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ARSENIC BACKGROUND STUDY REPORT NS MAYPORT FL
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TETRA TECH

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Project Number 112G00436

Naval Facilities Engineering Command, Southeast
ATTN: Dana Hayworth, Remedial Project Manager
South Atlantic IPT
135 Ajax Street North
Jacksonville, Florida 32212-0030

Reference: CLEAN IV Contract Number N62467-04-D-0055
Contract Task Order 0033

Subject: Arsenic Background Study Report
Naval Station Mayport, Mayport, Florida

Dear Mr. Hayworth:

Tetra Tech NUS, Inc. (TtNUS) is pleased to submit the Arsenic Background Study Report at Naval Station (NAVSTA) Mayport, Florida. This report was prepared for the United States Navy, Naval Facilities Engineering Command Southeast (NAVFAC SE) under Contract Task Order (CTO) 0033 for the Comprehensive Long-term Environmental Action Navy (CLEAN) IV Contract Number N62467-04-D-0055. The purpose of the Arsenic Background Study was to establish the background arsenic concentrations in soil at NAVSTA Mayport by determining if there is a statistically significant difference in the arsenic concentrations detected in soils associated with sites [e.g., Solid Waste Management Units (SWMUs), Areas of Concerns, and Underground Storage Tanks Sites] found throughout the installation versus soils collected away from these sites, including industrial areas of operation and known native soil areas. This report presents the analytical results from the Arsenic Background Study, a discussion of statistical analyses performed on this analytical data, and the established background concentration for arsenic in soils at NAVSTA Mayport.

BACKGROUND

Soils at NAVSTA Mayport are predominantly composed of dredged fill material. With the concentrations of arsenic in soils being fairly consistent throughout the various sites at the facility, the Navy proposes to use the results of this study to determine background arsenic concentrations in soil at NAVSTA Mayport.

Past sampling activities at the NAVSTA Mayport SWMUs have yielded more than 800 soil samples. The soil sampling locations completed at NAVSTA Mayport prior to this background study are depicted on Figure 1. These samples were collected over several years from surface and subsurface soil intervals. The surface depth interval is 0 to 1 foot below ground surface (bgs) and all other depths below 1 foot represent subsurface soil. The data sets for this study include the surface and subsurface soil sampling results available via the Environmental Geographic Information System (EGIS) database for NAVSTA Mayport as of May 2007 (Revision 4.1). A total of 416 sample results represent the site surface soil arsenic concentrations, and a total of 395 sample results represent the site subsurface soil arsenic concentrations. The arsenic concentrations detected in soil at the facility ranged from 15.6 to 0.006 (non-detect) milligrams per kilogram (mg/kg) with a combined surface and subsurface mean of 1.15 mg/kg and a combined median of 0.77 mg/kg. The Florida Department of Environmental Protection (FDEP) Soil Cleanup Target

Level (SCTL) for arsenic in a residential direct exposure scenario is 2.1 mg/kg. The FDEP SCTL for arsenic in an industrial direct exposure scenario is 12 mg/kg.

To fulfill study sampling objectives, TtNUS collected additional samples in 40 previously unsampled areas to provide adequate spatial and statistical coverage for NAVSTA Mayport base-wide arsenic concentrations in soil (Figure 2). Soil sampling activities were performed in accordance with TtNUS' final Arsenic Background Study Workplan (January 2008). The statistical methodology developed by TtNUS in conjunction with the FDEP and the University of Florida and used to determine the arsenic sample locations for this background study is provided in Attachment 1. Additional information regarding the basis for the analytical approach for the Arsenic Background Study can be found in the Response to Comments for the University of Florida dated June 22, 2007 (see Attachment 2).

SUMMARY OF FIELD ACTIVITIES

To support background arsenic soil assessment activities throughout the base, TtNUS collected soil samples using hand augering at 40 locations across the facility. Two soil samples were collected at each location. Forty surface soil samples were collected within the upper 1 foot (0 to 1 foot bgs) and 40 subsurface soil samples (80 total soil samples) were collected above the water table over at depths ranging from 2 to 13 feet bgs. Soil sample locations are shown on Figure 2. The sampling event was conducted from November 26 through December 13, 2007, after FDEP approval was given in November 2007 to proceed with field investigations based upon a review of the draft document and coordination with TtNUS, the FDEP, and the University of Florida.

Soil sampling procedures were conducted in accordance with FDEP Standard Operating Procedures 001/01: FS3000: Soil Sampling and FS1000: General Sampling Procedures. Twelve equipment rinseate blank samples were also collected. Each soil sample location was surveyed with a Trimble global positioning system unit that is capable of achieving an accuracy of less than 1 meter. Following completion of the field sampling event, all survey data was entered into the EGIS database for NAVSTA Mayport. The field notes, soil boring logs, and chain-of-custody forms completed by TtNUS for the 40 soil sampling locations shown on Figure 2 are provided in Attachment 3. The analytical data for arsenic soil samples collected during this study are provided in Attachment 4.

STATISTICAL ANALYSES

In June of 2008, statistical analyses were finalized using analytical data for site arsenic concentrations and arsenic concentrations from previously unsampled areas to determine the relative magnitudes of arsenic concentrations in these two categories. Two specific areas at the installation that are known to be native soil are represented in the sampling scheme; therefore, arsenic concentrations for these areas were compared to arsenic concentrations from the other areas containing dredged material. A distinction between surface and subsurface soils associated with sites found throughout the installation and surface and subsurface soils collected away from these sites was made as part of these statistical analyses.

The statistical analyses performed on the analytical data for arsenic in soils at NAVSTA Mayport was completed with consideration given to FDEP's March 2008 "Guidance for Comparing Background and Site Chemical Concentrations in Soil". In addition to the FDEP guidance, on-going communications were held between TtNUS, the FDEP, and the University of Florida from April 2008 until June 2008 while the overall statistical analysis was developed for arsenic in soils at the base. Based upon the draft version of the statistical analyses for arsenic in soils at NAVSTA Mayport, the University of Florida submitted comments to TtNUS. The Response to Comments Summary for the University of Florida dated June 17, 2008, is provided in Attachment 5.

Once the comments regarding the draft version of the statistical analyses were resolved, the statistical analyses were finalized and re-submitted to the FDEP and the University of Florida. The results of the statistical analyses performed on surface soil at NAVSTA Mayport are presented in Attachment 6. The

results of the statistical analyses performed on subsurface soil at NAVSTA Mayport are presented in Attachment 7.

Surface Soil Comparisons

Forty surface soil samples were collected from areas not previously sampled and located away from the sites and industrial operations located throughout NAVSTA Mayport. Four of the 40 samples were collected in areas representative of known native soils. Therefore, analytical data for arsenic in 36 of the 40 surface soil samples collected (representing background arsenic concentrations) were statistically compared with historical analytical data for arsenic in surface soil at NAVSTA Mayport (representing site arsenic concentrations).

Table 1 contains the descriptive statistics for the background and site surface soil arsenic concentrations. From Table 1, it can be seen that the mean and median concentrations are similar (with a difference of 0.71 and 0.02, respectively), as verified with a formal statistical test. It can also be seen that the lower and upper quartile (25th percentile and 75th percentile, respectively) are similar (with a difference of 0.07 and 0.10, respectively). Further statistical analysis concluded that the site surface soil arsenic concentrations are within the range of the background surface soil arsenic concentrations.

Table 1 - Descriptive Statistics for Arsenic in Surface Soil – Site versus Background

Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std. Dev.
Site	416	1.10	0.79	0.06	13.90	0.51	1.20	1.24
Background	36	1.81	0.81	0.31	12.40	0.58	1.30	2.92

Included in the 40 surface soil samples were four samples collected from known native soil sites. The native surface soil samples were statistically compared with the site arsenic concentrations. Table 2 contains the descriptive statistics for the native and site surface soil arsenic concentrations. From Table 2, it can be seen that the mean concentrations are different with a difference of 0.71 whereas the median concentrations are relatively similar with a difference of 0.43. It can also be seen that the maximum native soil arsenic concentration is the same as the lower quartile (25th percentile) for the site surface soil arsenic concentrations. From this small sample size it appears that the site surface soil arsenic concentrations are greater than the native surface soil arsenic concentrations.

Table 2 - Descriptive Statistics for Arsenic in Surface Soil – Site versus Native

Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std. Dev.
Site	416	1.10	0.79	0.06	13.90	0.51	1.20	1.24
Native	4	0.39	0.36	0.33	0.51	0.34	0.44	0.08

The native surface soil samples were then statistically compared with the background surface soil arsenic concentrations. Table 3 contains the descriptive statistics for the background and native surface soil arsenic concentrations. From Table 3 it can be seen that there is a difference between the mean and median concentrations with differences of 1.42 and 0.45, respectively.

Table 3 - Descriptive Statistics for Arsenic in Surface Soil – Background versus Native

Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std. Dev.
Background	36	1.81	0.81	0.31	12.40	0.58	1.30	2.92
Native	4	0.39	0.36	0.33	0.51	0.34	0.44	0.08

A summary of the surface soil comparison results is provided in Table 4 and detections of arsenic in surface soil sample locations are depicted on Figure 3. Detailed analysis describing the formal statistical tests used to compare the background, native, and site surface soil arsenic concentrations is provided in Attachment 6.

Table 4 - Results of Surface Soil Comparisons

Sample Location Comparison	Results
Background versus Site	Indistinguishable
Native versus Site	Site exceeds > 0.08 mg/kg
Native versus Background	Background exceeds > 0.08 mg/kg

Subsurface Soil Comparisons

Forty subsurface soil samples were collected from areas not previously sampled and located away from the sites and industrial operations located throughout NAVSTA Mayport. Four of the 40 samples were collected in areas representative of known native soils. Therefore, analytical data for arsenic in 36 of the 40 subsurface soil samples collected (representing background arsenic concentrations) were statistically compared with historical analytical data for arsenic in subsurface soil at NAVSTA Mayport (representing site arsenic concentrations).

Table 5 contains the descriptive statistics for the background and site subsurface soil arsenic concentrations. From Table 5, it can be seen that the mean and median concentrations are similar (with a difference of 0.63 and 0.03, respectively), as verified with a formal statistical test. It can also be seen that the lower and upper quartile (25th percentile and 75th percentile) are similar (with a difference of 0.04 and 0.15, respectively). Further statistical analysis concluded that the site subsurface soil arsenic concentrations are within the range of the background subsurface soil arsenic concentrations.

Table 5 - Descriptive Statistics for Arsenic in Subsurface Soil – Site vs. Background

Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std. Dev.
Site	395	1.17	0.75	0.07	13.75	0.51	1.20	1.57
Background	36	1.80	0.78	0.12	13.70	0.55	1.05	2.78

Included in the 40 surface soil samples were four samples collected from known native soil sites. The native subsurface soil samples were statistically compared with the site subsurface soil arsenic concentrations. Table 6 contains the descriptive statistics for the native and site subsurface soil arsenic concentrations. From Table 6, it can be seen that the mean and median concentrations are similar with differences of 0.42 and 0.03, respectively. It can also be seen that the maximum native concentration is slightly greater than the upper quartile (75th percentile) for the site subsurface soil concentrations. From this small sample size it appears that the site subsurface soil arsenic concentrations are greater than the native subsurface soil arsenic concentrations.

Table 6 - Descriptive Statistics for Arsenic in Subsurface Soil – Site vs. Native

Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std. Dev.
Site	395	1.17	0.75	0.07	13.75	0.51	1.20	1.57
Native	4	0.75	0.72	0.26	1.30	0.40	1.10	0.45

The native subsurface soil samples were then statistically compared with the background subsurface soil arsenic concentrations. Table 7 contains the descriptive statistics for the native and background subsurface soil arsenic concentrations. From Table 7 it can be seen that the mean concentrations are different with a difference of 1.05, whereas the median concentrations are relatively similar with a difference of 0.06.

Table 7 - Descriptive Statistics for Arsenic in Subsurface Soil – Background vs. Native

Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std. Dev.
Background	36	1.80	0.78	0.12	13.70	0.55	1.05	2.78
Native	4	0.75	0.72	0.26	1.30	0.40	1.10	0.45

A summary of the subsurface soil comparison results is provided in Table 8 and detections of arsenic in subsurface soil sample locations are depicted on Figure 4. Detailed analysis describing the formal statistical tests used to compare the background, native and site subsurface soil arsenic concentrations is provided in Attachment 7.

Table 8 - Results of Subsurface Soil Comparisons

Sample Location Comparison	Results
Background versus Site	Indistinguishable
Native versus Site	Site exceeds > 0.45 mg/kg
Native versus Background	Background exceeds > 0.45 mg/kg

CONCLUSIONS

Historical data confirms that much of NAVSTA Mayport is located on disturbed soil. Statistical analyses performed on soils at NAVSTA Mayport indicate that the concentrations of arsenic in soil at the site are representative of local background conditions. The maximum arsenic concentration on site is 13.75 mg/kg, while the maximum background concentration is 13.70 mg/kg. While arsenic concentrations at the various sites and background sample locations appear to be higher than in undisturbed, native soil, there is no indication that an arsenic spill or discharge to the environment has occurred that would warrant cleanup. A July 28, 2008, letter from the University of Florida supporting the conclusion that there is no indication that an arsenic spill or discharge to the environment has occurred that would warrant cleanup for arsenic in surface and subsurface soils at NAVSTA Mayport is included in Attachment 8.

Based upon the statistical analyses for arsenic in soils at NAVSTA Mayport and the technical guidance provided by the University of Florida, it was concluded that the background arsenic concentration for surface and subsurface soils at NAVSTA Mayport is 13.70 mg/kg. The statistical analysis supporting the

background arsenic concentration and University of Florida conclusions were presented to FDEP. A letter dated July 30, 2008, from FDEP states that using the maximum background concentration of 13.70 mg/kg to represent the upper range of background concentrations for arsenic at NAVSTA Mayport is acceptable to FDEP (Attachment 9).

Based on the results of this background study, guidance from University of Florida, and concurrence from the FDEP, no action is required for addressing arsenic detected in surface and subsurface soil at NAVSTA Mayport below the FDEP approved background arsenic concentration of 13.70 mg/kg provided there is not current or historical activities at the site that could have resulted in an arsenic spill or discharge to the environment that would warrant cleanup. In the event there are current or historical activities at the site that could have resulted in an arsenic spill or discharge to the environment (i.e., pesticide storage facility), the Navy will need to consult further with the FDEP. The FDEP will have to provide direction to the Navy as to whether or not the FDEP residential direct exposure SCTL of 2.1 mg/kg or the FDEP industrial direct exposure SCTL of 12 mg/kg for arsenic should be used more appropriately.

If you have any questions with regard to this submittal, please feel free to contact me at (904) 616-6125, or via e-mail at Shina.Ballard@TetraTech.com.

Sincerely,

Shina A. Ballard

Shina A. Ballard
Task Order Manager

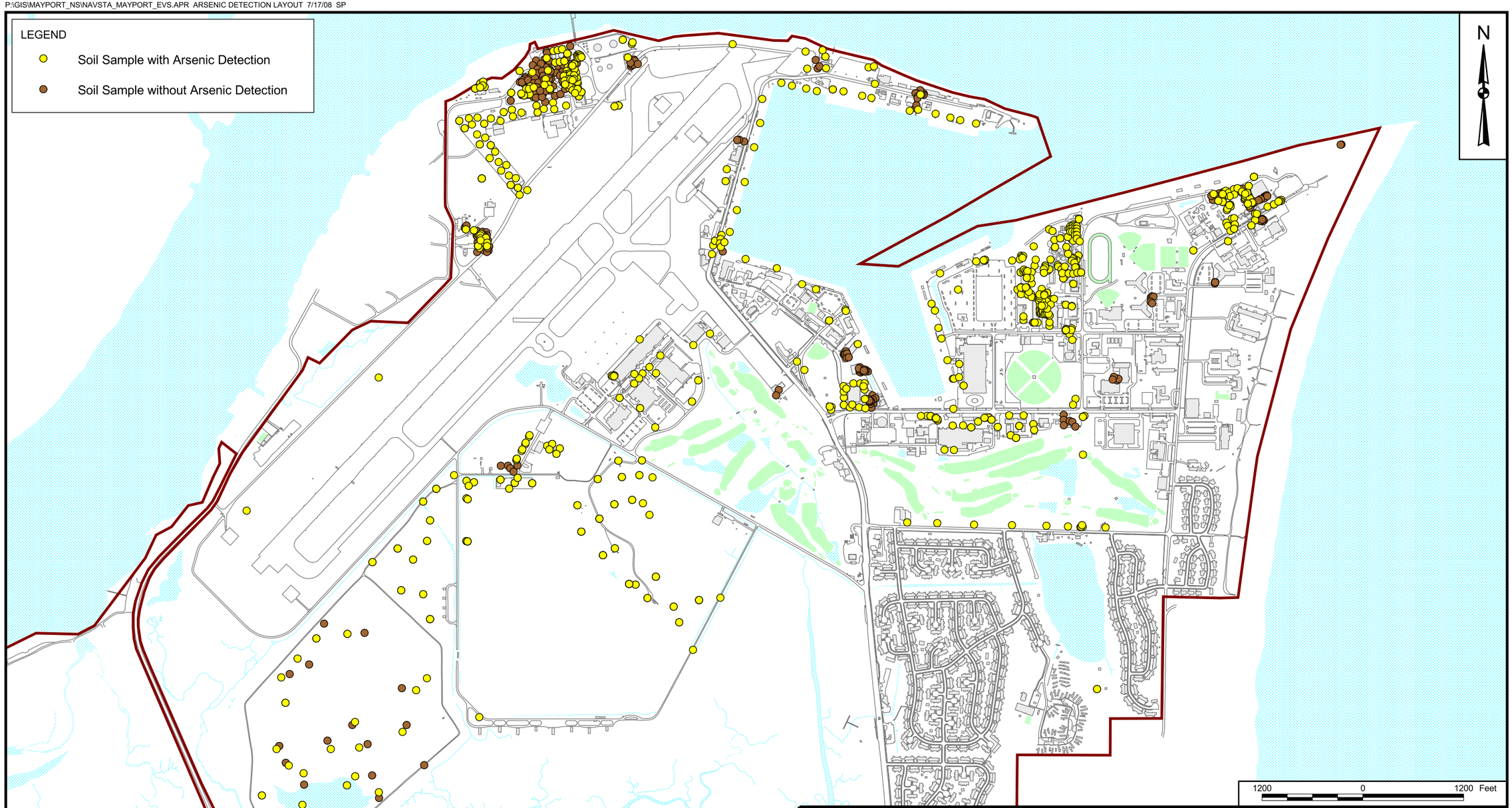
SB

Enclosures (14)

pc: John Winters P.G., FDEP (2 copies, 1 CD)
Craig Benedikt, USEPA (CD only)
Adrienne Wilson, NAVFAC SE (CD only)
Diane Racine, NAVSTA Mayport (1 copy, 1 CD)
Casey Hudson, CH2MHill (CD only)
Mike Halil, CH2MHill (CD only)
Debbie Humbert, TtNUS (cover letter only)
Mark Perry, TtNUS (unbound copy, CD)
NAVSTA Mayport Administrative Record
CTO 0033 Project File

FIGURES

P:\GIS\MAYPORT_NS\NAVSTA_MAYPORT_EVS.APR ARSENIC DETECTION LAYOUT 7/17/08 SP

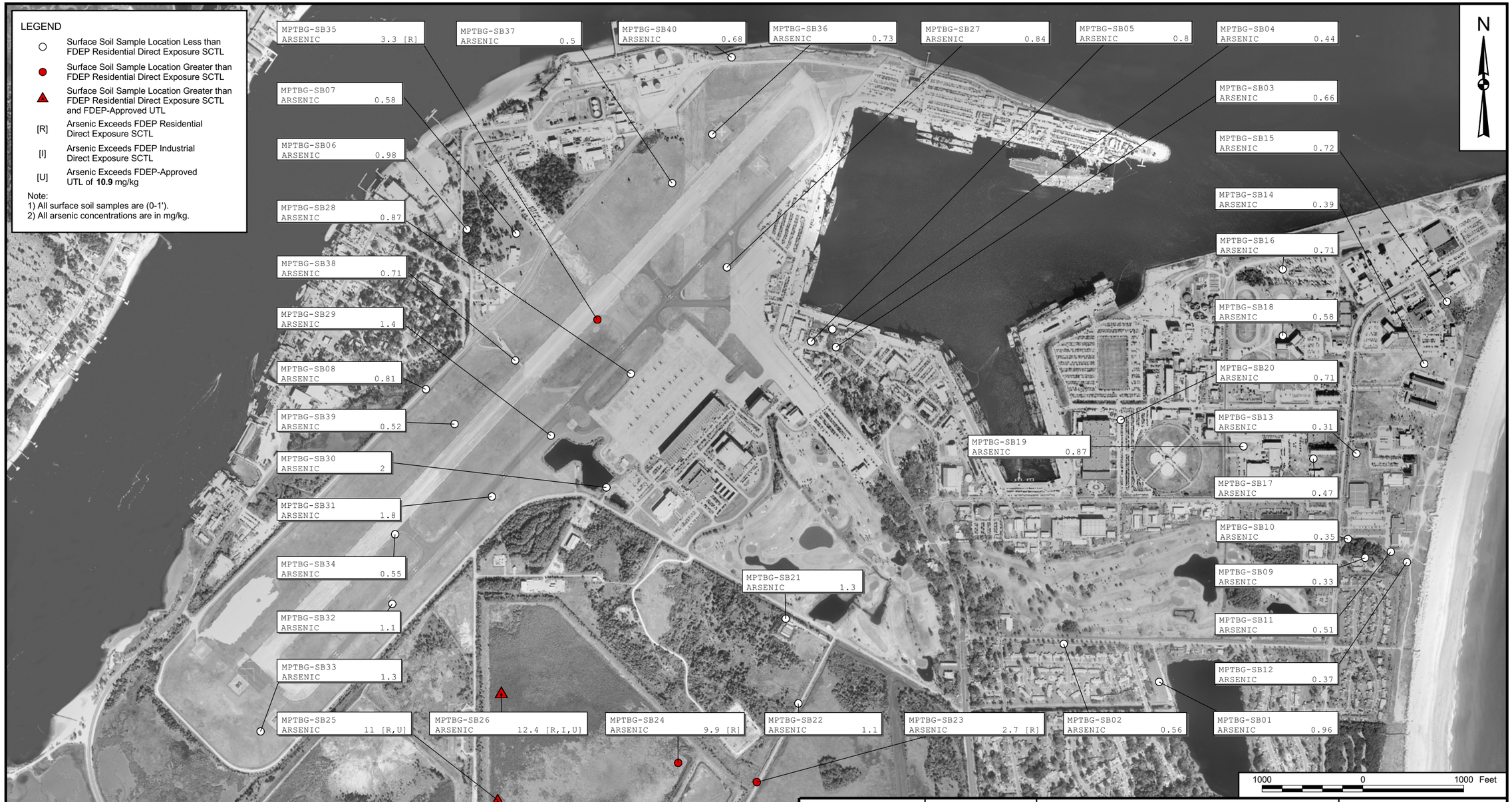


DRAWN BY S. PAXTON	DATE 1/21/08	ARSENIC SOIL SAMPLING LOCATIONS PRIOR TO ARSENIC BACKGROUND SAMPLING ARSENIC BACKGROUND STUDY REPORT NAVSTA MAYPORT JACKSONVILLE, FLORIDA	CONTRACT NO. CTO 0033
CHECKED BY R. MCCANN	DATE 7/17/08		APPROVED BY ____ DATE ____
COST/SCHED-AREA			APPROVED BY ____ DATE ____
SCALE AS NOTED			DRAWING NO. FIGURE 1 / REV. 0

P:\GIS\MAYPORT_NS\NAVSTA_MAYPORT_EVS.APR ARSENIC SAMPLE LOCATION LAYOUT 7/17/08 SP

DRAWN BY S. PAXTON	DATE 2/14/08	40 ARSENIC BACKGROUND SOIL SAMPLE LOCATIONS ARSENIC BACKGROUND STUDY REPORT NAVSTA MAYPORT JACKSONVILLE, FLORIDA	CONTRACT NO. CTO 0033
CHECKED BY R. MCCANN	DATE 7/17/08		APPROVED BY ____ DATE ____
COST/SCHED-AREA			APPROVED BY ____ DATE ____
SCALE AS NOTED			DRAWING NO. FIGURE 2 / REV. 0

P:\GIS\MAYPORT_NS\NAVSTA_MAYPORT_EVS.APR ARSENIC SURFACE SOIL TAG LAYOUT 7/17/08 SP



DRAWN BY S. PAXTON	DATE 2/21/08	ARSENIC SAMPLING RESULTS IN 40 SURFACE SOIL SAMPLES ARSENIC BACKGROUND STUDY REPORT NAVSTA MAYPORT JACKSONVILLE, FLORIDA	CONTRACT NO. CTO 0033
CHECKED BY R. MCCANN	DATE 7/17/08		APPROVED BY ____ DATE ____
COST/SCHED-AREA			APPROVED BY ____ DATE ____
SCALE AS NOTED			DRAWING NO. FIGURE 3 / REV. 0

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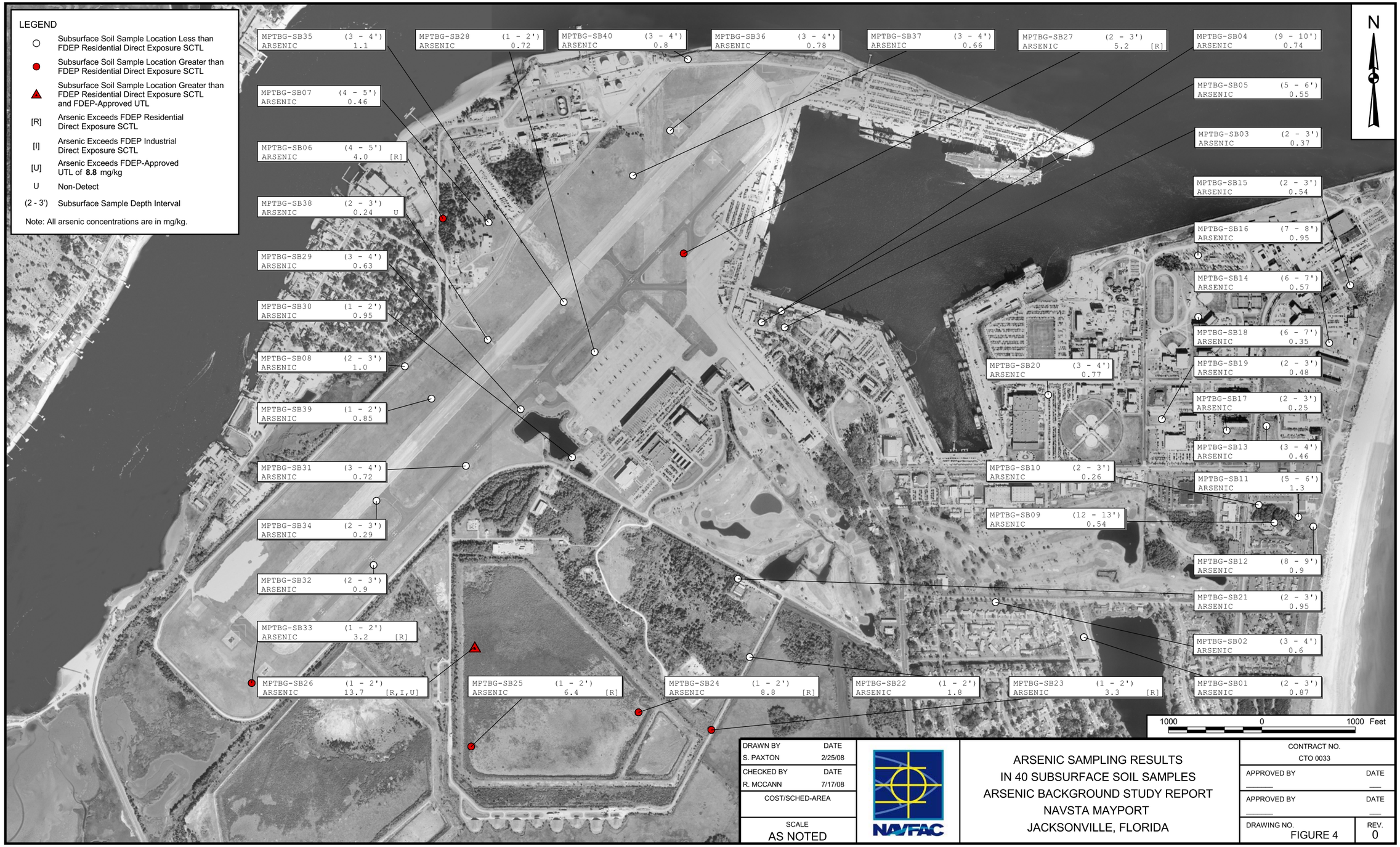

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S. PAXTON	2/25/08
CHECKED BY	DATE
R. MCCANN	7/17/08
COST/SCHED-AREA	
SCALE	
AS NOTED	

NAVFAC

ARSENIC SAMPLING RESULTS
IN 40 SUBSURFACE SOIL SAMPLES
ARSENIC BACKGROUND STUDY REPORT
NAVSTA MAYPORT
JACKSONVILLE, FLORIDA

CONTRACT NO.	
CTO 0033	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 4	REV. 0

ATTACHMENT 1

USING STATISTICS TO CALCULATE THE ADDITIONAL SAMPLES NEEDED TO FULLY IDENTIFY THE ARSENIC CONCENTRATIONS IN SOIL ACROSS NAVAL STATION MAYPORT, FLORIDA

Using Statistics to Calculate the Additional Samples Needed to Fully Identify the Arsenic Concentrations in Soil across Naval Station Mayport, FL

Introduction

The purpose of this study is to establish the number and locations of additional soil sample needed to achieve a statistically meaningful sample population for arsenic concentrations in soil at Naval Station (NAVSTA) Mayport. The analytical results from these additional samples will be combined with the installation's existing arsenic concentration database and analyzed statistically to determine if there is a statistically significant difference in the arsenic concentrations detected in soils associated with Solid Waste Management Units (SWMUs) vs. soils collected located away from the SWMUs and industrial operations.

The following are the statistical software packages that are used to determine the number and locations of the additional soil samples:

C Tech EVS-PRO – A graphical, parameter spacing tool that uses system-driven kriging algorithms with best fit variograms. This program considers the measured uncertainty in available data as well as spatial positions of the sampled locations. In doing so it computes proposed sample locations with a goal of limiting future concentration estimates to an acceptable level of uncertainty.

Visual Sample Plan (VSP) – A publicly available software tool that generates technically defensible sampling schemes for site characterization. This program computes the minimum number of samples necessary to detect a predetermined difference between a data set mean and a numerical level (an action level). This program may also be used to compute the number of samples required to detect a prescribed difference between two data sets. This program does not consider nor does it propose lateral or vertical positions of samples locations.

VSP, which was developed with the support of the U.S. EPA, was used to independently verify the number of samples generated by the EVS-PRO.

The following sections, which follow the Data Quality Objectives (DQO) process, present the approach used to select the required number of additional soil samples and their locations.

DQO Step 1 - State the Problem

Past sampling at the NAVSTA Mayport (SWMUs) has yielded more than 800 soil samples. These samples were collected over several years from surface and subsurface soil intervals. The surface depth interval is 0-2 feet (below ground surface) bgs; all other depths represent subsurface soil.

The arsenic concentrations detected to date in soil at the installation ranged 15.6 to 0.006 (non-detect) milligram/kilogram (mg/kg) with a combined surface and subsurface mean of 1.15 mg/kg (1.25mg/kg for subsurface soil) and a combined median of 0.77 mg/kg. The Florida Department of Environmental Protection (FDEP) Soil Clean-up Target Level (SCTL) for arsenic is 2.1 mg/kg.

Several areas at the installation that are located away from the SWMUs and industrial operations have not been sampled. The relative magnitude of the arsenic concentrations in the SMWU areas compared to arsenic concentrations in the unsampled areas is unknown. It is anticipated that the arsenic concentrations in these previously unsampled areas are less than or equal to already measured arsenic concentrations.

For the purposes of the statistical study that will follow the sampling effort, there are three different types of soil areas:

- Group 1: SWMU areas that have already been sampled.
- Group 2: Areas away from the SWMUs and industrial operations that have not been sampled.
- Group 3: Areas within Group 2 that represent native soil.

The study will proceed with the following steps:

- Previously unsampled areas will be sampled to provide adequate spatial and statistical coverage for NAVSTA Mayport-wide arsenic concentrations in soil.

- Data sets for SMWU area arsenic concentrations and arsenic concentrations from previously unsampled areas will be compared to determine the relative magnitudes of arsenic concentrations in these two categories.

- Two specific areas at the installation that are known to be native soil will be represented in the sampling scheme so arsenic concentrations for those areas can be compared to arsenic concentrations from the other areas.

Soils across NAVSTA Mayport are believed to be uniform enough in geologic composition as to represent similar geochemistry regardless of location. The geochemistry, however, may vary with depth. Furthermore, risk assessments commonly subdivide soils samples into surface and subsurface groups because exposure scenarios are different for these groups. Consequently, only two potentially significant soil groups will be used in the study, surface and subsurface.

Two primary questions will need to be answered in the statistical study:

- Are arsenic concentrations from already sampled areas significantly different, based on statistical analysis, than arsenic concentrations in previously unsampled areas?

- Are arsenic concentrations from already sampled areas significantly different, based on statistical analysis, than arsenic concentrations in the native soil areas?

If the answer to either of these questions is yes, additional study activities may be warranted. The additional actions to be taken will depend on the relative magnitudes of the Group 1 arsenic concentrations and the Group 2 and Group 3 arsenic concentrations.

DQO Step 2: State the Decisions

The decisions to be addressed in the study are:

- Determine whether arsenic concentrations from already sampled areas are statistically greater than arsenic concentrations in previously unsampled areas. If they are, additional study activities may be warranted; otherwise, conclude that no further action is required.

- Determine whether arsenic concentrations from already sampled areas are statistically greater than arsenic concentrations in the native soil areas. If they are, additional study activities may be warranted; otherwise, conclude that no further action is required.

DQO Step 3: Identify Inputs to the Decisions

The analyte of interest is arsenic. The analytical method to be used for arsenic measurement will be U.S EPA SW-846 6010B or SW-846 6020. Which method is actually used will depend on the selected laboratory; however, all practical efforts will be made to select a laboratory that uses the same analytical method that was used for previously analyzed samples. This is an important factor in ensuring that the data are comparable from the two sampling periods. Whichever laboratory is used, they will be required to comply with analytical method QC requirements. The precision and accuracy requirements for the arsenic data are:

- Laboratory matrix spike (MS) and duplicate samples will be analyzed at the rate of one MS and one duplicate per 20 field samples.

- Individual matrix spike (MS) arsenic recoveries shall be no less than 50 percent.

- Mean MS arsenic recoveries shall be in the range of 65 to 135 percent.

- If accuracy requirements are not met, the quality of the data will be considered to be substandard and corrective actions will be taken to repeat the analyses, recollect samples and analyze the replacement samples, or to discuss with regulators the appropriate course of action.

- Individual relative percent difference (RPD) values for laboratory duplicate samples should be no more than 50 percent for arsenic.

- If the precision (RPD) target is not met an evaluation will be conducted to determine whether the level of uncertainty is sufficient to compromise decision making. If it is, corrective action will be taken. The first step will be a discussion with regulators concerning the appropriate course of action.

- Collection of field duplicates is not recommended because it is more important to obtain spatial coverage and estimates of uncertainty across the sampled area than to obtain estimates of sampling precision in individual samples.

- Additional sample volume must be collected to accommodate QC sample analyses.

- Samples will be handled and stored the same way they were handled in the past. This will help to ensure comparability of data.

DQO Step 4: Identify the Study Boundaries

There are no temporal considerations of importance for sample collection. Arsenic concentrations in soil today are not expected to have changed significantly in the past decade nor are they expected to change significantly within the next decade. Nevertheless, a change in analytical method could cause an artificial difference to appear among data sets. This is addressed in DQO Step 3.

Soils investigated at NAVSTA Mayport were found to be geologically similar; therefore the need to separate soils into different groups because of geochemical differences is not anticipated. Past sampling patterns and areal coverage are the driving factors for this sampling effort. The intent is to collect samples from the surface and subsurface in previously unsampled areas and compare past data with these new data. The areas to be sampled are identified in Step 1 and on Figure 1.

Surface and subsurface soils are not considered to be geologically different but they are considered to be different with respect to risk exposure. Hence, development of the sampling plan will be designed to consider these depth intervals separately as well as together.

DQO Step 5: Specify the Analytic Approach

Once the data are compiled into what are considered to be representative data sets for the sampled areas, the following decision rules will be applied:

1. If mean arsenic concentrations in the previously unsampled areas are greater than 2.1mg/kg (SCTL), additional study activities may be warranted; otherwise, conclude that no further action is required.

2. If mean arsenic concentrations from already sampled areas are greater than arsenic concentrations in previously unsampled areas, additional study activities may be warranted; otherwise, conclude that no further action is required.

3. If mean arsenic concentrations from already sampled areas are greater than arsenic concentrations in the native soil areas, additional study activities may be warranted; otherwise, conclude that no further action is required.

DQO Step 6: Specify Error Tolerances

Previously unsampled areas are in locations where industrial activities are believed to have not occurred or at least not to the same degree that occurred in the SWMUs. Thus the areas to be sampled are expected to have arsenic concentrations that are less than or equal to those observed from previously sampled areas. The null hypothesis was chosen to be that the data to be collected will have a mean arsenic concentration less than the arsenic SCTL (2.1 mg/kg).

It is understood that spatial differences in arsenic concentrations, variations in sample collection technique, analytical uncertainty, etc., can cause arsenic concentration results to be somewhat uncertain. This is true whether examining an arsenic concentration for a single sample or a mean concentration for multiple samples. The inevitable conclusion is that any measurement of the mean arsenic concentration is almost certain to not be equal to the true mean concentration. Hence, the measured mean will either be greater than or less than the true mean. The problem is that there is no way to know whether it is greater than or less than the true mean. In statistical parlance, this leads to two types of decision error that can be made from a measurement. With the null hypothesis as stated above, a Type I error is erroneously deciding that the true mean concentration exceeds 2.1 mg/kg. This would occur when the measured mean value is greater than 2.1 mg/kg, but the true mean is less than 2.1 mg/kg. Type II error would be to erroneously decide that the mean arsenic concentration is less than 2.1 mg/kg.

This would occur when the measured mean concentration is less than 2.1 mg/kg, but the true mean concentration is greater than 2.1 mg/kg.

Statisticians have devised a way to manage this decision uncertainty. The general approach is to first recognize that either type of error is possible and that one type of error might actually be made. The goal is to collect enough samples to minimize each type of error to a tolerable level. It is recognized that the chance of making either error decreases as the number of samples collected increases. It is also recognized that the cost of sample collection and analysis increases with each additional sample. The "law" of diminishing returns says that only so many samples can be collected before no significant benefit is added by additional sample collection.

VSP Approach A (Corresponds to Decision Rule 1)

After recognizing that either type of error can be made, it is customary to establish the tolerable probabilities for making each error. For this study, the following rationale was used to establish the tolerable probabilities. It was first recognized that there is a concentration region close to the mean within which it is acceptable to ignore decision errors. Because a typical RPD value for duplicate samples is less than 50 percent, the action level was multiplied by about 50 percent to yield 3.15 mg/kg. Within the concentration range of 2.1 to 3.15 mg/kg, the tendency will be to error on the side of not taking corrective action even if the true mean concentration exceeds 2.1 mg/kg. The rationale for this is that more than 800 samples have already indicated that the true mean is less than 2.1 mg/kg.

The range of 2.1 to 3.15 mg/kg is called the Gray Region and 3.15 mg/kg is called the upper bound of the Gray Region (UBGR). The action level, 2.1 mg/kg, is the lower bound of the Gray Region (LBGR). At this point we ask ourselves the following question: If the true concentration were infinitesimally less than 2.1 mg/kg, what would be the tolerance for concluding that the mean concentration exceeds 2.1 mg/kg? Because the true mean is not that different than the STCL, the tolerance is relatively high. The study team set this tolerance at 20 percent. This means that if the statistical study could be repeated many times, 20 percent of the time the team would tolerate taking corrective action even though the true mean arsenic concentration was slightly less than 2.1 mg/kg. Now we ask: If the true mean concentration were infinitesimally greater than 3.15 mg/kg what would be the tolerance for not taking corrective action? Because the true mean in this scenario is slightly greater than the upper end of the region where we agreed that decision errors are not very serious, the tolerance is also relatively high. However, the study team set the tolerance for this error at 10 percent because the UBGR is already greater than the 2.1 mg/kg action level.

The last statistical value to be established was the estimated standard deviation of the data to be collected. The planning team reasoned that the standard deviation is likely to be less than the standard deviation of the available data. Using available subsurface soil data (more than 300 data concentration values) the computed standard deviation was 1.82 mg/kg. Subsurface soil data were used because they represent the greater standard deviation of the surface and subsurface data. This is a conservative approach that causes the number of required samples to be artificially inflated.

VSP Approach B (Corresponds to Decision Rules 2 and 3)

In this scenario the intent is to determine whether the mean arsenic concentrations of two data sets differ by more than a prescribed amount (called delta). The planning team decided that a difference of less than about half of the standard deviation of available data, or 0.9 mg/kg, was

too difficult to detect. Furthermore, the mean subsurface soil arsenic concentration was 1.25 mg/kg and adding 0.85 mg/kg to 1.25 mg/kg yields the 2.1 mg/kg action level. The team wanted to be confident that exceedances of the action level are reasonably detectable.

The LBGR was set at 0.85 mg/kg. This means that the minimum detectable difference between the current mean of 1.25 mg/kg and the mean of the new data should be at least 0.85 mg/kg. Because the baseline assumption, however, is that the actual mean for the new data will not be greater than 2.1 mg/kg, some latitude is allowed for the mean to be as great as 3.15 without much concern for concluding that the site is not contaminated when in fact it is contaminated, based on regulatory standards. This is the upper gray region boundary concentration in VSP Approach A. With this upper concentration limit and a current mean of 1.25 mg/kg, the width of the gray region for differences between mean is 3.15 mg/kg – 1.25 mg/kg = 1.9 mg/kg. Thus the gray region for differences between means runs from 0.85 mg/kg to 1.9 mg/kg where 1.9 mg/kg is the upper bound of the gray region (UBGR) for differences between data set means. Alpha and beta were maintained as above: alpha = 10 percent at the LBGR; beta = 20 percent at the UBGR.

If the difference between data set means is 1.9 mg/kg, this would equate to the actual concentration of the newly sampled areas being 1.25 mg/kg + 1.9 mg/kg = 3.15 mg/kg when these areas are considered to be more contaminated than the previously sampled areas. If the newly sampled areas are less contaminated then previously sampled areas, the mean arsenic concentration of the newly sampled areas would be 1.25 mg/kg – 1.9 mg/kg = -0.65 mg/kg, Of course, this result (a negative concentration) is untenable and simply indicates that the current mean arsenic concentration is close to non-detect values.

Step 7: Optimize the Design

Two approaches were taken to devise the proposed sampling plan. The first approach used EVS-PRO to krig the data and estimate arsenic concentrations for areas not previously sampled as described below in the GIS Approach. The VSP approach relies primarily on statistical inferences based on decision error tolerances developed in Step 6, above.

EVS-PRO Approach

The following optimization approach was taken to arrive at the sampling distribution presented in Figure 1. First, the available surface and subsurface soil results were combined into a single data set. The results were plotted spatially to show surface soil spatial coverage and subsurface soil spatial coverage.

There were fewer subsurface soil data collected (337 samples) than surface soil data (550 samples). Furthermore, the plotted subsurface soil data represented less spatial coverage across the study area than the surface soil data. While most sample locations with a subsurface sample also have an associated surface soil sample, the converse is not always true, thus causing the discrepancy between spatial coverages. Since it is planned that for each newly proposed sample location, both a subsurface and a surface sample would be collected, it was decided to focus the kriging efforts on the subsurface soil data as a “worst case scenario” to maximize the improvement in overall spatial coverage for both data sets.

The subsurface soil data were kriged to obtain estimates of arsenic concentrations where samples had not been collected previously. Based on the kriged data, areas representing the greatest degree of uncertainty in the estimated concentrations were identified. EVS-PRO

defines uncertainty as a function of predicted concentration levels and the resulting confidence levels of those predictions where uncertainty is high at locations where concentrations are predicted to be relatively high, but the confidence in that prediction is low.

The modeling software was then used to add a number of points to the spatial plot to reduce the estimated uncertainties. The software allows the user to specify two primary factors during this optimization: 1) the factor within which the estimated concentration is expected to agree with the true concentration and 2) the confidence level of this estimate.

The primary objective was to obtain at least an 80 percent confidence that all estimated concentrations were within a factor of 1.7 of the true value for at least 90 percent of the area covered by NAVSTA Mayport. In this case, it was assumed that knowing any arsenic concentration to within a factor of 1.7 of the true concentration would be acceptable.

The factor of 1.7 represents a relative percent difference (RPD) of approximately 50 percent [$200\% \times (1.7x - x)/(1.7x+x) = 52\%$]. This value (i.e., 50 percent) is commonly used as the upper end of the target acceptance range for field duplicate sample precision and also represents a relative standard deviation (RSD) of approximately 37 percent. These conservative input error limits were used because the interpolated arsenic concentrations generated by the kriging model were based on sparsely distributed samples in some of the areas. This can result in large concentration estimate errors that will not be measurable until the data are collected.

Another reason for using conservative input values is that some sampling locations may not be accessible because the ground surface could be unstable or obstacles could be present. The sampling team will be able to move a sample location up to 100 feet away from the designated location without effecting spatial distribution. This 100 feet limit represents less than the radius of influence of each new sample location in the kriging model. This approach was taken to fine tune the kriging model because some of the computer generated sampling locations were placed on a runway or in a building.

Confidence plots were generated for the original 337 subsurface soil samples using a factor of 1.7. Subsequent plots were then generated using factors of 1.5, 1.85, and 2.0 for comparison purposes. The results of these plots are presented in Figure 2.

Confidence plots were then generated using the original 337 subsurface soil samples plus an additional 40 samples as designated by the modeling software based on the areas of greatest uncertainty. The placement of some locations were modified just enough to avoid known obstacles such as buildings, runways, and roads. Proposed locations that the modeling software placed within the Turning Basin were relocated to the two “native soil” areas. These plots were generated using factors of 1.5, 1.7, 1.85, and 2.0 for comparison purposes. The results are presented in Figure 3.

An additional objective was to ensure that at least seven samples were collected from the two “native soil” areas. Seven samples were chosen because the study team’s experience with similar projects indicated that five to seven samples often provide enough data to make defensible decisions when the true mean concentration differs from the action level by at least 50 percent. Figure 1 shows that this objective was achieved.

VSP Approach A (Corresponds to Decision Rule 1)

Using the inputs from DQO Step 6, VSP (Version 4.4b) was used to compute the minimum number of samples that should be collected to meet the specified decision performance. The outputs are provided in Attachment A along with explanatory text and graphs to support the text.

The VSP software uses the following equation (when ignoring analytical uncertainty) to compute the required number of samples:

$$n = \frac{2s^2\left(z_{1-\alpha} + z_{1-\beta}\right)^2}{\Delta^2} + \frac{z_{1-\alpha}^2}{4}$$

In this equation, *n* is the minimum number of samples required to yield the desired decision making confidence; *s* is the expected standard deviation of the data; alpha (α) and beta (β) are the Type I and Type II error tolerance values; and *z* is the standard normal deviate. Delta (Δ) is the width of the gray region.

The arsenic concentrations for the available data were not normally distributed. Therefore, the VSP software was run in the "non-parametric" mode. This mode makes very few assumptions about the distribution of the data.

Run 1:

Analytical uncertainty was ignored because it is commonly understood to be much less than the sampling uncertainty. Sampling uncertainty is the inherent variability in concentration from one sample to another. The VSP software computed that at least 29 samples should be collected to meet the decision specifications.

VSP outputs for this approach are provided in Attachment A.

Run 2:

After computing the number of samples using these inputs, another computation was done. The standard deviation of existing subsurface data is 1.82 mg/kg. It is commonly recognized that being able to detect a difference less than a single standard deviation between a mean concentration and a numerical criterion frequently is not cost-effective. Therefore the computation was rerun using 1.8 mg/kg as the width of the gray region boundary. This yielded UBGR = 2.1 mg/kg + 1.8 mg/kg = 3.9 mg/kg. The number of samples computed was 10. This helps to confirm that approximately 29 samples should be sufficient. This provides some perspective on the previously computed 29 samples.

VSP outputs for this approach are not included in this report.

VSP Approach B (Corresponds to Decision Rules 2 and 3)

Based on the specifications of DQO Step 6, the VSP software computed the minimum number of samples to be 32. This is an indication that discriminating between data set means is likely to be more difficult than discriminating between the mean concentration of a data set and the 2.1

mg/kg action level. Given that the data to be collected are expected to have a lower mean arsenic concentration than previously collected data, this is not a serious deficiency.

VSP outputs for this approach are provided in Attachment B.

Sampling Plan Synopsis

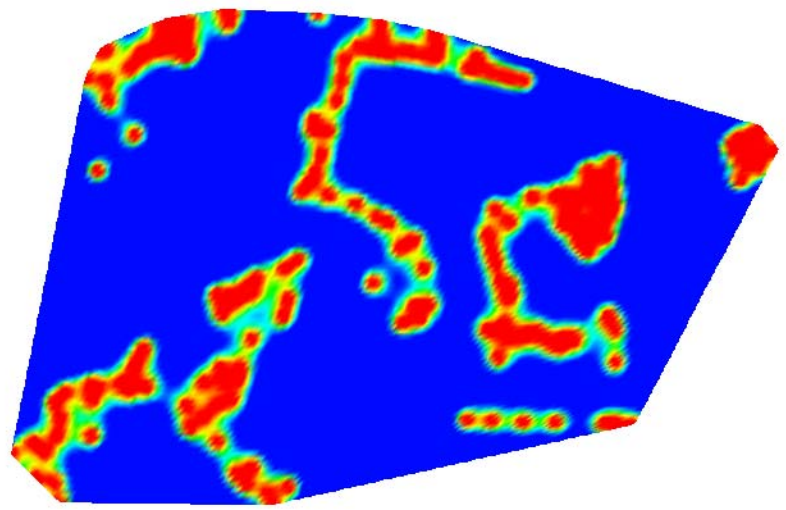
Based on the VSP and EVS-PRO computations, it is evident that about 30 to 40 samples would be sufficient to support all three decision rules (assuming the input assumptions hold). Because both surface and subsurface soils must be represented, the total number of soil samples should be 60 to 80, with half of the samples collected in the surface soil and the other half in the subsurface soil. The surface soil interval is 0 to 2 feet bgs; the subsurface soil interval is 2 to 8 feet bgs. In the subsurface, it is desirable to represent all possible depths without collecting the entire 2 to 8 foot bgs interval at each location. Therefore, the subsurface soil at each sample location will be divided into three 2-foot intervals (2-4 feet, 4-6 feet, and 6-8 feet) and samples will be alternatively collected from one of the subsurface intervals. Every location will be sampled in the 0-2 foot interval. This strategy will yield two soil samples at each location, a surface sample and a subsurface sample drawn from one of the three possible 2-foot subsurface intervals.

Because the number of additional soil sample locations calculated by EVS (40) and VSP (32) represent the minimum number required to satisfy the goals of this study, it was decided that 80 samples will be collected at the 40 locations specified by the EVS software. All samples will be stored, prepared for analysis, and analyzed in as similar a manner to previous operations as practicable.

P:\GIS\MAYPORT_NS\NAVSTA_MAYPORT_EVS.APR PROPOSED LOCATION LAYOUT 4/06/07 AJ

DRAWN BY A. JANOCHA	DATE 4/06/07	ALL SOIL SAMPLES WITH 40 PROPOSED SAMPLE LOCATIONS NAVSTA MAYPORT MAYPORT, FLORIDA	CONTRACT NO. CTO 0033
CHECKED BY T. JOHNSTON	DATE 4/06/07		APPROVED BY ___ DATE ___
COST/SCHED-AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 1 / REV 0

P:\GIS\MAYPORT_NS\NAVSTA_MAYPORT_EVS.APR SB ORIGINAL SAMPLES LAYOUT 4/06/07 AJ



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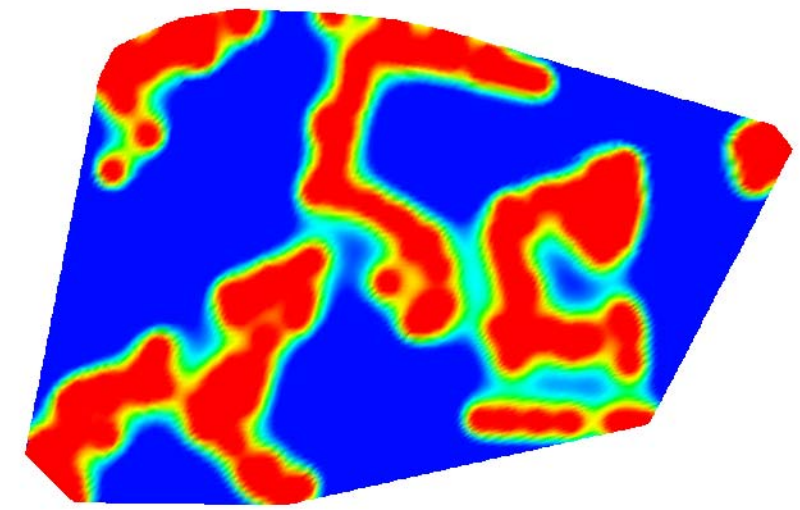

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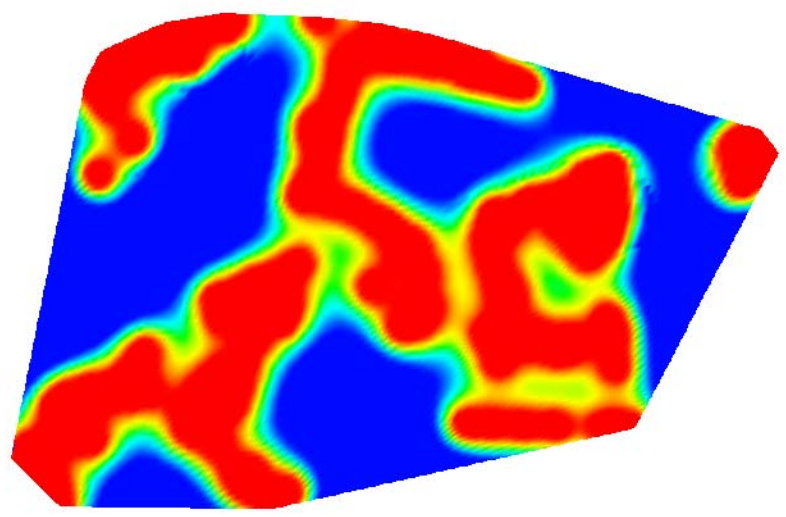

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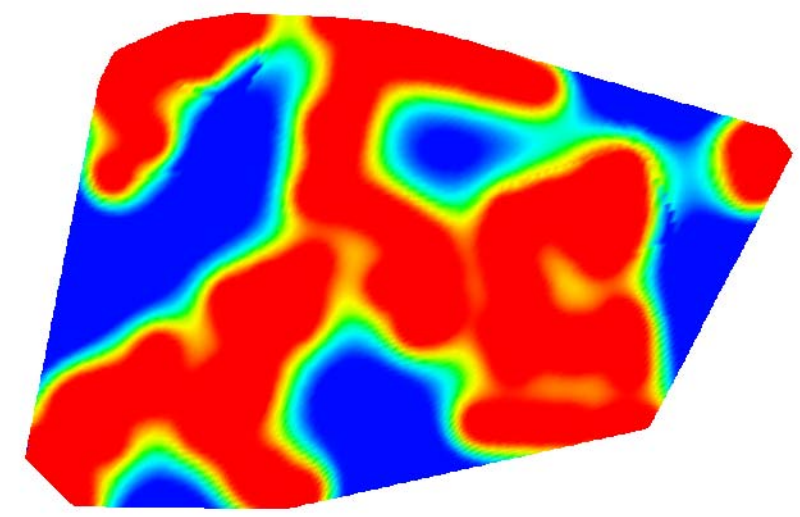
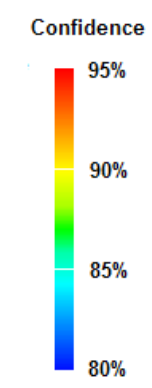


Factor = 2.0



NOTE: Each panel shows, as a function of location, the confidence that the predicted concentration will be within a designated factor of the true value. The factors are shown on each panel (e.g., Factor = 1.5 and Factor = 1.7).

N

CONTRACT NO.
CTO 0033

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 2

REV 0

CONFIDENCE MAP FOR ORIGINAL SUBSURFACE SOIL SAMPLES
NAVSTA MAYPORT
MAYPORT, FLORIDA

NAVFAC

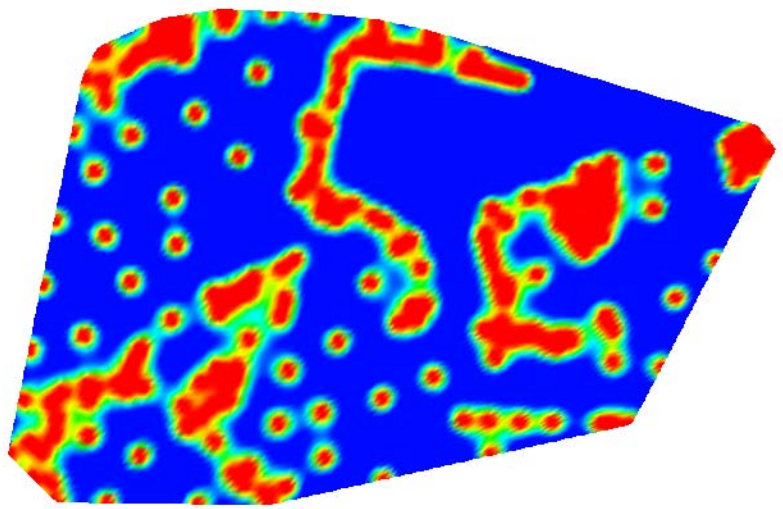
DRAWN BY A. JANOCHA DATE 3/30/07

CHECKED BY T. JOHNSTON DATE 4/06/07

COST/SCHED-AREA

SCALE AS NOTED

P:\GIS\MAYPORT_NS\NAVSTA_MAYPORT_EVS.APR SB 40 ADDITIONAL SAMPLES LAYOUT 4/06/07 AJ



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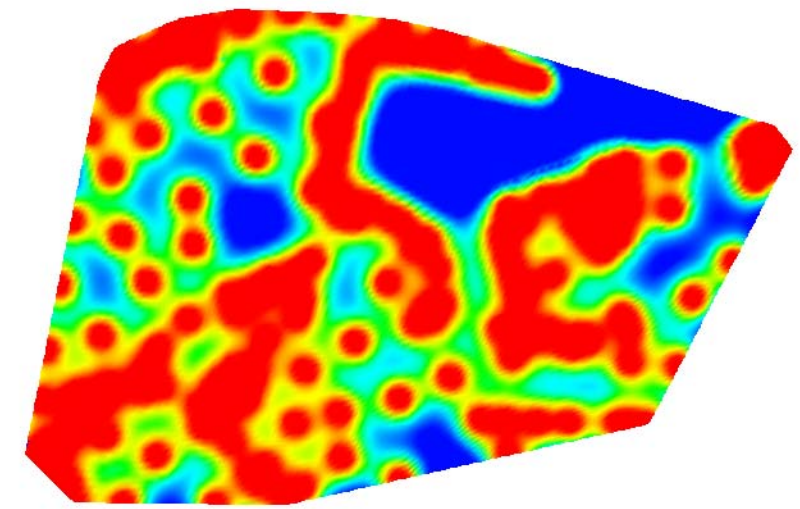

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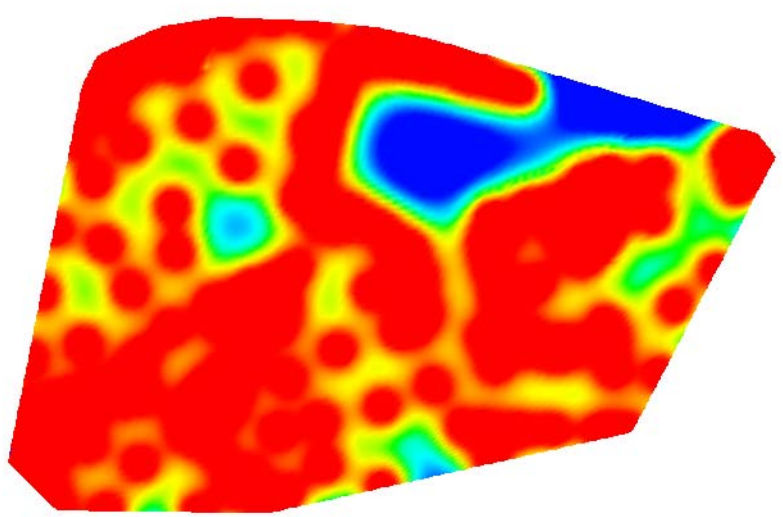
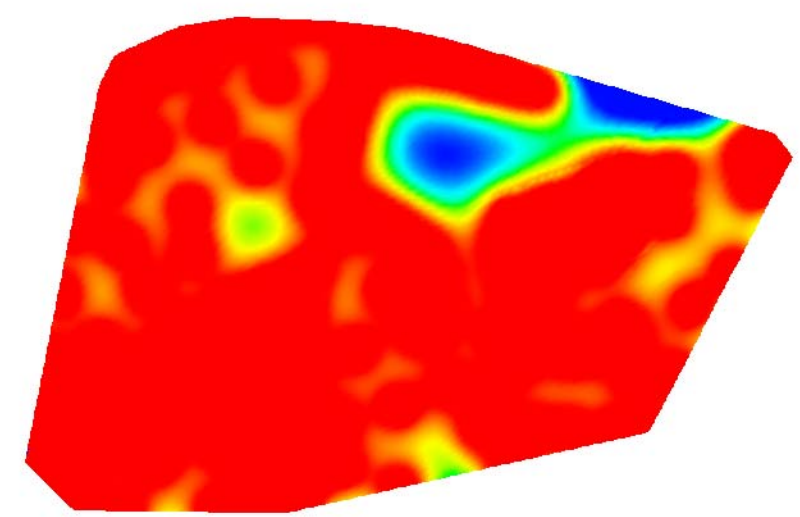


Factor = 1.85



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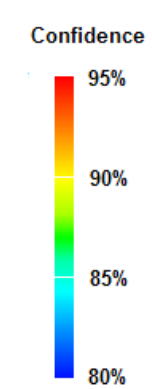


NOTE: Each panel shows, as a function of location, the confidence that the predicted concentration will be within a designated factor of the true value. The factors are shown on each panel (e.g., Factor = 1.5 and Factor = 1.7).

N

CONTRACT NO.
CTO 0033

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 3

REV 0

CONFIDENCE MAP FOR ORIGINAL SUBSURFACE SOIL SAMPLES
WITH 40 PROPOSED SAMPLE LOCATIONS
NAVSTA MAYPORT
MAYPORT, FLORIDA

NAVFAC

DRAWN BY A. JANOCHA DATE 4/06/07

CHECKED BY T. JOHNSTON DATE 4/06/07

COST/SCHED-AREA

SCALE AS NOTED

Attachment A

VSP Approach A

Random sampling locations for comparing a median with a fixed threshold (nonparametric - MARSSIM)

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean or median to a fixed threshold
Type of Sampling Design	Nonparametric
Sample Placement (Location) in the Field	Simple random sampling
Working (Null) Hypothesis	The median(mean) value at the site is less than the threshold
Formula for calculating number of sampling locations	Sign Test - MARSSIM version
Calculated total number of samples	29
Number of samples on map [a]	0
Number of selected sample areas [b]	0
Specified sampling area [c]	5000.00 ft^2
Total cost of sampling [d]	$15500.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.

Primary Sampling Objective

The primary purpose of sampling at this site is to compare a site median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is less than the threshold. The alternative hypothesis is that the median(mean) value is equal to or exceeds the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach

A nonparametric random sampling approach was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs

The equation used to calculate the number of samples is based on a Sign test (see PNNL 13450 for discussion). For this site, the null hypothesis is rejected in favor of the alternative one if the median(mean) is sufficiently larger than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = 1.20\left[\frac{\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2}{4(SignP - 0.5)^2}\right]$$

where

$$SignP = \Phi\left[\frac{\Delta}{\left(s^2_{sample} + \frac{s^2_{analytical}}{r}\right)^{1/2}}\right]$$

$\Phi(z)$ is the cumulative standard normal distribution on $(-\infty,z)$ (see PNNL-13450 for details),
n is the number of samples,
S is the estimated standard deviation of the measured values including analytical error,
Δ is the width of the gray region,
α is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
β is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,
$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

Note: MARSSIM suggests that the number of samples should be increased by at least 20% to account for missing or unusable data and uncertainty in the calculated value of n. VSP allows a user-supplied percent overage as discussed in MARSSIM (EPA 2000, p. 5-33).

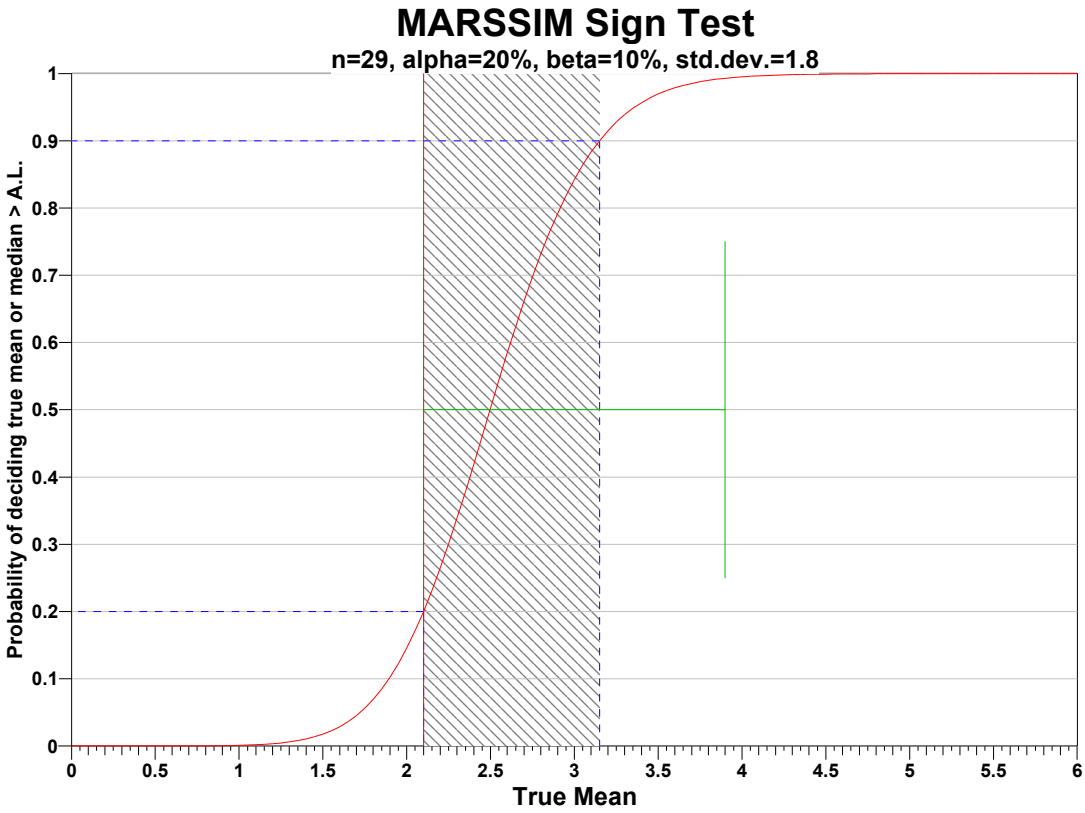
The values of these inputs that result in the calculated number of sampling locations are:

Analyte	n[a]	Parameter					
		S	Δ	α	β	$Z_{1-\alpha}$ [b]	$Z_{1-\beta}$ [c]
	29	1.8	1.05	0.2	0.1	0.841621	1.28155

[a] The final number of samples has been increased by the MARSSIM Overage of 20%.
[b] This value is automatically calculated by VSP based upon the user defined value of α.
[c] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the lower horizontal dashed blue line is positioned at α on the vertical axis; the upper horizontal dashed blue line is positioned at $1-\beta$ on the vertical axis. The vertical green line is positioned at one standard deviation above the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at α and the upper bound of Δ at $1-\beta$. If any of the inputs change, the number of samples that result in the correct curve changes.



Statistical Assumptions

The assumptions associated with the formulas for computing the number of samples are:

1. the computed sign test statistic is normally distributed,
2. the variance estimate, S^2, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected randomly.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the sample locations were selected using a random process.

Sensitivity Analysis

The sensitivity of the calculation of number of samples was explored by varying s, UBGR, β and α and examining the resulting changes in the number of samples. The following table shows the results of this analysis.

Number of Samples							
AL=2.1		α=10		α=15		α=20	
		s=3.6	s=1.8	s=3.6	s=1.8	s=3.6	s=1.8
UBGR=110	β=5	4750	1192	3988	1001	3430	861
	β=10	3645	915	2981	748	2501	628
	β=15	2981	748	2384	599	1958	491
UBGR=120	β=5	1192	303	1001	255	861	219
	β=10	915	232	748	190	628	160
	β=15	748	190	599	153	491	125
UBGR=130	β=5	533	138	448	116	386	100
	β=10	410	106	335	87	281	74
	β=15	335	87	268	70	220	58

s = Standard Deviation
UBGR = Upper Bound of Gray Region (% of Action Level)
β = Beta (%), Probability of mistakenly concluding that μ < action level
α = Alpha (%), Probability of mistakenly concluding that μ > action level
AL = Action Level (Threshold)

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $15500.00, which averages out to a per sample cost of $534.48. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**29 Samples**
Field collection costs		$100.00	$2900.00
Analytical costs	$400.00	$400.00	$11600.00
Sum of Field & Analytical costs		**$500.00**	**$14500.00**
Fixed planning and validation costs			$1000.00
Total cost			**$15500.00**

Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

This report was automatically produced* by Visual Sample Plan (VSP) software version 4.6d.
Software and documentation available at http://dqo.pnl.gov/vsp
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* - The report contents may have been modified or reformatted by end-user of software.

Attachment B

VSP Approach B

Random sampling locations for comparing two population means or medians (site and reference) [nonparametric]

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean or median to a reference area mean or median
Type of Sampling Design	Nonparametric
Sample Placement (Location) in the Field	Simple random sampling
Working (Null) Hypothesis	The difference between the medians(means) is less than or equal to the threshold
Formula for calculating number of sampling locations	Wilcoxon rank sum test
Calculated total number of samples for each survey and reference area [a]	32
Number of samples on map [b]	0
Number of selected sample areas [c]	0
Specified sampling area [d]	5000.00 ft^2
Total cost of sampling [e]	$32.00

[a] Based on the analyte with the highest minimum number of survey unit samples.
[b] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[c] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[d] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[e] Costs for one sampling area, including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.

Primary Sampling Objective

The primary purpose of sampling at this site is to compare a site median or mean value with a reference area median or mean value. This is achieved by testing the difference between the site and reference area medians(means). The working hypothesis (or 'null' hypothesis) is that the difference between the site median(mean) and the reference area median(mean) is less than the threshold. The alternative hypothesis is that the difference is equal to or exceeds the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach

A nonparametric random sampling approach was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples

are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs

The equation used to calculate the number of samples is based on a Wilcoxon Rank Sum test. For this site, the null hypothesis is rejected in favor of the alternative one if the difference between the site and reference area median(mean) is sufficiently larger than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = m = 1.16\left[\frac{2\left(S^2_{sample} + \frac{S^2_{analytical}}{r}\right)}{\Delta^2}\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2 + 0.25 Z^2_{1-\alpha}\right]$$

where

n is the number of samples for the site and is equal to m,

m is the number of samples for the reference area and is equal to n,

S is the estimated standard deviation of the measured values including analytical error,

Δ is the width of the gray region,

α is the acceptable probability of incorrectly concluding the difference between the medians(means) exceeds the threshold,

β is the acceptable probability of incorrectly concluding the difference between the medians(means) is less than the threshold,

$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is 1-α,

$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is 1-β.

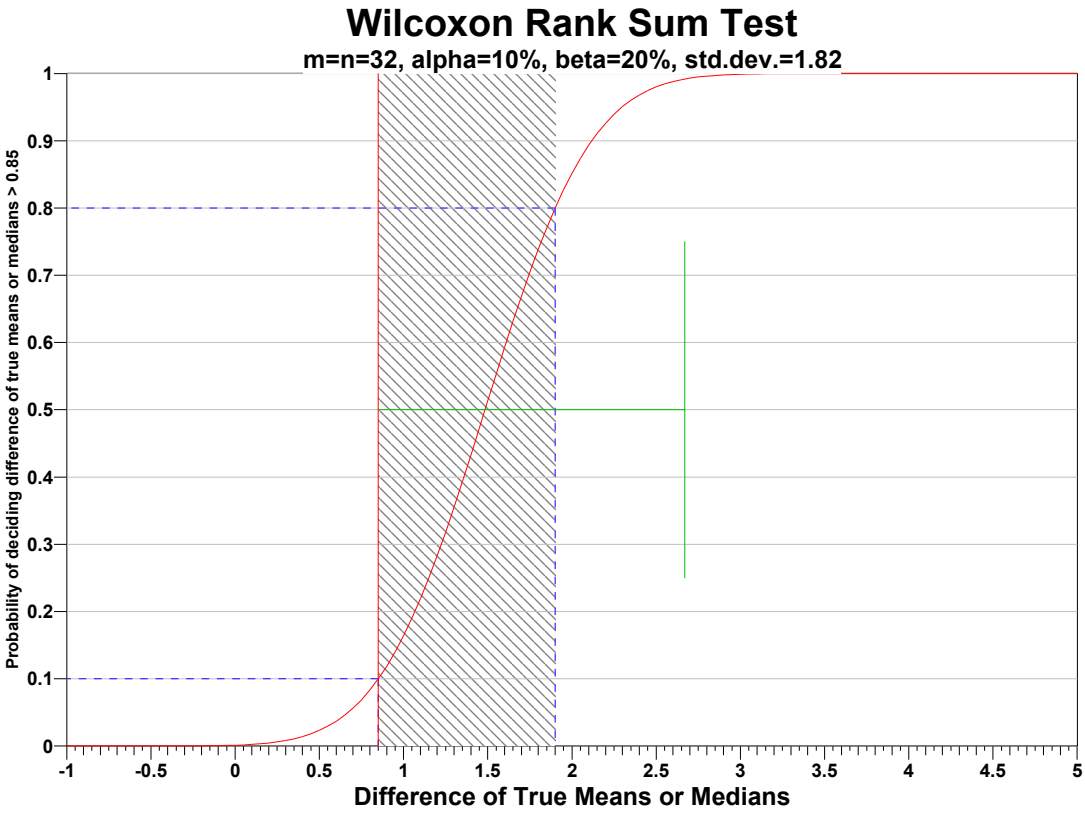
The values of these inputs that result in the calculated number of sampling locations are:

Analyte	n	Parameter					
		S	**Δ**	**α**	**β**	**$Z_{1-\alpha}$** [a]	**$Z_{1-\beta}$** [b]
	32	1.82	1.05	0.1	0.2	1.28155	0.841621

[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty (the probability that the difference between the site median(mean) and the reference area median(mean) exceeds the threshold) on the vertical axis versus a range of possible true differences between the medians(means) on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the lower horizontal dashed blue line is positioned at α on the vertical axis; the upper horizontal dashed blue line is positioned at 1-β on the vertical axis. The vertical green line is positioned at one standard deviation above the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at α and the upper bound of Δ at 1-β. If any of the inputs change, the number of samples that result in the correct curve changes.



Statistical Assumptions

The assumptions associated with the formulas for computing the number of samples are:

1. the data from each area (site and reference area) originate from symmetric (but not necessarily normal) populations,
2. the variances of the site and reference populations are equal,
3. the variance estimate, S^2, is reasonable and representative of the populations being sampled,
4. the population values are not spatially or temporally correlated, and
5. the sampling locations will be selected randomly.

The first four assumptions will be assessed in a post data collection analysis. The last assumption is valid because the sample locations were selected using a random process.

Sensitivity Analysis

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, upper bound of gray region (% of action level), beta (%), probability of mistakenly concluding that μ < action level and alpha (%), probability of mistakenly concluding that μ > action level and examining the resulting changes in the number of samples. The following table shows the results of this analysis.

Number of Samples							
AL=0.85		α=5		α=10		α=15	
		s=3.64	s=1.82	s=3.64	s=1.82	s=3.64	s=1.82
UBGR=110	β=15	202	51	151	38	121	31
	β=20	174	44	127	32	99	25
	β=25	151	39	108	28	82	21
UBGR=120	β=15	202	51	151	38	121	31
	β=20	174	44	127	32	99	25
	β=25	151	39	108	28	82	21
UBGR=130	β=15	202	51	151	38	121	31

β=20	174	44	127	32	99	25
β=25	151	39	108	28	82	21

s = Standard Deviation
UBGR = Upper Bound of Gray Region (% of Action Level)
β = Beta (%), Probability of mistakenly concluding that μ < action level
α = Alpha (%), Probability of mistakenly concluding that μ > action level
AL = Action Level (Threshold)

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $32.00, which averages out to a per sample cost of $1.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**32 Samples**
Field collection costs		$1.00	$32.00
Analytical costs	$0.00	$0.00	$0.00
Sum of Field & Analytical costs		**$1.00**	**$32.00**
Fixed planning and validation costs			$0.00
Total cost [a]			**$32.00**

[a] Total cost for one sampling area.

Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the difference between the site and reference area median(mean) values with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

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* - The report contents may have been modified or reformatted by end-user of software.

ATTACHMENT 2

TETRA TECH RESPONSE TO UNIVERSITY OF FLORIDA COMMENTS
JUNE 22, 2007

Response to University of Florida Comments on "Using Statistics to Calculate the Additional Samples needed to fully identify the Arsenic Concentrations in Soil across Naval Station Mayport, FL"
June 22, 2007

Comment 1:

The analysis is intended to address two questions (pg 2): "Are arsenic concentrations from already sampled areas significantly different, based on statistical analysis, than arsenic concentrations in previously unsampled areas?" and "Are arsenic concentrations from already sampled areas significantly different, based on statistical analysis, than arsenic concentrations in the native soil areas?" The intent of the first question appears to be a determination of whether arsenic concentrations in SWMUs are representative of "anthropogenic background," and the second question a determination of whether arsenic concentrations in SWMUs are representative of natural background conditions. Both are legitimate issues to address in managing potential soil arsenic contamination. In Florida (under Chapter 62-780, FAC), naturally-occurring chemicals are not considered to pose an unacceptable risk if they are present in concentrations equivalent to local, unaffected background conditions [second question]. There is no basis in rule to eliminate a chemical from consideration based on comparison with anthropogenic background levels, but such comparisons are valuable nonetheless because they aid in determining whether a release has occurred for which cleanup can be compelled, and if so, the operational boundaries of that release.

In describing the analytical approach (pg 4), a third comparison is presented – the mean arsenic concentration from previously unsampled areas with the Florida residential soil cleanup target level (SCTL) for arsenic of 2.1 mg/kg. The rationale for this comparison is unclear. It has no direct bearing on either the primary questions to be addressed by the analysis (see above), nor are there obvious regulatory implications of a finding one way or the other (except perhaps calling into question whether the background locations were truly unaffected).

Response to Comment 1:

The SCTL of 2.1 mg/kg is introduced on page 1 of the subject report in "DQO Step 1 – State the Problem". This cleanup level provides a point of reference that reflects a conservative cleanup level to which soils may be remediated. The conservatism of SCTLs, in general, is reflected in statements such as, "Therefore, a value of 200 mg/day is considered to be conservative estimate of the mean [ingestion rate]" and "This assumption [of exposed skin area] is reasonably conservative…" (FDEP, 2005). FDEP (2005) also states that "SCTLs are based on default assumptions and are intended to be widely applicable."

The following text will be inserted at the end of DQO Step 2 – State the Problem in the next issue of this document:

> "Also of interest is whether the concentrations in a particular area significantly exceed the typical soil cleanup level of 2.1 mg/kg. This level represents a target to which a site may be remediated."

Comment 2:

The analytical approach (pg 4), one of the decision rules is stated as follows: "If mean arsenic concentrations from already sampled areas are greater than arsenic concentrations in previously unsampled areas, additional study activities may be warranted; otherwise, conclude that no further action is required." We assume by "no further action," the report means no further background sampling or statistical comparison, not "no further action" in terms of cleanup. In effect, this result would mean that arsenic concentrations in the SWMUs are greater than anthropogenic background, in which some remedial action could be warranted. The same comment applies to the decision rule that follows this one in text referring to the comparison between mean arsenic concentrations in already sampled areas and native soil areas.

Response to Comment 2:

"No further action" in the context cited above means no further sampling or statistical analysis is required. This clarification will be added to the next issue of this document.

Comment 3:

The surface soil interval is specified as 0 to 2 ft below land surface bgs (pg 9), and subsurface soil will be divided into 2 ft intervals from 2 to 8 ft bgs. As a practical matter, some vertical compositing is necessary, and 2 foot intervals for soil below 2 ft bgs is reasonable, in our opinion. However, representing surficial soil as a single 0 to 2 ft bgs composite weakens the analysis. In some situations, arsenic contamination can remain near the surface, and vertical compositing with lower, cleaner soils results in an underestimation of the concentration to which individuals have the greatest contact. For this reason, FDEP recommends sampling intervals for metals of 0 to 0.5 ft bgs, 0.5 to 2 ft bgs, and two-foot intervals thereafter. We realize that the use of historical data may prevent the soils from being divided into these intervals but, if data for these intervals exist, they should be used in the analysis.

Response to Comment 3:

The selected surface soil interval was a matter of practicality. On one hand, the actual subinterval for any particular soil sample was not consistently known. Therefore, it is impossible to accurately segregate samples based on subintervals within two feet of ground surface. On the other hand, the samples that have a bottom depth of two feet or less are readily discerned from those with a bottom depth greater than 2 ft bgs. Part of the difficulty derives from incomplete historical records. As a matter of practicality, the Navy also believes it is reasonable to use the 0 to 2-ft interval to represent surface soils because it spans all reasonable surface intervals associated with typical exposure scenarios.

Comment 4:

Figure 1 shows proposed sampling locations that include areas near large buildings and a runway. Without additional information, it is impossible to determine whether locations near buildings are potentially influenced by prior activities or releases. Also, if the areas near runways are in a swale or area that collects surface water runoff, they will be unsuitable for assessment of background conditions.

Response to Comment 4:

The unsampled areas selected for sampling in this study are not located in areas of concern (AOCs) or solid waste management units (SWMUs). Whereas unsampled areas may reflect anthropogenic contamination, any potential cleanup in these areas to concentrations less than anthropogenic background levels is not likely to be required. Therefore, the use of samples collected from the areas in question is viewed to be acceptable.

Comment 5:

A site-specific relative percent difference should be used for the calculations. The upper end estimate of the variance (based upon the acceptance range for field duplicate sample precision) is not conservative, as the report contends, and the UBGR and the factor within which the estimated concentration is expected to agree with the true concentration could be overestimated.

Response to Comment 5:

Forty out of 51 surface soil RPD values were less than 50 percent and the highest value was 112 percent. All other values were between 50 and 74 percent. Twenty out of 21 subsurface RPD values were less than 50 percent and the highest was 53 percent. In total, 60 out of 72 RPD values across all soil

samples were less than 50 percent. These values support the use of 50 percent RPD as an upper limit. In addition, the actual standard deviation for surface soil (=1.08 mg/kg) was almost the same value obtained (=1.05) based on a typical upper limit of 50 percent RPD. For subsurface soil the actual standard deviation was 1.82 mg/kg. Given these statistical parameters and the fact that planning inputs to the computation of number of samples are only estimates, the Navy believes the inputs are valid. See also the response to comment 7. Furthermore, the computed number of samples represents the number of samples to be collected from each population and is far less than the 800+ samples already collected. Therefore, more statistical power will be achieved in the data analysis than would be expected based on the number of sample computations presented in the subject report.

Comment 6:

Page 5 of the report states "Subsurface soil data were used because they represent the greater standard deviation of the surface and subsurface data."

When determining the UBGR for VSP Approach A, Run 2, the subsurface soil standard deviation was added to the arsenic criteria to yield a value of 3.9 mg/kg. Although this may be an appropriate number for subsurface soil, it is an overestimation for surface soils. The surface soil standard deviation is smaller and will yield a smaller UBGR.

Response to Comment 6:

The standard deviation, *s*, of the subsurface soil data was approximately 1.8 mg/kg and for surface soils it was approximately 1.2 mg/kg. If the UBGR is determined by adding the value of *s* to 1.2 mg/kg, the width of the gray region, Δ, is equal to *s*. Computation of the number of samples depends on Δ and *s,* but the absolute location of the UBGR is not important in this regard. This can be seen by inspection of the equation on page 8, which incorporates Δ and *s*, but not UBGR. In VSP Approach A, Run 2 was developed using LBGR = 2.1 mg/kg and *s* = 1.8 mg/kg. In this case Δ = 1.8 mg/kg as well. The number of samples computed by VSP depends on the square of the standard deviation (i.e., the variance) divided by the square of the gray region width. However, the gray region width and the standard deviation are equal, so the ratio is unity (1.0). The same will be true no matter what value is selected for *s*.

To make this clearer, the following text will be inserted at the end of the first paragraph of VSP Approach A, Run 2 in the next issue of this document:

> "The number of samples is essentially proportional to the ratio Δ/s. This can be seen by inspecting the equations in Appendices A and B. The approach used in this Run 2 requires that Δ = s, therefore,

the same number of samples is computed regardless of the value used for s."

Comment 7:

The null hypotheses used in both Attachment A and Attachment B assume the mean value for the previously sampled areas (SWMUs) and the difference between mean values is less than or equal to the threshold. In effect, these hypotheses assume that the SWMUs represent background conditions, unless the statistical comparison shows, with high confidence, that this presumption is false. This is not very conservative. When the data are obtained, they should also be used to test the alternative hypothesis that the previously unsampled areas and the already sampled areas are different. This approach guards against making the more harmful error of concluding that the site is not contaminated when in fact it is.

Response to Comment 7:

The overall soil mean is 1.15 mg/kg with a subsurface soil mean of 1.25 mg/kg and a surface soil mean of 1.05 mg/kg. With standard deviations comparable in magnitude to this value, there is little "room" for a mean in the unsampled areas to be low enough to cause the SWMU data sets to appear different than the unsampled area data sets. Therefore, the Navy is comfortable in stating the null hypotheses as presented in the subject report. After data collection, the null and alternative hypotheses will be evaluated. This is an inherent part of evaluating the decision rules.

References

FDEP, 2005. Technical Report: Development of Cleanup Target Levels (CTLs) For Chapter 62-777, F.A.C., prepared for the Division of Waste Management Florida Department of Environmental Protection by Center for Environmental & Human Toxicology, University of Florida, Gainesville, Florida. February.

ATTACHMENT 3

FIELD FORMS

11/26/07 112600436 SOIL SAMPLING CTO 33 US NAVY

PERSONNEL : TERRY COTTENOIR (TC), DONALD HARDISON (DH)
TRUCK : 2001 F-250 SD
PHONES : 5431, 5429
PPE : LEVEL D
WEATHER : 75°F, MOSTLY SUNNY
OBJECTIVE : COLLECT 80 SOIL SAMPLES FROM 40 LOCATIONS FOR ARSENIC BACKGROUND STUDY.

0700 TC & DH AT TENUS OFFICE PREPARING FOR TODAY'S WORK.
0830 TC & DH DEPART FOR NAVSTA MAYPORT.
0910 TC & DH ON BASE. GO PICK UP THREE DIG PERMITS FROM WAYNE PURIFOY.
0930 TC & DH SET UP & BEGIN TO COLLECT SOIL SAMPLES (SEE TABLE BELOW FOR DETAILS)

BORING #	SAMPLE ID	TIME	ANALYSIS	LAB	NORTHING (ft)	EASTING (ft)
SB01	MPTBG-SS01-01-112607	0939	ARSENIC	ACCUTEST	516162.165	2944372.298
↓	MPTBG-SB01-03-112607	0959	↓	↓	↓	↓
SB02	MPTBG-SS02-01-112607	1016	↓	↓	516512.309	2943408.418
↓	MPTBG-SB02-04-112607	1025	↓	↓	↓	↓
SB03	MPTBG-SS03-01-112607	1040	↓	↓	519384.368	2941061.997
↓	MPTBG-SB03-03-112607	1046	↓	↓	↓	↓
SB04	MPTBG-SS04-01-112607	1055	↓	↓	519559.864	2941018.636
↓	MPTBG-SB04-10-112607	1114	↓	↓	↓	↓
SB05	MPTBG-SS05-01-112607	1151	↓	↓	519438.833	2940816.886
↓	MPTBG-SB05-06-112607	1201	↓	↓	↓	↓
SB06	MPTBG-SS06-01-112607	1218	↓	↓	520444.903	2937362.019
↓	MPTBG-SB06-05-112607	1229	↓	↓	↓	↓
SB07	MPTBG-SS07-01-112607	1243	↓	↓	520414.899	2937854.763
↓	MPTBG-SB07-05-112607	1253	↓	↓	↓	↓
SB08	MPTBG-SS08-01-112607	1309	↓	↓	518847.151	2937009.524
↓	MPTBG-SB08-03-112607	1317	↓	↓	↓	↓

* SEE SOIL SAMPLE LOG SHEETS FOR DETAILS

1330 TC SHOWS DH OTHER LOCATIONS FOR TOMORROW'S WORK.
1400 TC & DH DEPART NAVSTA MAYPORT

TC

Terry Cottenoir

Personnel: Donald Harelison (DH)
Truck: 2001 F-250 SD
Phone: 5429
PPE: Level D
Weather: 70s, overcast and rainy, sunny in afternoon
objective: Collect 80 soil samples from 40 locations for Arsenic Background study

0700 - DH at TetNus office preparing for Today's work
0830 - DH departs for NAVSTA Mayport
0910 - At Commercial gate. Long line and wait to get in.
0955 - DH picks up remaining Dig Permits from Wayne Purifoy
10 25 - DH at first location setting up to collect soil samples (see table below for Details)

Boring #	Sample ID	Time	Analysis	Lab	Northing (ft)	Easting (ft)
Rinsate Blank	MPTBG-RB01-112707	1035	Arsenic	Accutest	N/A	N/A
SB09	MPTBG-SS09-01-112707	1045	↓	↓	517462.579	2946375.378
↓	MPTBG-SB09-13-112707	1100	↓	↓	↓	↓
SB10	MPTBG-SS10-01-112707	1145	↓	↓	517642.046	2946200.619
↓	MPTBG-SB10-03-112707	1150	↓	↓	↓	↓
SB11	MPTBG-SS11-01-112707	1225	↓	↓	517526.039	2946627.335
↓	MPTBG-SB11-06-112707	1235	↓	↓	↓	↓
Rinsate Blank	MPTBG-RB02-112707	1300	↓	↓	N/A	N/A
SB12	MPTBG-SS12-01-112707	1310	↓	↓	517427.753	2946790.820
↓	MPTBG-SB12-09-112707	1320	↓	↓	↓	↓
SB13	MPTBG-SS13-01-112707	1405	↓	↓	518488.224	2946257.881
↓	MPTBG-SB13-04-112707	1412	↓	↓	↓	↓
Rinsate Blank	MPTBG-RB03-112707	1455	↓	↓	N/A	N/A
SB14	MPTBG-SS14-01-112707	1510	↓	↓	519397.263	2946900.109
↓	MPTBG-SB14-07-112707	1525	↓	↓	↓	↓

* SEE Soil Sample Log sheets for Details

1610 - DH departs NAVSTA Mayport

DH

DH DH

1/28/07 112GD0436 Soil Sampling CTO33 US NAVY

Personnel: Donald Hardison (DH)
Truck: 2001 F-250 SD
Phone: 5429
PPE: Level D
Weather: 70s, overcast
Objective: Collect 80 soil samples from 40 Locations for Arsenic Background Study.

0700 DH at TetNus office preparing for todays work
0805 DH departs for NAUSTA Mayport
0845 DH at commercial gate. Long line to get in.
0930 DH at first sample location setting up. (See Table below for details).

Boring #	Sample ID	Time	Analysis	Lab	Northing(ft)	Easting(ft)
Rinsate Blank	MPTBG-RB04-112807	0945	Arsenic	Accutest	N/A	N/A
SB15	MPTBG-SS15-01-112807	0950	↓	↓	520023.867	2947107.098
↓	MPTBG-SB15-03-112807	1000	↓	↓	↓	↓
SB16	MPTBG-SS16-01-112807	1055	↓	↓	520294.596	2945465.572
↓	MPTBG-SB16-08-112807	1110	↓	↓	↓	↓
Rinsate Blank	MPTBG-RB05-112807	1200	↓	↓	N/A	N/A
SB17	MPTBG-SS17-01-112807	1220	↓	↓	518431.759	2945831.102
↓	MPTBG-SB17-03-112807	1230	↓	↓	↓	↓
SB18	MPTBG-SS18-01-112807	1310	↓	↓	519635.959	2945489.998
↓	MPTBG-SB18-07-112807	1320	↓	↓	↓	↓
Rinsate Blank	MPTBG-RB06-112807	1350	↓	↓	N/A	N/A
SB19	MPTBG-SS19-01-112807	1400	↓	↓	518528.851	2945134.934
↓	MPTBG-SB19-03-112807	1405	↓	↓	↓	↓
SB20	MPTBG-SS20-01-112807	1455	↓	↓	518751.528	2943908.088
↓	MPTBG-SB20-04-112807	1505	↓	↓	↓	↓

* See Soil sample Log sheets for details

1540 DH leaves NASTA May port

DH

11/29/07 112G00436 SOIL SAMPLING CTO 33 US NAVY

PERSONNEL : TERRY COTTENOIR (TC), DONALD HARDISON (DH)
TRUCK : 2001 F-250 SD
PHONE : 5431, 5429
PPE : LEVEL D
WEATHER : 78°F, OVERCAST
OBJECTIVE: CONTINUE COLLECTING SOIL SAMPLES FOR ARSENIC BACKGROUND STUDY & DO UTILITY LOCATES.

0700 TC & DH AT TENUS OFFICE PREPARING FOR TODAY'S WORK.
0930 TC & DH DEPART FOR NAVSTA MAYPORT.
1015 TC & DH AT COMMERCIAL GATE. LINE TO GET ON BASE.
1035 ON BASE. MEET WITH THOMAS OF CENTRAL LOCATING SERVICE. DISCUSS UTILITY LOCATES FOR SWMUS 2, 3, 4, 5, & 22. THOMAS SAYS HE HAS NO UTILITIES IN THE AREA
1100 TC & DH BEGIN TO MARK LOCATIONS FOR SWMUS 2, 3, 4, 5, & 22 FOR OTHER UTILITY LOCATES.
* NOTE: DID NOT MARK ALL LOCATIONS. SOME ARE HARD TO ACCESS DUE TO DENSE WOODS.
1240 TC & DH AT FIRST SAMPLE LOCATION. BEGIN TO SET UP & COLLECT SAMPLES (SEE TABLE BELOW FOR DETAILS)

BORING #	SAMPLE ID	TIME	ANALYSIS	LAB	NORTHING (FT)	EASTING (FT)
SB21	MPTB6-SS21-01-112907	1250	ARSENIC	ACCUTEST	516677.570	2940649.413
↓	MPTB6-SB21-03-112907	1255	↓	↓	↓	↓
RINSATE BLANK	MPTB6-RB07-112907	1300			N/A	N/A
SB22	MPTB6-SS22-01-112907	1328			515844.043	2940797.153
↓	MPTB6-SB22-02-112907	1331			↓	↓
RINSATE BLANK	MPTB6-RB08-112907	1340			N/A	N/A
SB23	MPTB6-SS23-01-112907	1345			515050.769	2940407.947
↓	MPTB6-SB23-02-112907	1350	↓	↓	↓	↓

* SEE SOIL SAMPLE LOG SHEETS FOR DETAILS.

1430 TC & DH LEAVE NAVSTA MAYPORT.

TC

Terry Cottenoir

ARSENIC BACKGROUND STUDY

'1/30/07 112G00436 SOIL SAMPLING CTO 33 US NAVY

PERSONNEL: TERRY COTTENOIR (TC), DONALD HARDISON (DH)
TRUCK : F-250 SD
PHONE : 5431
PPE : LEVEL D
WEATHER : 73°F, OVERCAST
OBJECTIVE: CONTINUE TO COLLECT SOIL SAMPLES FOR ARSENIC BACKGROUND STUDY.

'700 TC & DH AT TENNS OFFICE PREPARING FOR TODAY'S WORK.
'845 TC & DH DEPART FOR NAVSTA MAYPORT, WILL STOP FOR GAS ON THE WAY TO SITE.
'930 ON BASE. NO LINE AT COMMERCIAL GATE. GO CHECK IN AT MUNITIONS BLDG TO GO TO DREDGE SPOIL AREA.
'945 TC & DH IN DREDGE SPOIL AREA. SET UP & BEGIN TO COLLECT SOIL SAMPLES. (SEE TABLE BELOW FOR DETAILS)

BORING #	SAMPLE ID	TIME	ANALYSIS	LAB	NORTHING (FT)	EASTING (FT)
SB24	MPTB6-SS24-01-113007	0955	ARSENIC	ACCUTEST	515218.552	2939622.586
↓	MPTB6-SB24-02-113007	1000	↓	↓	↓	↓
SB25	MPTB6-SS25-01-113007	1017	↓	↓	514796.106	2937844.802
↓	MPTB6-SB25-02-113007	1022	↓	↓	↓	↓
SB26	MPTB6-SS26-01-113007	1032	↓	↓	515863.689	2937848.669
↓	MPTB6-SB26-02-113007	1037	↓	↓	↓	↓

* SEE SOIL SAMPLE LOG SHEETS FOR DETAILS.

1100 TC & DH CHECK OUT WITH MUNITIONS BLDG.
1105 TC & DH GO TO WAYNE PURIFOY'S OFFICE. SPEAK WITH HIM ABOUT DIG PERMITS.
1200 TC & DH LEAVE BASE. WILL GO BACK TO THE OFFICE TO PREPARE SAMPLES FOR ACCUTEST PICK UP.
1440 SAMPLES PICKED UP BY ACCUTEST.

TC

Terry Cottenoir

Arsenic Background Study

12/12/07 112G00436 Soil sampling CTO 33 US NAVY

Personnel: Donald Hardison (DH)
Truck: F250 SD
Phone: 5429
PPE: Level D
Weather: 70s-80s, Sunny
Objectives: Continue to collect soil samples for Arsenic Background Study

0715 - DH at office Preparing for Today's work
1000 - New GPS unit arrives at office for work
1015 - Leave office for Site. Stop to get unit in Time
1050 - Meet w/ Tag McNeal at Building 90 to obtain access to Flight line area
1100 - DH at first location setting up to begin to collect soil samples (See Table Below for details)

Boring #	Sample ID	Time	Analysis	Lab	Northing (ft)	Easting (ft)
Rinsate Blank	MPTBG-RB09-121207	1100	Arsenic	Accutest	* Recorded on hand held GPS unit	
SB27	MPTBG-SS27-01-121207	1125				
↓	MPTBG-SB27-03-121207	1130				
SB28	MPTBG-SS28-01-121207	1205				
↓	MPTBG-SB28-02-121207	1210				
SB29	MPTBG-SS29-01-121207	1230				
↓	MPTBG-SB29-04-121207	1235				
SB30	MPTBG-SS30-01-121207	1255				
↓	MPTBG-SB30-02-121207	1300				
SB31	MPTBG-SS31-01-121207	1320				
↓	MPTBG-SB31-04-121207	1325				
SB32	MPTBG-SS32-01-121207	1345				
↓	MPTBG-SB32-03-121207	1350				
Rinsate Blank	MPTBG-RB10-121207	1445				

* GPS coordinates did not match previous collected on back pack unit. These data were collected on Trimble GeoXT hand held and sent to Jon Wright for post processing

1530 - DH off site and back to office

DH

Arsenic Background Study

12/13/07 112G00436 Soil sampling CTO 083 USNAVY

Personnel: Donald Hendrison (DH)
Truck: F250 SD
Phone: 5429
GPS: Trimble GeoXT hand held
PPE: Level D
Weather: 70's, overcast
Objective: Continue to collect soil samples for Arsenic Background Study

0630 - At office preparing for day work
0715 - Leave office for NAVSTA Mayport
0750 - At Commercial gate. Long line to get into base.
0815 - Meet Tag McNeal at Building 90 to obtain access to site. Tag will show DH remaining locations and give radio so DH can communicate with tower and work on flightline alone.
0920 - Have found all remaining locations. Tag McNeal leaving site
0930 - DH at first location setting up. to begin to collect soil samples. (See Table for details).

Boring #	Sample ID	Time	Analysis	Lab	GPS coordinates
RinsateBlank	MPTBG-RB11-121307	0930	Arsenic	Accutest	collected on Trimble GeoXT handheld and stored for download.
SB33	MPTBG-SB33-01-121307	0940			
	MPTBG-SB33-02-121307	0945			
SB34	MPTBG-SB34-01-121307	1000			
	MPTBG-SB34-03-121307	1005			
SB35	MPTBG-SB35-01-121307	1030			
	MPTBG-SB35-04-121307	1035			
SB36	MPTBG-SB36-01-121307	1055			
	MPTBG-SB36-04-121307	1100			
SB37	MPTBG-SB37-01-121307	1130			
	MPTBG-SB37-04-121307	1135			
SB38	MPTBG-SB38-01-121307	1150			
	MPTBG-SB38-03-121307	1155			
SB39	MPTBG-SB39-01-121307	1210			
	MPTBG-SB39-02-121307	1215			
SB40	MPTBG-SB40-01-121307	1255			
	MPTBG-SB40-04-121307	1300			
RinsateBlank	MPTBG-RB12-121307	1315			

* See Soil Sample Log Sheets for details

12/17/07

- It was determined that data collected with backpack Trimble GPS on 11/26/07 to 11/30/07 was wrong. Soil boring SB01 to SB26 are to be recollected with hand held Trimble GeoXT and datafiles sent to Jon Wright for post processing

1400 Collect GPS data for SB01 to SB21

1715 Headed back to office to send data to Jon Wright

12/19/07

1000 - DH obtaining access to weapons area at NAUSTA Mayport

- Collecting GPS data for SB22 to SB26

* Data presented on Table on next page. Data was collected on Trimble GeoXT hand held unit and then sent to Jon Wright for post processing

DH

RM [illegible]

112G00436 Arsenic Background Study Soil Sampling CTO 33 US NAVY

Bore hole	Easting (ft.)	(ft.) Northing
MPTBG-SB01	528533.51	2199413.61
MPTBG-SB02	527586.36	2199788.99
MPTBG-SB03	525326.73	2202731.78
MPTBG-SB04	525291.74	2202907.26
MPTBG-SB05	525079.66	2202787.74
MPTBG-SB06	521665.36	2203899.32
MPTBG-BG07	522154.53	2203857.67
MPTBG-SB08	521258.55	2202314.68
MPTBG-SB09	530575.38	2200642.81
MPTBG-SB10	530406.91	2200829.76
MPTBG-SB11	530831.97	2200702.88
MPTBG-SB12	530991.93	2200599.23
MPTBG-SB13	530490.12	2201675.89
MPTBG-SB14	531162.89	2202565.38
MPTBG-SB15	531387.74	2203183.44
MPTBG-SB16	529757.17	2203503.13
MPTBG-SB17	530063.57	2201626.98
MPTBG-SB18	529759.41	2202844.28
MPTBG-SB19	529369.50	2201748.22
MPTBG-SB20	528151.29	2202008.90
MPTBG-SB21	524827.78	2200038.89
MPTBG-SB22	524952.67	2199199.77
MPTBG-SB23	524541.63	2198419.89
MPTBG-SB24	523761.62	2198608.87
MPTBG-SB25	521968.99	2198242.53
MPTBG-SB26	522006.74	2199308.25
MPTBG-SB27	524244.78	2203523.09
MPTBG-SB28	523291.29	2202468.65
MPTBG-SB29	522498.53	2201854.85
MPTBG-SB30	523049.64	2201340.49
MPTBG-SB31	521912.09	2201249.23
MPTBG-SB32	520924.27	2200186.71
MPTBG-SB33	519617.50	2198921.54
MPTBG-SB34	520952.90	2200875.55
MPTBG-SB35	522959.90	2203004.58
MPTBG-SB36	524099.96	2204840.72
MPTBG-SB37	523701.84	2204358.61
MPTBG-SB38	522145.32	2202599.86
MPTBG-SB39	521543.18	2201968.93
MPTBG-SB40	524290.93	2205604.48

RM 24-1

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB01
DATE: 11/26/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	2.0					GRAY	V.F. SAND						
2.0	2.5					GRAY	V.F. SAND W/BLK CLAY						
2.5	3.0					GRAY	V.F. SAND W/SOME	CLAY					
3.0	3.5					GRAY	CLAY W/SOME V.F.	SAND	∇ - WATER TABLE				
3.5	4.0					GRAY	V.F. SAND W/SOME	CLAY					0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~ 3.0 ft.

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS01-01-112607
Sample Location: SB01
Sampled By: TC / DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 0939 Method: HAND AUGER Monitor Reading (ppm): 0.0	0 - 1 ft	GRAY	V. FINE SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

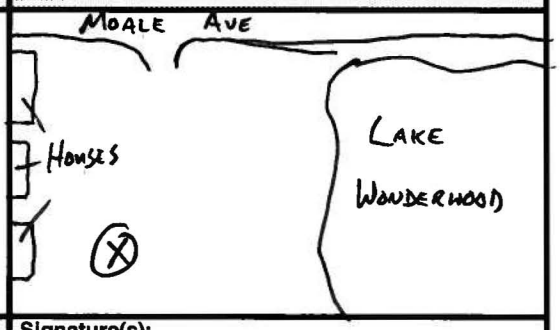
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 516162.165 ft
E: 2944372.298 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB01-03-112607
Sample Location: SB01
Sampled By: TC/DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 0959 Method: HAND AUGER Monitor Reading (ppm): 0.0	2 - 3 ft	GRAY	V.F. SAND W/SOME CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

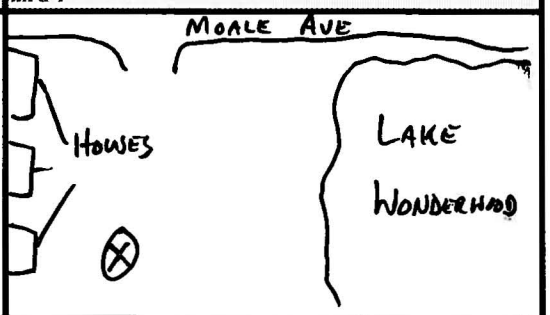
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 516162.165 ft
E: 2944372.298 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Catt

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A HAND AUGER

BORING NUMBER: SB02
DATE: 11/26/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	4				LT	GRAY	V.F. SAND		DRY				
4	5				LT	GRAY	V.F. SAND		∇ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~ 4 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS02-01-112607
Sample Location: SB02
Sampled By: TC / DH
C.O.C. No.: 26085

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1016 Method: HAND AUGER Monitor Reading (ppm): 0.0	0 - 1	LT GRAY	V. F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

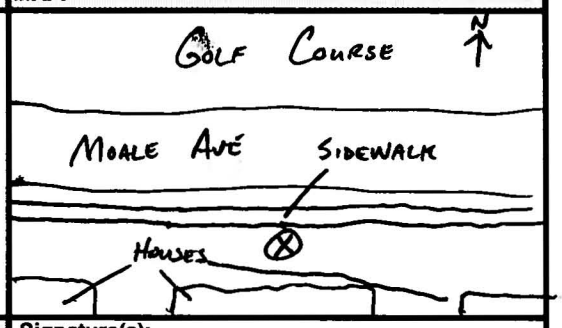
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -		Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 516512.309 ft.
E: 2943408.418 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott.

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTB6-SB02-04-112607
Sample Location: SB02
Sampled By: TC/DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1025 Method: HAND AUGER Monitor Reading (ppm): 0.0	3 - 4 ft	LT. GRAY	V.F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

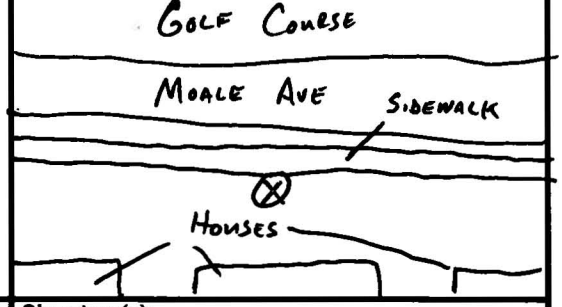
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES

N: 516512.309 ft
E: 2943408.418 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cattin

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB03
DATE: 11/26/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	1					GRAY	V.F. SAND		DRY				
1	3					BROWN	V.F. SAND W/SHELLS		DRY				
3	4					BROWN	V.F. SAND W/SHELLS		∇ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~ 3 ft bls

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTB6-SS03-01-112607
Sample Location: SB03
Sampled By: TC / DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1040 Method: HAND AUGER Monitor Reading (ppm): 0.0	0-1 ft.	GRAY	V. F. SAND

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

NO COMPOSITE SAMPLE COLLECTED

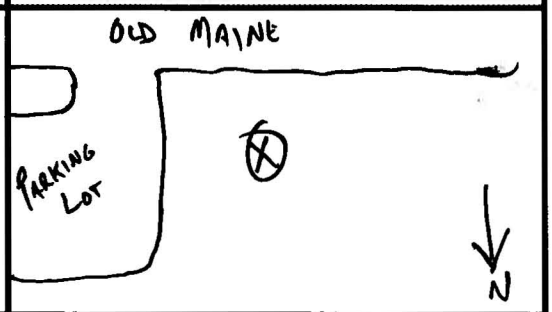
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES:
N: 519384.368 ft
E: 2941061.997 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cole

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB03-03-112607
Sample Location: SB03
Sampled By: TC / DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1046 Method: HAND AUGER Monitor Reading (ppm): 0.0	2 - 3 ft	BROWN	V.F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

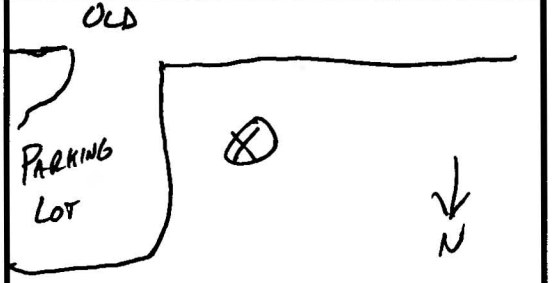
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 519384.368 ft
E: 2941061.997 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cotti

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
BORING NUMBER: SB04
PROJECT NUMBER: 112G00436
DATE: 11/26/07
DRILLING COMPANY: N/A
GEOLOGIST: T. Cottenoir
DRILLING RIG: N/A - Hand Auger
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	10					Gray	V.F. Sand w/shells		Dry				
10	11					Gray	V.F. Sand w/shells		▽ - Water Table				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks: Water Table @ ~10 ft b/s

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS04-01-112607
Sample Location: SB04
Sampled By: TC / DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1055 Method: HAND AUGER Monitor Reading (ppm): 0.0	0 - 1 ft	GRAY	V.F. SAND W/SHELLS

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

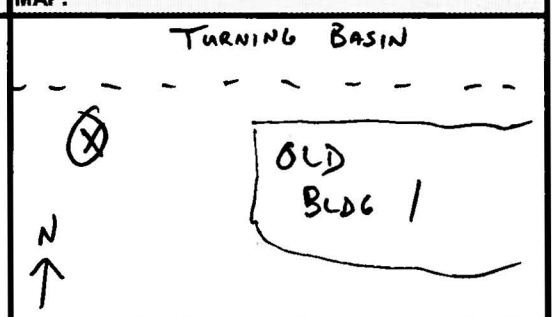
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 519559.864 ft
E: 2941018.636 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB04-10-112607
Sample Location: SB04
Sampled By: TC / DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1114 Method: HAND AUGER Monitor Reading (ppm): 0.0	9-10 ft	GRAY	V.F. SAND w/SHELLS

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES:
N: 519559.864 ft
E: 2941018.636 ft

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB05
DATE: 11/26/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	PID/FID Reading (ppm): Sampler BZ	PID/FID Reading (ppm): Borehole**	PID/FID Reading (ppm): Driller BZ**
0	6					BROWN	V.F. SAND		DRY				
6	7				DM	BROWN	V.F. SAND		▽ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~ 6 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS05-01-112607
Sample Location: SB05
Sampled By: TC / DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1151 Method: HAND AUGER Monitor Reading (ppm): 0.0	0-1 ft.	BROWN	V.F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

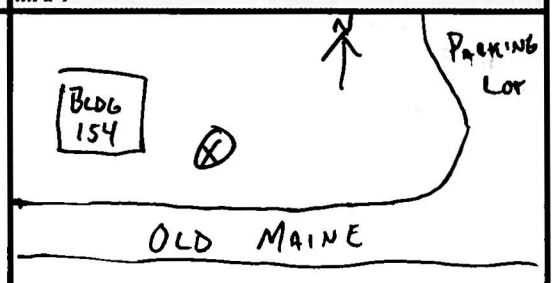
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 519438.833 ft
E: 2940816.886 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB05-06-112607
Sample Location: SB05
Sampled By: TC / DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1201 Method: HAND AUGER Monitor Reading (ppm): 0.0	5-6 ft	BROWN	V.F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

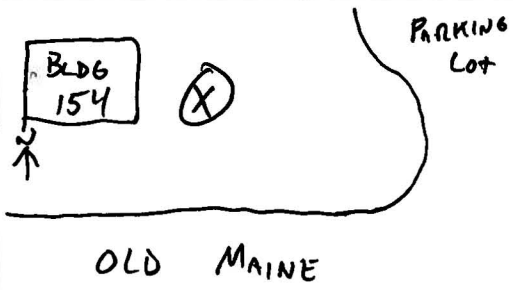
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES:
N: 519438.833 ft
E: 2940816.886 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Tony Catt

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB06
DATE: 11/26/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	1					BROWN	V.F. SAND		DRY				
1	2					TAN	V.F. SAND		DRY				
2	3					TAN	V.F. SAND W/GRAY CLAY		DRY				
3	5					TAN	V.F. SAND W/GRAY CLAY		DRY				
5	6					TAN	V.F. SAND		∇ - WATER TABLE				0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~5 ft bls

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTB6-SS06-01-112607
Sample Location: SB06
Sampled By: TC/DH
C.O.C. No.: 26085

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1218 Method: HAND AUGER Monitor Reading (ppm): 0.0	0-1 ft	DARK BROWN	V.F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

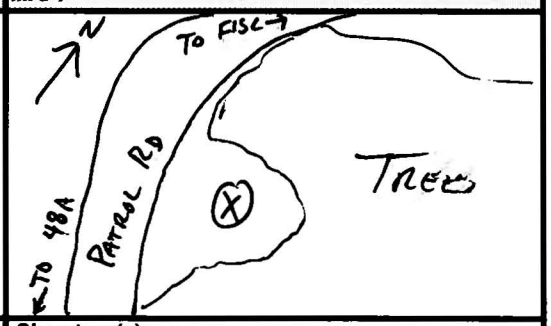
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES:
N: 520444.903 ft
E: 2937362.019 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Catt

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB06-05-112607
Sample Location: SB06
Sampled By: TC/DH
C.O.C. No.: 26085

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1229 Method: HAND AUGER Monitor Reading (ppm): 0.0	4-5 ft	TAN	V.F. SAND w/ GRAY CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

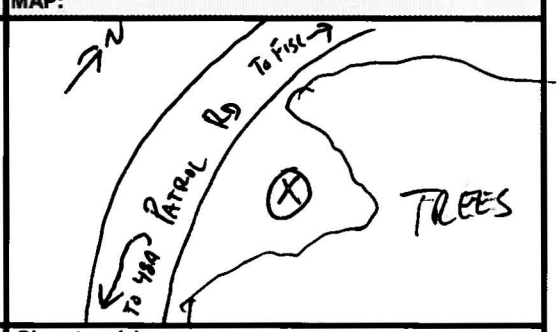
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES:
N: 520444.903 ft
E: 2937362.019 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cotti

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: 5807
DATE: 11/26/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	1				LT	BROWN	V.F. SAND W/SHELLS		DRY				
1	5				TAN		V.F. SAND W/SHELLS		DRY				
5	6				LT	BROWN	V.F. SAND W/CLAY & SHELLS		▽ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~ 5 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS07-01-112607
Sample Location: SB07
Sampled By: TC / DH
C.O.C. No.: 26085

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1243 Method: HAND AUGER Monitor Reading (ppm): 0.0	0-1 ft.	LT. BROWN	V.F. SAND W/SHELLS

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

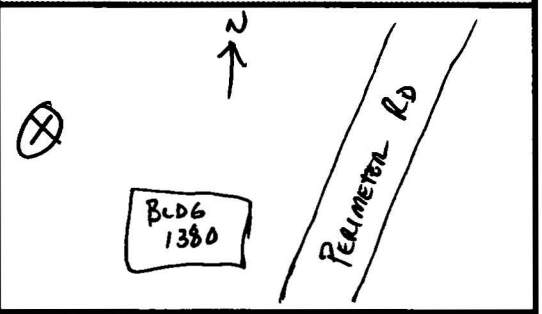
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 520414.899 ft
E: 2937854.763 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cotti

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB07-05-112607
Sample Location: SB07
Sampled By: TC/DH
C.O.C. No.: 260816

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1253 Method: HAND AUGER Monitor Reading (ppm): 0.0	4-5 ft	TAN	V.F. SAND W/SHELLS

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

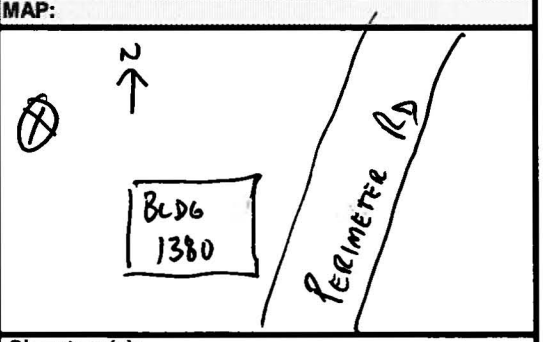
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -		Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 520414.899 ft
E: 2937854.763 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB08
DATE: 11/26/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	PID/FID Reading (ppm): Sampler BZ	PID/FID Reading (ppm): Borehole**	PID/FID Reading (ppm): Driller BZ**
0	3				BROWN V.F SAND W/SHELLS				DRY				
3	4				DK. BROWN V.F. SAND W/SHELLS				∇ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~ 3 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS08-01-112607
Sample Location: SB08
Sampled By: TC / DH
C.O.C. No.: 26086

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1309 Method: HAND AUGER Monitor Reading (ppm): 0.0	0 - 1 ft	BROWN	V.F. SAND W/SHELLS

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

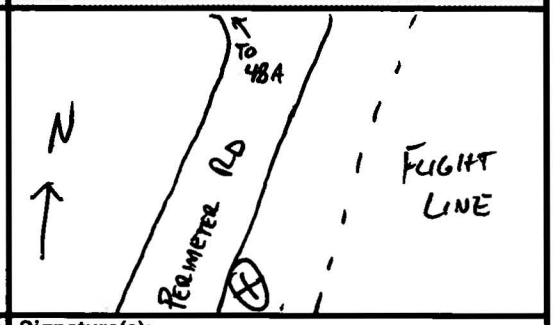
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -		Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 518847.151 ft
E: 2937009.524 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPPBG-SB08-03-112607
Sample Location: SB08
Sampled By: TC/DH
C.O.C. No.: 76086

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/26/07 Time: 1317 Method: HAND AUGER Monitor Reading (ppm): 0.0	2-3	BROWN	V.F. SAND W/SHELLS.

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

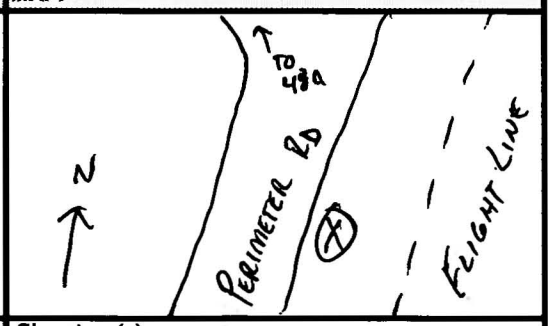
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 518847.151 ft
E: 2937009.524 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cotton

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A Hand Auger
BORING NUMBER: SB09
DATE: 11/27/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Dk Brown	Fine Sand	SM	organic, sampled				
	1-12					Tan	Fine Sand	SM					
	12-13					Tan	Fine Sand	SM	Sampled	▽	WT		
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ - 13.0 ft

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS09-01-112707
Sample Location: SB09
Sampled By: D. Hardison
C.O.C. No.: 26086

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1045 Method: Hand Auger Monitor Reading (ppm): N/A	0 - 1	Dk. Brown	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

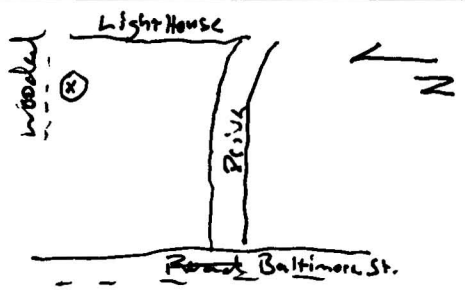
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	ZH	Accutest

OBSERVATIONS / NOTES:

GPS coordinates
Northing: 517462.579 ft.
Easting: 2946375.378 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): ZH

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB09-0~~8~~13-112707
Sample Location: SB09
Sampled By: DH
C.O.C. No.: 26086

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1100 Method: Hand Auger Monitor Reading (ppm): NA	12-13	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

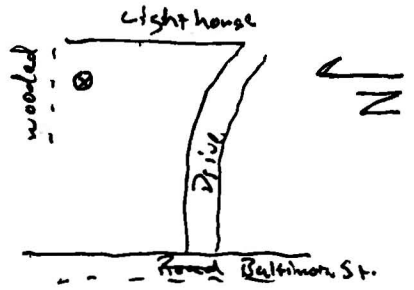
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 517462.579 ft
E: 2946375.378 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB 10
DATE: 11/27/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Dk Brown	Fine Sand	SM	Sampled				
	1-2					Tan	Fine Sand	SM					
	2-3					Tan	Fine Sand	SM	Sampled ▽ Water Table				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water table @ ~3.0 ft

Drilling Area Background (ppm): ____

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS10-01-112707
Sample Location: SB10
Sampled By: DH
C.O.C. No.: 26086

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1145 Method: Hand Auger Monitor Reading (ppm): N/A	0-1	Dk. Brown	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	BH	Accutest

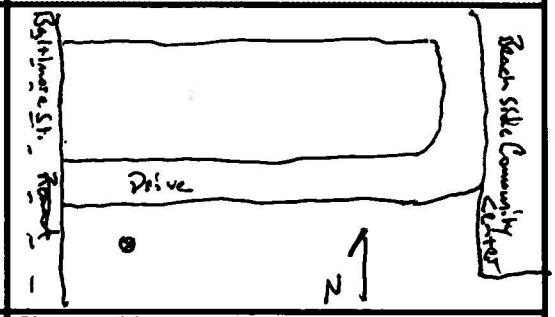
OBSERVATIONS / NOTES:

GPS coordinates

N: 517642.046 ft.

E: 2946200.619 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): BH

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB10-03-112707
Sample Location: SB10
Sampled By: DH
C.O.C. No.: 26086

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1150 Method: Hand Auger Monitor Reading (ppm): NA	2-3	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

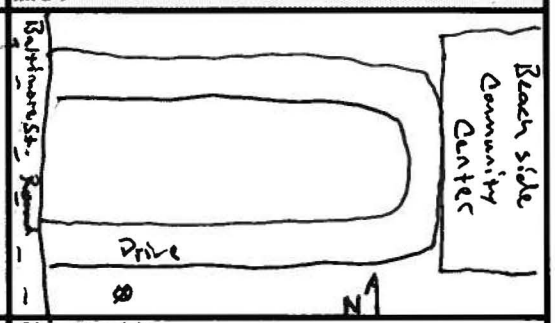
OBSERVATIONS / NOTES:

GPS Coordinates

N: 517642.046 ft.

E: 2946200.619 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB11
DATE: 11/27/07
GEOLOGIST: D. Hendrison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Dk Brown	Fine Sand	SM	Sampled					
	1-5					Tan	Fine Sand	SM						
	5-6					Brown	Fine Sand	SM	Sampled					▽ Water?
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 6.0 ft bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPYB6-SS11-0)-112707
Sample Location: SS11
Sampled By: DH
C.O.C. No.: 26086

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1225 Method: Hand Auger Monitor Reading (ppm): N/A	0 - 1	Dk. Brown	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

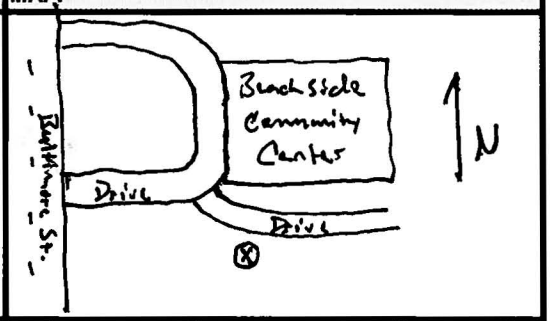
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 517526.039 ft.
E: 2946627.335 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB11-06-112707
Sample Location: SB11
Sampled By: DH
C.O.C. No.: 26086

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1235 Method: Hand Auger Monitor Reading (ppm): N/A	5-6	Brown	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

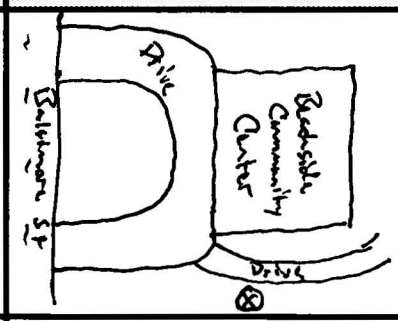
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS coordinates

N: 517526.039 ft.
E: 2946627.335 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB12
DATE: 11/27/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Tan	Fine Sand	SM	Sampled					
	1-3					Tan	Fine Sand	SM						
	3-4					DK Brown	Fine Sand	SM						
	4-8					Tan	Fine Sand	SM						Water Table
	8-9					Tan	Fine Sand	SM	Sampled				0	▽

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 9 ft bgs

Drilling Area Background (ppm):

Converted to Well: Yes ___ No X Well I.D. #:

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS12-01-112707
Sample Location: SB12
Sampled By: DH
C.O.C. No.: 26086

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1310 Method: Hand Auger Monitor Reading (ppm): N/A	0-1	Tan	Fine-Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

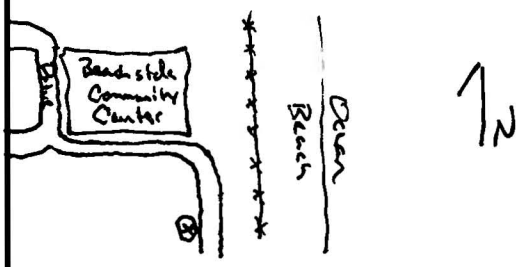
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	814	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 517427.753 ft.
E: 2946790.820 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB12-09-112707
Sample Location: SB12
Sampled By: DH
C.O.C. No.: 26086

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1320 Method: Hand Auger Monitor Reading (ppm): N/A	8-9	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

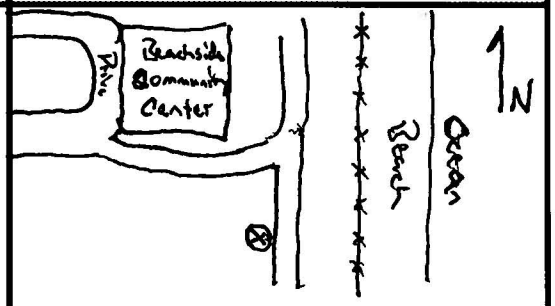
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 517427.753 ft.
E: 2946790.820 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB13
DATE: 11/27/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown	Fine Sand w/ shell	SM	Sampled					
	1-3					Tan	Fine Sand	SM						
	3-4					Tan	Fine Sand	SM	Sampled					▽ Water Ta
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks: Water Table @ ~ 4 ft. bgs

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS13-01-112707
Sample Location: SB13
Sampled By: DH
C.O.C. No.: 260886

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1405 Method: Hand Auger Monitor Reading (ppm): N/A	0-1	Brown	Fine Sand w/ Shell

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: Method: Monitor Readings (Range in ppm):	NO COMPOSITE SAMPLE COLLECTED			

SAMPLE COLLECTION INFORMATION:

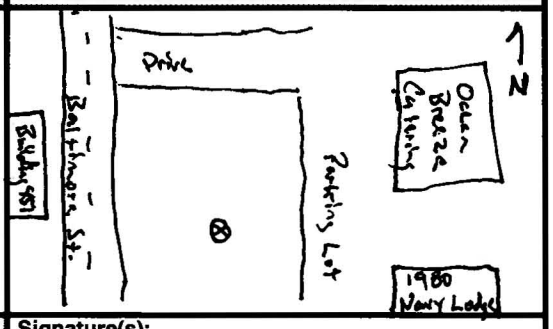
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	BM	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates

N: 518488.224 ft.
E: 2946257.881 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): BM

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB13-04-112707
Sample Location: SB13
Sampled By: DH
C.O.C. No.: 260086

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1412 Method: Hand Auger Monitor Reading (ppm): N/A	3-4	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date: 11	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

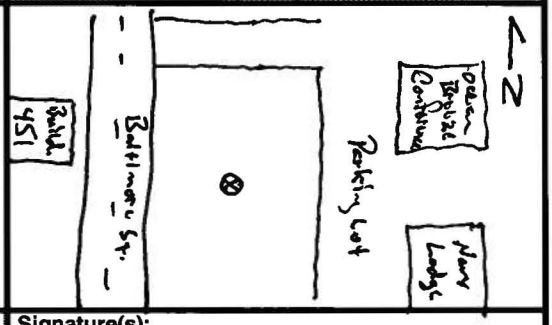
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates

N: 518488.224 ft.
E: 2946257.881 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB 14
DATE: 11/27/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Tan	Fine Sand w/ shell	SM	Sampled				
	1-3					Tan	Fine Sand w/ shell	SM					
	3-6					Tan	Fine Sand	SM					
	6-7					Tan	Fine Sand	SM	Sampled				
													0

Water Table

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~7ft. Bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS14-01-112707
Sample Location: SB14
Sampled By: DH
C.O.C. No.: ~~26165~~ 26167

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1510 Method: Hand Auger Monitor Reading (ppm): N/A	0-1	Brown	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

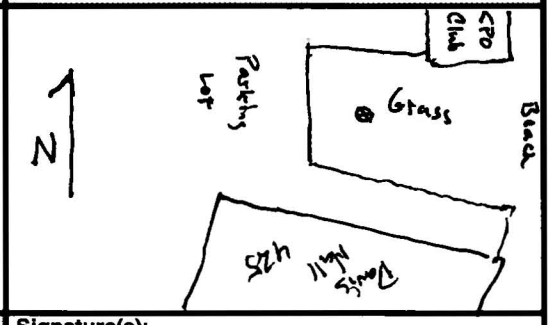
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz.	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 519397.263 ft.
E: 2946900.109 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB14-07-112707
Sample Location: SB14
Sampled By: DH
C.O.C. No.: ~~26165~~ 26167

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/27/07 Time: 1525 Method: Hand Auger Monitor Reading (ppm): N/A	6-7	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

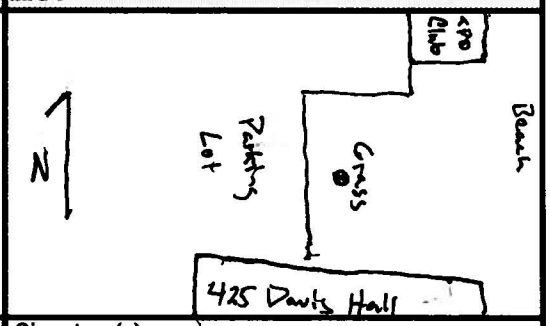
OBSERVATIONS / NOTES:

GPS Coordinates

N: 519397.263 ft.

E: 2946900.109 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB15
DATE: 11/28/07
GEOLOGIST: D. Hendrickson
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
~~0-1~~	0-1					Brown	Fine Sand	SM	Sampled				
	1-2					Tan	Fine Sand	SM					
	2-3					Tan	Fine Sand	SM	Sampled				
													0

Water Table

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 3 ft. bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS15-01-112807
Sample Location: SB15
Sampled By: DH
C.O.C. No.: ~~26165~~ 26167

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 0950 Method: Hand Auger Monitor Reading (ppm): N/A	0-1	Brown	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

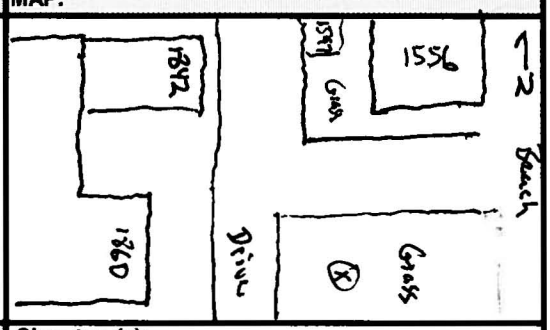
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 520023.867 ft.
E: 2947107.098 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPT86-SB15-03-112807
Sample Location: SB15
Sampled By: DH
C.O.C. No.: ~~26165~~ 26167

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1000 Method: Hand Auger Monitor Reading (ppm): N/A	2-3	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

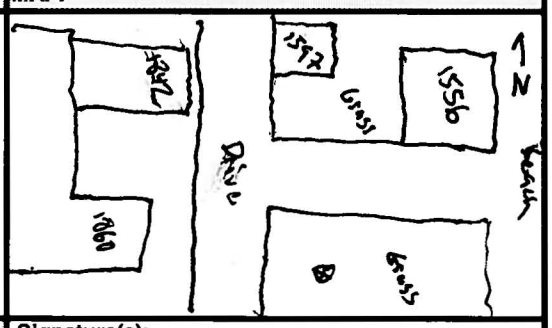
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 520023.867 ft.
E: 2947107.098 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB16
DATE: 11/28/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown	Fine Sand	SM	sampled					
	1-4					Brown	Clay w/ sand	CL	w/ shell					
	4-6					Brown	Sand w/ clay	SC	w/ shell					
	6-7					Tan	Sand	SM						
	7-8					Tan	Fine Sand	SM	sampled				0	▽ Water Table

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 8 ft bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS16-01-112807
Sample Location: SB16
Sampled By: DH
C.O.C. No.: ~~26165~~ 26167

[X] Surface Soil (SS)
[ ] Subsurface Soil (SU)
[ ] Sediment (SD)
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1055 Method: Hand Auger Monitor Reading (ppm): N/A	0-1	Brown	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

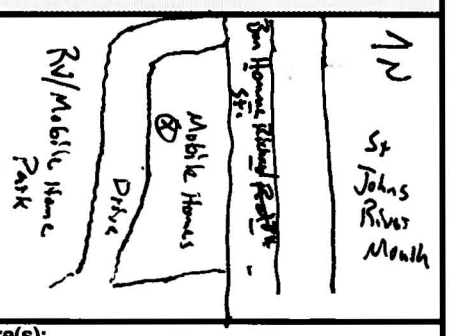
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates

N: 520294.596 ft.
E: 2945465.572 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB16-08-112807
Sample Location: SB16
Sampled By: DH
C.O.C. No.: ~~26165~~ 26167

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1110 Method: Hand Auger Monitor Reading (ppm): N/A	7-8	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

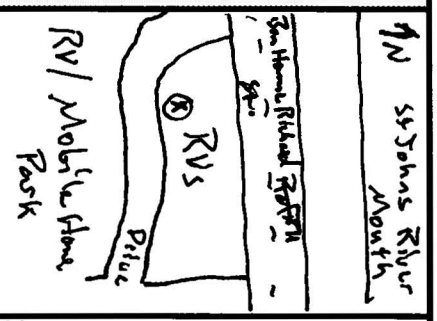
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 520294.596 ft.
E: 2945465.572 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB17
DATE: 11/28/07
GEOLOGIST: D. Haralison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Brown	Fine Sand	SM	w/Shell, sampled				
	1-2					Tan	Fine Sand	SM					
	2-3					Tan	Fine Sand	SM	sampled				
													0

▽ Water Table

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 3ft bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS17-01-112807
Sample Location: SB17
Sampled By: DH
C.O.C. No.: 26167

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1220 Method: Hand Auger Monitor Reading (ppm): N/A	0-1	Brown	Fine Sand w/ Shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	[illegible]	Accutest

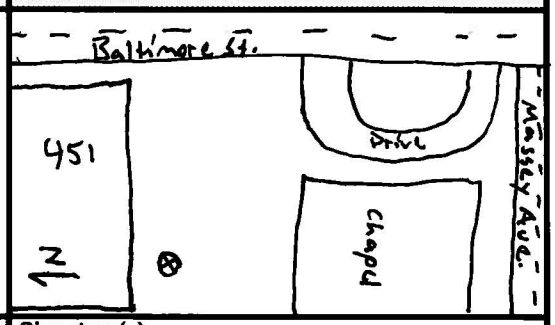
OBSERVATIONS / NOTES:

GPS Coordinates

N: 518431.759 ft

E: 2945831.102 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB17-03-112807
Sample Location: SB17
Sampled By: DH
C.O.C. No.: 26167

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1230 Method: Hand Auger Monitor Reading (ppm): N/A	2-3	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

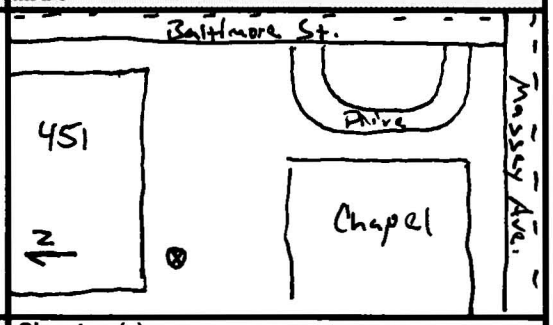
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 518431.759 ft.
E: 2945831.102 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DM A-1

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB18
DATE: 11/28/07
GEOLOGIST: D. Hendrison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown	Fine Sand	SM	w/shell, sampled					
	2-3					Tan	Fine Sand	SM						
	3-4					Tan	Fine Sand w/ clay stringer	SC						
	4-6					Tan	Fine Sand	SM						
	6-7					Tan	Fine Sand	SM	sampled				0	▽ water Table

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~7 ft. bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS18-01-112807
Sample Location: SB18
Sampled By: DH
C.O.C. No.: 26168

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1310 Method: Hand Auger Monitor Reading (ppm): N/A	0-1	Brown	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

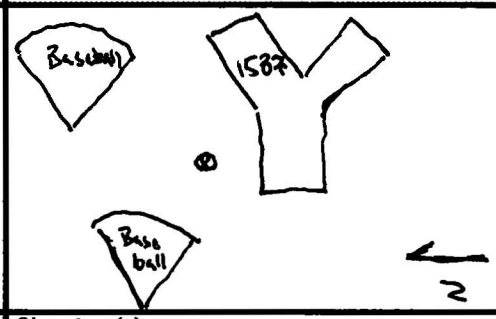
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates

N: 519635.859 ft.
E: 2945489.998 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB18-07-112807
Sample Location: SB18
Sampled By: DH
C.O.C. No.: 26168

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1320 Method: Hand Auger Monitor Reading (ppm): N/A	6-7	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

NO COMPOSITE SAMPLE COLLECTED

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

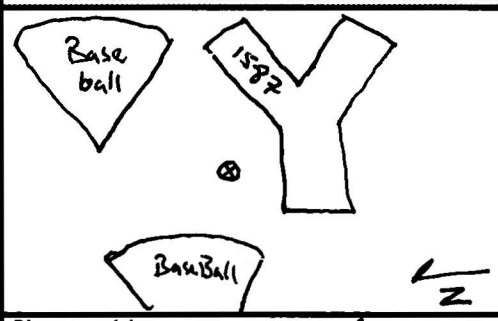
OBSERVATIONS / NOTES:

GPS Coordinates

N: 519635.859 ft.

E: 2945489.998 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB19
DATE: 11/28/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-0.5					Brown	Limestone and Fine Sand	Fill					
	0.5-1					Brown	Fine Sand	SM	w/ Shell Sampled				
	1-2					Tan	Fine Sand	SM	w/ Shell				
	2-3					Tan	Fine Sand	SM	sampled				
													0

Water Table

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~3ft bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS19-01-112807
Sample Location: SB19
Sampled By: DH
C.O.C. No.: 26168

[X] Surface Soil (SS)
[ ] Subsurface Soil (SU)
[ ] Sediment (SD)
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1400 Method: Hand Auger Monitor Reading (ppm): NA	0-1	Brown	Fine Sand w/ Shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

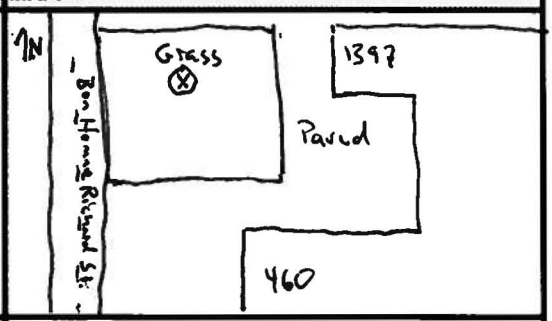
OBSERVATIONS / NOTES:

GPS Coordinates

N: 518528.851 ft.

E: 2945134.934 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB19-03-112807
Sample Location: SB19
Sampled By: DH
C.O.C. No.: 26168

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1405 Method: Hand Auger Monitor Reading (ppm): N/A	2-3	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

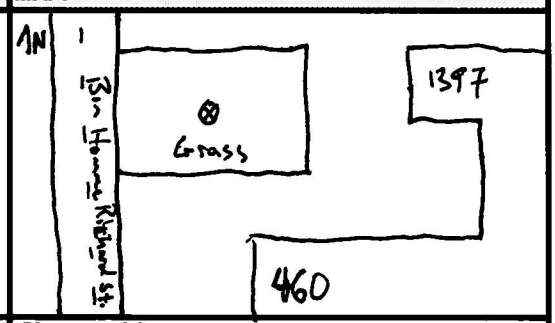
OBSERVATIONS / NOTES:

GPS Coordinates

N: 518528.851 ft.

E: 2945134.934 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB20
DATE: 11/28/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-0.5					Brown	Fine Sand and Lime Rock	Fill						
	0.5-1					Brown	Fine Sand and Shell	SM	Sampled					
	1-3					Tan	Fine Sand w/ shell	SM						
	3-4					Tan	Fine Sand w/ shell	SM	Sampled					water ▽ Table
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 4 ft. bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS20-01-112807
Sample Location: SB20
Sampled By: DH
C.O.C. No.: 26168

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1455 Method: Hand Auger Monitor Reading (ppm): N/A	0 - 1	Brown	Sand w/ shell

COMPOSITE SAMPLE DATA:

Date: 11/28/07	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

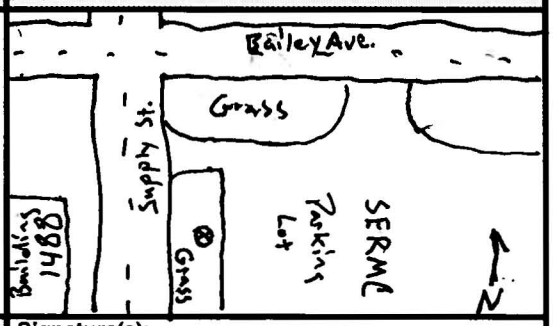
OBSERVATIONS / NOTES:

GPS Coordinates

N: 518751.528 ft.

E: 2943908.088 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB20-04-112807
Sample Location: SB20
Sampled By: DH
C.O.C. No.: 26168

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/28/07 Time: 1505 Method: Hand Auger Monitor Reading (ppm): N/A	3-4	Tan	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	BH	Accutest

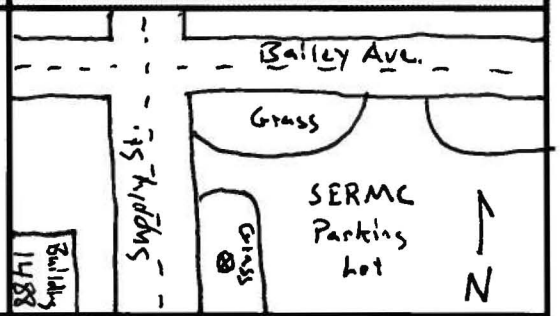
OBSERVATIONS / NOTES:

GPS Coordinates

N: 518751.528 ft.

E: 2943908.088 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): BM A-1

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB21
DATE: 11/28/07
GEOLOGIST: T. COTTENOIR
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	PID/FID Reading (ppm): Sampler BZ	PID/FID Reading (ppm): Borehole**	PID/FID Reading (ppm): Driller BZ**
0	1				DARK	BROWN	V.F. SAND W/SHELLS		DRY				
1	3				BROWN		V.F. SAND W/SHELLS		DRY				
3	4				BROWN		V.F. SAND W/SHELLS		∇ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~ 3 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS21-01-~~112807~~ 112907
Sample Location: SB21
Sampled By: TC / DH
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: ~~11/28/07~~ 11/29/07	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1250	0 - 1 ft	Dark Brown	V.F. SAND w/ SHELLS
Method: Hand Auger			
Monitor Reading (ppm): 0.0			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

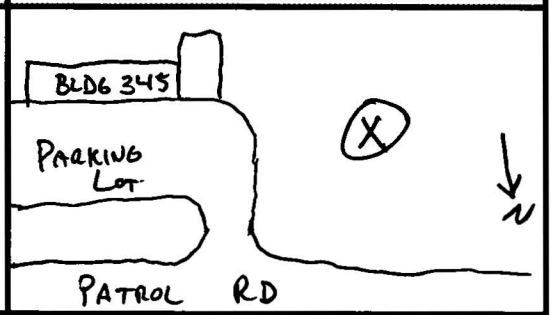
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES:
N: 516677.570 ft
E: 2940649.413 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Catt

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB21-03-~~H2807~~ 11/29/07 (TC)
Sample Location: SB21
Sampled By: TC/DH
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: ~~11/28/07~~ 11/29/07 Time: 1255 Method: HAND AUGER Monitor Reading (ppm): 0.0	2-3 ft	BROWN	V.F SAND w/SHELLS

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

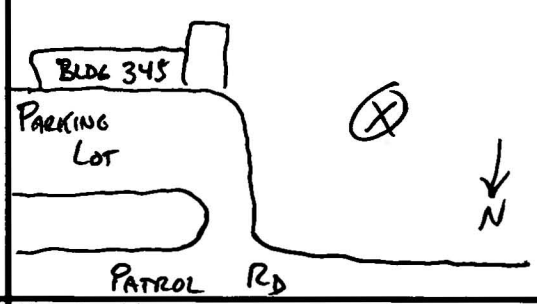
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -		Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 516677.570 ft
E: 2940649.413 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cotti

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB22
DATE: 11/29/07
GEOLOGIST: T. COTTENDIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	2				BROWN		V.F. SAND		DRY				
2	3				BROWN		V.F. SAND		∇ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~2 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPT86-SS22-01-112907
Sample Location: SB22
Sampled By: TC/DH
C.O.C. No.:

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/29/07 Time: 1328 Method: HAND AUGER Monitor Reading (ppm): 0.0	0-1 ft	BROWN	V.F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

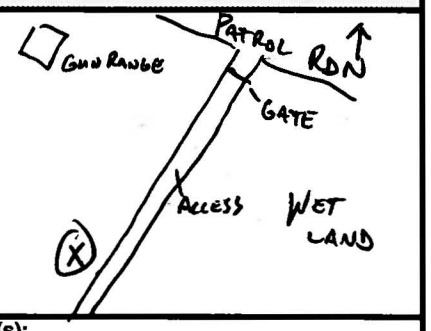
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES

N: 515844.043 ft
E: 2940797.153 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB22-02-112907
Sample Location: SB22
Sampled By: TC / DH
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/29/07 Time: 1331 Method: HAND AUGER Monitor Reading (ppm): 0.0	1 - 2	BROWN	V. F. SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

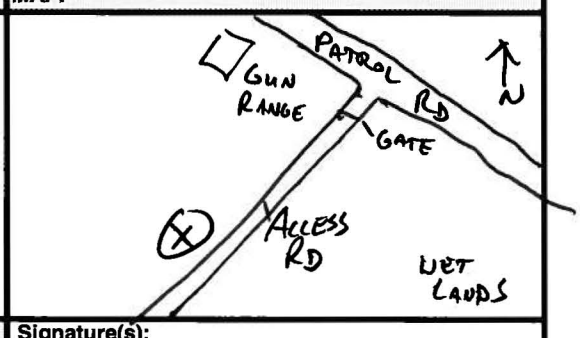
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 515844.043 ft
E: 2940797.153 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB23
DATE: 11/29/07
GEOLOGIST: T. COTTENDOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	2					BROWN	V.F. SAND W/SHELLS		DRY				
2	3					BROWN	V.F. SAND W/SHELLS		▽ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~ 2 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTB6-SS23-01-112907
Sample Location: SB23
Sampled By: TC/DH
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/29/07 Time: 1345 Method: HAND AUGER Monitor Reading (ppm): 0.0	0-1 ft	BROWN	V.F. SAND W/SHELLS

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

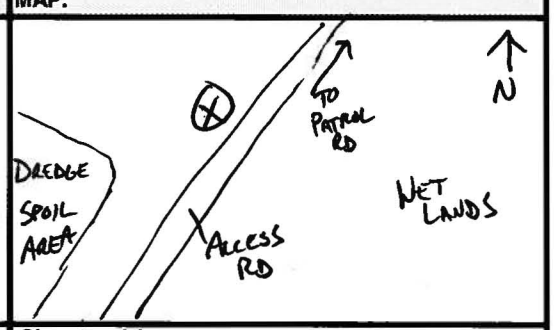
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES

N: 515050.769 ft
E: 2940407.947 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB23-02-112907
Sample Location: SB23
Sampled By: TC/DH
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/29/07 Time: 1350 Method: HAND AUGER Monitor Reading (ppm): 0.0	1-2 ft	BROWN	V.F. SAND w/SHELLS

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

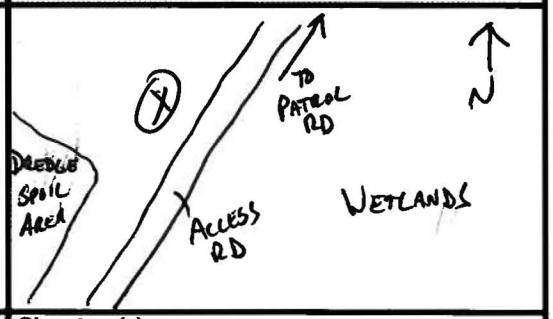
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 515050.769 ft
E: 2940407.947 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB24
DATE: 11/30/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	2				DARK	GRAY	SILTY CLAY		DRY				
2	3				DARK	GRAY	SILTY CLAY		▽ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~2 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS24-01-113007
Sample Location: SB24
Sampled By: TC / DH
C.O.C. No.:

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/30/07 Time: 0955 Method: HAND AUGER Monitor Reading (ppm): 0.6	0 - 1 ft	DARK GRAY	SILTY CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

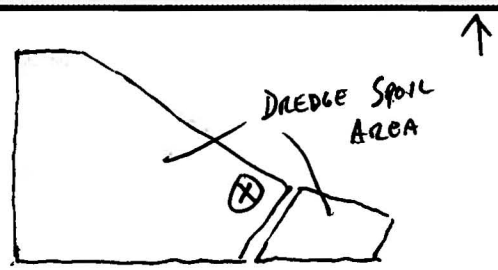
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 515218.552 ft
E: 2939622.586 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cotter

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB24-02-113007
Sample Location: SB24
Sampled By: TC/DH
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/30/07 Time: 1000 Method: HAND AUGER Monitor Reading (ppm): 0.0	1 - 2 ft	DARK GRAY	SILTY CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

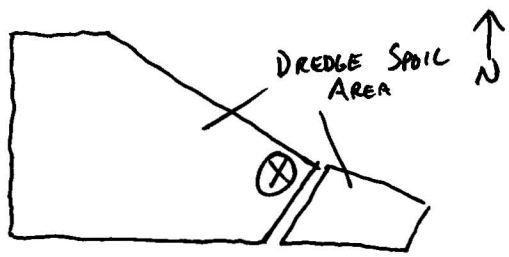
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 515218.552 ft
E: 2939622.586 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB 25
DATE: 11/30/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0	2				DARK	GRAY	SILTY CLAY		DRY				
2	3				DARK	GRAY	SILTY CLAY		▽ - WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~2 ft b/s

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS25-01-113007
Sample Location: SB25
Sampled By: TC / DH
C.O.C. No.:

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/30/07 Time: 1017 Method: HAND AUGER Monitor Reading (ppm): 0.0	0 - 1 ft	DARK GRAY	SILTY CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

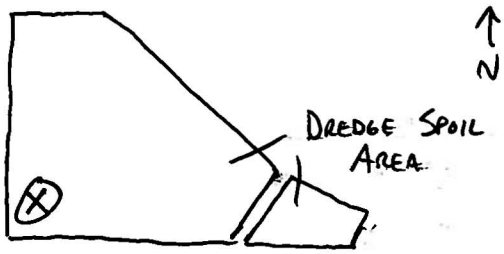
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES
N: 514796.106 ft
E: 2937844.802 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cott

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB25-02-113007
Sample Location: SB25
Sampled By: TC/DH
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/30/07 Time: 1022 Method: HAND AUGER Monitor Reading (ppm): 0.0	1-2 ft	DARK GRAY	SILTY CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

OBSERVATIONS / NOTES:

GPS COORDINATES

N: 514796.106 ft

E: 2937844.802 ft.

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Cole

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: N/A - HAND AUGER
BORING NUMBER: SB26
DATE: 11/30/07
GEOLOGIST: T. COTTENOIR
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	PID/FID Reading (ppm): Sampler BZ	PID/FID Reading (ppm): Borehole**	PID/FID Reading (ppm): Driller BZ**
0	2				DARK	GRAY	SILTY CLAY		DRY				
2	3				DARK	GRAY	SILTY CLAY		▽- WATER TABLE				
													0

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: WATER TABLE @ ~2 ft bls

Drilling Area Background (ppm):

Converted to Well: Yes _____ No _____ Well I.D. #: _____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS26-01-113007
Sample Location: SB26
Sampled By: TC/DH
C.O.C. No.:

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/30/07 Time: 1032 Method: HAND AUGER Monitor Reading (ppm): 0.0	0-1 ft.	DARK GRAY	SILTY CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

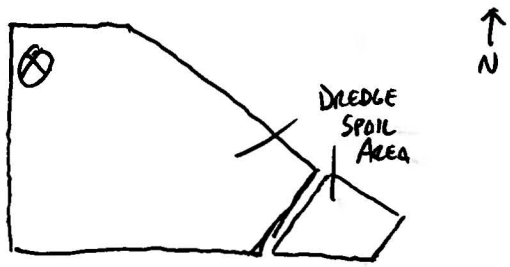
OBSERVATIONS / NOTES:

GPS COORDINATES

N: 515863.689 ft

E: 2937848.669 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Terry Catt

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB26-02-113007
Sample Location: SB26
Sampled By:
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 11/30/07 Time: 1037 Method: HAND AUGER Monitor Reading (ppm): 0.0	1 - 2 ft.	DARK GRAY	SILTY CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	✓	Accutest

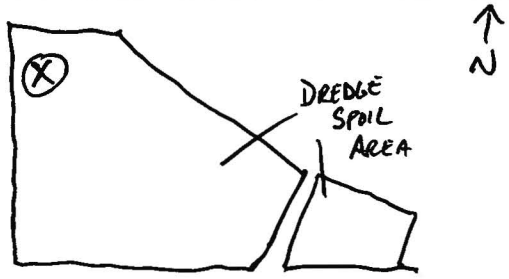
OBSERVATIONS / NOTES:

GPS COORDINATES

N: 515863.689 ft

E: 2937848.669 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Terry Cott

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Augers
BORING NUMBER: SB27
DATE: 12/12/07
GEOLOGIST: D. Hendrison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					PK Brown	Fine Sand		Sampled					
	1-2					Tan	Fine sand		w/ shell					
	2-3					Brown	Fine Sand to Clay		w/ shell sampled					▽ WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 3 ft. bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPG-SS27-01-121207
Sample Location: SB27
Sampled By: DH
C.O.C. No.: 26234

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1135 Method: Hand auger Monitor Reading (ppm): N/A	0-1 feet	Brown	Silt, Clay and Sand

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	NO COMPOSITE SAMPLE COLLECTED			
Method:				
Monitor Readings (Range in ppm):				

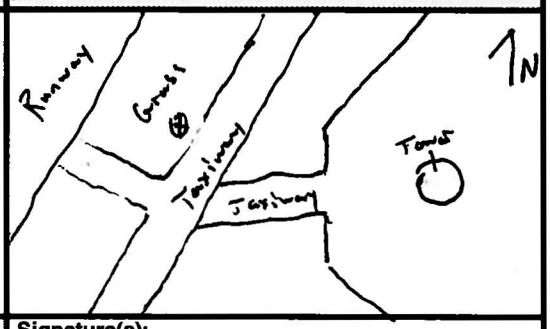
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	SH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 2203523.54 ft
E: 524243.70 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPG-SB27-D3-121207
Sample Location: SB27
Sampled By: DH
C.O.C. No.: 26234

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1130 Method: Hand Auger Monitor Reading (ppm): N/A	2-3 feet	Brown	Clay and Sand

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	NO COMPOSITE SAMPLE COLLECTED			
Method:				
Monitor Readings (Range in ppm):				

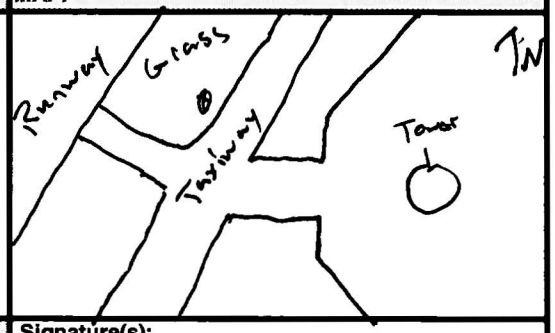
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

N: 2203523.54 ft.
E: 524243.70 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB28
DATE: 12/12/07
GEOLOGIST: D. Hendrickson
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Dk Brown	Fine Sand		sampled				
	1-2					Tan	Fine Sand w/shell		sampled				
													0

WT

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 2ft bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPG-SS28-DI-121207
Sample Location: SS28
Sampled By: DH
C.O.C. No.: 26234

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1205 Method: Hand Auger Monitor Reading (ppm): N/A	0-1 foot	Brown	Fine Sand

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	NO COMPOSITE SAMPLE COLLECTED			
Method:				
Monitor Readings (Range in ppm):				

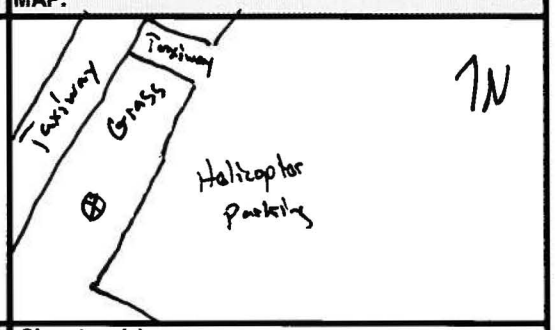
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	8 oz	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 2202466.90 ft.
E: 523290.33 ft.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPG-SB28-02-121207
Sample Location: SB28
Sampled By: BH
C.O.C. No.: 26234

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1310 Method: Hand Auger Monitor Reading (ppm): N/A	1-2 feet	Tan	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

NO COMPOSITE SAMPLE COLLECTED

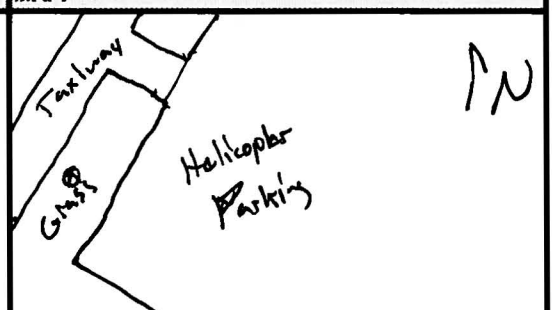
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	BH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 2202466.90 ft
E: 523290.33 ft

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): BH

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB29
DATE: 12/12/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Dk. Brown	Fine Sand		Sampled				
	1-3					Tan	Fine Sand w/ Shell						
	3-4					Tan	Fine Sand w/ Shell		Sampled				
													0

▽ WT

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~4 ft bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS29-01-121207
Sample Location: SB29
Sampled By: DH
C.O.C. No.: 26234

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1230 Method: Hand Auger Monitor Reading (ppm): N/A	0-1 foot	Dk. Brown	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

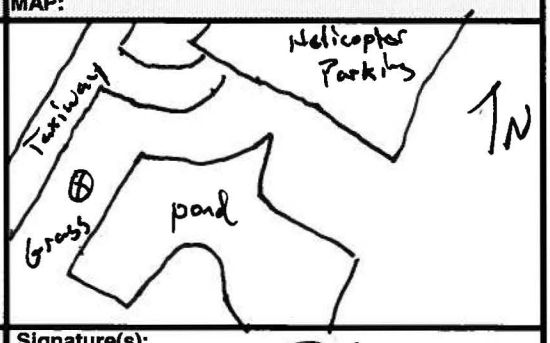
OBSERVATIONS / NOTES:

GPS Coordinates

N: 2201854.69

E: 522499.61

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB29-04-121207
Sample Location: SB 29
Sampled By: DH
C.O.C. No.: 26234

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1235 Method: Hand Auger Monitor Reading (ppm): N/A	3-4 feet	Tan	Fine sand w/ Shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	BH	Accutest

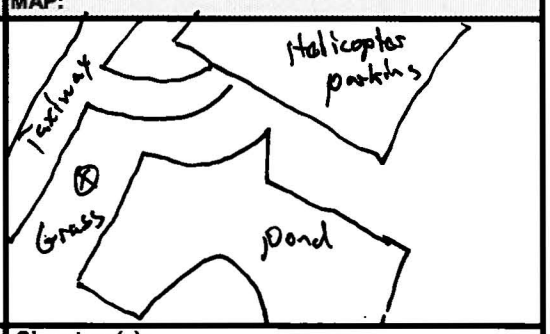
OBSERVATIONS / NOTES:

GPS Coordinates

N: 2201854.69

E: 522499.61

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB 30
DATE: 12/12/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					DK Brown	Fine Sand		Sampled					
	1-2					Brown	Fine Sand w/ shell		Sampled					▽ WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: water Table @ ~ 2 ft. bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS30-01-121207
Sample Location: SB30
Sampled By: DH
C.O.C. No.: 26234

[X] Surface Soil (SS)
[ ] Subsurface Soil (SU)
[ ] Sediment (SD)
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1255 Method: Hand Auger Monitor Reading (ppm): N/A	0-1 foot	DK Brown.	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

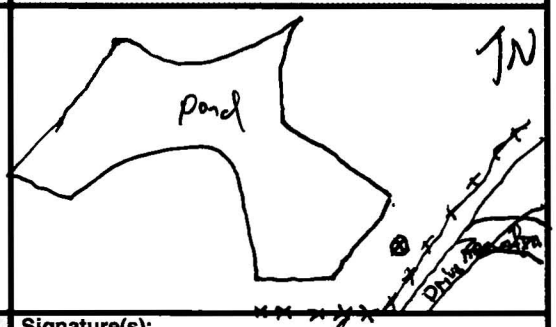
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
N: 2201341.26 ft N
523047.94 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB30-02-121207
Sample Location: SB30
Sampled By: DA
C.O.C. No.: 26234

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1300 Method: Hand Auger Monitor Reading (ppm): N/A	1-2 feet	Tan	Fine Sand w/ Shell

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	NO COMPOSITE SAMPLE COLLECTED			
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

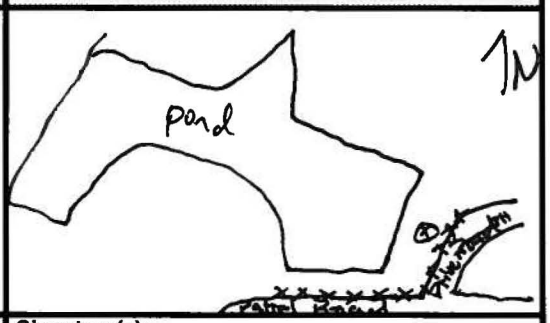
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DA	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates

2201 341.26 ft N
523 047.94 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB 31
DATE: 12/12/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Brown	Fine Sand w/ shell		Sampled				
	1-3					Tan	Fine Sand w/ shell						
	3-4					Brown	Fine Sand w/ shell		Sampled				
													0

WT

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: water Table @ ~4 ft. bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS31-01-121207
Sample Location: SB31
Sampled By: DH
C.O.C. No.: 26234

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1320 Method: Hand auger Monitor Reading (ppm): N/A	0-1 foot	~~Dk.~~ Brown.	Fine Sand w/ Shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

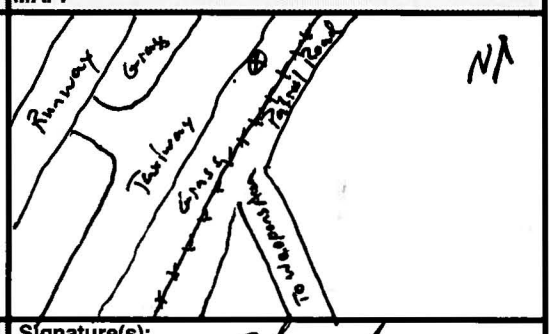
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2201249.79 ft N
521910.26 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB31-04-121207
Sample Location: SB31
Sampled By: DIt
C.O.C. No.: 26234

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1325 Method: Hand auger Monitor Reading (ppm): N/A	3-4 Feet	Brown	Fine Sand w/ Shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

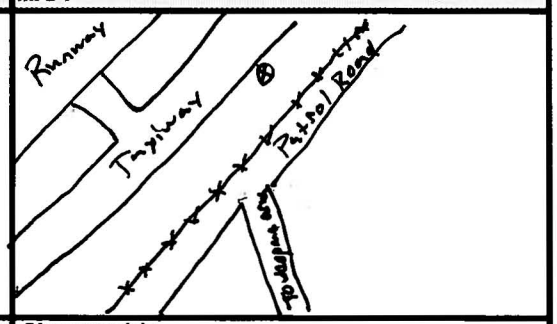
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DIt	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates

2201249.79 ft. N
521910.26 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB 32
DATE: 12/12/07
GEOLOGIST: D. Hendrison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown	Fine Sand w/Shell		sampled					
	1-2					Brown	Fine Sand w/Shell							
	2-3					Brown	Fine Sand w/Shell		sampled					▽ WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 3 ft bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPT BG-SS32-01-121207
Sample Location: SB32
Sampled By: DH
C.O.C. No.: 26234

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1345 Method: Hand Auger Monitor Reading (ppm): N/A	0-1 foot	Brown	Fine Sand w/ Shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

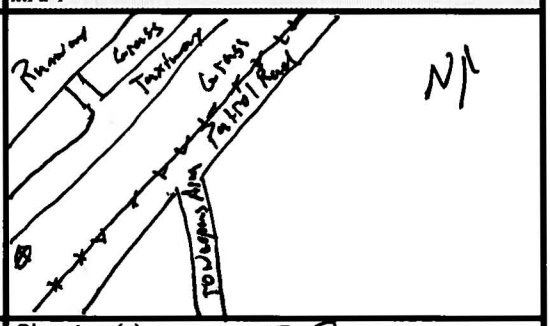
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2200186.66 ft ~~E~~ N
520923.99 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB32-03-121207
Sample Location: SB32
Sampled By: DH
C.O.C. No.: 26234

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/12/07 Time: 1350 Method: Hand Auger Monitor Reading (ppm): N/A	2-3 feet	Brown	Fine Sand w/ Shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

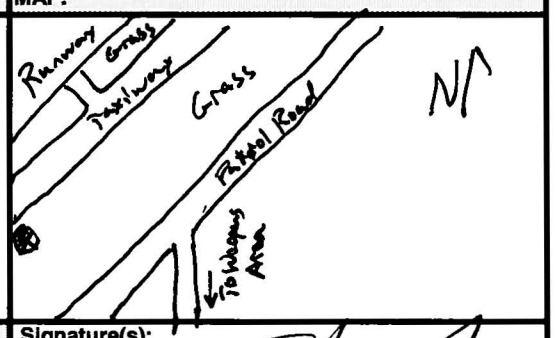
Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates

2200186.66 ft N
520923.99 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB33
DATE: 12/13/07
GEOLOGIST: D. Hendrison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Brown	Fine Sand w/ shell	SM	Sampled				
	1-2					Tan	Fine Sand w/ shell	SM	Sampled				
													0

▽ WT

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~2 feet bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS33-01-121307
Sample Location: SB33
Sampled By: DH
C.O.C. No.: 26235

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 0940 Method: Hand Auger Monitor Reading (ppm): N/A	DH 0-1 feet	Dark Brown	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

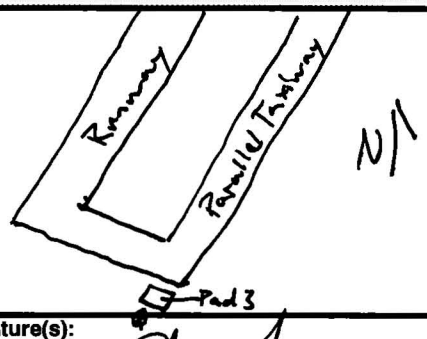
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
219892.13 ft. N
519617.99 ft. E

MAP:



N/A

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SB33-02-121307
Sample Location: SB33
Sampled By: DH
C.O.C. No.: 26235

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 0945 Method: Hand Auger Monitor Reading (ppm): N/A	1-2 feet	Tan	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

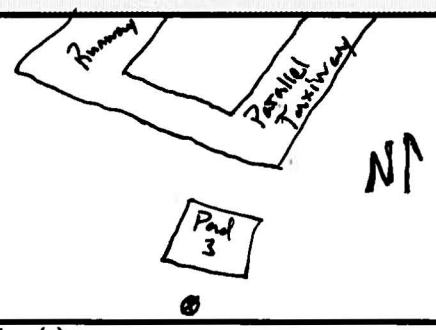
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2198922.13 ft. N
519617.99 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [illegible]

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB34
DATE: 12/13/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown	Fine Sand	SM	Sampled					
	1-2					Tan	Fine Sand	SM						
	2-3					Tan	Fine Sand	SM	Sampled					▽WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 3 feet bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS34-01-121307
Sample Location: SB34
Sampled By: DH
C.O.C. No.: 26235

[X] Surface Soil (SS)
[ ] Subsurface Soil (SU)
[ ] Sediment (SD)
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

Date: 12/13/07	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1000	0-1 feet	Brown	Fine Sand
Method: Hand Auger			
Monitor Reading (ppm): N/A			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

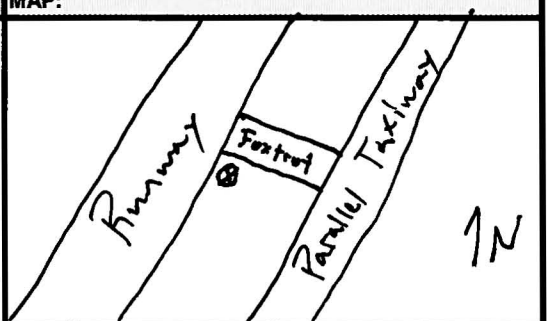
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2200875.69 ft. N
520953.19 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MTTBG-SB~~35~~34-03-121307
Sample Location: SB34
Sampled By: DH
C.O.C. No.: 26235

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1005 Method: Hand Auger Monitor Reading (ppm): N/A	2-3 feet	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

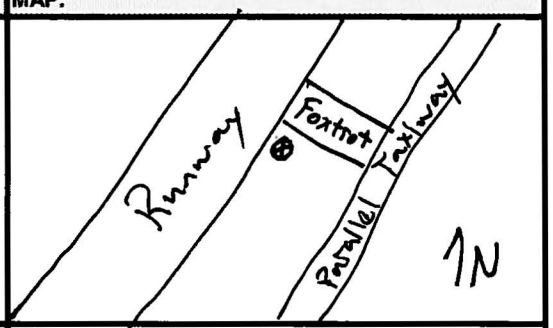
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2200875.69 ft. N
520953.19 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB35
DATE: 12/13/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	D-1					Brown	Fine Sand	SM	Sampled					
	1-3					Tan	Fine Sand w/Shell	SM						
	3-4					Tan	Fine Sand	SM	Sampled					▽ WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~4 feet bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPT BG-SB35-04-121307
Sample Location: SB35
Sampled By: DH
C.O.C. No.: 26235

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1035 Method: Hand Auger Monitor Reading (ppm): N/A	3-4 feet	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2203004.17 ft. N
522959.36 ft. E

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): ZM A-1

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SS35-01-121307
Sample Location: SB35
Sampled By: PH
C.O.C. No.: 26235

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1030 Method: Hand Auger Monitor Reading (ppm): N/A	0-1 foot	Brown	Fine Sand

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	NO COMPOSITE SAMPLE COLLECTED			
Method:				
Monitor Readings (Range in ppm):				

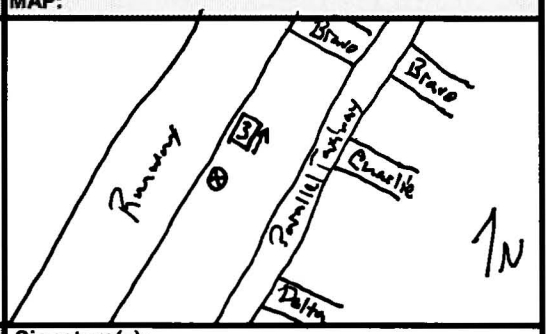
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	PH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2203004.17 ft N
522959.36 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): PH

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB36
DATE: 12/13/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown	Brown Fine Sand	SM	Sampled					
	1-3					Tan	Fine Sand w/shell	SM						
	3-4					Tan	Fine Sand w/shell	SM	sampled					▽ WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 4 feet bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS36-01-121307
Sample Location: SB36
Sampled By: DH
C.O.C. No.: 26235

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1055 Method: Hand Auger Monitor Reading (ppm): N/A	0-1 foot	Brown	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

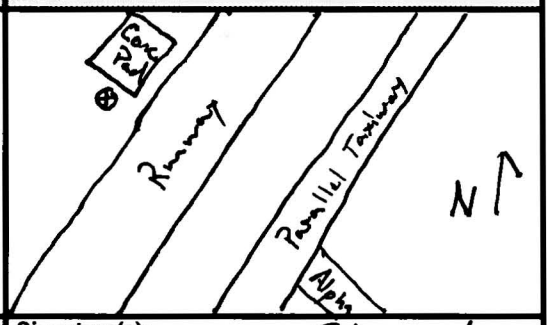
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2204841.18 ft N
524098.82 ft E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB36-04-121307
Sample Location: SB36
Sampled By: DH
C.O.C. No.: 26235

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1100 Method: Hand Auger Monitor Reading (ppm): N/A	3-4 Feet	Tan	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

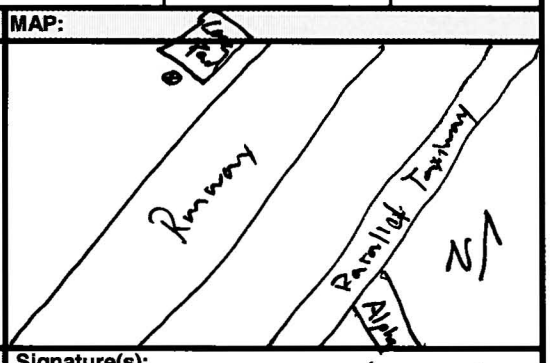
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
220~~4~~841.18 ft. N
524098.82 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB37
DATE: 12/13/07
GEOLOGIST: D. Hamilton
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	0-1					Brown	Fine Sand w/ shell	SM	Sampled				
	1-3					Tan	Fine Sand	SM					
	3-4					Tan	Fine Sand	SM	Sampled				
													0

▽ WT

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 4 ft. bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS37-01-121307
Sample Location: SS37
Sampled By: DH
C.O.C. No.: 26235

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1130 Method: Hand Auger Monitor Reading (ppm): N/A	0-1 feet	Brown	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

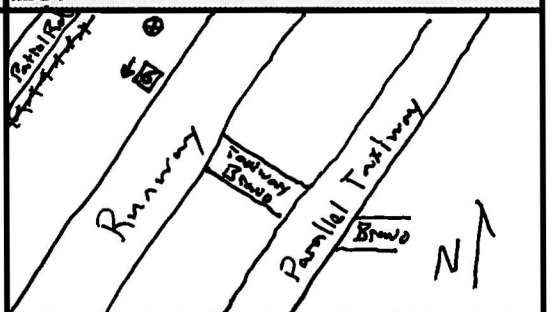
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2204359.06 ft. N
523702.04 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPT BG-SB37-04-121307
Sample Location: SB37
Sampled By: DH
C.O.C. No.: 26235

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1135 Method: Hand Auger Monitor Reading (ppm): N/A	3-4 feet	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

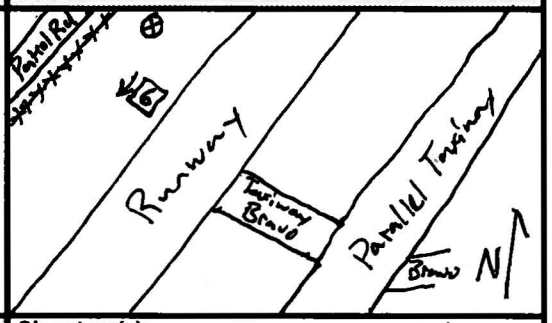
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2204 359.06 ft. N
523 702.04 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB38
DATE: 12/13/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown	Fine Sand	SM	Sampled					
	1-2					tan	Fine Sand	SM						
	2-3					Tan	Fine Sand	SM	Sampled					▽ WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 3 ft. bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS38-01-121307
Sample Location: SB38
Sampled By: DH
C.O.C. No.: 26235

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1150 Method: Monitor Reading (ppm):	0-1 feet	Brown	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

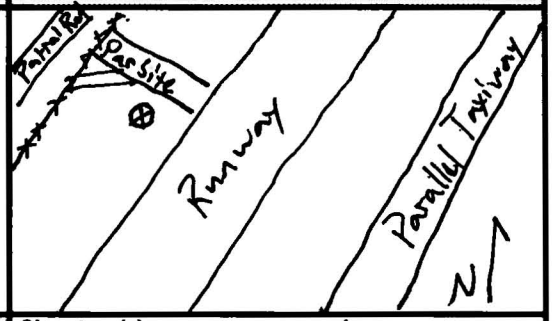
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2202600.07 ft. N
522145.14 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB38-03-121307
Sample Location: SB38
Sampled By: DH
C.O.C. No.: 26237

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1155 Method: Hand Auger Monitor Reading (ppm): N/A	2-3 Feet	Tan	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

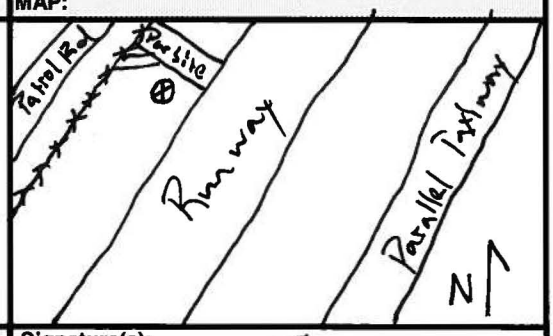
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2202600.07 ft. N
522145.14 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH A-1

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand auger
BORING NUMBER: SB39
DATE: 12/13/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown to Grey	Fine Sand	SM	Sampled					
	1-2					Grey	Fine Sand	SM	Sampled					▽WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 2 feet bgs

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS39-01-121307
Sample Location: SB39
Sampled By: DH
C.O.C. No.: 26237

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1210 Method: Hand Auger Monitor Reading (ppm): N/A	0 - 1 feet	Brown to Gray	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

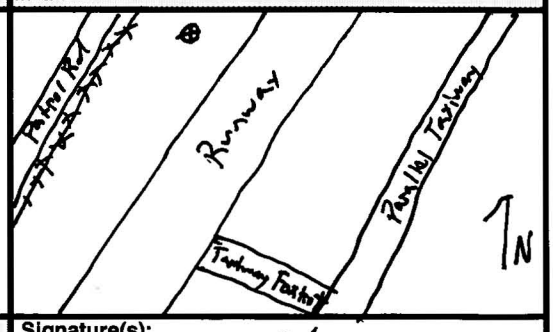
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz.	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2201968.40 ft. N
521543.12 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB39-02-121307
Sample Location: SB39
Sampled By: DH
C.O.C. No.: 26237

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1215 Method: Hand Auger Monitor Reading (ppm): N/A	1-2 feet	Grey	Fine Sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

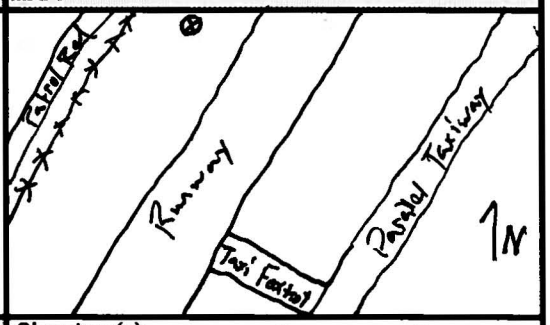
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2201968.40 ft. N
521543.12 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): DH

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: Arsenic Background Study
PROJECT NUMBER: 112G00436
DRILLING COMPANY: N/A
DRILLING RIG: Hand Auger
BORING NUMBER: SB40
DATE: 12/13/07
GEOLOGIST: D. Hardison
DRILLER: N/A

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**	
	0-1					Brown	Fine Sand	SM	Sampled					
	1-3					Brown	Fine Sand w/ shell	SM						
	3-4					Brown	Fine Sand w/ shell	SM	sampled					▽ WT
													0	

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: Water Table @ ~ 4 ft. bgs.

Drilling Area Background (ppm):

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

Sample ID No.: MPTBG-SS40-01-121307
Sample Location: SB40
Sampled By: DH
C.O.C. No.: 26237

[X] Surface Soil (SS)
[] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1255 Method: Hand Auger Monitor Reading (ppm): N/A	0-1 feet	Brown	Fine sand

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:	NO COMPOSITE SAMPLE COLLECTED			
Monitor Readings (Range in ppm):				

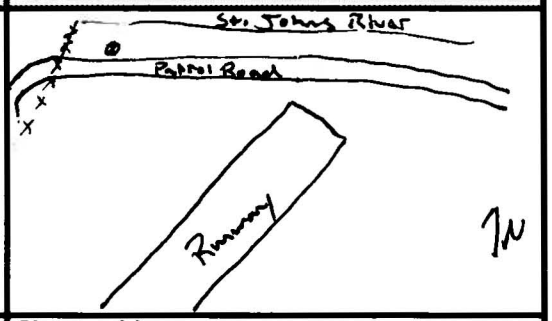
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2205604.46 ft. N
524290.68 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: Arsenic Background Study
Project No.: 112G00436

[] Surface Soil (SS)
[X] Subsurface Soil (SU)
[] Sediment (SD)
[] Other:
[] QA Sample Type:

Sample ID No.: MPTBG-SB40-04-121307
Sample Location: SB40
Sampled By: DH
C.O.C. No.: 26237

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 12/13/07 Time: 1300 Method: Hand auger Monitor Reading (ppm): N/A	3-4 feet	Brown	Fine Sand w/ shell

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	NO COMPOSITE SAMPLE COLLECTED			
Method:				
Monitor Readings (Range in ppm):				

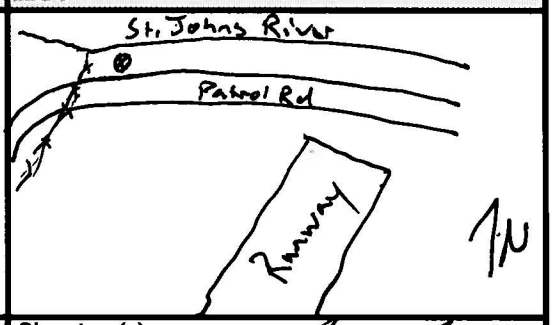
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	LAB
Arsenic / 6010B	1 x 4 oz. -	DH	Accutest

OBSERVATIONS / NOTES:

GPS Coordinates
2205604.46 ft. N
524290.68 ft. E

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

TETRA TECH NUS, INC. | **CHAIN OF CUSTODY** | **NUMBER** 26085 | **PAGE** 1 **OF** 5

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00436	NAVSTA MAYPORT	SHINA BALLARD	(904) 636-6125	ACCUTEST / H. WANDREY
SAMPLERS (SIGNATURE)		**FIELD OPERATIONS LEADER**	**PHONE NUMBER**	**ADDRESS**
Terry Cottenoir		TERRY COTTENOIR	(904) 636-6125	4405 VINELAND RD, C-15
		CARRIER/WAYBILL NUMBER		**CITY, STATE**
		COURIER PICK UP		ORLANDO, FL

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G
PRESERVATIVE USED: –

DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: Arsenic (6010B)								COMMENTS
11/26	0939	MPTBG-SS01-01-112607		0	1	SO	G	1	X								Cool to 4°C
	0959	MPTBG-SB01-03-112607		2	3	SO	G	1	X								
	1016	MPTBG-SS02-01-112607		0	1	SO	G	1	X								
	1025	MPTBG-SB02-04-112607		3	4	SO	G	1	X								
	1040	MPTBG-SS03-01-112607		0	1	SO	G	1	X								
	1046	MPTBG-SB03-03-112607		2	3	SO	G	1	X								
	1055	MPTBG-SS04-01-112607		0	1	SO	G	1	X								
	1114	MPTBG-SB04-10-112607		9	10	SO	G	1	X								
	1151	MPTBG-SS05-01-112607		0	1	SO	G	1	X								
	1201	MPTBG-SB05-06-112607		5	6	SO	G	1	X								
	1218	MPTBG-SS06-01-112607		0	1	SO	G	1	X								
	1229	MPTBG-SB06-05-112607		4	5	SO	G	1	X								
	1243	MPTBG-SS07-01-112607		0	1	SO	G	1	X								

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY: [signature]	11/30/07	1440	1. RECEIVED BY: [signature]	12/3/07	14:40
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. | **CHAIN OF CUSTODY** | **NUMBER** 26886 | **PAGE** 2 **OF** 5

PROJECT NO: 112G00436	**FACILITY:** NAUSTA MAYPORT	**PROJECT MANAGER** SHINA BALLARD	**PHONE NUMBER** (904) 636-6125	**LABORATORY NAME AND CONTACT:** ACCUTEST / H. WANDREY
SAMPLERS (SIGNATURE) Terry Cott		**FIELD OPERATIONS LEADER** TERRY COTTENOIR	**PHONE NUMBER** (904) 636-6125	**ADDRESS** 4405 VINELAND RD, C-15
		CARRIER/WAYBILL NUMBER COURIER PICK UP		**CITY, STATE** ORLANDO, FL

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G
PRESERVATIVE USED: -

DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: ARSENIC (6010B)								COMMENTS
11/26	1253	MPTBG-SB07-05-112607		4	5	SO	G	1	X								Cool to 4°C
	1309	MPTBG-SS08-01-112607		0	1	SO	G	1	X								
	1317	MPTBG-SB08-03-112607		2	3	SO	G	1	X								
11/27	1045	MPTBG-SS09-01-112707		0	1	SO	G	1	X								
	1100	MPTBG-SB09-13-112707		12	13	SO	G	1	X								
	1145	MPTBG-SB10-01-112707		0	1	SO	G	1	X								
	1150	MPTBG-SB10-03-112707		2	3	SO	G	1	X								
	1225	MPTBG-SB11-01-112707		0	1	SO	G	1	X								
	1235	MPTBG-SB11-06-112707		5	6	SO	G	1	X								
	1310	MPTBG-SS12-01-112707		0	1	SO	G	1	X								
	1320	MPTBG-SB12-09-112707		8	9	SO	G	1	X								
	1405	MPTBG-SS13-01-112707		0	1	SO	G	1	X								
	1412	MPTBG-SB13-04-112707		3	4	SO	G	1	X								

1. RELINQUISHED BY	DATE 11/30/07	TIME 1440	1. RECEIVED BY	DATE 11/30/07	TIME 1440
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. | **CHAIN OF CUSTODY** | **NUMBER** 26167 | **PAGE** 3 **OF** 5

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00436	NAVSTA Mayport	Shina Ballard	904-636-6125	Accutest / H. Wandry
SAMPLERS (SIGNATURE)		**FIELD OPERATIONS LEADER**	**PHONE NUMBER**	**ADDRESS**
		Terry Cottenoir	904-636-6125	4405 Vineland Rd., C-15
		CARRIER/WAYBILL NUMBER		**CITY, STATE**
		Courier Pick Up		Orlando, FL

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	Arsenic (6010B)	Arsenic (6010B)							COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)									G	P							
PRESERVATIVE USED										HNO3							
11/27	1510	MPTBG-SS14-01-112707		0	1	SO	G	1	X								Cool to 4°C
	1525	MPTBG-SB14-07-112707		6	7	SO	G	1	X								
	1035	MPTBG-RB01-112707				QC	G	1		X							
	1300	MPTBG-RB02-112707				QC	G	1		X							
	1455	MPTBG-RB03-112707				QC	G	1		X							
11/28	0945	MPTBG-RB04-112807				QC	G	1		X							
	0950	MPTBG-SS15-01-112807		0	1	SO	G	1	X								
	1000	MPTBG-SB15-03-112807		2	3	SO	G	1	X								
	1055	MPTBG-SS16-01-112807		0	1	SO	G	1	X								
	1110	MPTBG-SB16-08-112807		7	8	SO	G	1	X								
	1200	MPTBG-RB05-112807				QC	G	1		X							
	1220	MPTBG-SS17-01-112807		0	1	SO	G	1	X								
	1230	MPTBG-SB17-03-112807		2	3	SO	G	1	X								

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
	11/30/07	1440		11/30/07	1440
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. | CHAIN OF CUSTODY | NUMBER 26168 | PAGE 4 OF 5

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00436	NAVSTA Mayport	Shina Ballard	904-636-6125	Accutest / H. Wandry
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
[signature]		Terry Cottenoir	904-636-6125	4405 Vineland Rd., C-15
		CARRIER/WAYBILL NUMBER		CITY, STATE
		Courier Pick Up		Orlando, FL

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G P
PRESERVATIVE USED: - HNO3

TYPE OF ANALYSIS: Arsenic (6010B) | Arsenic (6010B)

DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	Arsenic (6010B)	Arsenic (6010B)							COMMENTS
11/28	1310	MPTBG-SS18-01-112807		0	1	SO	G	1	X								Cool to 4°
	1320	MPTBG-SB18-07-112807		6	7	SO	G	1	X								
	1350	MPTBG-RB06-112807				QC	G	1		X							
	1400	MPTBG-SS19-01-112807		0	1	SO	G	1	X								
	1405	MPTBG-SB19-03-112807		2	3	SO	G	1	X								
	1455	MPTBG-SS20-01-112807		0	1	SO	G	1	X								
	1505	MPTBG-SB20-04-112807		3	4	SO	G	1	X								
11/29	1250	MPTBG-SS21-01-112907		0	1	SO	G	1	X								
	1255	MPTBG-SB21-03-112907		2	3	SO	G	1	X								
	1300	MPTBG-RB07-112907				QC	G	1		X							
	1328	MPTBG-SS22-01-112907		0	1	SO	G	1	X								
	1331	MPTBG-SB22-02-112907		1	2	SO	G										
	1340	MPTBG-RB08-112907				QC	G	1		X							

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY [signature]	11/30/07	1440	1. RECEIVED BY [signature]	11.30.07	1440
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. | **CHAIN OF CUSTODY** | **NUMBER** 26089 | **PAGE** 5 **OF** 5

PROJECT NO: 112G00436	**FACILITY:** NAVSTA MAYPORT	**PROJECT MANAGER** SHINA BALLARD	**PHONE NUMBER** (904) 636-6125	**LABORATORY NAME AND CONTACT:** ACCUTEST / H. WANDREY
SAMPLERS (SIGNATURE) Terry Cottenoir		**FIELD OPERATIONS LEADER** TERRY COTTENOIR	**PHONE NUMBER** (904) 636-6125	**ADDRESS** 4405 VINELAND RD, C-15
		CARRIER/WAYBILL NUMBER COURIER PICK UP		**CITY, STATE** ORLANDO, FL

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G P
PRESERVATIVE USED: - HNO3

DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: ARSENIC (6010B)	ARSENIC (6010B)							COMMENTS
11/29	1345	MPTBG-SS23-01-112907		0	1	SO	G	1	X								Cool to 4°C
↓	1350	MPTBG-SB23-02-112907		1	2	SO	G	1	X								
11/30	0955	MPTBG-SS24-01-113007		0	1	SO	G	1	X								
	1000	MPTBG-SB24-02-113007		1	2	SO	G	1	X								
	1017	MPTBG-SS25-01-113007		0	1	SO	G	1	X								
	1022	MPTBG-SB25-02-113007		1	2	SO	G	1	X								
	1032	MPTBG-SS26-01-113007		0	1	SO	G	1	X								
↓	1037	MPTBG-SB26-02-113007		1	2	SO	G	1	X								

1. RELINQUISHED BY	DATE 11/30/07	TIME 1440	1. RECEIVED BY	DATE 11.2.07	TIME 14.40
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. **CHAIN OF CUSTODY** | **NUMBER** 26234 | **PAGE** 1 **OF** 3

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00436	NAVSTA Mayport	Shina Ballard	(904) 636-6125	Accutest / H. Wandix
SAMPLERS (SIGNATURE)		**FIELD OPERATIONS LEADER**	**PHONE NUMBER**	**ADDRESS**
JM A-1		Donald Hardison	(904) 636-6125	4405 Vineland Rd, C-15
		CARRIER/WAYBILL NUMBER		**CITY, STATE**
		Courier Pick up		Orlando, FL

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G R
PRESERVATIVE USED: - HNO3

DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS:	Arsenic (6010B)	Arsenic (6010B)							COMMENTS
12/12	1100	MPTBG-RB09-121207				QC	G	1		X								Cool to 4°C
	1125	MPTBG-SS27-01-121207		0	1	SO	G	1	X									
	1130	MPTBG-SB27-03-121207		2	3	SO	G	1	X									
	1205	MPTBG-SS28-01-121207		0	1	SO	G	1	X									
	1210	MPTBG-SB28-02-121207		1	2	SO	G	1	X									
	1230	MPTBG-SS29-01-121207		0	1	SO	G	1	X									
	1235	MPTBG-SB29-04-121207		3	4	SO	G	1	X									
	1255	MPTBG-SS30-01-121207		0	1	SO	G	1	X									
	1300	MPTBG-SB30-02-121207		1	2	SO	G	1	X									
	1320	MPTBG-SS31-01-121207		0	1	SO	G	1	X									
	1325	MPTBG-SB31-04-121207		3	4	SO	G	1	X									
	1345	MPTBG-SS32-01-121207		0	1	SO	G	1	X									
	1350	MPTBG-SB32-03-121207		2	3	SO	G	1	X									

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY: Elizabeth Clagget	12-14-07	12:49	1. RECEIVED BY: [illegible] (Alex)	12/14/07	12:50
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. | **CHAIN OF CUSTODY** | **NUMBER** 26235 | **PAGE** 2 **OF** 3

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00436	NAVSTA Mayport	Shina Ballard	(904) 636-6125	Accutest / H. Wandry

SAMPLERS (SIGNATURE)	FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
[signature]	Donald Hardison	(904) 636-6125	4405 Vineland Rd., C-15
	CARRIER/WAYBILL NUMBER		**CITY, STATE**
	Courier Pickup		Orlando, FL

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G P
PRESERVATIVE USED: – HNO3

DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: Arsenic (6010B)	Arsenic (6010B)							COMMENTS
12/12	1445	MPTBG-RB10-121207				QC	G	1		X							Cool to 4°C
12/13	0930	MPTBG-RB11-121307				QC	G	1		X							
	0940	MPTBG-SS33-01-121307		0	1	SO	G	1	X								
	0945	MPTBG-SB33-02-121307		1	2	SO	G	1	X								
	1000	MPTBG-SS34-01-121307		0	1	SO	G	1	X								
	1005	MPTBG-SB34-03-121307		2	3	SO	G	1	X								
	1030	MPTBG-SS35-01-121307		0	1	SO	G	1	X								
	1035	MPTBG-SB35-04-121307		3	4	SO	G	1	X								
	1055	MPTBG-SS36-01-121307		0	1	SO	G	1	X								
	1100	MPTBG-SB36-04-121307		3	4	SO	G	1	X								
	1130	MPTBG-SS37-01-121307		0	1	SO	G	1	X								
	1135	MPTBG-SB37-04-121307		3	4	SO	G	1	X								
	1150	MPTBG-SB38-01-121307		0	1	SO	G	1	X								

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY: Elizabeth Clagg	12/14/07	12:49	1. RECEIVED BY: [signature] (Alex)	12/14/07	12:50
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. | **CHAIN OF CUSTODY** | **NUMBER** 26237 | **PAGE** 3 **OF** 3

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00436	NAVSTA Mayport	Shina Ballard	(904) 636-6125	Accutest / H. Wandry
SAMPLERS (SIGNATURE)		**FIELD OPERATIONS LEADER**	**PHONE NUMBER**	**ADDRESS**
SM 7H:1		Donald Hardison	(904) 636-6125	4405 Vineland Rd., C-15
		CARRIER/WAYBILL NUMBER		**CITY, STATE**
		Courier Pickup		Orlando, FL

STANDARD TAT ☒ X
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G P
PRESERVATIVE USED: – HNO3

DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: Arsenic (6010B)	Arsenic (6010B)							COMMENTS
12/13	1155	MPTBG-SB38-03-121307		2	3	SO	G	1	X								Cool to 4°C
	1210	MPTBG-SS39-01-121307		0	1	SO	G	1	X								
	1215	MPTBG-SB39-02-121307		1	2	SO	G	1	X								
	1255	MPTBG-SS40-01-121307		0	1	SO	G	1	X								
	1300	MPTBG-SB40-04-121307		3	4	SO	G	1	X								
	1315	MPTBG-RB12-121307				QC	G	1		X							

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY Elizabeth Cleagzett	12/14/07	12:49	1. RECEIVED BY [illegible]	12/14/07	12:50
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

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4/02R
FORM NO. TtNUS-001

ATTACHMENT 4

ARSENIC BACKGROUND STUDY SOIL SAMPLING RESULTS

Table 1
Arsenic Background Study Soil Sampling Results

Arsenic Background Study Report
Naval Station Mayport
Mayport, Florida

Sample ID: MPTBG-	FDEP SCTL		SB01-03-112607	SB02-04-112607	SB03-03-112607	SB04-10-112607	SB05-06-112607	SB06-05-112607
Sample Date	FL77DER	FL77DEI	20071126	20071126	20071126	20071126	20071126	20071126
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.87	0.6	0.37	0.74	0.55	**4.0 [DER]**
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	79.90%	88.60%	85.30%	97%	89.10%	75.50%

Sample ID: MPTBG-	FDEP SCTL		SB07-05-112607	SB08-03-112607	SB09-13-112707	SB10-03-112707	SB11-06-112707	SB12-09-112707
Sample Date	FL77DER	FL77DEI	20071126	20071126	20071127	20071127	20071127	20071127
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.46	1	0.54	0.26	1.3	0.9
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	95.60%	90.10%	95.90%	77.40%	91.30%	95.10%

Sample ID: MPTBG-	FDEP SCTL		SB13-04-112707	SB14-07-112707	SB15-03-112807	SB16-08-112807	SB17-03-112807	SB18-07-112807
Sample Date	FL77DER	FL77DEI	20071127	20071127	20071128	20071128	20071128	20071128
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.46	0.57	0.54	0.95	0.25	0.35
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	89.70%	93.40%	72%	75.30%	89.10%	83.20%

Sample ID: MPTBG-	FDEP SCTL		SB19-03-112807	SB20-04-112807	SB21-03-112907	SB22-02-112907	SB23-02-112907	SB24-02-113007
Sample Date	FL77DER	FL77DEI	20071128	20071128	20071129	20071129	20071129	20071130
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.48	0.77	0.95	1.8	**3.3 [DER]**	**8.8 [DER]**
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	86.60%	84.40%	86.90%	81.70%	79.60%	62%

Table 1
Arsenic Background Study Soil Sampling Results

Arsenic Background Study Report
Naval Station Mayport
Mayport, Florida

Sample ID: MPTBG-	FDEP SCTL		SB25-02-113007	SB26-02-113007	SB27-03-121207	SB28-02-121207	SB29-04-121207	SB30-02-121207
Sample Date	FL77DER	FL77DEI	20071130	20071130	20071212	20071212	20071212	20071212
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	**6.4 [DER]**	**13.7 [DER] [DEI]**	**5.2 [DER]**	0.72	0.63	0.95
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	90.50%	48.20%	69.30%	93.70%	94.60%	81.90%

Sample ID: MPTBG-	FDEP SCTL		SB31-04-121207	SB32-03-121207	SB33-02-121307	SB34-03-121307	SB35-04-121307	SB36-04-121307
Sample Date	FL77DER	FL77DEI	20071212	20071212	20071213	20071213	20071213	20071213
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.72	0.9	**3.2 [DER]**	0.29	1.1	0.78
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	91.80%	93.90%	91%	79.20%	83.80%	95.40%

Sample ID: MPTBG-	FDEP SCTL		SB37-04-121307	SB38-03-121307	SB39-02-121307	SB40-04-121307	SS01-01-112607	SS02-01-112607
Sample Date	FL77DER	FL77DEI	20071213	20071213	20071213	20071213	20071126	20071126
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.66	0.24 U	0.85	0.8	0.96	0.56
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	95.80%	80.40%	86.60%	95.40%	88.30%	91%

Sample ID: MPTBG-	FDEP SCTL		SS03-01-112607	SS04-01-112607	SS05-01-112607	SS06-01-112607	SS07-01-112607	SS08-01-112607
Sample Date	FL77DER	FL77DEI	20071126	20071126	20071126	20071126	20071126	20071126
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.66	0.44	0.8	0.98	0.58	0.81
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	97.90%	98.10%	96.40%	94.90%	97.40%	95%

Table 1
Arsenic Background Study Soil Sampling Results

Arsenic Background Study Report
Naval Station Mayport
Mayport, Florida

Sample ID: MPTBG-	FDEP SCTL		SS09-01-112707	SS10-01-112707	SS11-01-112707	SS12-01-112707	SS13-01-112707	SS14-01-112707
Sample Date	FL77DER	FL77DEI	20071127	20071127	20071127	20071127	20071127	20071127
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.33	0.35	0.51	0.37	0.31	0.39
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	97.40%	82.40%	98.40%	98.90%	98.10%	97.30%

Sample ID: MPTBG-	FDEP SCTL		SS15-01-112807	SS16-01-112807	SS17-01-112807	SS18-01-112807	SS19-01-112807	SS20-01-112807
Sample Date	FL77DER	FL77DEI	20071128	20071128	20071128	20071128	20071128	20071128
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.72	0.71	0.47	0.58	0.87	0.71
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	90%	89.90%	98.30%	97.50%	98%	91.60%

Sample ID: MPTBG-	FDEP SCTL		SS21-01-112907	SS22-01-112907	SS23-01-112907	SS24-01-113007	SS25-01-113007	SS26-01-113007
Sample Date	FL77DER	FL77DEI	20071129	20071129	20071129	20071130	20071130	20071130
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	1.3	1.1	**2.7 [DER]**	**9.9 [DER]**	**11 [DER]**	**12.4 [DER] [DEI]**
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	86.10%	93.50%	88.80%	64%	65%	65.20%

Sample ID: MPTBG-	FDEP SCTL		SS27-01-121207	SS28-01-121207	SS29-01-121207	SS30-01-121207	SS31-01-121207	SS32-01-121207
Sample Date	FL77DER	FL77DEI	20071212	20071212	20071212	20071212	20071212	20071212
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	0.84	0.87	1.4	2	1.8	1.1
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	96.50%	94.40%	98.60%	97%	98.20%	96.80%

Table 1
Arsenic Background Study Soil Sampling Results

Arsenic Background Study Report
Naval Station Mayport
Mayport, Florida

Sample ID: MPTBG-	**FDEP SCTL**		SS33-01-121307	SS34-01-121307	SS35-01-121307	SS36-01-121307	SS37-01-121307	SS38-01-121307
Sample Date	FL77DER	FL77DEI	20071213	20071213	20071213	20071213	20071213	20071213
Inorganics (mg/kg)								
ARSENIC	**2.1**	**12**	1.3	0.55	**3.3 [DER]**	0.73	0.5	0.71
Miscellaneous Parameters (%)								
PERCENT SOLIDS	NA	NA	87.50%	95.90%	98.40%	97.10%	98%	95.40%

Sample ID: MPTBG-	**FDEP SCTL**		SS39-01-121307	SS40-01-121307
Sample Date	FL77DER	FL77DEI	20071213	20071213
Inorganics (mg/kg)				
ARSENIC	**2.1**	**12**	0.52	0.68
Miscellaneous Parameters (%)				
PERCENT SOLIDS	NA	NA	85.90%	97.30%

ATTACHMENT 5

TETRA TECH RESPONSE TO UNIVERSITY OF FLORIDA COMMENTS
JUNE 17, 2008

TETRA TECH NUS, INC.
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Document Tracking Number 08JAX0041

June 17, 2008

Project Number 112G00436

Naval Facilities Engineering Command, Southeast
ATTN: Mr. Dana Hayworth
Remedial Project Manager
135 Ajax Street North, Building 135
Naval Air Station Jacksonville
Jacksonville, FL 32212-0030

Reference: CLEAN IV Contract Number N62467-04-D-0055
Contract Task Order Number 0033

Subject: Response to Comments, Arsenic Background Study
Naval Station Mayport
Mayport, Florida

Dear Mr. Hayworth:

Tetra Tech NUS, Inc. (TtNUS) is pleased to submit this letter responding to the comments on the Arsenic Background Study at Naval Station (NAVSTA) Mayport. The questions and/or comments received by TtNUS from Mr. Stephen M. Roberts, Ph.D., from the University of Florida are addressed below.

UNIVERSITY OF FLORIDA

Comment 1: In the analysis of soil data from Naval Station Mayport, raw (un-transformed) data were examined and found not to be normally distributed. Based upon this observation, nonparametric methods for comparison were chosen. Soil concentration data are typically skewed. As a result, transformation of the data, such as logarithmic, is often utilized so that the assumption of normality is more nearly met, allowing normal-based methods to be used. These methods have more power than non-parametric methods.

Response: A log transformation of the data was conducted. The log transformed data were then fit to a normality plot and the Shapiro Wilk statistic was calculated. From examination of the probability plots and the Shapiro Wilk statistic is was concluded that the log transformation does not improve the fit to normality (See Normality Attachment). In addition to conducting a log transformation the distributions of the data were evaluated using the Pro UCL 4.0 software. The output from Pro UCL 4.0 can be seen in Distributions Attachment. From the various distribution tests conducted it was concluded that the data do not follow a normal or a log normal distribution.

Comment 2: Because the null hypothesis was consistently taken to be that the medians of background and site were equal, no justification is given that the sample size is large enough to give confidence in the conclusion that contamination is not present.

Response: For case where the Kruskal Wallis nonparametric ANOVA was computed with the hypothesis that the medians of the background and site were equal. This will be replaced with a Monte Carlo Approach.

The surface soil comparison will be changed to the following:

A Monte Carlo Test was conducted to test the null hypothesis that the mean site concentrations are greater than or equal to the background concentrations. This test employed a resampling technique to generate a t-statistic data distribution based on the data that have already been collected. The already computed test statistic from the actual data was then compared to this distribution to determine whether it has a significant probability of occurring for reasons other than random chance. For this test the site data were not required to exceed the background by an offset value. If an offset had been used then the test result would b more statistically significant but this added significance was not necessary, as described below. The description of the Monte Carlo method follows.

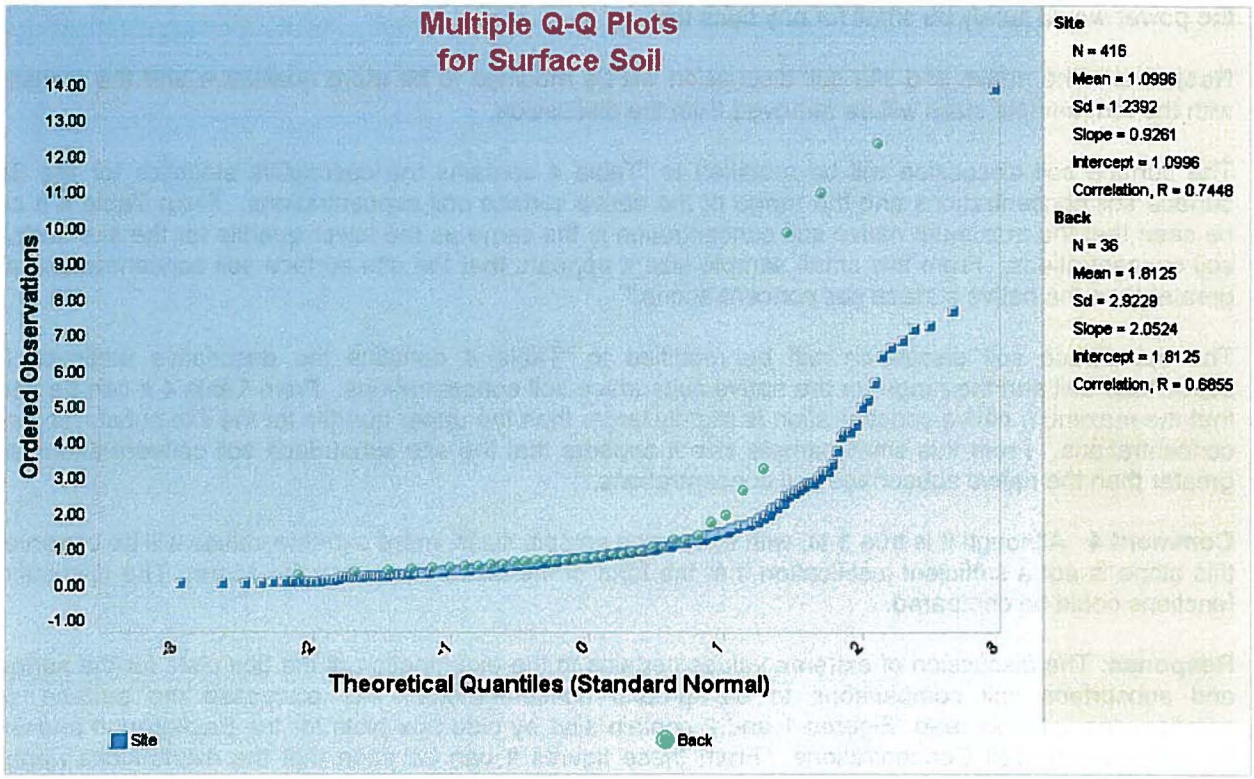
First the t-statistic (see Data Quality Assessment: Statistical Methods for Practitioners page 67 for calculation) for the original site and background data was computed to be -1.45. Next the site and background data were placed into one data set. 400 samples with replacement were taken of size 416 and size 36 to represent the site and background data sets, respectively. Then t-statistics were computed for each of the 400 data sets. From this a p-value was computed. The p-value is the proportion of t-statistics from the Monte Carlo simulations that are less than the test statistic for the original data sets. The null hypothesis will be rejected if the p-value is less than 0.05. For the surface soil simulations 6 out of 400 test statistics were smaller than the test statistic from the original test. This results in a p-value of 0.015. Therefore, the null hypothesis that the site concentrations are greater than the background concentrations was rejected. It is concluded that the site surface soil concentrations are within the range of the background surface soil concentrations.

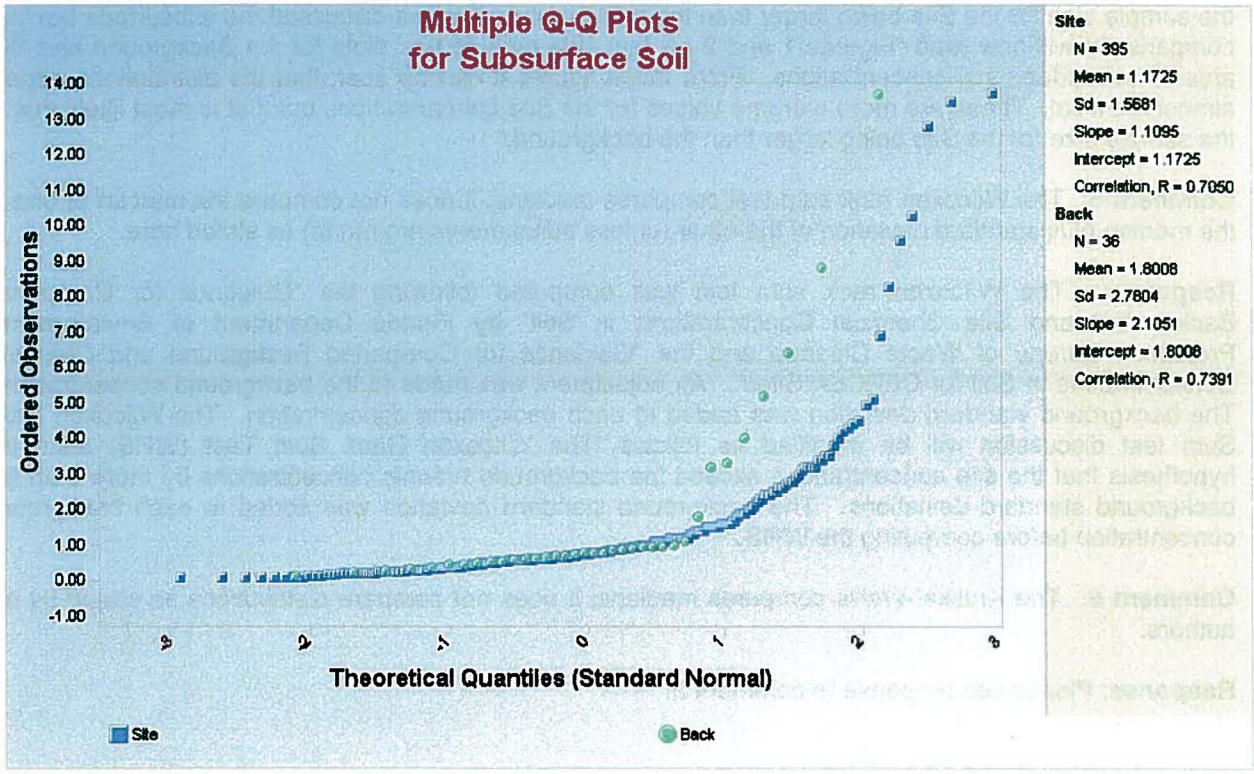
The subsurface soil comparison will be changed to the following:

A Monte Carlo Test was conducted to test the null hypothesis that the mean site concentrations are greater than or equal to the background concentrations. This test employed a resampling technique to generate a t-statistic data distribution based on the data that have already been collected. The already computed test statistic from the actual data was then compared to this distribution to determine whether it has a significant probability of occurring for reasons other than random chance. For this test the site data were not required to exceed the background by an offset value. If an offset had been used then the test result would b more statistically significant but this added significance was not necessary, as described below. The description of the Monte Carlo method follows.

First the t-statistic (see Data Quality Assessment: Statistical Methods for Practitioners page 67 for calculation) for the original site and background data was computed to be -1.34. Next the site and background data were placed into one data set. 400 samples with replacement were taken of size 395 and size 36 to represent the site and background data sets, respectively. Then t-statistics were computed for each of the 400 data sets. From this a p-value was computed. The p-value is the proportion of t-statistics from the Monte Carlo simulations that are less than the t-statistic for the original data sets. The null hypothesis will be rejected if the p-value is less than 0.05. For the subsurface soil simulations 13 out of 400 test statistics were smaller than the test statistic from the original test. This results in a p-value of 0.03. Therefore, the null hypothesis that the site concentrations are greater than the background concentrations was rejected. It is concluded that the site subsurface soil concentrations are within the range of the background surface soil concentrations.

In addition to the Monte Carlo tests quantile plots were generated for the site and background concentrations. From these graphs it can be seen that the site concentrations are within the range of the background concentrations. The site and background data distributions are coincident over most of the observed concentrations ranges. In the upper ends of the ranges, the site data quantiles appear to deviate from background but are within the observed background concentrations.


Multiple Q-Q Plots
for Surface Soil
Ordered Observations
Theoretical Quantiles (Standard Normal)
Site
Back
Site
N = 416
Mean = 1.0996
Sd = 1.2392
Slope = 0.9261
Intercept = 1.0996
Correlation, R = 0.7448
Back
N = 36
Mean = 1.8125
Sd = 2.9229
Slope = 2.0524
Intercept = 1.8125
Correlation, R = 0.6855


Multiple Q-Q Plots
for Subsurface Soil
Ordered Observations
Theoretical Quantiles (Standard Normal)
Site
Back
Site
N = 395
Mean = 1.1725
Sd = 1.5681
Slope = 1.1095
Intercept = 1.1725
Correlation, R = 0.7050
Back
N = 36
Mean = 1.8008
Sd = 2.7804
Slope = 2.1051
Intercept = 1.8008
Correlation, R = 0.7391

Comment 3: The use of only four native observations highlights the concerns in the comment above, as the power would surely be small for any such test.

Response: The native and site soil discussion will be modified to be more qualitative and the statistics with the four sample sizes will be removed from the discussion.

The surface soil discussion will be modified to "Table 4 contains the descriptive statistics for the Site surface soil concentrations and the range of the native surface soil concentrations. From Table 4 it can be seen that the maximum native soil concentration is the same as the lower quartile for the site surface soil concentrations. From this small sample size it appears that the site surface soil concentrations are greater than the native surface soil concentrations."

The subsurface soil discussion will be modified to "Table 4 contains the descriptive statistics for subsurface soil and the range for the native subsurface soil concentrations. From Table 4 it can be seen that the maximum native concentration is slightly larger than the upper quartile for the site subsurface soil concentrations. From this small sample size it appears that the site subsurface soil concentrations are greater than the native subsurface soil concentrations.

Comment 4: Although it is true that, with increasing sample sizes, more extreme values will be observed, this alone is not a sufficient justification that the form of the distributions are the same. The distribution functions could be compared.

Response: The discussion of extreme values pertains to the examination of the box plots for the surface and subsurface soil comparisons to background concentrations. As discussed the surface soil comparisons will now read "Figures 1 and 2 contain side by side box plots for the Background and Site Arsenic Surface Soil Concentrations. From these figures it can be seen that the distributions appear almost identical. There are more extreme values for the Site concentrations but that is most likely due to the sample size for the Site being larger than the background. Also as discussed the subsurface box plot comparisons will now read "Figures 1 and 2 contain side by side box plots for the Background and Site arsenic subsurface soil concentrations. From these figures it can be seen that the distributions appear almost identical. These are more extreme values for the Site concentrations but that is most likely due to the sample size for the Site being larger than the background."

Comment 5: The Wilcoxon rank sum test compares medians; it does not compare the median of one to the median plus standard deviation of the other (unless adjustments are made) as stated here.

Response: The Wilcoxon rank sum test was computed following the "Guidance for Comparing Background and Site Chemical Concentrations in Soil" by Florida Department of Environmental Protection Bureau of Waste Cleanup and the "Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites". An adjustment was made to the background concentrations. The background standard deviation was added to each background concentration. The Wilcoxon Rank Sum test discussion will be modified as follows "The Wilcoxon Rank Sum Test (WRS) tests the hypothesis that the site concentrations exceed the background arsenic concentrations by more than the background standard deviations. The background standard deviation was added to each background concentration before computing the WRS.

Comment 6: The Kruskal-Wallis compares medians; it does not compare distributions as stated by the authors.

Response: Please see response to comment 2.

If you have any questions with regard to this submittal, please contact me via e-mail at Shina.Ballard@TetraTech.com or by phone at (904) 730-4669, Extension 222.

Sincerely,

Shina A. Ballard

Shina A. Ballard
Task Order Manager

SB

Enclosure

c: Ms. Adrienne Wilson, NAVFAC SE
Mr. John Winters FDEP
Ms. Diane Racine, NAVSTA Mayport
Mr. Craig Benedikt, USEPA
Mr. Mike Halil, CH2M Hill
Mr. Casey Hudson, CH2M Hill
Ms. Debra Humbert, TtNUS
Mr. Mark Perry, TtNUS
CTO 0033 Project File

ATTACHMENT 6

SURFACE SOIL COMPARISONS

Surface Soil Comparisons

Site versus Background Comparison

Table 1 contains the descriptive statistics for the Background and Site Arsenic Surface Soil Concentrations. From Table 1 it can be seen that the mean and median concentrations are similar (with a difference of 0.71 and 0.02 respectively), as verified later on with a formal statistical test. It can also be seen that the lower and upper quartile (25th percentile and 75th percentile) are similar (with a difference of 0.07 and 0.10 respectively).

	Descriptive Statistics Surface Soil Comparison							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Site	416	1.10	0.79	0.06	13.90	0.51	1.20	1.24
Background	36	1.81	0.81	0.31	12.40	0.58	1.30	2.92

Table 1

Figures 1 and 2 contain side by side box plots for the Background and Site Arsenic Surface Soil Concentrations. From these figures it can be seen that the distributions appear almost identical. There are more extreme values for the Site concentrations but that is most likely due to the sample size for the Site being larger than the background.

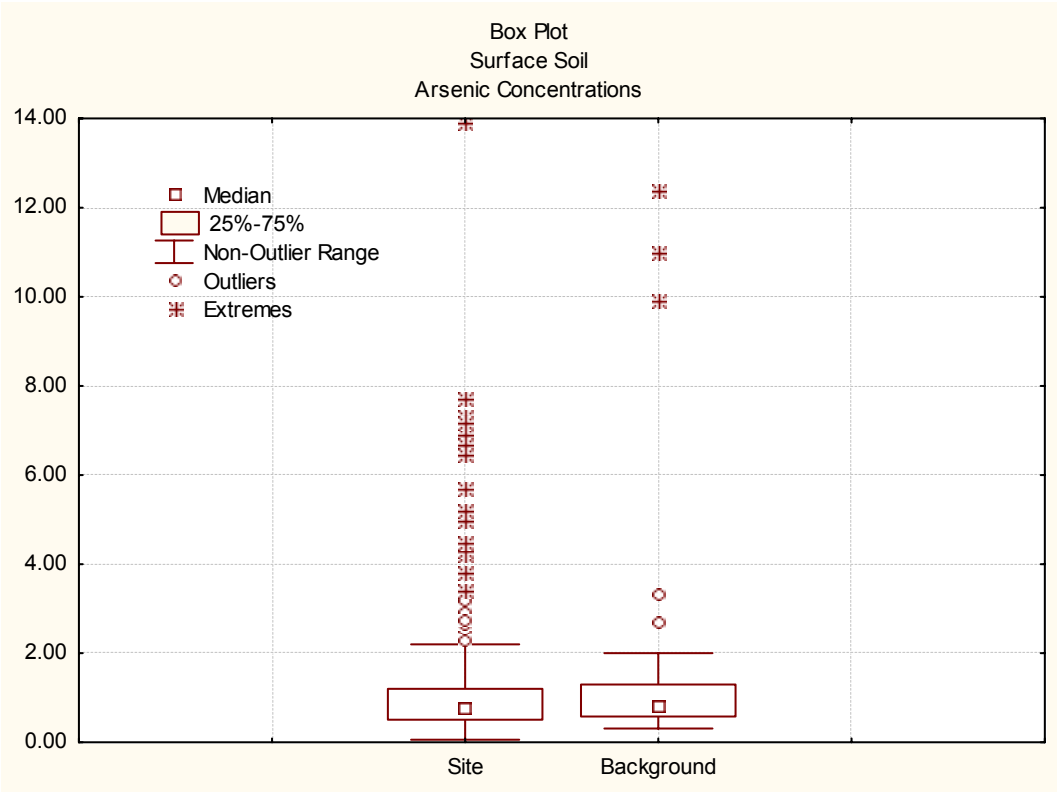


Figure 1

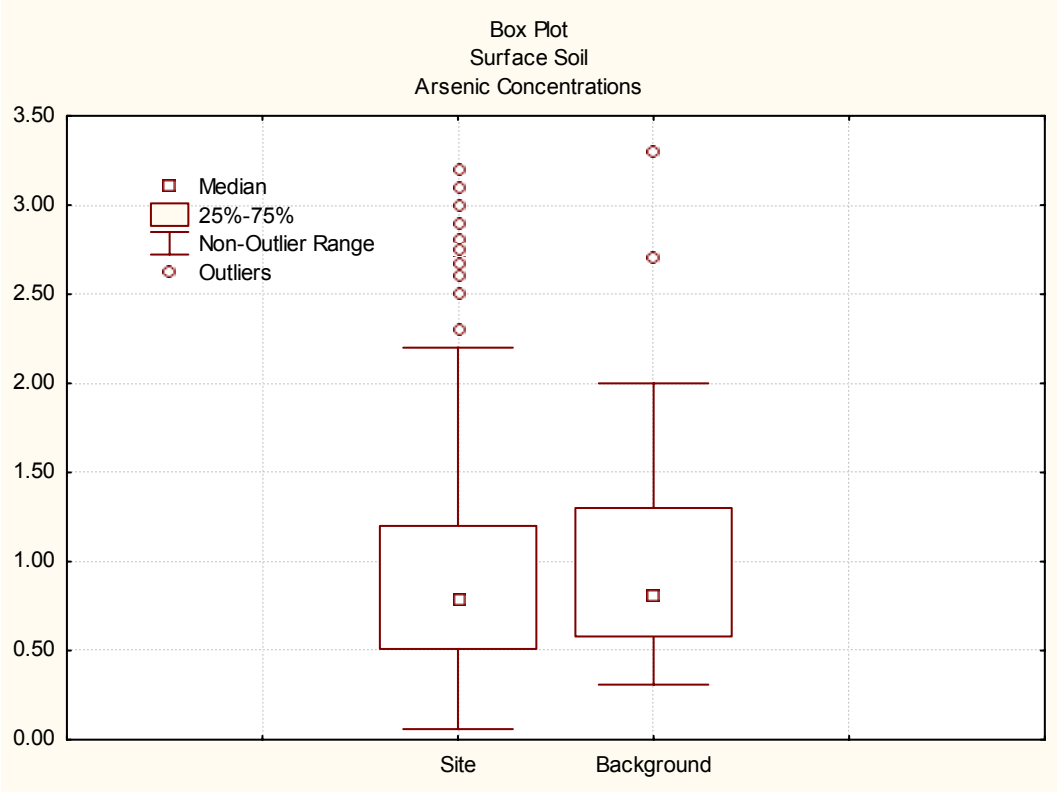


Figure 2

Figures 3 and 4 show the Normal Probability Plots and the corresponding Shapiro Wilk Statistic. If the data is normally distributed then the data will roughly follow the line drawn on the probability plot. The Shapiro Wilk Test tests the hypothesis that the data is normally distributed. If the p-value for the Shapiro Wilk Test is less than 0.05 then the data is not normally distributed. From Figure 3 it can be seen that the Site Arsenic Concentrations do not follow the line on the probability plot and the Shapiro Wilk Statistic is 0.00. Thus the Site Surface Soil Arsenic Concentrations are not normally distributed. From Figure 4 it can be seen that the Background Surface Soil Arsenic Concentrations do not follow the line on the probability plot and the Shapiro Wilk p-value is 0.00. Thus, the Background Surface Soil Arsenic Concentrations are not normally distributed. It should be noted that a log transformation was performed on the data sets. The log transformed data were then fit to a normality plot and the Shapiro Wilk statistic was calculated. From examination, of the probability plots and the Shapiro Wilk statistic it was concluded that the log transformations do not improve the fit to normality (See Normality Attachment and Distribution Attachment for details on determining the distribution of the data sets).

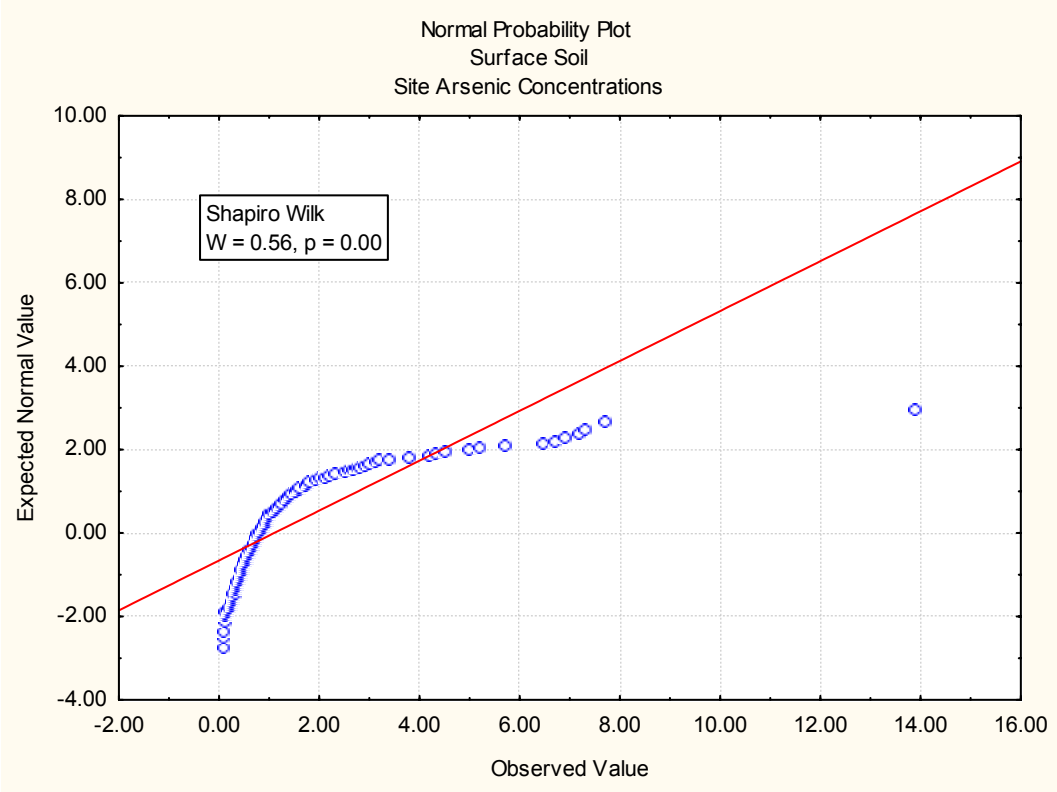


Figure 3

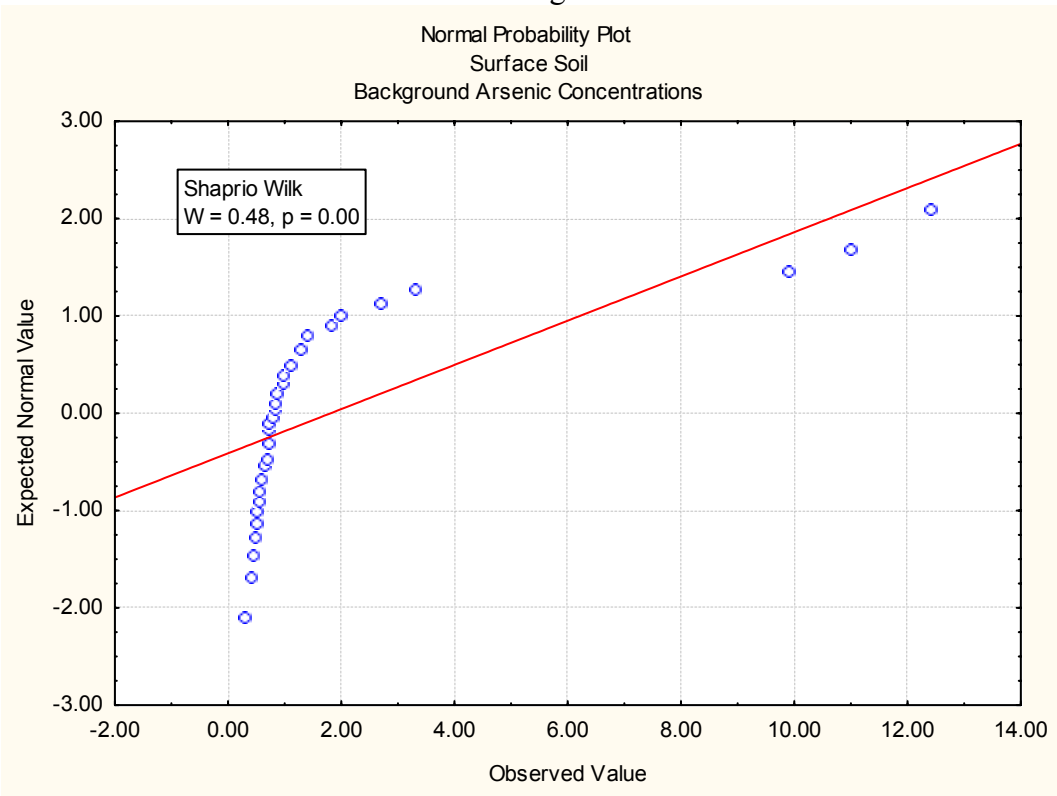
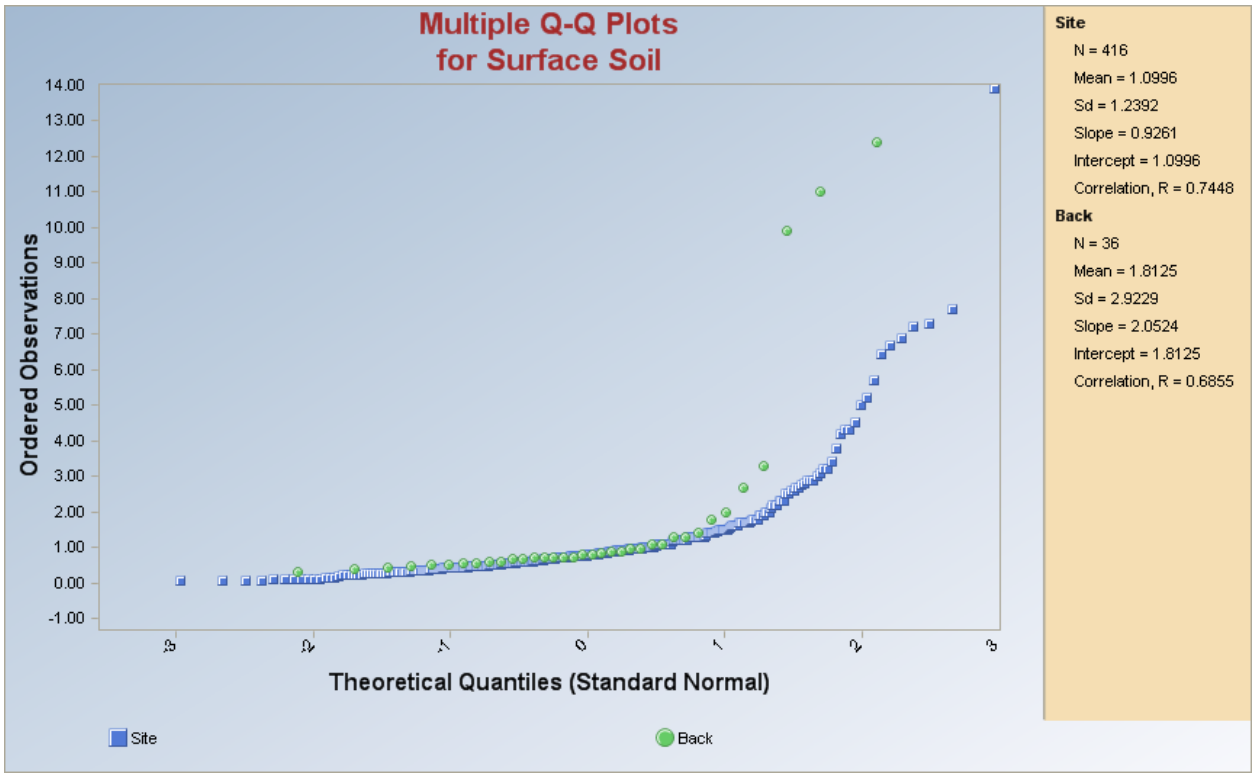


Figure 4

A Monte Carlo Test was conducted to test the null hypothesis that the mean site concentrations are greater than or equal to the background concentrations. This test employed a resampling technique to generate a t-statistic data distribution based on the data that have already been collected. The already computed test statistic from the actual data was then compared to this distribution to determine whether it has a significant probability of occurring for reasons other than random chance. For this test the site data were not required to exceed the background by an offset value. If an offset had been used then the test result would b more statistically significant but this added significance was not necessary, as described below. The description of the Monte Carlo method follows.

First the t-statistic (see Data Quality Assessment: Statistical Methods for Practitioners page 67 for calculation) for the original site and background data was computed to be -1.45. Next the site and background data were placed into one data set. 400 samples with replacement were taken of size 416 and size 36 to represent the site and background data sets, respectively. Then t-statistics were computed for each of the 400 data sets. From this a p-value was computed. The p-value is the proportion of t-statistics from the Monte Carlo simulations that are less than the test statistic for the original data sets. The null hypothesis will be rejected if the p-value is less than 0.05. For the surface soil simulations 6 out of 400 test statistics were smaller than the test statistic from the original test. This results in a p-value of 0.015. Therefore, the null hypothesis that the site concentrations are greater than the background concentrations was rejected. It is concluded that the site surface soil concentrations are within the range of the background surface soil concentrations.

In addition to the Monte Carlo tests quantile plots were generated for the site and background concentrations. From these graphs it can be seen that the site concentrations are within the range of the background concentrations. The site and background data distributions are coincident over most of the observed concentrations ranges. In the upper ends of the ranges, the site data quantiles appear to deviate from background but are within the observed background concentrations.



Site versus Native Soil Comparison

Table 4 contains the descriptive statistics for the Site surface soil concentrations and the range of the native surface soil concentrations. From Table 4 it can be seen that the maximum native soil concentration is the same as the lower quartile for the site surface soil concentrations. From this small sample size it appears that the site surface soil concentrations are greater than the native surface soil concentrations.

Variable	Descriptive Statistics Surface Soil Arsenic							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Site	416	1.10	0.79	0.06	13.90	0.51	1.20	1.24
Native	4	0.39	0.36	0.33	0.51	0.34	0.44	0.08

Table 4

ATTACHMENT 7

SUBSURFACE SOIL COMPARISONS

Subsurface Soil Comparisons

Site versus Background Comparison

Table 1 contains the descriptive statistics for the Background and Site arsenic subsurface soil concentrations. From Table 1 it can be seen that the mean and median concentrations are similar (with a difference of 0.63 and 0.03 respectively) as shown with statistical evaluation in further text. It can also be seen that the lower and upper quartile (25th percentile and 75th percentile) are similar (with a difference of 0.04 and 0.15 respectively).

Variable	Descriptive Statistics Subsurface Soil Arsenic							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Site	395	1.17	0.75	0.07	13.75	0.51	1.20	1.57
Background	36	1.80	0.78	0.12	13.70	0.55	1.05	2.78

Table 1

Figures 1 and 2 contain side by side box plots for the Background and Site arsenic subsurface soil concentrations. From these figures it can be seen that the distributions appear almost identical. These are more extreme values for the Site concentrations but that is most likely due to the sample size for the Site being larger than the background.

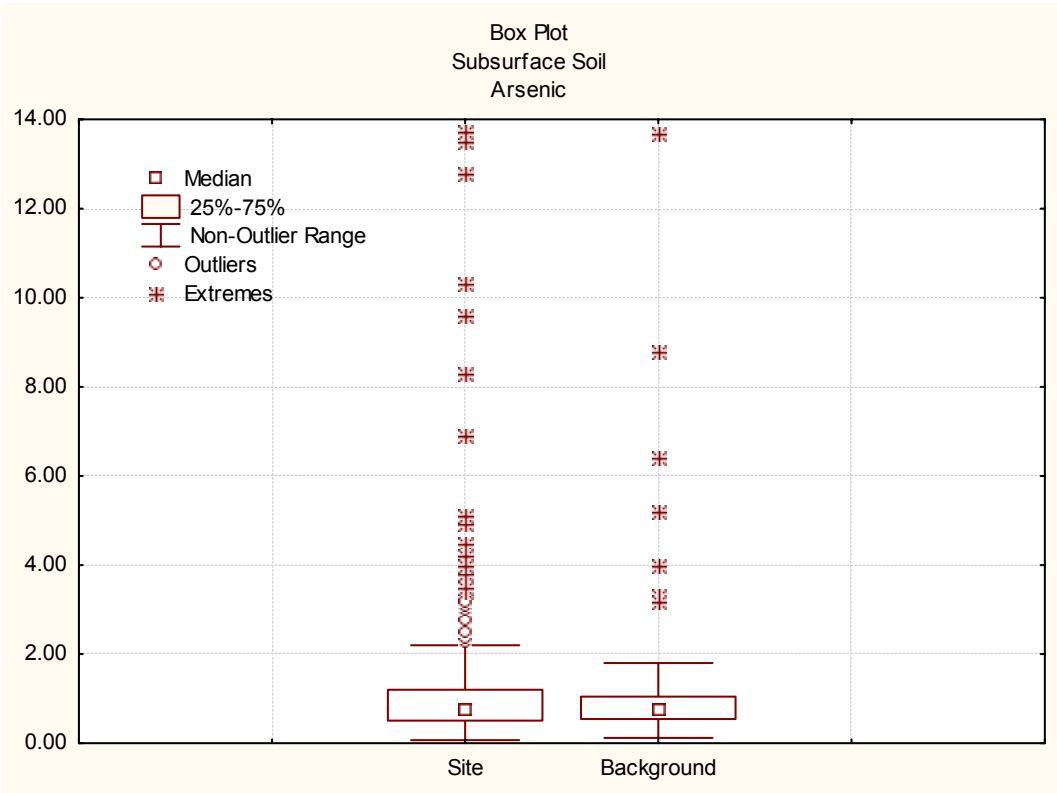


Figure 1

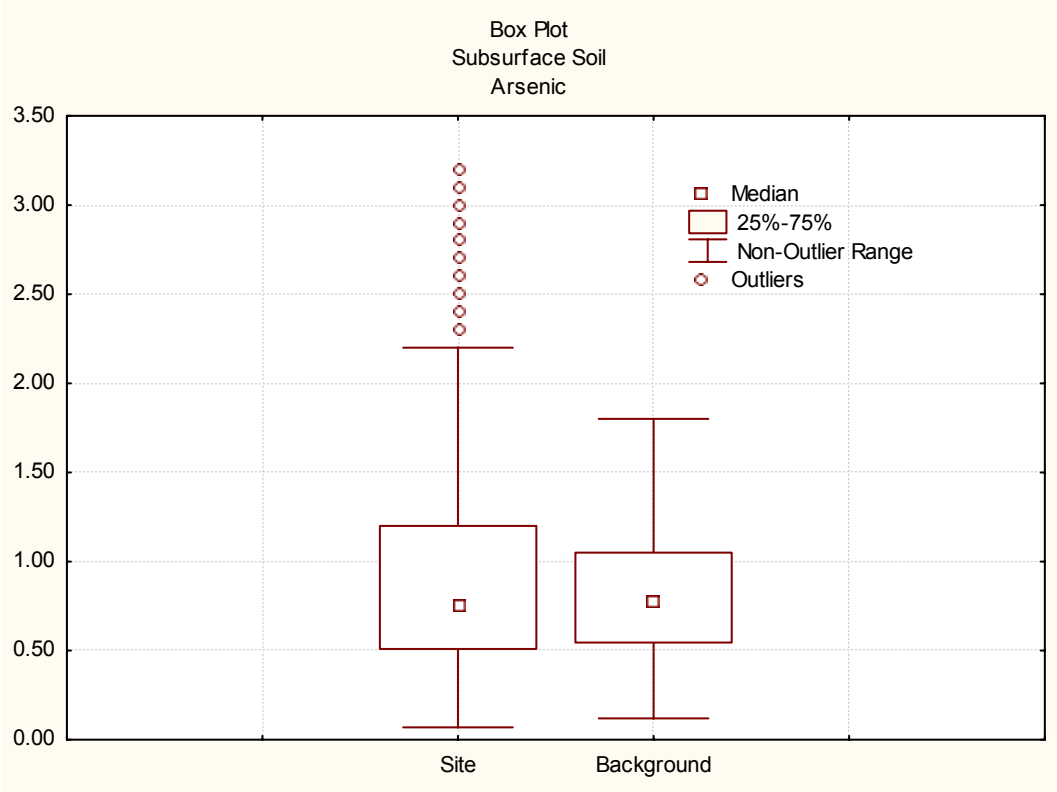


Figure 2

Figures 3 and 4 show the Normal probability plots and the corresponding Shapiro Wilk statistic. If the data is normally distributed then the data will roughly follow the line drawn on the probability plot. The Shapiro Wilk Test tests the hypothesis that the data is normally distributed. If the p-value for the Shapiro Wilk Test is less than 0.05 then the data is not normally distributed. The 0.05 significance value was chosen based on statistical convention. From Figure 3 it can be seen that the Site Arsenic Concentrations do not follow the line on the probability plot and the Shapiro Wilk Statistic is 0.00. Thus the Site subsurface soil arsenic concentrations are not normally distributed. From Figure 4 it can be seen that the Background surface soil arsenic concentrations do not follow the line on the probability plot and the Shapiro Wilk p-value is 0.00. Thus, the Background subsurface soil arsenic concentrations are not normally distributed. It should be noted that a log transformation was performed on the data sets. The log transformed data were then fit to a normality plot and the Shapiro Wilk statistic was calculated. From examination, of the probability plots and the Shapiro Wilk statistic it was concluded that the log transformations do not improve the fit to normality (See Normality Attachment and Distribution Attachment for details on determining the distribution of the data sets).

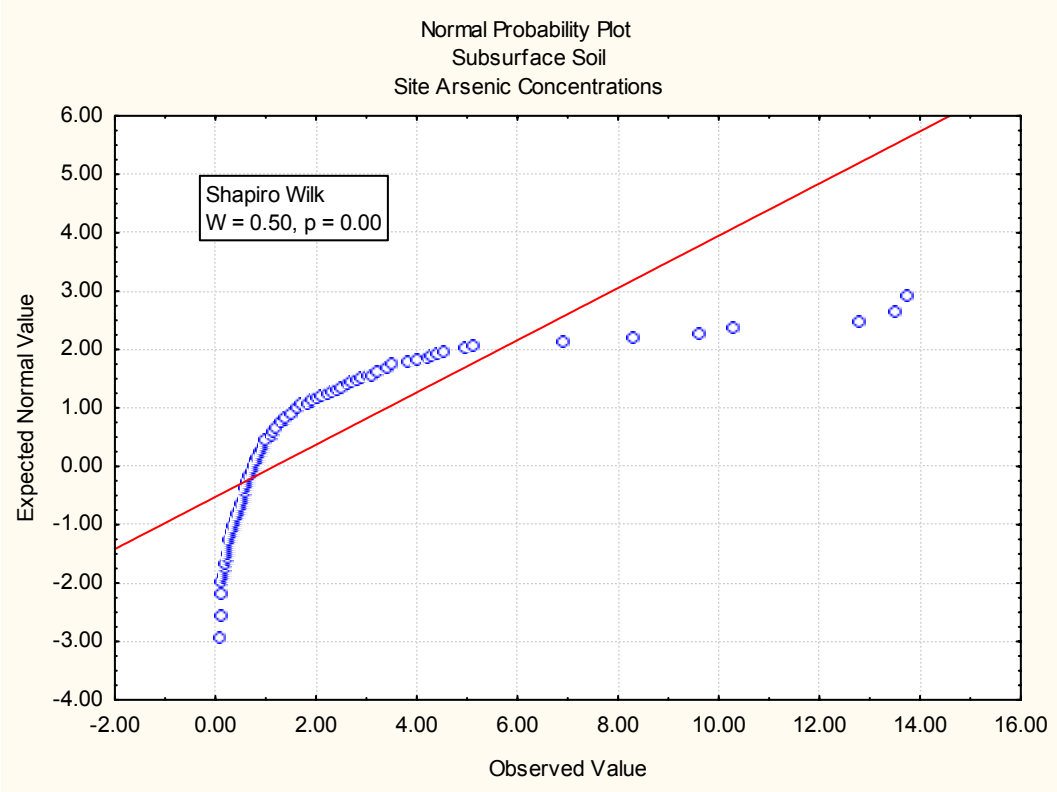

Normal Probability Plot
Subsurface Soil
Site Arsenic Concentrations
Shapiro Wilk
W = 0.50, p = 0.00
Expected Normal Value
Observed Value
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00

Figure 3

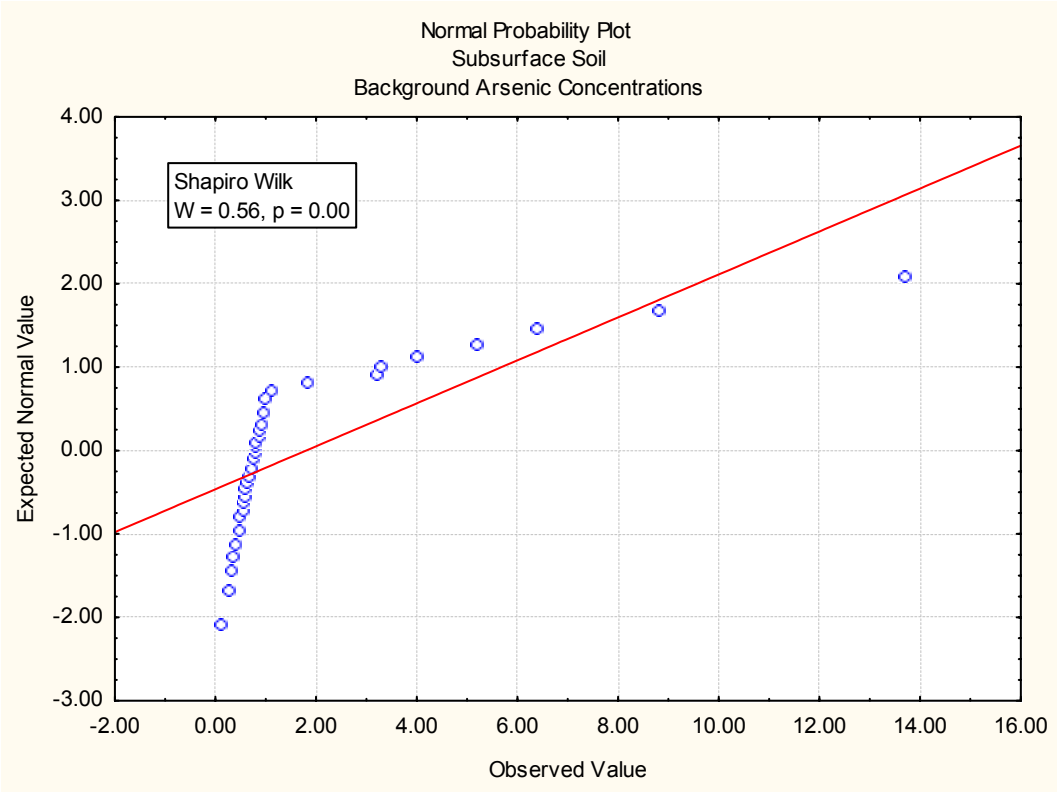
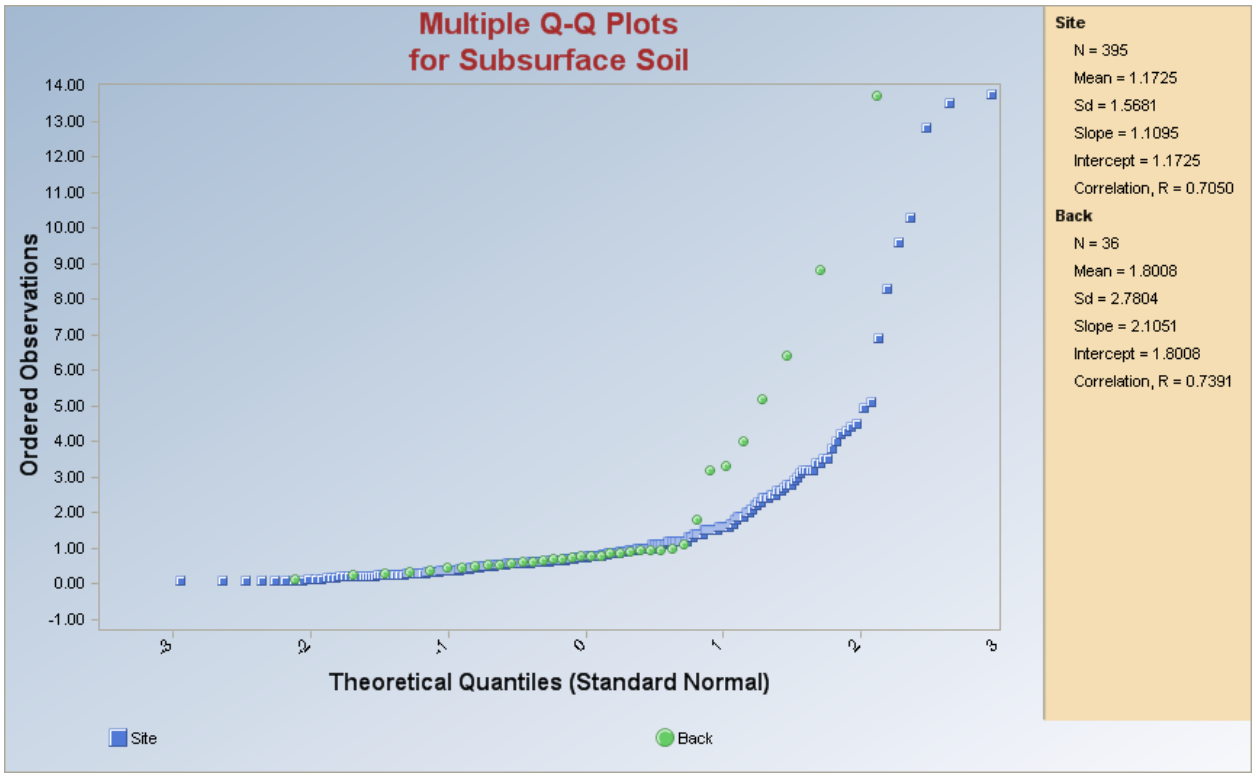

Normal Probability Plot
Subsurface Soil
Background Arsenic Concentrations
Shapiro Wilk
W = 0.56, p = 0.00
Expected Normal Value
Observed Value
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-2.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00

Figure 4

A Monte Carlo Test was conducted to test the null hypothesis that the mean site concentrations are greater than or equal to the background concentrations. This test employed a resampling technique to generate a t-statistic data distribution based on the data that have already been collected. The already computed test statistic from the actual data was then compared to this distribution to determine whether it has a significant probability of occurring for reasons other than random chance. For this test the site data were not required to exceed the background by an offset value. If an offset had been used then the test result would b more statistically significant but this added significance was not necessary, as described below. The description of the Monte Carlo method follows.

First the t-statistic (see Data Quality Assessment: Statistical Methods for Practitioners page 67 for calculation) for the original site and background data was computed to be -1.34. Next the site and background data were placed into one data set. 400 samples with replacement were taken of size 395 and size 36 to represent the site and background data sets, respectively. Then t-statistics were computed for each of the 400 data sets. From this a p-value was computed. The p-value is the proportion of t-statistics from the Monte Carlo simulations that are less than the t-statistic for the original data sets. The null hypothesis will be rejected if the p-value is less than 0.05. For the subsurface soil simulations 13 out of 400 test statistics were smaller than the test statistic from the original test. This results in a p-value of 0.03. Therefore, the null hypothesis that the site concentrations are greater than the background concentrations was rejected. It is concluded that the site subsurface soil concentrations are within the range of the background surface soil concentrations.

In addition to the Monte Carlo tests quantile plots were generated for the site and background concentrations. From these graphs it can be seen that the site concentrations are within the range of the background concentrations. The site and background data distributions are coincident over most of the observed concentrations ranges. In the upper ends of the ranges, the site data quantiles appear to deviate from background but are within the observed background concentrations.



Site versus Native Soil Comparison

Table 4 contains the descriptive statistics for subsurface soil and the range for the native subsurface soil concentrations. From Table 4 it can be seen that the maximum native concentration is slightly larger than the upper quartile for the site subsurface soil concentrations. From this small sample size it appears that the site subsurface soil concentrations are greater than the native subsurface soil concentrations.

Variable	Descriptive Statistics Subsurface Soil Arsenic							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Site	395	1.17	0.75	0.07	13.75	0.51	1.20	1.57
Native	4	0.75	0.72	0.26	1.30	0.40	1.10	0.45

Table 4

ATTACHMENT 8

UNIVERSITY OF FLORIDA LETTER
JULY 28, 2008

UF | UNIVERSITY of FLORIDA

Center for Environmental & Human Toxicology

PO Box 110885
Gainesville, FL 32611-0885
352-392-2243, ext. 5500
352-392-4707 Fax

July 28, 2008

Ligia Mora-Applegate
Bureau of Waste Cleanup
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, FL 32399

Re: Response to Comments, Arsenic Background Study, Naval Station Mayport

Dear Ms. Mora-Applegate:

In a letter to you dated May 2, 2008, I provided comments on a statistical analysis of site versus background data for arsenic in soil at Naval Station Mayport. In a subsequent conference call on May 28 with Dr. Linda Young (Professor of Statistics at UF) participating, we further explained our concerns regarding the analysis.

TetraTech have substantially revised the analysis and provided responses to our comments in the form of a letter dated June 17, 2008. Dr. Young and I have reviewed the responses and find them to be satisfactory. The revised statistical analysis is now, in our opinion, more technically sound.

Documentation has been provided previously showing that much of Naval Station Mayport is on disturbed soil, and the statistical analysis indicates that the concentrations of arsenic in soil at the site are representative of local background conditions. The maximum arsenic concentration on site is 13.75 mg/kg, while the maximum background concentration is 13.70 mg/kg. The mean arsenic concentration on site, 1.17 mg/kg is somewhat less than the mean arsenic for background samples, 1.80 mg/kg. While arsenic concentrations appear to be higher than in undisturbed, native soil (mean, 0.75 mg/kg; maximum, 1.30 mg/kg), there is no indication that an arsenic spill or discharge to the environment has occurred that would warrant cleanup.

Sincerely,

Stephen M. Roberts, Ph.D.

ATTACHMENT 9

FDEP APPROVAL LETTER
JULY 30, 2008

Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

July 30, 2008

Mr. Dana Hayworth
Department of the Navy
Naval Facilities Engineering Command Southeast
Naval Air Station Building 135
Post Office Box 30
Jacksonville. Florida 32212

RE: Follow-up Response to Comments, Arsenic Background Study, Naval Station MAYPORT, Mayport, Florida (University of Florida's Center for Environmental & Human Toxicology, July 28, 2008)

Dear Mr. Hayworth:

Dr. Steve Roberts and his staff have completed their review of Tetra Tech NUS' recent response to comments from June 17, 2008 concerning the Arsenic Background Study at Naval Station Mayport (please see attachment). They have found them to be satisfactory. In their opinion, the revised statistical analysis (Monte Carlo analysis) is more technically sound. They also state that "While arsenic concentrations appear to be higher than in undisturbed, native soil, there is no indication that an arsenic spill or discharge to the environment has occurred that would warrant cleanup." In the letter, Dr. Roberts suggests using the maximum background concentration of 13.70mg/kg to represent the upper range of background concentrations for arsenic at Naval Station Mayport. This approach is acceptable to myself and the Florida Department of Environmental Protection.

If you require additional clarification or other assistance please feel free to contact me at 850/245-8999.

Sincerely,

John Winters, P.G.
Remedial Project Manager

JJC ESN ESN

cc Tim Bahr, FDEP, Tallahassee

Attachment