QUALITY ASSURANCE PROJECT PLAN

National Park Service

Engineering Estimate/Cost Analysis

for

Redwood National Park
Alder Creek Road Firing Range

December 23, 2014

Prepared for:

National Park Service
Pacific West Regional Office
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Prepared by:

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Date: December 23, 2014

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SECTION A – PROJECT MANAGEMENT

This section of the Quality Assurance Project Plan (QAPjP) describes the management approach to be used by Patriot Technical Consultants, Inc. (Patriot) and Versar, Inc. (Versar) on this Engineering Evaluation/Cost Estimate (EE/CA). Patriot is the prime consultant to the National Park Service (NPS) on this project and Versar is a sub consultant to Patriot.

A.1 Distribution List

Individual and organizations who need a copy of the approved QAPjP and any subsequent revisions are in Table 1.

Table 1. Distribution List for Quality Assurance Project Plan

Stephen Mitchell, P.E.	Contracting Officer's Representative and NPS Project Manager	National Park Service
Joseph Seney	Field Manager	National Park Service
Paul Day	Patriot Project Manager and QA/QC Officer	Patriot Technical Consultants, Inc.
Tim Berger, P.G.	Versar Project Manager	Versar, Inc.

Additionally, Mr. Paul Day will ensure that a copy of the currently approved QAPjP has been submitted for inclusion in the Administrative Record (AR) for this EE/CA. Mr. Seney will have the responsibility for physical placement of the QAPjP in the local AR repository.

A.2 Project/Task Organization

The Patriot Project Manager for this EE/CA is Mr. Paul Day, Patriot, Richland, Washington. Mr. Day is responsible for the content and quality of all documents generated in support of this EE/CA. He will serve as Patriot's primary point of contact between NPS and the Patriot Team.

Mr. Day also serves as the Quality Assurance/Quality Control (QA/QC) Officer for this EE/CA. He is responsible for verifying field work performed and analytical data collected conform to the requirements established for the specific data quality objectives detailed in the QAPjP. Mr. Day will communicate any deficiencies or recommendations directly Patriot staff, Versar staff, the laboratory, or NPS, as appropriate.

Mr. Tim Berger serves as Versar's Project Manager and reports to Mr. Day under this project. Mr. Berger is Versar's primary point of contact with Mr. Day regarding subcontract issues, technical issues, work quality, deliverables, and the project schedule related to this EE/CA.

The Health and Safety Officer for this project is Ms. Nicole Hastings, Versar. Versar is responsible for conducting the field activities at the Site, so it is appropriate that the HSO responsibilities be under Versar's scope. The HSO is responsible for implementing the project Health and Safety Plan (HASP), monitoring compliance with the HASP, stopping work due to health and safety concerns, implementing corrective actions to project health and safety deficiencies, and reporting accidents and violations of the HASP.

Other Patriot and Versar staff who comprise the balance of the Patriot Team for this EE/CA have technical and administrative support roles under their respective managers. The general roles for Patriot and Versar staff are shown on Table 2.

The laboratory manager and laboratory QA manager are responsible for data review and have the authority to approve or disapprove specific analyses and final reports that they generate. The laboratory QA officer reviews all QC data prior to its release. The laboratory manager and laboratory QA manager are responsible for advising on all aspects of QA/QC including:

- Assuring proper QA/QC procedures are employed during data generation;
- Periodically reviewing QA/QC procedures; and,
- Making recommendations to ensure that appropriate corrective actions are taken if problems are detected.

Table 2. Roles and Responsibilities

Individual Assigned	Role on Project	Responsibility
Paul Day (Patriot)	Patriot Project Manager and QA/QC Officer	Oversee all aspects of project and to provide QAQC reviews
David Lincoln (Patriot)	Senior CERCLA Specialist and Risk Analyst	Develop project documents and deliverables assigned to Patriot
Tim Berger Versar	Versar Project Manager	Manage Versar staff and interface with Patriot Project Manager
Larry Kleinecke (Versar)	Senior Environmental Specialist	Develop project documents and deliverables assigned to Patriot
Nicole Hastings (Versar)	Field Manager Health and Safety Officer Environmental Specialist	Conduct all field and sampling activities and coordinate lab analyses. Manage all on-site activities to meet Health and Safety Plan

Figure 1 is a project organization chart that shows the chain of command and responsibilities for each Patriot Team member. Mr. Tim Berger serves as Versar's Project Manager and reports to Mr. Day under this project. Mr. Day reports to the NPS Contracting Officer regarding contractual matter and to the NPS Contracting Officer regarding technical issues.

Figure 1. Organization Chart

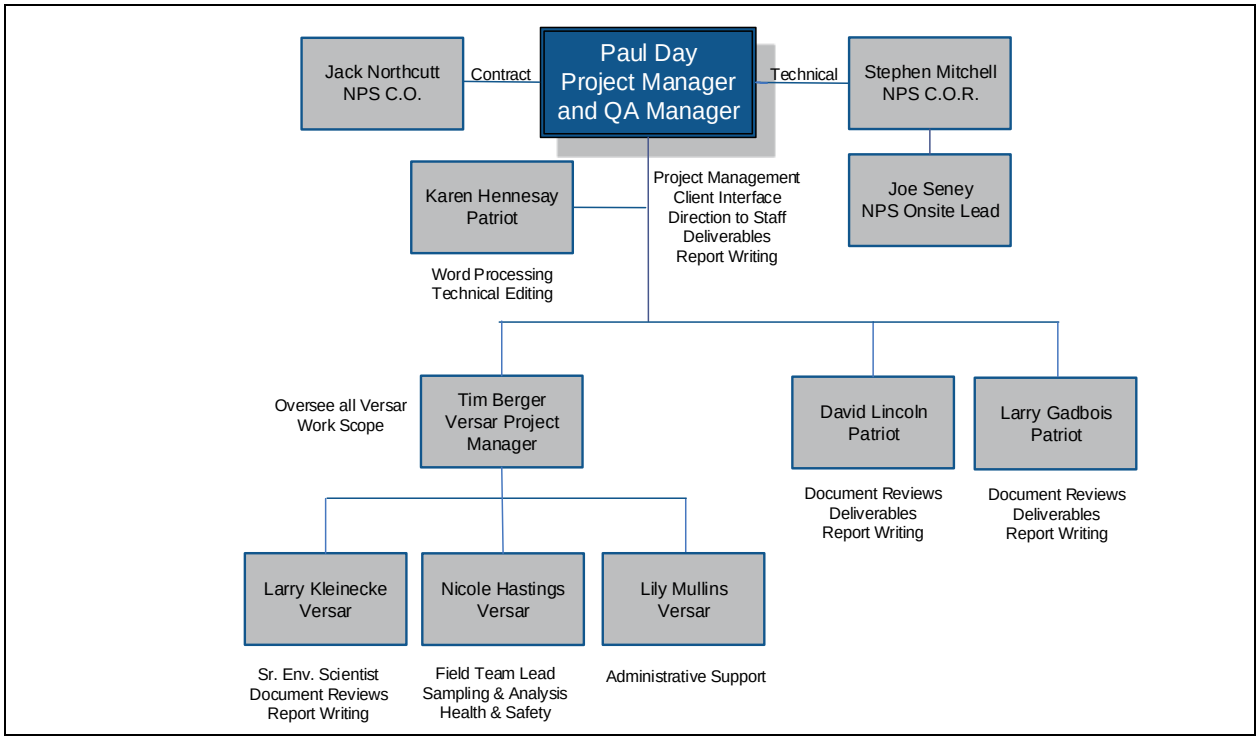


Table 3 table shows the general split of responsibility between Patriot and Versar for each task and sub task defined in the Statement of Work for this EE/CA. Table 3 shows that Versar generally has the lead for field activities at the Site. This assignment of responsibility is due to Versar's physical proximity and prior experience at the Site.

Table.3. Estimated Project Schedule and Consultant Roles

Task No.	EE/CA Task Name	Planned Completion Date	Lead or Support Role on Each Task	
			Patriot	Versar
1	Project Conference and Schedule	9/19/2014	Lead	Support
2	Initial Field Visit	9/30/2014	Support	Lead
3	Response Activities			
3a	Administrative Record File (ongoing)	9/30/2014 to 8/10/2015	Lead	Support
3b	Administrative Record Index (ongoing)			
3c	EE/CA Approval Memorandum	10/26/2014	Lead	Support
3d	Community Relations Plan	10/31/2014	Lead	Support
3e	EE/CA Work Plan	11/26/2014	Lead	Support
3f	EE/CA Report	3/30/2015	Lead	Support
3g	Response to Significant Public Comments	6/10/2015	Lead	Support
3h	EE/CA Action Memorandum	7/13/2015	Lead	Support
4	Develop Health and Safety Plan	9/26/2014	Support	Lead
5	Develop Sampling and Analysis Plan	10/31/2014	Support	Lead
6	Develop Quality Assurance Project Plan	12/23/2014	Lead	Support
7	Field Activities	12/4/2014	Support	Lead
8	Sample Analysis			
8a	Sample Collection and Laboratory Analysis	12/31/2014	Support	Lead
8b	Quality Assurance of Laboratory Data	1/14/2015	Lead	Support

A.3 Problem Definition/Background

The NPS has the responsibility, under the Comprehensive Environmental Response Compensation and Liabilities Act (CERCLA), to determine the nature and extent of potential hazardous substances at the Alder Camp Road area of the Redwood National Park (Site). Versar, Inc. (Versar) conducted a Preliminary Assessment (PA) of the Site in March 2011. The PA did not include sampling and analysis, but contained sufficient information for the NPS to proceed with an EE/CA for the Site. The history and background pertaining to this Site is well documented in the PA. The PA is contained in the AR for this EE/CA and the reader is referred to that document for additional details on site history and background.

The objective of the EE/CA is to determine the nature and extent of hazardous substances that may be present at the Site. A further objective is to determine the course of action that the NPS should take based on the findings of the EE/CA. The two courses of action identified at the beginning of the project are 1) implementation of a CERCLA non-time critical removal action to address the presence of lead and other heavy metals associated with use of the firing range over at least 30 years, and 2) no action alternative, always considered under the EE/CA process.

The National Park Service retained Patriot Technical Consultants, Inc. (Patriot) to conduct this EE/CA under Purchase Order (P.O.) Number P14PX03671. Patriot obtained Versar as a sub consultant to conduct the field work, sampling and analysis, and to assist with preparation of certain documents as shown on Table 3.

A.4 Project/Task Description

The work to be performed under this EE/CA is outlined in Table 3. Soil sampling locations are identified on Figure 1 of the Sampling and Analysis Plan (SAP) that was developed and approved for this EE/CA. This SAP is included in the Administrative Record for this EE/CA. The primary contaminant of concern is lead and additional contaminants of concern are antimony, barium, and copper. Sampling and analysis requirements for these elements are included in the SAP.

No airborne contaminants are believe to exist at this site. Therefore, modified Level D personnel protective equipment is specified in the SAP.

Patriot has developed a project schedule and has provided this schedule to the NPS Contracting Officer Representative (COR). Table 3 shows Patriot's estimated completion dates for each task. These dates could shift, depending on activities beyond Patriot's control. Generally, the EE/CA began upon contract award on September 16, 2014, and is anticipated to end on August 17, 2015.

A.5 Quality Objectives and Criteria

The quality objectives for this EE/CA are to provide sufficient data and information on which the NPS can make a final decision regarding a non-time critical removal action. The use of a graded approach to data collection is driven by a variety of factors, including site location, characteristics, type and extent of contamination, and risk to human health and the environment. Management of this EE/CA and development of the documents and activities listed in Table.3 adhere to the concept of a graded approach to data and information on which final decisions will be made.

A rigorous approach to quality assurance facilitates the generation of scientifically valid and reproducible data using published technical protocols, including EPA, Soil Science Society of America (SSSA), Association of Official Analytical Chemists (AOAC), ASTM and other methodologies. Quality assurance and control procedures guide the lab towards publishing only unbiased and scientifically valid data free from third party influence.

A.6 Special Training or Certification

Field activities conducted under this EE/CA consist of an initial Site visit/walk-down, followed by soil sampling activities. The field work and sampling and analysis is being conducted by a single Versar staff member who is part of the Patriot Team for this project. Ms. Nicole Hastings, Versar, serves as both the Field Team Leader and the Health and Safety Officer for this EE/CA project. She will collect the soil samples and take them to a certified laboratory for analysis. She is responsible for adhering to the specific sampling and analysis protocols that are detailed in the SAP. She is also responsible for the safety and health of any personnel who may be present during the field walk-down or the sampling event and will ensure that all parties adhere to the Health and Safety Plan (HASP) developed by Versar for this EE/CA.

Ms. Hastings has conducted similar types of soil sampling on other projects that involved similar contaminants of concern. She has six years of experience in conducting environmental investigations of this type for Versar. She has a B.S. degree in Environmental Management and Protection and she is currently certified in Hazardous Waste Operations and Emergency Response, both at the work and supervisor level.

A.7 Documents and Records

Mr. Paul Day, Patriot, has the responsibility for ensuring that the appropriate project personnel have the most current version of this QAPjP. He will distribute the final copy to each person listed in Table 1 and will verify with Mr. Joseph Seney, NPS, that the current version is placed in the Administrative Record repository.

The laboratory QA staff shall issue QA reports to the laboratory management, laboratory supervisors and task leaders. These reports shall describe the results of QC measurements, performance audits, and systems audits, and confirmation sample comparisons performed for

each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage shall be documented with the corrective actions that have been taken to correct the deficiencies identified.

Data will be acquired from all instruments using the manufacturer's software, Agilent ChemStation or a LIMS system and analyzed by user-set methods. Formula for external and internal standard calculations shall be are used that are identical to those found in method 8000 of SW-846. Chromatograms shall be scrutinized and quantitations reviewed before being reported in a run log or sent on to the LIMS. High values shall be double-checked for calculation error and low values for the possibility of contamination. Raw data are converted to standard reporting units by the usual method of numerator and denominator unit cancellation. The lab manager provides final report review, before the data is delivered to the client.

Standard laboratory procedure shall be to protect and back up all electronic records. To minimize unauthorized use or manipulation of data records and reporting systems, access or use shall require a user password or code; each code and password shall be unique. Raw data from shall be backed to a CD. Duplicate copies shall be made of the CDs, one record is stored in the lab for chemist access; the other record is stored in high capacity hard drive and placed in a safe box for disaster recovery. All records, including but not limited to instrumental raw data, run logs, analytical reports, instrument maintenance logs, standard logs and QA documents will be retained in the lab for a period of seven years. Records older than seven years will be destroyed.

If discrepant data arises - data that is serially inconsistent or is inconsistent with different but related test methodologies, the cause shall be investigated, including reanalysis and re-extraction of the sample, until a conclusion is made as to the cause of the discrepancy, and the probability of which data are correct. If there is a probability of lab error, published data shall be revised. If there is a probability of sampling error we will inform the sampler. If there is a probability of sample inhomogeneity the data shall be averaged and either the entire data or averaged value will be flagged as such.

Clients will occasionally contest the results of a specific sample and the subsequent re-analysis of this sample provides further feedback on the quality of analytical work. If reanalysis shows that the lab's original results are in error, then reanalysis shall be free of charge and corrective action taken. If and when ethical concerns issues arise; they will be immediately brought to the attention of both QA and laboratory management for further investigation and resolution. Together they will work towards resolving the matter. The laboratories shall strive towards publishing only unbiased and scientifically valid data that is free from third party influence.

SECTION B – DATA GENERATION & AQCUISITION

B.1 Sampling Process Design

The soil sampling design is described in detail in the SAP. This section provides an overview of the sampling design and does not repeat the detail contained in the SAP. Table 1, taken from the SAP, identifies the number of soil samples, sampling depths, analytes, and analytical methods. Figure 2, also taken from the SAP, shows the general locations at which soil samples (discrete and composite) will be taken. All soil samples will be obtained in a single mobilization sampling event.

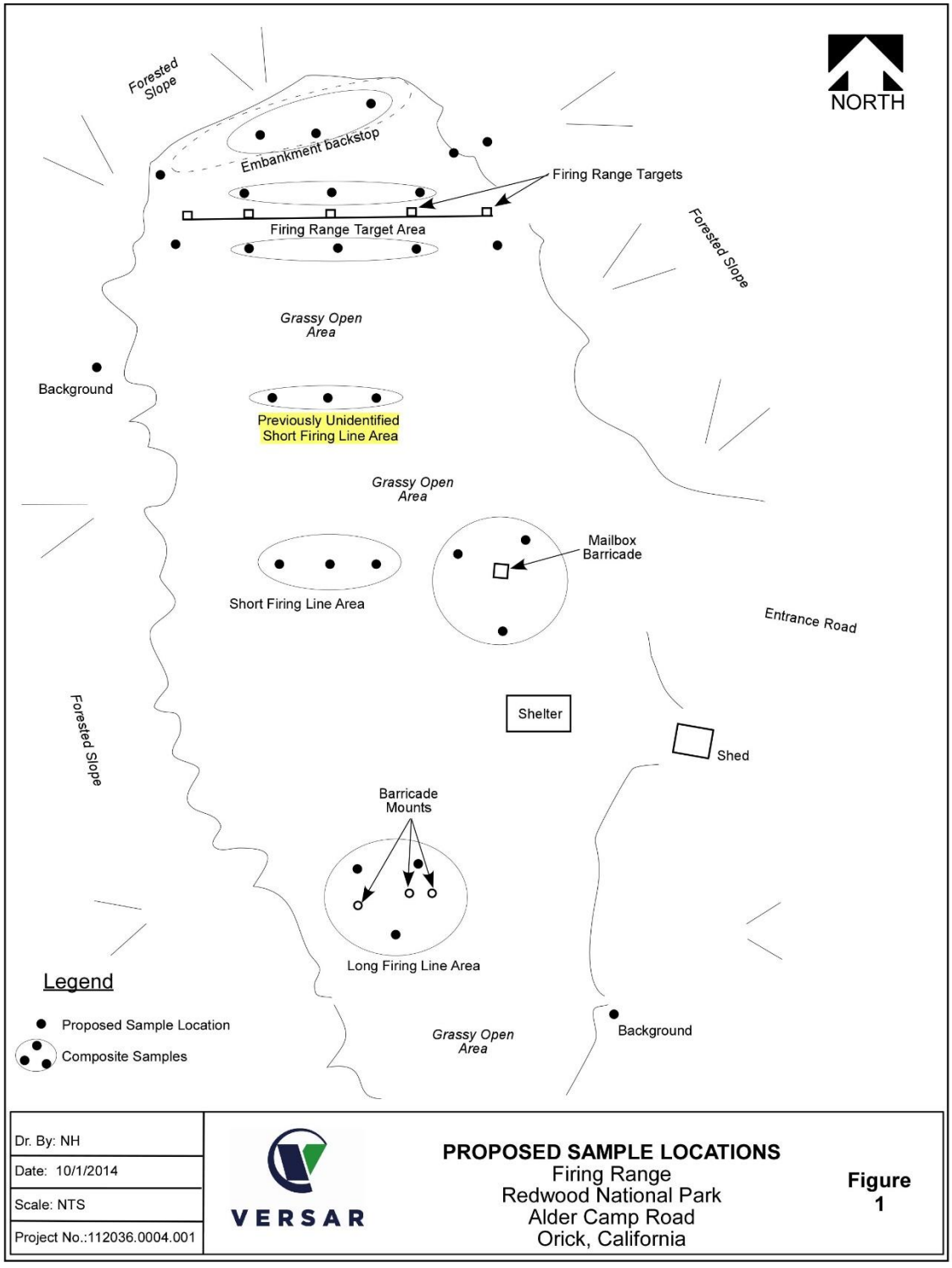
The area on Figure 2 highlighted in yellow indicates an additional area to be sampled. This area was discovered during the September 29, 2014 initial field visit by conducted by NPS and Versar staff.

Table 4. Soil Sampling Locations

Area of Concern	Proposed No. of Sample Locations	Proposed No. of Samples Submitted for Analysis	Proposed Soil Sample Collection Depth (inches)	Antimony, Copper, and Lead	Barium	California WET (Lead tested/ area)
Decision Unit/ Test Method				EPA Series 6010	EPA Series 6010	
#1 Firing range target area	14	8	0-3"/6"-12"	8	0	1
#2 Short firing line area	3	1	0-6"	1	1	1
#3 Mailbox barricade	3	1	0-6"	1	1	1
#4 Long firing line area	3	1	0-6"	1	1	1
#5 Background soils	2	2	0-3"/6"-12"	2	2	--
#6 New short firing line area	3	1	0-6"	1	1	1
Proposed Total	N/A	14	N/A	14	6	5

Note: Table 4 does not include quality control/quality assurance samples.

Figure 2. Proposed Sampling Locations



B.2 Sampling Methods

The Versar Field Team Leader is responsible for understanding the SAP and this QAPjP for sampling begins. The Field Team Leader is responsible for every aspect of the sampling event, including transport of the samples to the laboratory. The Field Team Leader will document any deviations from the protocols described in the SAP and will document such deviations in the logbook. Deviations will be evaluated for significance and if the Versar Project Manager or the Patriot QA/QC Officer will enter such deviations into the AR File, if warranted.

The Site will be divided into five decision units:

1. Firing range target area
2. Short firing line area
3. Mailbox barricade area
4. Long firing line area
5. Background area

The following steps will be taken for surface and near-surface sampling:

1. Sample locations will be selected from each of the five locations.
2. Samples will be collected from surface or near-surface soils using a drive sampler, hand auger or other appropriate sampling device.
3. Surface samples from the firing range target area and background area will be collected from 0 to 3 inches below ground surface (bgs). An additional near-surface sample from each firing range target area and background area sampling location will be collected from 6 to 12 inches (if possible). The additional samples will be held at the laboratory for possible analysis based on the results of the surface soil sample analysis.
4. Each sample from the short firing line area, long firing line area and mailbox barricade will be collected from 0 to 6 inches bgs.
5. At each sample location a #40 sieve will be used to sieve the sample into another clean container.
6. The remaining sample will be placed in a clean sample jar, labeled and placed on ice in a cooler for delivery to the contract laboratory. Composite samples will be collected separately and composited by the contract laboratory.
7. The number of visible lead particles collected on the sieve will be counted and noted on a table.

Samples will be delivered to the analytical laboratory the within two days following sampling. No sample preservation measure will be necessary for these samples and holding times through completion of analysis (180 days in this case) are not an issue for the analytes being tested and the analytical methods being used.

All sampling activities shall be recorded in the field logbook. The following information shall be recorded each time a sample is collected:

- Sample location,
- Sample depth,
- Visual characteristics of the sample, and,
- Other relevant field information.

The following procedure shall be used to decontaminate sampling devices intended for re-use. For samplers and hand auguring devices, scrub the equipment with a solution of potable water and Alconox, or equivalent laboratory-grade detergent. Then rinse the equipment with potable water, followed by ASTM Type II Reagent Water or distilled water. Air dry the equipment on a clean surface or rack, such as Teflon, stainless steel, or oil-free aluminum elevated at least two feet above ground. If the sampling device is not used immediately after being decontaminated, it shall be wrapped in oil-free aluminum foil, or placed in a clean, closed container.

B.3 Sampling Handling and Custody

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

EPA Method 6010 and the California 22 Wet Extraction Test (WET) will be used to analyze the soil samples from the Site. These methods requires that a minimum of four ounces of soil be obtained for each sample and that a glass jar be used. The maximum holding time allowed for these samples, prior to completion of laboratory analysis, is 180 days. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. In the unlikely event that samples not preserved or analyzed in accordance with the test method requirements shall be re-sampled and re-analyzed.

Sample containers will be pre-cleaned to laboratory standards and treated according to EPA specifications for the listed methods. Sampling containers that are reused will be decontaminated between uses by the EPA-recommended procedures (i.e., EPA 540/R-93/051). Containers will be stored in clean areas to prevent exposure to dusts, fuels, solvents, and other contaminants.

Versar shall maintain chain-of-custody records for all samples. A sample is defined as under a person's custody if any of the following conditions exist: (1) it is in their possession, (2) it is in their view, after being in their possession, (3) it was in their possession and they secured it or, (4) it is in a designated secure area. All sample containers shall be sealed in a manner that shall prevent or detect tampering if it occurs.

The following minimum information concerning the sample shall be documented on the Versar chain-of-custody (COC) form:

1. Unique sample identification
2. Date and time of sample collection
3. Source of sample (including name, location, and sample type)
4. Analyses required
5. Name of collector(s)
6. Custody transfer signatures, dates and times of sample transfer from the field to transporters and to the laboratory or laboratories.

Sampling equipment and laboratory coolers will be shipped directly to the contract laboratory for analysis. Versar will prepare all necessary paperwork, provide the laboratory with the proper labels, and coordinate transport of the sampling containers and equipment to the laboratory.

B.4 Analytical Methods

Standard methods for analysis of all soil samples are identified in Table.4. Versar will request a laboratory turnaround time of 15 calendars days for the initial sample results from EOA Method 6010 and the WET analyses, as discussed in Section B.3. The laboratory will provide analytical results for all samples, including data validation and a QA/QC report.

The Versar Project Manager shall have the responsibility to follow up with the laboratory, as necessary, to clarify issues associated with the analytical report, to resolve any issues raised by the laboratory, and to take any corrective actions regarding the laboratory data that may be warranted. The Versar Project Manager shall document any findings or discrepancies regarding the analytical results and report them to the Patriot Project Manager and the NPS Contracting Officer Representative.

B.5 Quality Control

The laboratory and laboratory QA managers are responsible for data review and have the authority to approve or disapprove specific analyses and final reports. The lab and QA managers are responsible for advising on all aspects of QA/QC including: assuring proper QA/QC procedures are employed during data generation; periodically reviewing QA/QC procedures; and, if problems are detected, making recommendations to ensure that appropriate corrective actions are taken. The laboratory QA officer reviews all QC data prior to its release.

Laboratory QC standards, blanks, method performance check standards, surrogates will be examined daily within each analytical batch for sequence and evaluated against the laboratory acceptance criteria, and corrective action taken if needed. These parameters will be plotted and the graphs reviewed on a regular basis to determine trends and anticipate deviations. Laboratories shall have a dedicated QA/AC officer who reviews all QC data, monitors QC compliance with established and method-specified criteria.

Patriot will conduct an independent verification of the QC package that the analytical laboratory

will provide with its data package. Patriot will consult first with Versar if there appear to be any discrepancies in the laboratory QC package. Versar will then raise any remaining discrepancies with the laboratory and will develop a resolution or corrective actions, as necessary. All interaction between these parties will be documented. Patriot will enter the final analytical results, the final laboratory QC package, and its own verification document into the AR File for this EE/CA.

B.6 Instrument/Equipment Testing, Inspection, and Maintenance

Simple laboratory equipment such as refrigerator and freezer temperatures will be recorded daily, and drying ovens as used. The thermostats of these appliances will be adjusted as necessary to maintain their working range, or the equipment repaired or replaced.

B.7 Instrument/Equipment Calibration and Frequency

Field instrumentation will not be used for the soil sampling event at the Site. Therefore, field equipment calibration is not applicable to this EE/CA.

The accuracy of the gravimetric balance will be checked monthly against class S weights and a record kept of these measurements. The manufacturer will be consulted for corrective action if discrepancies greater than two percent are observed.

All pipettes will be tested for accuracy monthly. Pipettes with an error greater than two percent will be refurbished or replaced. Method specified rotation rates (rpms) will be verified annually for rotating extraction devices. Autoclaves will be tested periodically for sterility, maximum temperature and timer accuracy.

Results will be recorded and corrective action taken if necessary. Incubators will be tested periodically for sterility and temperature accuracy. Results will be recorded and corrective action taken if necessary. All measuring devices used to record temperatures, weights and volumes, including thermometers, balances and volumetric devices, shall be periodically calibrated against traceable standards, and the calibration documented.

The laboratory maintains all records pertaining to instrument and equipment calibration. These records are available upon request.

B.8 Inspection/Acceptance of Supplies and Consumables

The Versar Field Manager will be responsible for inspection and acceptance of equipment, supplies and consumables that may be necessary to support the sampling event and transport of samples to the laboratory.

The laboratory QA manager will be responsible for inspection and acceptance of supplies and consumables that may be necessary to conduct the analytical procedures on the Site samples.

The supplies and consumables necessary to carry out the sampling and analysis procedures must meet the applicable design and QA requirements in each case before they can be used in support of this EE/CA.

B.9 Data Acquisition Requirements for Non-Direct Measurements

Patriot will use only data that meet the requirements of this QAPjP will be submitted to NPS as part of this EE/CA. Other available information or data that do not meet the QA/QC requirements will not be used directly in the decision-making process, but may be considered as anecdotal information. Such information may lead the Patriot Team to expand the sampling program, for example, but it will not be used as stand-alone data on which NPS will make final decisions with regard to the EE/CA.

The PA conducted by Versar in 2011 did not contain analytical data, nor was a CERCLA Site Investigation (SI) performed at the Site. The Patriot Team is unaware of any other available data or non-direct measurement information that may be available at this time. Patriot will discuss any data or non-direct measurement information that may become available during the conduct of this EE/CA with NPS to determine if and how such information might be used as part of this EE/CA.

B.10 Data Management

Standard laboratory procedure shall be to protect and back up all electronic records. To minimize unauthorized use or manipulation of data records and reporting systems, access or use shall require a user password or code; each code and password shall be unique. Raw data from shall be backed to a CD. Duplicate copies shall be made of the CDs, one record is stored in the lab for chemist access; the other record is stored in high capacity hard drive and placed in a safe box for disaster recovery. All records, including but not limited to instrumental raw data, run logs, analytical reports, instrument maintenance logs, standard logs and QA documents will be retained in the lab for a period of seven years. Records older than seven years will be destroyed.

Patriot will manage these data in accordance with its corporate QA Management Plan. Additionally, Patriot will maintain all data, including QC packages, which it receives from the laboratory in a secure location on CD for a period of seven years following issuance of the EE/CA Report.

SECTION C – ASSESSMENT AND OVERSIGHT

C.1 Assessments and Response Actions

The primary assessments planned for this EE/CA are the analytical data validation and usability reviews described in Sections D.1 and D.2 of this QAPjP. The laboratory data obtained from the soil sampling event will be performed by the laboratory and by the Patriot QA/QC Officer, with support from Versar staff, upon completion of the analyses. The timing for these reviews is planned to occur in mid-January 2014, as shown on Table 3.

The laboratory analyst performing the tests shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by the supervisor of the respective analytical section using the same criteria.

Laboratory information will be confirmed with the QA/QC samples provided. The laboratory will perform a verification/validation package to Versar and will discuss any discrepancies with Versar. Versar will then raise any remaining discrepancies with the laboratory and will develop a resolution or corrective actions, as necessary. All issues regarding data quality must be fully resolved before the EE/CA Report is issued for public comment. Patriot's QA/QC Officer shall then review the entire definitive data report package, and with the field records, apply the final data qualifiers for the definitive data.

Errors, deficiencies and data that do not pass acceptance criteria will be investigated. Some of these instances may require corrective actions. These corrective actions will be documented in appropriate locations including instrument-specific maintenance logs, run logs and the company error log. Clients will occasionally contest the results of a specific sample and the subsequent re-analysis of this sample provides further feedback on the quality of analytical work. If reanalysis shows that the lab's original results are in error, then the analysis is free of charge and corrective action will be taken. An overall lab error log is kept as record of our laboratory's performance and is available for client inspection.

Other types of assessment and oversight are dependent on the type of data and information received. For example:

- Field information will be confirmed from field notebooks and photographs.
- Internal analysis and reports will be reviewed internally and corrections will be implemented through discussions between original authors and reviewers. Corrective actions will be taken by the original author and confirmed by the reviewer.

C.2 Reports to Management

Project activities will be discussed at least biweekly between Versar and Patriot managers and more often at the point of major activities (e.g., field sampling, receipt of laboratory data, report preparation). Any problems identified will be discussed, and a response approach developed

following problem identification. The response(s) will be discussed at least during the following meeting, if not before, to confirm that appropriate action has been taken.

The laboratory QA staff shall issue QA reports to the laboratory management, laboratory supervisors and task leaders. These reports shall describe the results of QC measurements, performance audits, and systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data including field and confirmatory data, and data storage shall be documented with the corrective actions that have been taken to correct the deficiencies identified.

If a problem solution cannot be obtained within project scope, budget, and schedule, the issue will be raised to the NPS Project Manager.

SECTION D – DATA VALIDATION AND USABILITY

D.1 Data Review, Verification, and Validation

The laboratory analyst performing the tests shall review 100 percent of the definitive data. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or by the supervisor of the respective analytical section using the same criteria.

Data qualifiers shall be added or, if applied by a software package, reviewed by the laboratory supervisor of the respective analytical section, after the first and second level of laboratory data reviews have been performed. Analytical batch comments shall be added to the first page of the definitive data report packages to explain any nonconformance or other issues. When data are qualified, the laboratory supervisor shall apply a final qualifier to any data that have been affected by multiple qualifiers. This final qualifier shall reflect the most severe qualifier that was applied to the data, i.e., all data will have only one data qualifying flag associate with it. The allowable final data qualifiers for definitive data and the hierarchy of data qualifiers, listed in order of the most severe through the least severe, are *R, M, F, J, B,* and *U.*

Table 5 lists the various laboratory data qualifiers that could be applicable to this EE/CA.

Table 5. Laboratory Data Qualifiers

Qualifier	Description
J	The analyte was positively identified, the quantitation is an estimation.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F	The analyte was positively identified but the associated numerical value is below the RL.
R	The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
B	The analyte was found in an associated blank, as well as in the sample.
M	A matrix effect was present.
S	To be applied to all field screening data.

Table 6 shows the general data flagging conventions that could be applicable to this EE/CA.

Table 6. General Data Flagging Conventions

QC Requirement	Criteria	Flag	Flag Applied To
Holding Time	Time exceeded for extraction or analysis	R	All analytes in the sample
LCS	% R > UCL %R < LCL	J for the positive results J for the positive results, R for the non-detects	The specific analyte(s) in all samples in the associated AAB
Method Blank	Analyte(s) detected ≥ RL	B	The specific analyte(s) in all samples in the associated AAB
Equipment Blank	Analyte(s) detected ≥ RL	B	The specific analyte(s) in all samples with the same sampling date as the equipment blank
Field duplicates	Field duplicates > RLs AND RPD outside CL	J for the positive results R for the non-detects	The specific analyte(s) in all samples collected on the same sampling date
MS/MSD	MS or MSD % R > UCL or MS or MSD % R < LCL or MS/MSD RPD > CL	M for all results	The specific analyte(s) in all samples collected from the same site as the parent sample
Sample Preservation/ Collection	Preservation/collection requirements not met	R for all results	All analytes in the sample
Sample Storage	< 2°C or > 6°C	J for the positive results R for the non-detects	All analytes in the sample

UCL = upper control limit LCL = lower control limit CL = control limit

	Criteria	Flag *
Quantitation	≤ MDL	U
	> MDL < RL	F
	≥ RL	as needed

Example 1: if the MDL is 0.04, the RL is 0.9 and the result is 0.03, the concentration reported on the result form would be 0.04 (the MDL) and the qualifier flag would be U.

Example 2: if the MDL is 0.04, the RL is 0.9 and the result is 0.07, the concentration reported on the result form would be 0.07 and the qualifier flag would be F.

Example 3: if the MDL is 0.04, the RL is 0.9 and the result is 1.2, the concentration reported on the result form would be 1.2 and the qualifier would be any flag needed because of a data quality problem (e.g., R, J, B, etc.).

The laboratory shall apply data qualifying flags to each environmental field QC sample, i.e., ambient blanks, equipment blanks, trip blanks, field duplicates, matrix spike (MS) samples, and matrix spike duplicate (MSD) samples.

Patriot's QA/QC Officer shall review the entire definitive data report package, and with the field records, apply the final data qualifiers for the definitive data. Patriot's QA/QC Officer shall review the field QC samples and field logs, and shall then appropriately flag any of the associated samples identified with the field QC sample. Each matrix spike sample shall only be qualified by the laboratory, while the Patriot QA/QC Officer shall apply the final qualifying flag for a matrix effect to all samples collected from the same site as the parent sample or all samples showing the same lithologic characteristics as the MS/MSD.

Errors, deficiencies and data that do not pass acceptance criteria will be investigated and resolved, as described in Section C.1.

D.2 Verification and Validation Methods

The laboratory will provide internal data validation and verification of the analytical results. Patriot will review this information from the laboratory, along with the analytical data, and conduct an independent evaluation of the laboratory's data validation and verification. Patriot will resolve any discrepancies or apparent discrepancies with the laboratory and will enter all documents pertaining data validation and verification of the data in the AR File.

D.3 Reconciliation with User Requirements

The SAP for this EE/CA contains a discussion on data quality objectives (DQO). The DQO process helps to ensure sampling techniques, number and type of samples, and level of laboratory precision provide the decision-makers with the right quality of information to make decisions. The DQO assists NPS and the Patriot Team to plan the sampling and analysis activities well in advance of field work; thereby lessening the chance that reconciliation with user requirements will become an issue after the fact.

The DQOs developed for this EE/CA are summarized as follows:

- Versar will conduct an investigation of soils at the firing range in compliance with CERCLA to assess the presence of lead, antimony, barium and copper at the Site.

- Versar will survey the number of visible lead particles at the surface by screening with a #40 sieve prior to sampling, to produce an estimate of the quantity of lead particles for remedial soil screening as described in the Purchase Order Statement of Work.
- Soil samples will be analyzed for total lead, copper and antimony. Soil samples from the short firing line, mailbox barricade, long firing line and background will also be analyzed for total barium. The sample(s) from each area having the highest concentration of each metal will also be analyzed using the California Title 22 Waste Extraction Test (WET) to assess the soluble fraction.
- Near surface soil samples (collected from a depth of 6 to 12 inches) from the firing range target area and background locations will be held for analysis until a comprehensive review of the surface samples has been performed. If a review of the results of surface sampling identifies one or more locations exhibiting potentially hazardous concentrations of total lead, copper or antimony the near surface soil sample will be analyzed, with NPS authorization, to determine the potential depth of the high concentration metal.

Any apparent discrepancies in achieving these DQOs will be discussed with Versar. If they cannot be reconciled, then they will be raised to NPS COR.