 D:320 Flow:5(2)/2/12(EOR) 0.3min pur
Method : HP HP6890 FID-B DB5.625 30mx0.32mmx0.25um M: 21-APR-2000
Calib : 25APR00 8015 Mod DSL(10,12-24)/OTP/JP4/MOT.OIL(19,24-36)/BZA M: 26-APR-2000
Baseline Subtract File: B04APR000942 , 3

Target Analyte Results

Name	RT1	RT2	Total Area	Amount	RL	
Diesel ~C10 to ~C24/03APR00	3.90 -	14.00	11909015	59.812	1.0000	
Motor Oil ~C19 to ~C36/21APR00	10.90 -	19.20	4546068	22.352	5.0000	
Kerosene ~C8 to ~C16/25APR00	2.00 -	8.90	1163810	5.7716	1.0000	
Unknown12-36 based on DSL10-24	5.60 -	19.20	12219266	70.790	1.0000	
Unknown12-36 based on MO 19-36	5.60 -	19.20	12219266	83.799	5.0000	O

per client: subtract OOR Peak:

12219266 − 10271959 = 1947307

Unk based on DSL:

$$\frac{1947307}{19911} \times \frac{3}{30} = 9.780056$$

GAS 4/28/00

Surrogate Results

Peak Name	RT Actual	RT Diff	Area	Amount Present	Amount Spiked	%Rec
O-Terphenyl (Surr)/03A	10.813	-0.073	29	0.000104	1.3333	0.00%

✓ Unknown Hydrocarbon in the range of n-C8 to n-C34. Quantitation based on DSL 10-24 between n-C12 and n-C36 only.
Units: ug/L for aqueous samples, mg/kg for soil samples.
O = Concentration > calibration range. U = Concentration < calibration range.
Multiplier = Final Extract Volume (ml), Divisor = Initial Sample Weight (g) or Volume (l)

Group Peak Sum Ver 3.0 Reported at: 26-APR-2000 04:56:23

Injection Report

Acquired on 26-APR-2000 at 04:32

STL-Sacramento

Analyst Name : STAFFORL
Lims Id : 2FH
Comment : 50(2)/15/320(5); I:250 D:320 Flow:5(2)/2/12(EOR) 0.3min pur
Method Title : HP6890 FID-B DB5.625 30mx0.32mmx0.25um
Sample Name : DA9GM102 0094549 Si C300356-15
Sample Id : ,S,ETB
Sample Type : Sample Amount=1.00000
Bottle No : 27

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
1	2.004	2085	10084	
8	3.218	11487	26330	
13	3.809	3911	7218	
17	4.109	1023	2831	
28	4.798	1649	2455	
32	5.018	1275	1560	
35	5.191	1221	2186	
39	5.464	6390	10453	
41	5.618	1971	2969	
42	5.720	1830	2795	
50	6.202	3502	6175	
51	6.369	3210	7978	
52	6.440	2566	3675	
53	6.487	2607	3943	
63	7.056	4300	7225	
65	7.262	5460	10398	
66	7.362	2486	3626	
67	7.398	1385	2138	
68	7.524	1400	3179	
69	7.589	9640	15213	
70	7.651	16475	22926	
71	7.738	3467	5644	
74	7.938	7352	10925	
75	7.989	19618	29592	
76	8.056	4162	7154	
77	8.107	3479	5656	
78	8.176	4678	7324	
79	8.244	505013	805986	
80	8.358	51305	72260	
81	8.449	1129	3490	
86	8.782	1056	1910	
87	8.822	3268	5730	
90	9.100	1053	2726	
91	9.164	3202	7523	

Peak	RT mins	Hght uV	Area uVs	Peak name
95	9.540	701379	5901961	
96	9.689	258033	688172	
100	11.133	204454	204468	
101	11.236	876252	3477358	
102	11.340	71237	188565	
103	11.576	17879	67218	
104	11.804	14998	39770	
105	11.864	22225	97431	
106	11.996	23706	79922	
107	12.196	1772	7657	
110	12.560	1335	4614	
111	12.616	1206	3396	
112	12.776	1234	4504	
119	13.331	2248	5082	
124	13.869	2186	4528	
130	14.271	1124	2446	
131	14.389	6080	12731	
136	14.887	3783	7356	
141	15.373	7325	15769	
143	15.580	1332	4755	
145	15.784	3222	10768	
146	15.844	4973	11323	
148	15.953	2524	5078	Benzo(a)pyrene (Surr)/
149	15.989	2044	4790	
151	16.156	1062	2531	
152	16.207	1491	3804	
153	16.291	8154	23282	
154	16.362	1858	7148	
155	16.456	2502	6496	
156	16.584	5893	12872	
157	16.662	7768	27675	
158	16.904	10999	35027	
161	17.158	4808	13001	
162	17.296	1469	3213	
163	17.360	5173	17367	
164	17.418	4160	9672	
165	17.573	1412	4959	
169	17.858	10641	20042	
170	17.927	27818	55726	

Σ = 10271959

EWS 4/28/00

Totals		
Unknowns	3069892	12347338
Named	2524	5078
Grand Total	3072416	12352416

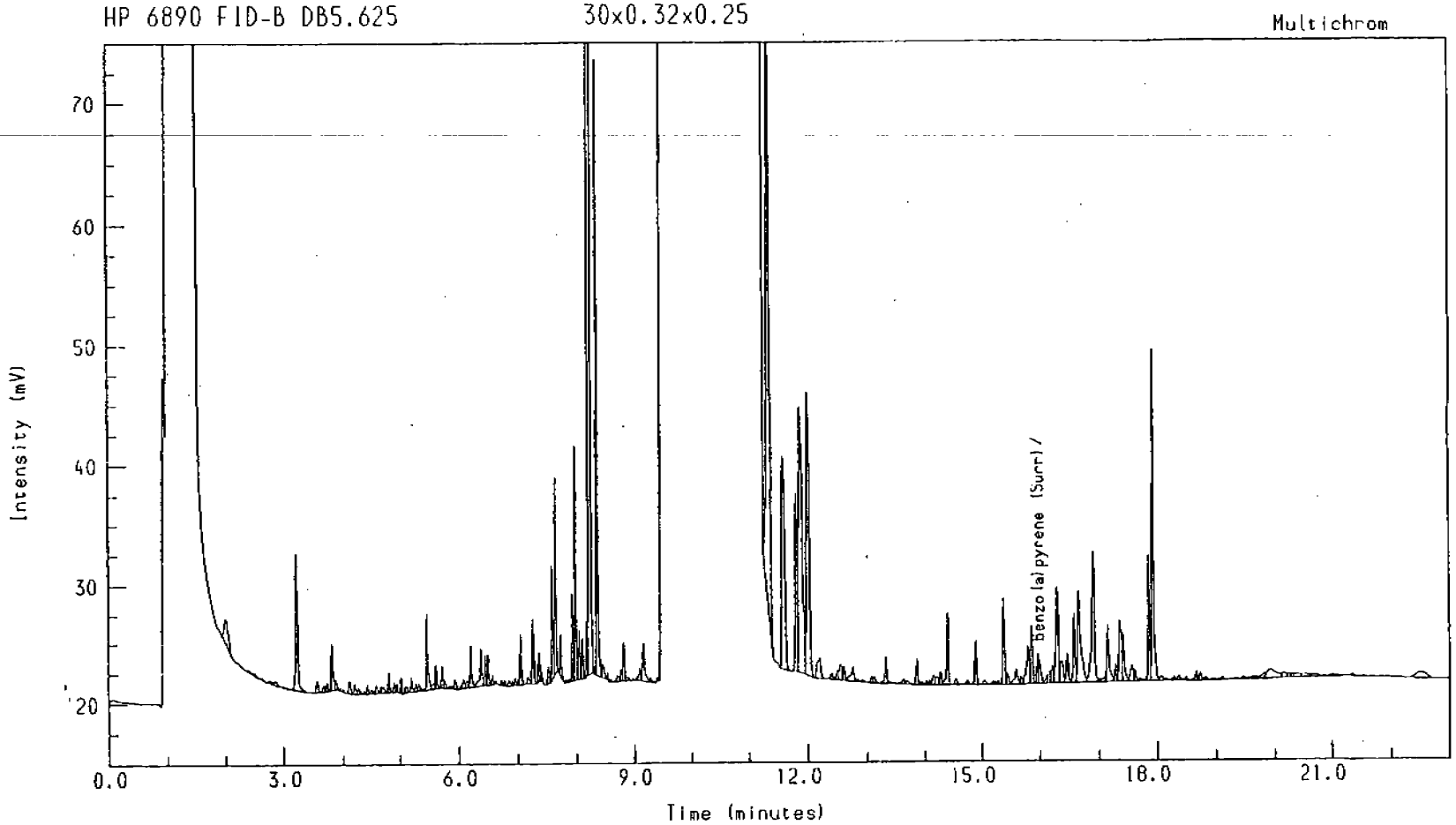
ANALYSIS SUMMARY

Method..... HP
Run sequence..... GCHP
Calibration..... 25APR00
External standard calibration using area
Calibration last modified on 26-APR-2000 at 04:25
Calibration initialised on 26-APR-1999 at 12:17
Method last modified on 21-APR-2000 at 10:33

Uncalibrated peaks use user factor (0.0000)

STL-Sacramento

Analysis Name : [APR2000] 90 70B25APR001508,27,1.
DA9GM102 0094549 Si C300356-15 Amount : 1.000
HP 6890 FID-B DB5.625 30x0.32x0.25



Instrument : GC #70-B
Channel Title : HP 6890 FID-B
Lims ID : ,S,ETB
Acquired on 26-APR-2000 at 04:32
Reported on 26-APR-2000 at 04:56

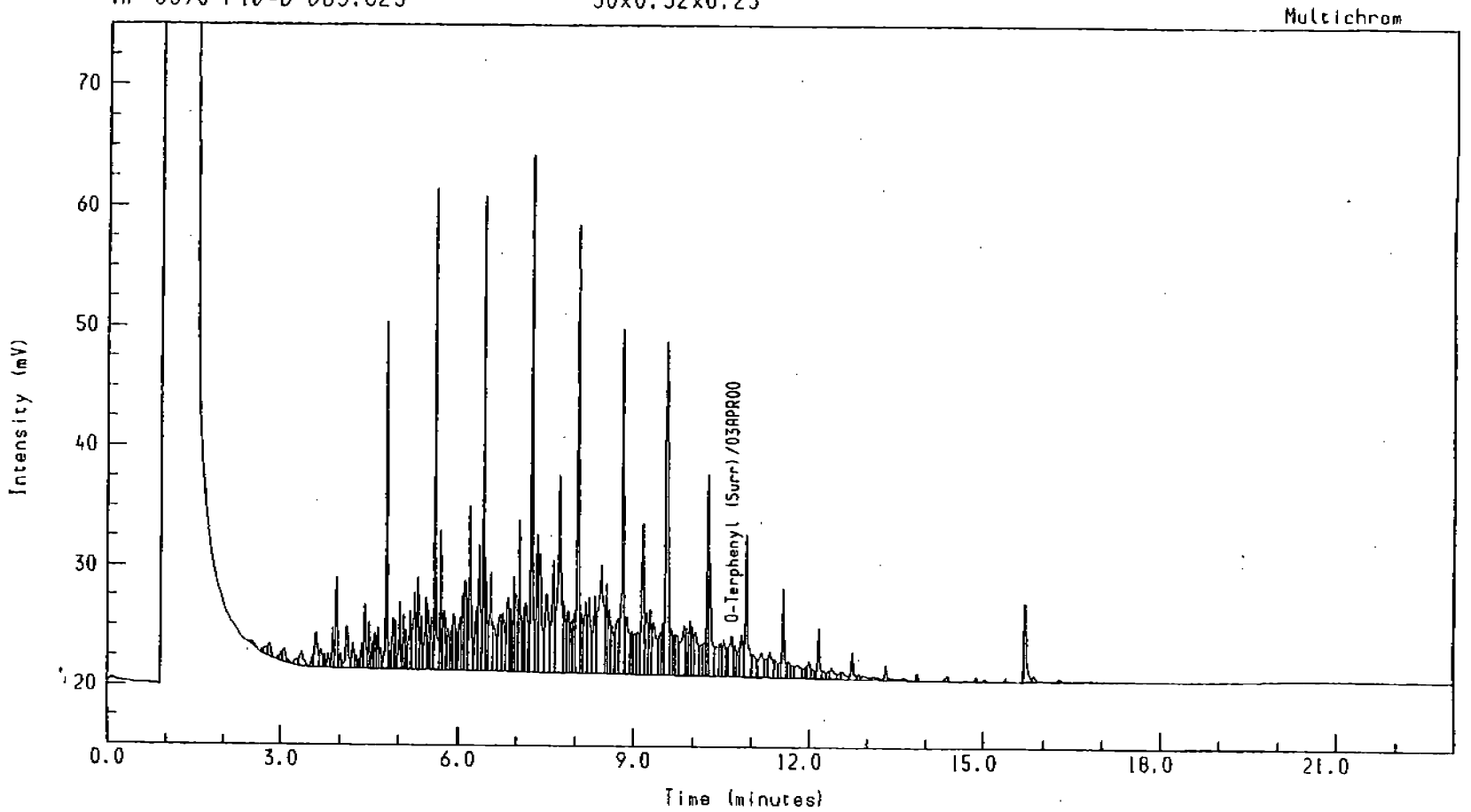
Method : HP
Calibration : 25APR00
Run Sequence : GCHP

ATTACHMENT I-2

TEPH STANDARD CHROMATOGRAMS FOR DIESEL, MOTOR OIL, AND KEROSENE

STL-Sacramento

Analysis Name : [APR2000] 90 70B07APR000728,89,1.
100 PPM DIESEL H012700D Amount : 1.000
HP 6890 FID-B DB5.625 30x0.32x0.25

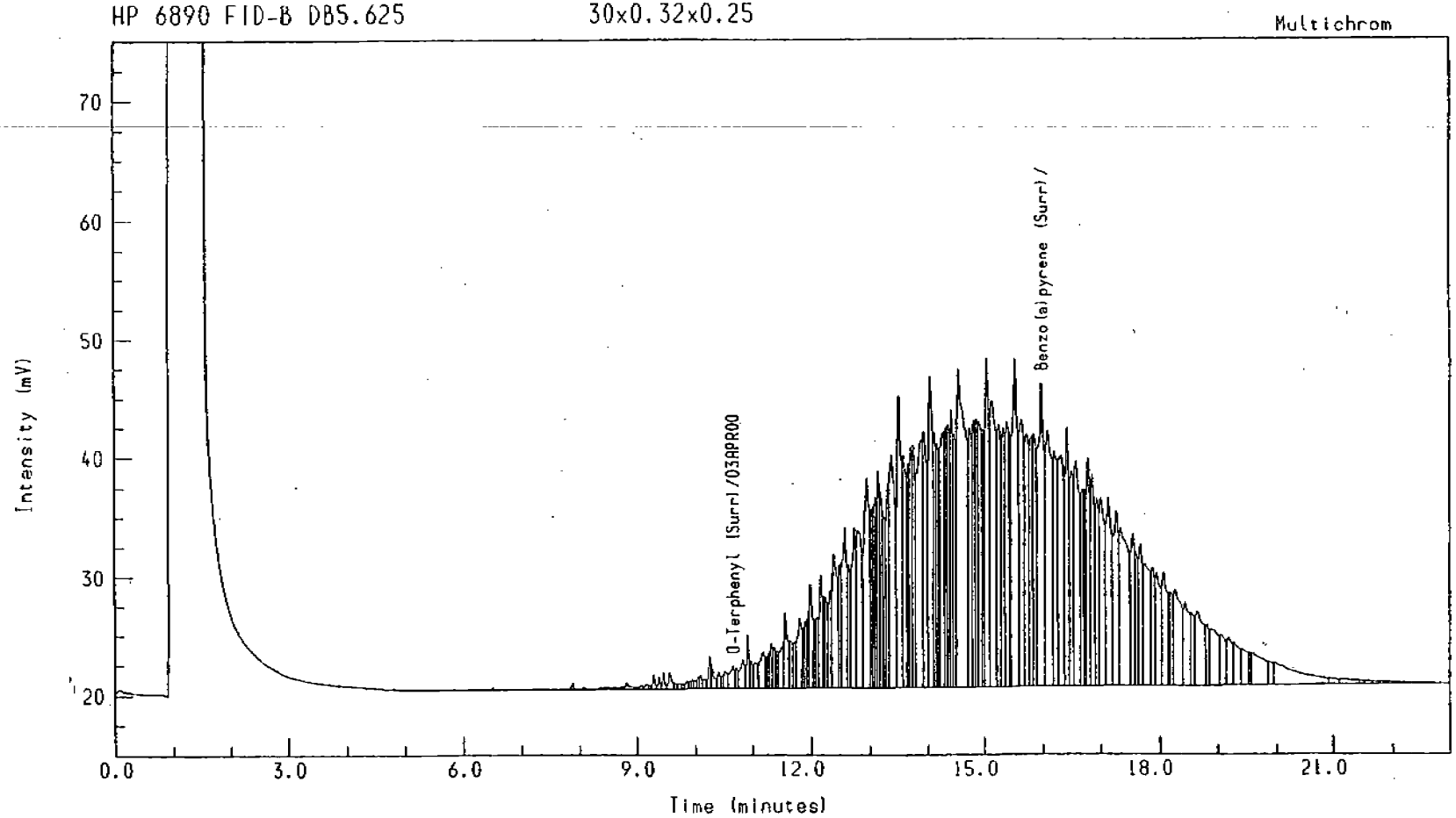


Instrument : GC #70-B
Channel Title : HP 6890 FID-B
Lims ID :
Acquired on 9-APR-2000 at 05:10
Reported on 9-APR-2000 at 05:33

Method : HP
Calibration : 03APR00
Run Sequence : GCHP

STL-Sacramento

Analysis Name : [APR2000] 90 70B07APR000728,88,1.
300 PPM MOTOR OIL H022900G Amount : 1.000
HP 6890 FID-B DB5.625 30x0.32x0.25

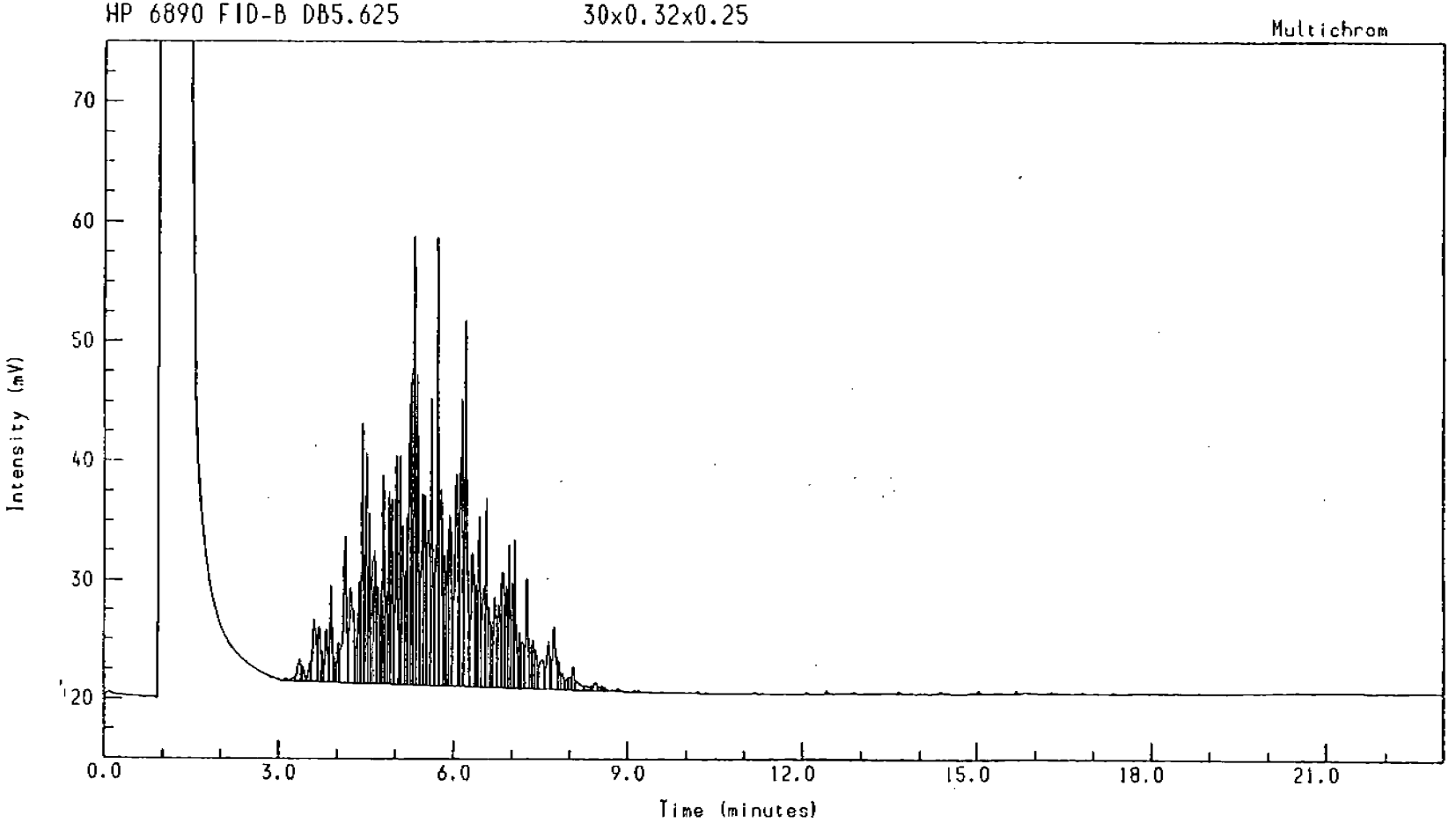


Instrument : GC #70-B
Channel Title : HP 6890 FID-B
Lims ID :
Acquired on 9-APR-2000 at 04:39
Reported on 9-APR-2000 at 05:03

Method : HP
Calibration : 03APR00
Run Sequence : GCHP

STL-Sacramento

Analysis Name : [APR2000] 90 70B07APR000728,90,1.
100 PPM KEROSENE H120699C Amount : 1.000
HP 6890 FID-B DB5.625 30x0.32x0.25



Instrument : GC #70-B
Channel Title : HP 6890 FID-B
Lims ID :
Acquired on 9-APR-2000 at 05:40
Reported on 9-APR-2000 at 06:03

Method : HP
Calibration : 03APR00
Run Sequence : GCHP