



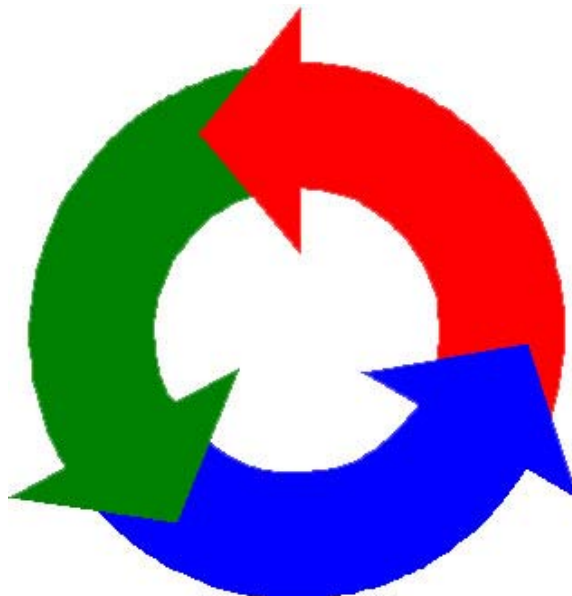
United States Air Force
15th Airlift Wing
Environmental Restoration Program

ENVIRONMENTAL RESTORATION PROGRAM

QUALITY ASSURANCE PROJECT PLAN FOR MULTIPLE PROJECTS FOR THE 15TH AIRLIFT WING

HICKAM AIR FORCE BASE

Oahu, Hawaii



APPENDIX A

Clarifications and Variances

Appendix A

Clarifications and Variances

This appendix includes the clarifications and formal variances to the *AFCEE Model Quality Assurance Project Plan, Version 4.0.01* (AFCEE QAPP) (AFCEE, May 2005) that are being proposed for this Environmental Restoration Program Quality Assurance Project Plan (ERP QAPP). Section A.1 details the clarifications to the AFCEE QAPP that are not considered to be formal variances to the requirements of the AFCEE QAPP, but are important to document for the 15th Airlift Wing (AW) Environmental Restoration Program (ERP) as these items might be subject to multiple interpretations. Section A.2 details the formal variances to the AFCEE QAPP, including justification to support their implementation. *[Note to reviewers: Once this draft ERP QAPP has been reviewed, revised as necessary, and the clarifications/variances have been approved by AFCEE, this introductory statement of this paragraph will be changed to simply state that these are the clarifications and formal variances from the AFCEE QAPP.]*

In addition to these variances, there are additional analytical methods included in the ERP QAPP that are not included in the AFCEE QAPP. The quality control (QC) requirements and reporting limits (RLs) for these additional methods are presented in Appendix B, in a comparable format to the analytical tables in Section 7.0 of the AFCEE QAPP.

A.1 Clarifications

The following clarifications are presented below in the order in which they appear within the ERP QAPP.

1. Sections 1.0 (Introduction), 2.0 (Project Objectives), and 3.0 (Project Organization). These sections have been modified to generally define this ERP QAPP as a program-oriented document uniquely associated to projects conducted for the 15th AW Installations in Hawaii, initiated by 15 AW, 15th Civil Engineer Squadron/Restoration Element (15 CES/CEVR), and Air Force Center for Environmental Excellence (AFCEE) staff.

2. Section 4.1. The following section and subsections (4.1.1, 4.1.2, and 4.1.3) were added to Section 4.0 to better define the Data Quality Objective (DQO) process required for expected project activities.

4.1 Use and Application of the ERP QAPP for Project-Specific Objectives

This ERP QAPP is an integral component of data quality planning and evaluation for all sampling and analysis activities to be done for various ERP

project activities at 15 AW installations. A consistent and comprehensive approach for using this ERP QAPP is necessary to ensure that enough data are produced that are of sufficient quality to make decisions for a variety of sites and phases of activities and operations.

In the planning for analytical programs, each SAP will have established Data Quality Objectives (DQOs), which specify the data types, quality, quantity, and uses as needed to make decisions and are the basis for designing data analysis and sample collection activities.

Typical data uses for expected project activities may include describing the nature and extent of chemicals in site media, such as surface soil, subsurface soil, sediment, surface water, soil gas and groundwater. The data may be used to support remedial investigations, feasibility studies, baseline risk assessment, fate and transport modeling, remedial action, or site closure.

Specifying the type, quantity, and quality of data needed for these potential data uses is not feasible within one functional QAPP. However, the ERP QAPP does provide the minimum specifications for data quality and validation required for typical and expected project activities. These minimum standards are designed to provide a common baseline for creating comparable data. Each individual activity that generates data may require additional elements that will be established in the project-specific DQOs and the project SAP.

The guidance for establishing DQOs as outlined in EPA QA/G-4, "Guidance on Systematic Planning Using the Data Quality Objectives Process" (EPA, February 2006) should be followed when planning for data collection. Furthermore, each project-specific FSP must incorporate the seven-step DQO process, as appropriate, using site-specific information as inputs to the DQO process. The FSP should include acceptable limits on decision errors, which will be used to establish appropriate performance goals for the data collection design. The seven-step DQO process as outlined in the EPA QA/G-4 document is as follows:

- Step 1: State the Problem
- Step 2: Identify the Decision
- Step 3: Identify the Inputs to the Decision
- Step 4: Define the Boundaries of the Study
- Step 5: Develop a Decision Rule
- Step 6: Specify Acceptable Limits on Decision Errors
- Step 7: Optimize the Design

To properly implement the baseline specifications provided in this ERP QAPP, project-specific DQOs and SAPs should consider the following factors in addition to those listed above.

4.1.1 Triad Guidance

The Triad approach to environmental work requires that special considerations be taken in the development of a project QAPP. Triad is a combination of three elements that are designed to streamline and reduce the cost and schedule for site investigations. These elements are as follows:

1. **Systematic planning:** involves the development of a conceptual site model and decision logic (trees) to be used in the site investigation to make decisions about the next steps in the investigation. The decision logic and DQOs are agreed to by all necessary stake holders.
2. **Dynamic work plans:** the output of the systematic planning, which includes the decision tree as its backbone. Appropriate field implementation documents such as SAPs are also included in the work plans.
3. **Real-time measurement technologies:** investigation methods that provide data nearly instantaneously, so that the decision trees can be quickly used to guide the next steps in the site investigation.

The overall concept for Triad is the development and implementation of work plans that allow modifications or adjustments to the site investigation as the work progresses. This approach should reduce the time required and cost compared to a phased approach to investigation.

The Triad process may also be expanded to include development of decision logic for the selection of remediation approaches for a site.

The following items are key impacts on the project QAPP:

1. During the Systematic Planning phase of the Triad approach, managing uncertainty is a core component as it helps ensure that data of known quality are collected and appropriate for the project. The development of project planning documents is the primary means by which uncertainty is controlled. SAPs serve to manage uncertainty in data collection. The underlying goal of these planning documents is to maximize the probability that information collected or data generated by a specific activity meets a defined decision quality. In the Triad Approach, these planning documents go a step further in that they specifically identify the rationale and procedures to manage individual sources of uncertainty and its overall impact on the decision confidence and defensibility of the data collected.
2. The use of real time information to support rapid decision-making processes is a key element. The foundation for appropriate real-time measurement technologies is laid during systematic planning. This connection assures that measurement or analytical techniques employed are the most appropriate for a given data collection task. Real time data may be generated by many mechanisms: real-time in-situ sensors such as membrane interface probe

(MIP) and laser-induced fluorescence (LIF), rapid off-site laboratory turnaround, an onsite mobile laboratory, or hand held instruments used in the field to evaluate discreet samples. Onsite analysis tools can be cost effective options for real-time data generation. However, effective use of these tools depends largely on the target compound and the ultimate use of the resulting data in the decision-making process.

The combination of systematic planning with real-time measurement attempts to pair the most cost-effective analytical tool with the planned use of the data collected. The use of onsite analytical techniques is generally considered screening-level. Yet, when these techniques are incorporated into a clear and defensible approach for site data collection, the results offer data more valuable than simple field screening measurements. In most instances, the use of onsite analysis will not eliminate the need for traditional laboratory analysis. However, when onsite analysis and traditional laboratory techniques are combined within the framework of a dynamic work plan, the resulting data sets are often more meaningful than data generation only through a fixed laboratory (for example, a more complete conceptual model is prepared). Aside from lower costs, the combination of onsite analysis and traditional laboratory techniques also allows generation of data sets with high confidence since they are more representative of site conditions. This concept is directly related to the ability of onsite analytical tools to dramatically increase sampling density with little impact to the overall investigation cost. In addition, a more rapid investigation is achieved, that can be used to focus further work that may require the installation of more permanent monitoring points.

4.1.2 Selection of Quantitation Limits

One of the goals of the DQO process is to use the ERP QAPP in selecting the analytical methods needed to achieve the appropriate detection limits for data use. The quantitation limits for a specific sampling effort are established by the use of the data. For example, if the data are needed to demonstrate compliance with a regulatory action level or project-specific cleanup level, the quantitation limits must be low enough to be accurate at the concentration of those levels. Similarly, if the sampling is being collected and analyzed to determine the effectiveness of a bench-scale test of a treatment technology, the quantitation limit is specified by the requirements of the treatment system.

The method/target analyte specific quantitation limit objectives in this ERP QAPP are to be used to select appropriate analytical methods for a particular sampling program. The project-specific QAPP can specify different quantitation limit objectives for a method, if the limits are achievable and suitable for the intended use of the data. In the absence of a specification provided in a project-specific QAPP, the limits in this ERP QAPP are the maximum limits for the method/target analyte.

4.1.3 Specification for Data Validation

The level of data validation is a function of the data use. The specification in this ERP QAPP for data validation is the minimum requirement. Data users may require additional validation because of the use of the data. Additional validation requirements are to be specified in the DQOs and SAP for each sampling effort. If a SAP is silent on data validation, the specifications in Section 8.0 of this ERP QAPP will be followed. The validation requirements will not be reduced for a sampling program performed under this ERP QAPP unless specifically discussed in the project-specific documents and with project stakeholder agreement.

3. Section 4.2 Data Quality Indicators. The following sentence was added to Section 4.2 to clarify that data quality indicators (DQIs) other than the ones specified in Sections 6.0 and 7.0 can be used if they meet the Project Quality Objectives (PQOs) and are approved by applicable stakeholders.

“Project-specific DQIs either stricter or less exacting than these are possible if the PQOs can be met.”

4. Section 4.4.3 Reporting Limits. The following has been added to the RL discussion for clarification:

Project-specific RLs must be provided in the project specific QAPP. The project-specific RLs may be equivalent to those defined in Section 7.0. To determine whether the method detection limits (MDLs) and RLs will meet the analytical PQOs, the MDLs and RLs must be compared to the project-specific screening criteria (to be defined in the project specific QAPP). If the MDL is below the screening criterion, the RL is sufficient for project decisionmaking. If not, other constituent-specific factors (potential use at the site, mobility, toxicity) may be discussed in the PQOs on a more qualitative basis. Chemicals for which screening objectives will not be met must be defined in the PQOs and typically would not be considered primary compounds of concern for a project effort.

Note that sample dilution because of target and or non-target compound concentrations or matrix interference may prevent RLs from being achieved. All samples must be initially analyzed undiluted when reasonable. If a dilution is necessary, both the original and diluted result must be delivered. Any samples that are not analyzed undiluted must have the express approval of CH2M HILL within extraction/analysis holding time and be supported by matrix interference documentation such as sample viscosity, color, odor or results from other analyses of the same sample to show that an undiluted sample is not possible. Appropriate clean-up procedures must be followed to minimize matrix effects on RLs.

5. Section 4.3.4 Calibration. The following was added to Section 4.3.4 to better define calibration requirements.

Calibrations must use the simplest calibration model first. Non-linear calibration should be considered only when a linear approach cannot be applied. It is not acceptable to use an alternate calibration procedure when a compound fails to perform in the usual manner. When this occurs it is indicative of instrument issues or operator error. When multi-point calibration is specified, the concentrations of the calibration standards should bracket those expected in the samples.

6. Section 4.4.2, Matrix Spike/Matrix Spike Duplicate. The following was added to Section 4.4.2 to define/clarify possible Matrix Spike/Matrix Spike Duplicate (MS/MSD) requirements for project specific activities.

The frequency of collecting MS/MSDs may be reduced without jeopardizing data quality based upon project-specific PQOs. For example, long-term monitoring projects typically have many years' worth of high-quality data and baseline conditions have been established. Many monitoring wells (excluding newly installed wells) may have a long history of monitoring results that future sample results could be compared to, thereby reducing the need for MS/MSDs. If sufficient MS data for the monitored sites exists, the laboratory control sample (LCS) has established control ranges that provide both precision and accuracy information. Therefore, MS/MSDs may be reduced so that they are collected and analyzed only where data trends indicated a precision problem. If MS/MSD frequency of collection is reduced, the frequency must be defined in the project-specific QAPP. Stakeholder consent would be required for each project interested in this approach.

7. Section 4.4.8, Ambient Blanks. The following frequency clarification is provided for ambient blanks.

An ambient blank shall be collected for each VOCs sampling event where the potential for introduction of contaminants from surrounding sources exist at the time of collection and at the discretion of the field team leader.

8. Section 4.4.8, Equipment Blanks. The following frequency clarification is provided for equipment blanks.

At a minimum, equipment rinsate blanks will be collected at a frequency of one per week or one per project mobilization effort (whichever is more frequent) per sampling crew for each decontaminated equipment type.

9. Section 4.4.8, Trip Blanks. The following frequency clarification is provided for trip blanks.

Trip blanks will not be analyzed for soil volatile organic compounds (VOCs) because the samples are frozen at the time of collection and the trip blank would break if included in the shipping cooler. VOC cross contamination is not expected with frozen samples.

10. Section 4.4.11, Field Duplicate (Replicate) Samples. The following was added to Section 4.4.11 to define possible Field Duplicate (FD) requirements that may be appropriate for specific project activities:

The standard collection frequency for duplicate samples is one for every 20 field samples. The frequency of collecting field duplicates may be reduced without jeopardizing data quality based upon project-specific DQOs for some projects. For example, long-term monitoring projects typically have many years' worth of high-quality data and baseline conditions have been established. Many monitoring wells (excluding newly installed wells) may have a long history of monitoring results that future sample results could be compared to, thereby reducing the need for field duplicates. For example, collection of field duplicates might be restricted to areas with low concentrations (such as the tail of plumes) and wells with little historical data, where precision data is most valuable. If field duplicate frequency of collection is reduced, the frequency must be defined in the project-specific QAPP. Stakeholder consent would be required for each project interested in this approach.

11. Section 5.1, Field Sampling. The following information has been added to Section 5.1 for clarification:

A brief summary of general sampling procedures are discussed below. General field procedures will be required for all projects that use this ERP QAPP. Project-specific procedures will be presented in a project-specific FSP. General field procedures include documentation, sample custody and security, sample shipment and handling, and equipment decontamination.

All personnel who will work on projects that use this ERP QAPP must read this ERP QAPP before planning or performing the fieldwork. Field activities coordinators and task leaders will ensure that field personnel have a copy of the ERP QAPP and project specific QAPP while in the field. All field activities must be conducted following health and safety procedures described in the project-specific HSP. Furthermore, the site-specific FSP will address special training requirements and certifications for personnel, if required.

12. Section 5.1.1, Documentation Procedures. The following information is provided in Section 5.1.1:

Guidance for documenting field samples is included in Section 5.2. The field team leader is responsible for ensuring that field sampling teams adhere to proper custody and documentation procedures. Field logbooks, field forms, and chain-of-custody (COC) forms will be the primary documentation mechanisms used to record and track information about each sample. Copies of the field logbooks and field forms will be retained in the project files.

Field personnel have the following responsibilities regarding documentation of field activities:

- Keep accurate written records of all activities that occur on the site (including sample collection activities) on the field forms and/or field logbooks.
- Ensure that all entries are legible, written in waterproof, black ink, and contain accurate and inclusive documentation of the field activities. This documentation

must include field data and observations, any problems encountered, and actions taken to solve the problem.

- Date and initial daily entries.
- Note errors or changes using a single line to cross out the entry, and date and initial the change.

Field logbooks and field forms will be available for review during technical systems audits or at any other time for QC checks. This documentation will provide verification of sampling procedures.

When photographs, slides, or movies are taken for visual documentation of a site or procedure, they will be numbered to correspond to the field logbook entries. If possible, a reference point (such as a building or sign) will be included to assist in verifying the location of the photograph and providing an approximate scale. The name of the photographer, date, time, site location, and site description will be documented in the field logbook as photos are taken. The development and use of Photo record forms that include space for all of these required data is encouraged. Photography will be coordinated with the 15 AW field project manager (FPM) to ensure adherence to 15 AW security regulations.

13. Section 5.1.2, Sample Containers. This section was shown as Section 5.1.1 in the AFCEE QAPP and has been clarified as follows for the re-use of sample bottles:

Once sample containers have been taken to the field, unused containers will not be returned to clean storage for later use. Unused bottles will be disposed of and not be returned to the laboratory.

14. Section 5.1.3, Sample Volumes, Container Types, and Preservation Requirements.

Table 5.1.2-1 presents the sample containers, volumes, and preservation and holding time requirements for each method. The following methods have been added that were not originally included in the AFCEE QAPP.

- Volatile petroleum hydrocarbons (VPH) fractional analyses, Method Northwest Total Petroleum Hydrocarbon (NWTPH)-VPH
- Extractable petroleum hydrocarbons (EPH) fractional analyses, Method NWTPH-EPH
- Glycols and/or Ethanol, Method SW8015B
- Methane, ethane, and ethene, Method RSK-175
- 1,4-Dioxane, Method SW8270C SIM
- Polychlorinated biphenyl (PCB) congeners, U.S. Environmental Protection Agency (EPA) Method 1668 Modified
- Perchlorate, EPA Method 6860
- Alkalinity, EPA Method 310.2

- Sulfide, Method 376.1 or SW9030

15. Section 5.2, Sample Handling and Custody. The following information has been added to Section 5.2 as clarification:

All samples shall be uniquely identified, labeled, and documented in the field at the time of collection in accordance with Section 6.2 of the project-specific FSP to meet the following minimum expectations. A sample label will be affixed to each sample collected. Sample labels identify the sample with the following information.

- A unique identification number
- The sample type (such as groundwater, soil, or sediment)
- Analytical method requested
- The sampler's name(s) or initials
- Date collected
- Time collected
- The preservation method used

These labels will be completed in waterproof, black ink. Labels that have pre-printed sample identifications (IDs) may be used; the remaining information is then completed at the time of sample collection. Use of additional tape to secure the sample labels is not recommended because of the potential for sample contamination from volatiles in the adhesives. Samples will be placed in plastic bags for storage and shipment to prevent sample loss or sample damage caused by melting ice, broken samples, or leaking samples.

If samples are not shipped on the day of collection, they will be refrigerated or stored on ice in the sample staging area. Security is maintained by having locked supplier facilities in the staging area, a locked security fence surrounding the staging area, and limited access to 15 AW installations.

Samples collected in the field shall be transported to the laboratory or field testing site as expeditiously as possible. Sample cooler packing will meet the following minimum requirements. When samples are required to be stored at 4 degrees Celcius (°C) or less, generous amounts of bagged wet ice will be packed with the samples. The ice will contact each sample and will be present at the top and bottom of the container. Samples will be cooled with ice or in a refrigerator (if available) before being packed for shipment.

The following procedures will be used to prevent bottle breakage and cross-contamination:

- Sample bottles will be sealed in individual plastic bags.
- All samples will be transported inside appropriate containers.
- All 40-mL VOA bottles will be placed in blocks of foam or in plastic bubble pack mesh sleeves.

- All other glass bottles will be placed in plastic bubble pack mesh sleeves to prevent glass-to-glass contact.
- Bagged ice or foam blocks will be used to separate glass bottles.
- Absorbent paper will be used to absorb any sample that may leak during transport.
- The original COC form will be packed inside the shipping container.
- The containers will be taped shut and sealed with strapping tape. A custody seal will be placed on the outside of the cooler such that it can not be opened without breaking the seal.
- Samples that are known or suspected to be highly contaminated (based on field-screening data or observation) will be packaged and shipped separately from other samples.
- Laboratories will be notified of any known or suspected highly contaminated samples. These samples will be stored separately from less contaminated samples to minimize the potential for cross-contamination.

16. Section 6.0, AFCEE Screening Analytical Methods. The following methods typically require an analysis as a definitive method rather than screening level method to meet project decision-making objectives.

- Filterable Residue (E160.1)
- Nonfilterable Residue (E160.2)
- Alkalinity (E310.1)
- Total Organic Carbon (SW9060)

In addition, Method SW9074 Total Petroleum Hydrocarbon (TPH) PetroFLAG was used to replace the TPH-immunoassay method recommended in Section 6.0. The petroFLAG method has shown better accuracy and precision in actual field tests and will better serve the typical project objective. Also, the immunoassay method for polyaromatic hydrocarbons (PAHs) was removed from the document because of poor overall accuracy and precision based on field experience. No substitute method was added. The following was used in Section 6.1.16 to describe Method SW9074 TPH PetroFLAG.

Method SW9074 – Screening of Soils for Total Petroleum Hydrocarbons by Immunoassay

Soil samples are screened for levels of TPH by using TPH test kits. A mini extraction of the soil sample is performed in the field to determine concentrations above 50 milligrams per kilogram (mg/kg). The test is a colorimetric determination by comparing the response produced by the sample to the response produced by a standard.

17. Section 7.0, Definitive Data Analytical Methods. The following was added to Section 7.0 as clarification. Please refer to Appendix B for applicable method information as defined below.

Additional methods approved for use by this ERP QAPP but not previously listed in the AFCEE QAPP Version 4.0.01 are presented in Appendix B (and in Table 5.1.2-1) with tables formatted like those presented in Section 7.0, defining RLs, control limits, and quality assurance/quality control (QA/QC) criteria. Any project-specific methods used to meet project-specific objectives but not included in this ERP QAPP must be presented in the project-specific QAPP.

As a clarification issue, some methods previously listed in the AFCEE QAPP were deleted because of a lack of use for typical project objectives. These methods included (but are not limited to) SW8070, SW8021, all of the series SW7000 methods for atomic absorption metals and EPA Method 314.0.

18. Section 7.1, Preparative Methods. The following were added to the definition of preparation methods for clarification:

Additional cleanup procedures are presented to minimize the effects of petroleum hydrocarbons on recoveries and reporting limits. Hydrocarbons can sometimes interfere with analyte integration/chromatography, resulting in dilutions that raise the reporting limits if cleanups are not performed. In order to maintain the lowest possible reporting limits, all method-applicable cleanup measures will be employed. Methods for sample cleanup include but are not limited to gel permeation chromatography, silica gel, alumina oxide, florisil, mercury (sulfur removal), sulfuric acid, and acid/base partitioning. Each of these methods is briefly discussed in the following subsections and in Table 7.1-1.

7.1.22 Absorption Column Chromatography - Alumina (Methods 3610 and 3611), Florisil (Method 3620), and Silica Gel (Method 3630)

Each of these methods are useful for separating analytes of a relatively narrow polarity range away from extraneous, interfering peaks of a different polarity. These are primarily used for cleanup of a specific chemical group of relatively non-polar analytes (for example, organochlorine pesticides, polynuclear aromatic hydrocarbons (PAHs), and nitrosamines). Solid phase extraction (SPE) cartridges have been added as an option.

7.1.23 Acid-Base Partitioning (Method 3650)

Useful for separating acidic or basic organics from neutral organics. It has been applied to analytes such as the chlorophenoxy herbicides and phenols. It is very useful for separating the neutral PAHs from the acidic phenols when analyzing a site contaminated with creosote and pentachlorophenol.

7.1.24 Gel Permeation Chromatography (Method 3640)

The most universal cleanup technique for a broad range of semivolatile organics and pesticides. It is capable of separating high molecular-weight, high boiling material from the sample analytes. It has been used successfully for all the semivolatile base, neutral, and acid compounds associated with the EPA Priority Pollutant and the Superfund Target Compound list before gas chromatography/mass spectrometry (GC/MS) analysis for semivolatiles and pesticides. Gel Permeation Chromatography (GPC) may not be applicable to elimination of extraneous peaks on a chromatogram which interfere with the analytes of interest. It is, however, useful for the removal of high boiling materials that would contaminate injection ports and column heads, prolonging column life, stabilizing the instrument, and reducing column reactivity.

7.1.25 Sulfur Cleanup (Method 3660)

Useful in eliminating sulfur from sample extracts, which may cause chromatographic interference with analytes of interest.

7.1.26 Sulfuric Acid/Permanganate Cleanup (Method 3665)

Useful for the rigorous cleanup of sample extracts prior to analysis for PCBs. This method should be used whenever elevated baselines or overly complex chromatograms prevent accurate quantitation of PCBs. This method cannot be used to clean up extracts for other target analytes, as it will destroy most organic chemicals including the pesticides Aldrin, Dieldrin, Endrin, Endosulfan (I and II), and Endosulfan sulfate.

19. Section 7.1.4, Method SW5035A – Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples. The following was added to the text of Section 7.1.4 to clarify the preferred collection approach for Method SW5035A that is compliant with method specification and best meets the conditions and needs of typical projects.

For low-level VOC analysis, the preferred preservation is freezing with a 14-day holding time. The soil is extruded into a 40-mL or 60-mL VOA empty vial (and frozen onsite) or into a vial containing water or methanol, PTFE stirrer, and if necessary sodium bisulfate as defined by the method.

20. Section 8.0, Data Management and Evaluation. The following has been added to introduce the 15 AW Data Management Plan (DMP):

A key component of the data management and analytical generation and assessment process is the Data Management Plan (DMP). The Installation-Wide 15 AW DMP is outlined in Appendix C. The DMP provides operating guidelines for satisfying the data management requirements for large quantities of data. The DMP includes processes and guidelines for sample tracking, storage, access, delivery, and reporting of new chemical, analytical, geologic, and spatial data

generated during 15 AW installation investigation and cleanup operations. In addition, the DMP addresses the management of historical data.

21. Section 8.2.1.1, Laboratory Data Reporting Requirements. The following has been added to Section 8.2.1.1 as clarification of the content required in the case narrative:

“Discussions and justifications for using marginal exceedances are required.”

22. Section 8.2.1.3, Tentatively Identified Compounds. The following has been added to Section 8.2.1.3 as clarification.

Reporting of tentatively identified compounds (TICs) will be determined on a project specific basis and defined in the project specific QAPP if required. If not defined, TICs will not be determined and reported.

23. Section 8.2.2.3 Data Validation Guidelines. The following was added to explain the validation approach and automated validation that may be employed for projects:

All project data will be validated as part of the data assessment for this project. This review will be performed on an analytical batch basis by assessing QC samples and associated field sample results. Data validation guidelines have been developed in accordance with the method requirements (Section 7.0), professional judgment and general AFCEE requirements (Table 8.2.2.4-2). Note that Table 8.2.2.4-2 has information added to help define additional general flagging criteria applied (in some cases based on professional judgment) that was not included in the table as published by AFCEE.

A tiered approach to data validation to suit varying PQOs can be applied. In summary, the three data validation tiers are as follows:

Tier I: This level of validation will be applied to screening level data. It will involve verification for completeness and review for format and content to ensure that all requested samples were analyzed, and that all data are present. The data shall be qualified with an “S” flag and further qualified if critical calibration and QC requirements are not within acceptable limits as defined in Section 8.1.

Tier II: This level of data validation will be performed for all project objectives. A Tier I data validation will be performed and, the results of QC checks and procedures are evaluated. The laboratory data package summary are also reviewed. This will include a review of the sample results, associated QA/QC sample results, the laboratory case narrative, chain of custody and sample receipt conditions. Data will be qualified in accordance with the requirements of Sections 7.0 and 8.0.

Tier III: This level of data validation will be performed based on specific requirements of PQOs (and must be defined in the project specific QAPP) or based upon the judgment of the project chemist to evaluate data anomalies determined from the Tier II data validation or project data users. A Tier II data validation will be performed in addition to raw data examination in

detail to check for calculation, compound identification, and transcription errors.

A fully automated approach to validation from electronic data may be used (for any Tier of validation) to do all of the comparisons against the limits for elements of QC that are available in the current form of the laboratory electronic deliverables (if electronic data are unavailable, manual hard copy review will be performed). The automated process includes data flagging for issues related to method blanks, equipment blanks, trip blanks, ambient blanks, LCSs, MS/MSD samples, field duplicates, surrogate recoveries, holding time, and reconciliation of dilutions and re-extractions. All of the elements of QC and their limits and logic for applying flags are incorporated in the computer application. Data flags, as well as the reason for each flag, are entered into an electronic database and made available to the data users. A final flag is applied to the data by the data validator or chemist after evaluating all flags entered into the database and selecting the most conservative of the validation flags.

24. Tables 8.2.2.4-2 through 8.2.2.4-3, Data Qualifying Conventions. General data qualifying conventions were added to the table to help define additional general flagging criteria applied (in some cases based on professional judgment) that were not included in the table as presented in the AFCEE QAPP.

TABLE 8.2.2.4-2
 Data Qualifying Conventions—General
 ERP QAPP for Multiple Projects for the 15th Airlift Wing

QC Requirement	Criteria	Flag	Flag Applied To
Holding Time	Time exceeded for extraction or analysis	J for the positive results R or UJ for non-detects*	All analytes in the sample
Sample Preservation	Sample not preserved (If sample preservation was not done in the field but was performed at the laboratory upon sample receipt, no flagging is required)	J positive results; R or UJ for non-detects*	Sample
	Temperature out of control	J positive results; R or UJ for non-detects*	Sample
Sample Integrity (SW8260)	Bubbles in VOA vial >¼ inch used for analysis	J for the positive results UJ for non-detects	Sample
Instrument Tuning	Ion abundance method-specific criteria not met	R all results	All associated samples in analysis batch
Initial Calibration	All analytes must be within method specified criteria (reference Section 7 tables)	J positive results ; R non-detects	All associated samples in analysis batch
Second Source Check or Continuing Calibration	All analytes must be within method specified criteria (reference Section 7 tables)	High Bias: J positive results, no flag for non-detects Low Bias: J positive results, UJ non-detects R all non-detects greater	All associated samples in analysis batch

TABLE 8.2.2.4-2
 Data Qualifying Conventions—General
 ERP QAPP for Multiple Projects for the 15th Airlift Wing

QC Requirement	Criteria	Flag	Flag Applied To
		than twice the control criteria	
Low Level Calibration Check or Interference Check Sample	All analytes must be within 20% of expected value	High Bias: J positive results, no flag for non-detects Low Bias: J positive results, UJ non-detects R all non-detects greater than twice the control criteria	All associated samples in analysis batch
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
Internal Standards	Area > UCL Area < LCL Sample is re-extracted AND reanalyzed AND recovery outside of criteria is confirmed as a matrix effect	J positive results J positive results, R non-detects M positive results, UM non-detects	Sample
Surrogate Spikes	%R > UCL %R < LCL and >10% %R <10% Excessive dilution*	J positive results J positive results, UJ non-detects J positive results, R non-detects No flag required	Sample
Blanks (Method, Equipment or Trip)	Analyte(s) detected > ½ RL (use the blank of the highest concentration)	U positive sample results ≤ 5x highest blank concentration (10x for common lab contaminants), also reference Section 8.2.2.3.3	All samples in preparation, field or analytical batch, whichever one applies
Field duplicates	RPD > CL and field duplicates > RLs or one field duplicate > RL, one ND	J for the positive results UJ for the non-detects	The specific analyte(s) in all samples collected on the same sampling date. Note: No flagging is required for RPDs based on F-flagged results

TABLE 8.2.2.4-2
Data Qualifying Conventions—General
 ERP QAPP for Multiple Projects for the 15th Airlift Wing

QC Requirement	Criteria	Flag	Flag Applied To
MS/MSD	MS or MSD % R > UCL or MS or MSD % R < LCL or MS/MSD RPD > CL Sample concentration > 4x spike concentration Excessive dilution*	M for all detected results and UM for all non- detected results No flag required No flag required	The specific analyte(s) in the parent sample
Post-Digestion Spike	All analytes must be within 25% of expected value	High Bias: J positive results Low Bias: J positive results, UJ non-detects	The specific analyte(s) in the parent sample
Serial Dilutions	All analytes must be within 10% of expected value	If Post Spike not analyzed High Bias: J positive results Low Bias: J positive results, UJ non-detects	The specific analyte(s) in the parent sample
Confirmation	RPD between primary and confirmation results > 40%	J for the positive results	Sample
Retention Time Window	Analyte within established window	R all results	Sample

* = Based on analyte-specific review

UCL = Upper control limit LCL = Lower control limit CL = Control limit

* = Based on analyte-specific review

A.2 Variances

The following variances are presented below in the order they appear within the ERP QAPP.

1. The following was added to Sections 4.5.2 and 8.2.2.3.5 to define or clarify the AFCEE QAPP MS/MSD requirements for project activities.

AFCEE QAPP Requirement: If either the MS or the MSD is outside the QC acceptance limits, the data shall be evaluated to determine whether there is a matrix effect or analytical error, and then the analytes in all related samples shall be qualified according to the data flagging criteria in Sections 7.0 and 8.0.

Variance: The way in which samples are related to one another for flagging will be determined on a project-specific basis. In addition, in cases of high sample dilution, out of control spike recoveries may not require sample qualification.

Justification: Matrix-related failures may be the result of a variety of factors including the geology of the sample or the nature of the contamination. In some cases, it may be appropriate to flag data with similar geologic association; in some cases it may be appropriate to flag data with similar contaminant concentrations, particularly oily matrices. Sample contaminant concentrations often are associated to dilution requirements that cause spike recoveries to be inaccurate.

2. Table 8.2.2.4-2, Data Qualifying Conventions – General. In addition to the AFCEE QAPP requirements for MS/MSD data flagging, the following variance is requested:

Variance: When the sample concentration exceeds the spike concentration by a factor of four or more, the data shall be reported unflagged.

Justification: If sample concentration is greater than four times the spike added, the signal of the spike aliquot is usually unrecoverable in comparison to the sample concentration signal and can result in inaccurate interpretation of matrix effects.

3. Table 8.2.1.5-1, Laboratory Data Qualifiers. In addition to the AFCEE QAPP requirements for data flagging in Table 8.2.1.5-1, the following variance is requested:

Variance: The “UM” flag was added to the list to qualify non-detects for matrix interference. The UM flag will be defined as “Matrix effect: The analyte was not detected; however, the result is estimated due to matrix effect.”

Justification: Non-detected results are potentially affected by low MS recoveries and should be flagged to note the possible bias.

4. Section 8.2.2.3.3, Blank Evaluation Guidelines. The following was added to Section 8.2.2.3.3 as a variance on data flagging for blank contamination. Table 8.2.2.4-2 was also amended to reflect this variance.

Variance: A target compound detected concentration that is $\leq 5X$ the blank contamination ($\leq 10X$ for common lab contaminants) may be considered a non-detect and flagged “U” at the detected concentration.

Justification: When a data set contains low-level detects in field samples and has associated field or laboratory blanks that have detects at similar concentrations, this suggests that the low-level detects in these field samples may be artifacts due to either field or laboratory practices.

5. Section 8.9, Hardcopy Data Reports for Screening and Definitive Data. The following was added to Section 8.9 as a variance on the required hardcopy report.

AFCEE QAPP Requirement: The hardcopy data reports shall conform to the formats identified in Section 8.9 of the AFCEE QAPP Version 4.0.01.

Variance: Note that a substituted summary form may be used for the applicable AFCEE form as needed as long as the information is equivalent to or exceeds the

required content of the AFCEE form. Form substitution should be discussed in the project-specific QAPP.

Justification: Not all laboratories are capable of delivering all forms defined in Section 8.0. Forms typically require coding in Laboratory Information Management System (LIMS) systems. Alternate forms are typically available that meet or exceed the required information from parallel AFCEE forms.



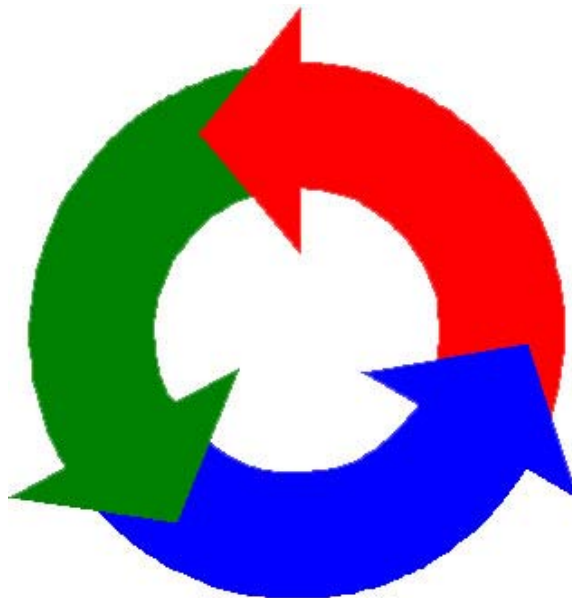
United States Air Force
15th Airlift Wing
Environmental Restoration Program

ENVIRONMENTAL RESTORATION PROGRAM

QUALITY ASSURANCE PROJECT PLAN FOR MULTIPLE PROJECTS FOR THE 15TH AIRLIFT WING

HICKAM AIR FORCE BASE

Oahu, Hawaii



APPENDIX B

Additional Methods

Appendix B

Additional Methods

In accordance with the preface of the *AFCEE Model Quality Assurance Project Plan, Version 4.0.01* (AFCEE QAPP) (AFCEE, May 2005) modification requests and additional methods that are not covered by the AFCEE QAPP are to be included as addendum (in this case titled as an appendix).

B.1 Section 7.0 Definitive Data Analytical Methods

The following are additional methods that may be required to meet project-specific data quality objectives (DQOs). These methods are approved for use by this Environmental Restoration Quality Assurance Project Plan (ERP QAPP) but were not previously listed in the AFCEE QAPP Version 4.0.01. They are presented with tables formatted similar to those presented in Section 7.0 of the AFCEE QAPP, defining reporting limits (RLs), control limits, and quality-assurance/quality-control (QA/QC) criteria. Methods used to meet project specific objectives but not included in this ERP QAPP must be presented in the project-specific QAPP.

- Gasoline range organics (GRO) in Air (EPA Method TO-3)
- Non-Methane Compounds in Air (EPA Method TO-12)
- Fixed gases in Air (Method SM2720C)
- Polychlorinated biphenyl (PCB) congeners (Method E1668 Modified)
 - Sulfides (Method SW9030)
 - Hardness, Total (Method E130)
 - Nitrogen, Ammonia (Method E350)
- Nitrate/Nitrite (Method E353)
- Alkalinity (Method E310.2 presented as a definitive method)
- Total dissolved and suspended Solids (Methods E60.1 and 2 presented as definitive methods)
- Total Organic Carbon in Soil (American Society for Testing and Materials [ASTM] E777-87)
 - Total Organic Carbon (SW9060 presented as a definitive method)

- Volatile petroleum hydrocarbons (Northwest Total Petroleum Hydrocarbon [NWTPH]-VPH)
- Extractable petroleum hydrocarbons (NWTPH-EPH)
- Perchlorate (Method SW6850)

B.2 Method Clarifications from the Guidelines Established in the AFCEE QAPP Version 4.0.01

There are no tables added for TO-15 as it is already included in the EPR QAPP. However, there are added target compounds that are defined in tables provided in Section 7.0 of the ERP QAPP. These added target compounds are required to meet objectives of the typical project. RL and control-limit objectives are also included for the added target compounds in Section 7.0 of the ERP QAPP. Similarly, carbon dioxide has been added to the target list of RSK175. 1,4-Dioxane has been added to the SW8270C SIM method. Glycols and ethanol are target compounds to be analyzed as defined by method 8015B. Residual range organics have been added as a possible target range to method SW8105B. Applicable Section 7.0 tables of the ERP QAPP include the RL and control limits for these two compounds. All QA/QC requirements defined in applicable method tables in Section 7.0 will apply.

B.3 Methods not included in the AFCEE QAPP Version 4.0.01

Method TO-3: This method is intended for the analysis of gasoline-range organics (GRO) in air. The analysis is based on desorbing a sample of air from a summa canister or tedlar bag onto a gas chromatograph and analyzed with a flame ionization detector. GRO is quantitated using all responses between C6 and C10.

Method TO-12: This method is intended for the analysis of non-methane compounds in air. The analysis is based on desorbing a sample of air from a summa canister or tedlar bag onto a gas chromatograph and analyzing it with a flame ionization detector.

Method SM2720C: This method uses a gas chromatograph and a thermoconductivity detector to determine methane, oxygen, carbon monoxide, carbon dioxide (CO₂), and nitrogen composition in air.

Method U.S. Environmental Protection Agency (EPA) 1668 Modified: This method uses a low-resolution mass spectrometer to analyze PCB congeners. The method is an isotopic dilution approach using labeled internal standards. The target list of congeners can be project specific and can contain up to 209 known congeners of concern.

Method SW9030 or EPA 376.1 – Total Sulfides (acid soluble + acid insoluble): This method is suitable for the determination of total sulfides. Under acidic conditions, the sample is heated and hydrogen sulfide (H₂S) is distilled and carried to scrubbing bottles containing zinc. The subsequent zinc sulfide precipitate is oxidized to sulfur, with a known volume of excess iodine. The excess iodine is determined by titration with sodium thiosulfate. Quantitation is based on sodium thiosulfate.

Method E130.1 – Hardness, Total (milligrams per liter [mg/L] as calcium carbonate [CaCO₃]);
EPA 130.1: The magnesium ethylenediamine tetraacetate (MgEDTA) exchanges magnesium on an equivalent basis for any calcium and/or other cation to form a more stable chelate than magnesium. The free magnesium reacts with calmagite at a pH of 10 to give a red-violet complex. By measuring only magnesium concentration in the final reaction stream, an accurate measurement of total hardness is possible.

Method E350.2 – Nitrogen, Ammonia; Colorimetric, Titrimetric, Potentiometric-Distillation Procedure: The sample is buffered at a pH of 9.5 with a borate buffer to decrease hydrolysis of cyanates and organic nitrogen compounds, and is then distilled into a solution of boric acid. The ammonia in the distillate can be determined colorimetrically by nesslerization, titrimetrically with standard sulfuric acid with the use of a mixed indicator, or potentiometrically by the ammonia electrode. The choice between the first two procedures depends on the concentration of the ammonia.

Method E353.3 – Nitrate/Nitrite as Nitrogen; Colorimetric, Automated, Cadmium Reduction: A filtered sample is passed through a column containing granulated copper-cadmium to reduce nitrate to nitrite. The nitrite (that originally present plus reduced nitrate) is determined by diazotizing with sulfanilamide and coupling that N-(1naphthyl)-ethylenediamine dihydrochloride to form a highly colored azo dye that is measured colorimetrically. Separate, rather than combined nitrate-nitrite, values are readily obtained by carrying out the procedure first with and then without the copper-cadmium reduction step.

Method E310.1 – Total Alkalinity: An unaltered sample is titrated to an end point of pH 4.5, using hydrochloric or sulfuric acid. The alkalinity is measured as calcium-carbonated equivalence.

Method E160.1 and 160.2 – Total Dissolved and Suspended Solids: A well-mixed sample is filtered through a standard glass fiber filter. The filtrate is evaporated and dried to constant weight at 180 degrees Celsius (°C) and is reported as total dissolved solids (TDS). A well-mixed sample is filtered through a glass-fiber filter. The residue retained on the filter is dried to constant weight at 103°C to 105°C and is reported as total suspended solids (TSS).

Method SW9060 – Total Organic Carbon (TOC): Organic carbon is measured using a carbonaceous analyzer. The instrument converts the organic carbon in a sample to carbon dioxide by either catalytic combustion or wet chemical oxidation (including UV-promoted, persulfate oxidation). The carbon dioxide formed is then either measured directly by an infrared detector or converted to methane and measured by a flame

ionization detector (FID). The amount of carbon dioxide or methane in a sample is directly proportional to the concentration of carbonaceous material in the sample.

Method ASTM E777-87 – Total Organic Carbon in Soil: TOC will be determined using guidance from Puget Sound Environmental Procedures (PSEPs) Recommended Protocols for Measuring Conventional Variables in Puget Sound (Tetra Tech, 1986) and ASTM E777-87. The solid sample will be combusted after addition of hydrochloric acid (HCl) to remove carbonates. The resulting CO₂ will be measured by infrared and related to the organic carbon concentration in the sample.

NWTPH-VPH: This method satisfies the requirements of the NWTPH-VPH methodologies and is designed to fractionate aliphatic (alkane) and aromatic hydrocarbons into several ranges (such as >C6-C8), as well as determine the total mass of purgeable analyte present in each sample using area sum calculations based on total peak area for a given sample. The method is designed to be used for samples containing purgeable hydrocarbons in the range of C5-C13 or less. The method is applicable to soil water or air. Example petroleum products suitable for evaluation using this method include, but are not limited to, gasoline and the lighter volatile portions of kerosene, jet fuels, and diesel and fuel oils.

NWTPH-EPH: This method satisfies the requirements of the NWTPH-EPH methodologies and is designed to fractionate extracts of petroleum samples into aliphatic (alkane) and aromatic hydrocarbon ranges (such as >C12-C16). This method is also designed to quantitate the total mass of analyte present in each sample using area sum calculations for several specific carbon ranges.

This method is suitable for evaluation of soil and water samples containing extractable hydrocarbons in the range of C8-C34. Example petroleum products suitable for evaluation using this method include, but are not limited to, kerosene, jet fuels, diesel and fuel oils, hydraulic oils, insulating oils, and lubricating oils.

Method SW6850 Perchlorate: This is a non-promulgated method for the analysis of perchlorate in groundwater and soil by liquid chromatography mass spectrometry (LC/MS). This method is required for perchlorate analysis by the U.S. Department of Defense (DoD) Perchlorate Handbook (DoD, March 2006). Reporting and control limits as well as method specific criteria and expectations are defined in applicable tables below. Soil samples require specific sample preparation defined as follows.

Currently there is no standard method for preparation of solid samples for the analysis of perchlorate. Before the publication of the SW-846 methods 6850, all solid samples processed for DoD must follow the procedure detailed below.

- Weigh 1 gram (g) of solid sample, recording the weight to 0.01 g. Transfer the sample to a 15 milliliter (mL) centrifuge tube.
- Add 10 mL of reagent water, 50 microliters (µL) of internal standard spiking solution. Vortex the mixture, followed by sonication for a minimum of 10 minutes, followed by additional vortexing.

- Centrifuge the sample for 5 minutes to separate the solids from the extract solution.
- Filter the supernatant extract solution using a plastic syringe fitted with a 0.45-micrometer (μm) membrane filter. Dispense the extract sample into an autosampler vial for analysis.
- If large quantities of organic contaminants are present in the solid sample extract (that is, if supernatant extract is highly colored), a cleanup step using a C18 column may be performed to remove organic contaminants from the supernatant extract solution.
 - > Activate the C18 cartridge column by pushing approximately 5 mL of methanol through the column, followed by 5 mL of reagent water. A flow rate of approximately 0.5 milliliters per minute (mL/min) is recommended. Care should be taken not to let the column become dry.
 - > Using gentle pressure, push approximately 6 mL of the supernatant extract solution through the activated column.
 - > Discard the first 2 mL of eluted sample extract. (DoD Perchlorate Handbook, March 2006; Appendix G, Page 5 of 13)
 - > Collect the remaining eluted sample extract (approximately 4 mL) in a clean container. Filter the sample extract using a plastic syringe fitted with a 0.45- μm membrane filter. Dispense the extract sample into an autosampler vial for analysis.

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TABLE B-1
 QC Acceptance Criteria for GRO in Air (C6-C10) by EPA Method TO-3

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^{a,b}	Flagging Criteria ^c
Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Least squares regression $r \geq 0.995$	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration.
Second Source calibration verification	Once per initial calibration	Analyzed result within 70-130% of the true value concentration	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration.
Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	Analyzed result within 75-125% of the true value concentration	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration verification.
Method blank	One per analytical batch	< RL	Correct the problem then reprep and analyze method blank and all samples processed with the contaminated blank.	Apply B to all results for the specific analyte in all samples in the associated analytical batch.
Lab duplicate	Once per day or per 20 samples	RPD<25	Project chemist will evaluate results for possible source of variability; notify data users.	Apply B to all results for the specific analyte in all samples in the associated analytical batch.

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bIf equipment blank is submitted to the laboratory blind, the corrective action is not applicable.

^cFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

Notes:

RL- Air = 33 ug/l (reporting limits may vary due to the response of compounds in the specified target list)

Accuracy (%R) = 75-125 percent

Precision Air (RPD) = 25 percent

TABLE B-2
 QC Acceptance Criteria for Total Non-Methane Organic Carbon by EPA Method TO-12

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Least squares regression $r \geq 0.995$	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration.
Second Source calibration verification	Once per initial calibration	Analyzed result within 70-130% of the true value concentration	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration.
Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	Analyzed result within 80-120% of the true value concentration	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration verification.
Method blank	One per analytical batch	< RL	Correct the problem then reprep and analyze method blank and all samples processed with the contaminated blank.	Apply B to all results for the specific analyte in all samples in the associated analytical batch.
Lab duplicate	Once per day or per 20 samples	RPD < 20	Project chemist will evaluate results for possible source of variability; notify data users.	Apply B to all results for the specific analyte in all samples in the associated analytical batch.

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cIf equipment blank is submitted to the laboratory blind, the corrective action is not applicable.

Notes:

TO-12

RL- Air = 0.1 ppmvC

Accuracy (%R) = 80-120 percent

Precision Air (RPD) = 20 percent

Table B-3

QC Acceptance Criteria for Standard Method 2720C Fixed Gases

Fixed Gases RL - Oxygen=0.6% Nitrogen=1.0% Carbon Monoxide=0.5% Methane=0.5% Carbon Dioxide =0.5 % Accuracy (%R) = 80-120 Precision Air (RPD) = 20
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QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Least squares regression $r \geq 0.995$	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Second Source calibration verification	Once per initial calibration	Analyzed result within 70-130% of the true value concentration	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Calibration verification	Daily, before sample analysis and every 12 hours of analysis time	Analyzed result within 80-120% of the true value concentration	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration verification
Method blank	One per analytical batch	< RL	Correct the problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte in all samples in the associated analytical batch
Laboratory control sample (LCS)	1 per analytical batch	80-120% recovery	1) If the preparative LCS recovers high outside the acceptance criteria and the analyte is ND, flag the LCS results and write a QCER. 2) If the LCS fails the acceptance criteria reanalysis will be necessary if samples are still within holding time and enough sample volume; if not, contact the project QA officer for a decision for possible resampling	For specific analyte in all samples in the associated analytical batch: if the LCS %R > UCL, apply J to all positive results if the LCS %R < LCL, apply J to all positive results, apply R to all non-detects
Lab duplicate	Once per day or per 20 samples	RPD<20	Project chemist will evaluate results for possible source of variability; notify data users.	Apply B to all results for the specific analyte in all samples in the associated analytical batch

^a All corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^b Flagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^c If equipment blank is submitted to the laboratory blind, the corrective action is not applicable.

TABLE B-4
Target Compounds for EPA Modified Method 1668 Polychlorinated Biphenyls

PCB-1	PCB-163	PCB-205 (8L)	PCB-53
PCB-1 (1L)	PCB-167	PCB-206	PCB-54
PCB-101	PCB-169	PCB-206 (9L)	PCB-54 (4F)
PCB-104	PCB-169 (6L)	PCB-208	PCB-56
PCB-104 (5F)	PCB-17	PCB-208 (9F)	PCB-6
PCB-105	PCB-170	PCB-22	PCB-60
PCB-110	PCB-171	PCB-24	PCB-64
PCB-114	PCB-174	PCB-25	PCB-64/40
PCB-118	PCB-177	PCB-26	PCB-66
PCB-123	PCB-179	PCB-27	PCB-7
PCB-126	PCB-18	PCB-28	PCB-70
PCB-126 (5L)	PCB-180	PCB-3	PCB-71
PCB-128	PCB-183	Pcb-3 (1l)	PCB-74
PCB-129/163	PCB-187	PCB-31	PCB-77
PCB-132	PCB-188	PCB-32	PCB-77 (4L)
PCB-135	PCB-188 (7F)	PCB-33	PCB-8
PCB-136	PCB-189	PCB-37	PCB-81
PCB-138	PCB-189 (7L)	PCB-37 (3L)	PCB-82
PCB-141	PCB-19	PCB-4	PCB-84
PCB-146	PCB-19 (3F)	PCB-4 (2F)	PCB-85
PCB-149	PCB-194	PCB-40	PCB-87
PCB-15	PCB-195	PCB-42	PCB-9
PCB-15 (2L)	PCB-196/203	PCB-44	PCB-92
PCB-151	PCB-196/203	PCB-45	PCB-95
PCB-153	PCB-199	PCB-46	PCB-97
PCB-155	PCB-2	PCB-47	PCB-99
PCB-155 (6F)	PCB-201	PCB-48	
PCB-156	PCB-202	PCB-49	
PCB-157	PCB-202 (8F)	PCB-50	
PCB-16	PCB-205	PCB-52	

^a Sensitivity of the method depends on the level of interferences rather than instrumental limitations. RLs for water are typically 0.50 ng/L. Samples may require higher reporting limits and/or additional cleanup techniques.

^b Correction for moisture content may raise reporting limits above these levels. Typical RLs for soil are 0.10 ug/kg. Samples may require higher reporting limits and/or additional cleanup techniques.

Total homologues per chlorination level" values are available upon client request.

Control limits for congeners is 30-140 percent, Labeled isomer control limits are 25-150 percent

TABLE B-4A
 Summary of Method Quality Assurance/Quality Control for EPA Modified Method 1668

Method	Parameter	Calibration	Frequency	Acceptance Criteria	Corrective Action
EPA 1668 Modified (GCMS)	PCBs	Tune using PFK.	Once per 12 hours, prior to sample analysis.	Resolving power $\geq 10,000$ at $m/z=304.9824 \pm 5$ ppm of expected mass.	1) Retune instrument. 2) Reanalyze PFK.
		Multipoint calibration (5 points, ICAL).	Initially and as required.	Int. std = <40% RSD Natives = <40% RSD Ion ratios within method limits, and $S/N \geq 10$	1) Evaluate system. 2) Recalibrate.
		Daily continuing calibration standard (CCAL).	Once per 12 hours, prior to sample analysis.	Int. Std = <40% D Natives = <40% D Ion ratios within method limits, and $S/N \geq 10$	1) Evaluate system. 2) Reanalyze CCAL. 3) Recalibrate (ICAL) as necessary.
	PCBs	Internal standards.	Every Sample, method blank, and LCS.	Internal standard recovery within limits stated in method.	1) Check chromatogram for interference. If found, flag data. 2) Check instrument and reanalyze the extract if a problem is found and corrected. 3) Check S/N. If < 10:1, reanalyze or reextract sample. 4) Evaluate data usability and flag as appropriate. 5) Reextract and reanalyze adversely affected samples.
		Method blank.	1 per analytical batch, not to exceed 20 samples, per matrix.	<RL	1) Reanalyze method blank. 2) If still exceeds and analyte conc. in sample < RL or > 10X blank concentration, report results and flag as appropriate. 3) If noncompliant and analyte concentration in sample is between RL and 10x blank concentration, assess impact or reextract and reanalyze affected samples.

TABLE B-4A
 Summary of Method Quality Assurance/Quality Control for EPA Modified Method 1668

Method	Parameter	Calibration	Frequency	Acceptance Criteria	Corrective Action
		LCS (include natives).	1 per analytical batch, not to exceed 20 samples, per matrix.	30 - 140 percent	1) Review Internal Standards, as above. 2) Evaluate data for usability. 3) If sample results are ND and RLs are met, no action required. 4) If samples have positives, reextract and reanalyze samples for analytes outside the acceptance criteria.
		Duplicates.	As per client request.	$\%RPD \leq 50\%$	1) Review data for usability. 2) Narrate outliers.
		Matrix Spike.	As per client request.	30 – 140 percent	1) Review data for usability. 2) Narrate outliers.
		Matrix Spike Duplicate.	As per client request.	30 – 140 percent.	1) Review data for usability.

TABLE B-5
 QC Acceptance Criteria for Method E310.1 – Total Alkalinity

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Titrant standardization	Daily (prior to sample analysis)	None.	None.	None
Initial calibration verification (ICV)	After standardization and before sample analysis	Analyzed result within 90-110% of the true value concentration ±.	Correct problem then repeat standardization.	Apply R to all results for specific analyte(s) for all samples associated with the standardization
Method Blank	One per preparation and analytical batch	<RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank.	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
Laboratory Control Sample (LCS)	One per preparation and analytical batch	75-125%	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch.	For specific analyte(s) in all samples in the associated analytical batch if: <ul style="list-style-type: none"> • The LCS %R > UCL, apply J to all positive results • The LCS %R < LCL, apply J to all positive results, apply R to all nondetects
MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	75-125% ,RPD <25	None.	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if: <ul style="list-style-type: none"> • %R for MS or MSD > UCL • %R for MS or MSD < LCL • MS/MSD RPD > CL
MDL study	Once per year	Detection limits established shall be < the RLs. ^c	None.	Apply R to all results for the specific analyte(s) in all samples analyzed
Results reported between MDL and RL	None	None.	None.	Apply F to all results between MDL and RL

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cQuality control acceptance criteria includes the following:

RL – Water = 10 mg/L

TABLE B-6

QC Acceptance Criteria for Method SW9060 (Modified) – Total Organic Carbon

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Initial Calibration – single or multi-point calibration depending on manufacturer's recommendation for instrumentation.	Daily before analysis	For multi-point calibration curve, regression criteria of $r > 0.995$ must be met prior to sample analysis.	For single point, repeat initial. For multi-point calibration, identify and repeat outlying point(s); recalculate curve using repeated point(s).	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Second source calibration verification (ICV)	Once per calibration. After initial calibration and before sample analysis	Analyzed result within $\pm 10\%$ of the true value concentration. For single point calibrations, ICV standard shall be at half the concentration of the initial calibration standard.	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration.
Initial Calibration Blank (ICB)	One per Initial calibration	<RL	Correct problem then reanalyze ICB and ICB in sequence.	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
Continuing calibration verification (CCV)	After every 10 samples and at the end of the analysis sequence	Response within $\pm 10\%$.	1) Repeat continuing calibration verification (CCV). 2) Identify and correct problem, if still out 3) Recalibrate and reanalyze all samples.	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Continuing Calibration Blank	One per preparation and analytical batch	<RL	Correct problem then reanalyze CCV and CCB and all samples associated with the contaminated blank.	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
Laboratory Control Sample (LCS)	One per every 20 samples or analysis batch whichever is the more frequent.	QC acceptance criteria. ^c	Correct problem and reanalyze the LCS and all samples in the affected AFCEE analytical batch.	For specific analyte(s) in all samples in the associated analytical batch if: <ul style="list-style-type: none"> • The LCS %R > UCL, apply J to all positive results • The LCS %R < LCL, apply J to all positive results, apply R to all nondetects

TABLE B-6

QC Acceptance Criteria for Method SW9060 (Modified) – Total Organic Carbon

MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria. ^c	None.	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if: <ul style="list-style-type: none"> • %R for MS or MSD > UCL • %R for MS or MSD < LCL • MS/MSD RPD > CL
MDL study	Once per year	Detection limits established shall be < the RLs. ^c	None.	Apply R to all results for the specific analyte(s) in all samples analyzed
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria. ^c	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria.	Apply R to all results for all samples analyzed by the analyst
Results reported between MDL and RL	None	None.	None.	Apply F to all results between MDL and RL

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cQuality control acceptance criteria includes the following:

RL – Water = 1.0 mg/L

RL – Soil = 5.0 mg/kg

Accuracy Water (% R) = 80-120 percent

Accuracy Soil (% R) = 80-120 percent

Precision Water (RPD) = ±20 percent

Precision Soil (RPD) = ±20 percent

TABLE B-7
 QC Acceptance Criteria for Method ASTM E777-81-Total Organic Carbon in sediment/soils.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Initial calibration verification	Initially, prior to any runs. Performed each day prior to analyzing samples.	Gravimetric determination of known standards must meet acceptance criteria above; no calibration curve is needed.	Correct problem then repeat testing.	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Second Source calibration verification	Once per day	Analyzed result within 70-130% of the true value concentration.	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Continuing calibration verification	Performed after every ten samples and at the end of each batch, or every 12 hours of analysis time	Analyzed result within 80-120% of the true value concentration.	Correct problem then repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration verification
Method blank	One per analytical batch	< RL	Correct the problem then reprep and analyze method blank and all samples processed with the contaminated blank.	Apply B to all results for the specific analyte in all samples in the associated analytical batch
Laboratory control sample (LCS)	1 per analytical batch	70-130% recovery.	Correct the problem and reanalyze the LCS.	For specific analyte in all samples in the associated analytical batch if: <ul style="list-style-type: none"> • The LCS %R > UCL, apply J to all positive results • The LCS %R < LCL, apply J to all positive results, apply R to all nondetects
Matrix spike/matrix spike duplicate (MS/MSD)	One MS/MSD per 20 samples	70-130% recovery and RPD < 30%.	If the MS and/or MSD is outside of either accuracy or precision tolerances and LCS results are acceptable, flag MS/MSD results and write QCER.	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if: <ul style="list-style-type: none"> • %R for MS or MSD > UCL • %R for MS or MSD < LCL • MS/MSD RPD > UCL
MDL Study	Once per year	Detection limits established shall be $\leq 1/2$ the RL.	None.	Apply R to all results for specific analyte(s) for all samples analyzed.
IDC study	Once per analyst	QC acceptance criteria. ^c	Recalculate results; locate and fix problem with the system and then re-run demonstration.	Apply R to all results for all samples analyzed by the analyst.

TABLE B-7

QC Acceptance Criteria for Method ASTM E777-81-Total Organic Carbon in sediment/soils.

Results reported between MDL and RL	None	None.	None.	Apply "F" to all results between MDL and RL.
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^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cQuality control acceptance criteria includes the following:

Total Organic Carbon

RL- Soil = 0.02% by wt**

Accuracy (%R) = 80-120 percent

Precision Soil (RPD) = ±30 percent

**Reporting limit translates to roughly 200 mg/kg, based on 0.5000g sample aliquot.

TABLE B-8
QC Acceptance Criteria for Method E160.1 – Total Dissolved Solids, E160.2 Total Suspended Solids

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Method Blank	One per preparation and analytical batch	<RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
Laboratory Control Sample (LCS)	One per preparation and analytical batch	QC acceptance criteria ^c	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch if: <ul style="list-style-type: none"> • if the LCS %R > UCL, apply J to all positive results • if the LCS %R < LCL, apply J to all positive results, apply R to all nondetects
Duplicate	One per preparation and analytical batch	RPD < 30%	None	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if: <ul style="list-style-type: none"> • %R for MS or MSD > UCL • %R for MS or MSD < LCL • MS/MSD RPD > CL
MDL study	Once per year	Detection limits established shall be < the RLs ^c	None	Apply R to all results for the specific analyte(s) in all samples analyzed
Results reported between MDL and RL	None	None	None	Apply F to all results between MDL and RL

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cQuality control acceptance criteria includes the following:

- RL – Water = 20 mg/L (TDS) 10mg/L (TSS)
- Accuracy Water (% R) = 70-130 percent
- Precision Water (RPD) = ±30 percent

TABLE B-9

QC Acceptance Criteria for Method E353 – Nitrogen, Nitrate-Nitrite

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Initial Calibration (4 standards and a blank)	Daily, prior to sample analysis	Correlation coefficient (r) > 0.995 Calibration MUST meet acceptance criteria prior to sample analysis.	1) Repeat outlying points. 2) Recalculate curve using valid points. 3) If still out, correct problem and recalibrate.	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Initial calibration verification (ICV)	Once per multipoint calibration	Within \pm 15% of expected value	1) Repeat ICV or CCV 2) If still out, identify and correct problem and repeat 3) If still out, repeat initial calibration.	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Continuing calibration verification (CCV)	After every 10 samples	85-115% recovery		
Method blank	1 per preparation batch and per analytical batch	< RL	1) If sample analyte concentration is < RL or if the sample analyte concentration is > 10 times the concentration in the method blank, then report results and write QCER. 2) If preparative method blank does not meet item 1), re extract/re-analyze if still within HT and enough sample volume; if not within HT or enough sample, contact project QA officer for decision.	Apply B to all results for the specific analyte in all samples in the associated analytical batch
Laboratory control sample (LCS), Matrix spike/matrix spike duplicate (MS/MSD)	1 LCS per preparation and per analytical batch 1 MS/MSD 5% each matrix	75-125% recovery and RPD < 25% and <30% for water and soil samples, respectively 75-125% recovery and RPD < 25% and <30% for water and soil samples, respectively	1) If the preparative LCS recovers high outside the acceptance criteria and the analyte is ND, flag the LCS results and write a QCER. 2) If the preparative LCS fails the acceptance criteria (other than shown in item 1), re extraction and reanalysis will be necessary if samples are still within holding time and enough sample volume; if not, contact the project QA officer for a decision for possible resampling. If the MS and/or MSD is outside of either accuracy or precision tolerances and LCS results are acceptable, flag MS/MSD results and write QCER.	For specific analyte in all samples in the associated analytical batch if: <ul style="list-style-type: none"> • The LCS %R > UCL, apply J to all positive results • The LCS %R < LCL, apply J to all positive results, apply R to all nondetects
Reduction check samples (same as LCS)	At start of analytical batch	NO ₃ -N peak response must equal NO ₂ -N peak response within \pm 15% .	Adjust hydrafine concentration.	Apply B to all results for the specific analyte in all samples in the associated analytical batch
Equipment blank	10% per site per matrix	< RL	Immediately notify project QA officer or field chemist so they can correct sampling or sample transfer procedures to eliminate contamination. ^c	Apply B to all results for the specific analyte in all samples in the associated analytical batch

TABLE B-9

QC Acceptance Criteria for Method E353 – Nitrogen, Nitrate-Nitrite

Temperature blank	Every cooler	4°C ± 2°C	Immediately notify project QA officer or field chemist so they can modify sample packing and/or preservation procedures; recollect samples if necessary.	Apply B to all results for the specific analyte in all samples in the associated analytical batch
Field duplicate	Minimum 10% of field samples	RPD < 50%	Project chemist will evaluate results for possible source of variability; notify data users.	Apply B to all results for the specific analyte in all samples in the associated analytical batch

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cIf equipment blank is submitted to the laboratory blind, the corrective action is not applicable.

Notes:

Water (RL) = 0.1 mg/L

TABLE B-10

QC Acceptance Criteria for Method E350 – Nitrogen, Ammonia (E350.2)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Initial Calibration (4 standards and a blank)	Daily before analysis	$r > 0.995$ Calibration MUST meet acceptance criteria prior to sample analysis	Identify and repeat outlying point(s); recalculate curve using repeated point(s).	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Initial calibration verification (ICV) and continuing calibration verification (ccv)	Daily before first batch is analyzed	Response within $\pm 15\%$	1) Repeat continuing calibration verification (CCV). 2) If still out, identify and correct problem. 3) Recalibrate and reanalyze all samples analyzed since last valid CCV.	Apply R to all results for specific analyte(s) for all samples associated with the calibration
Method blank	1 per preparation batch and analytical batch	< RL	1) If sample analyte concentration is < RL or if the sample analyte concentration is > 10 times the concentration in the method blank, then report results and write QCER. 2) If preparative method blank does not meet item 1), re-extract/re analyze if still within HT and enough sample volume; if not within HT or enough sample, contact project QA officer for decision.	Apply B to all results for the specific analyte in all samples in the associated analytical batch
Laboratory control sample (LCS)	1 per preparation batch and analytical batch	75-125% recovery	1) If the preparative LCS recovers high outside the acceptance criteria and the analyte is ND, flag the LCS results and write a QCER. 2) If the preparative LCS fails the acceptance criteria (other than shown in item 1), re-extraction and reanalysis will be necessary if samples are still within holding time and enough sample volume; if not, contact the project QA officer for a decision for possible resampling.	For specific analyte in all samples in the associated analytical batch if: <ul style="list-style-type: none"> • The LCS %R > UCL, apply J to all positive results • The LCS %R < LCL, apply J to all positive results, apply R to all nondetects
Matrix spike/matrix spike duplicate (MS/MSD)	5% for each matrix	75-125% recovery and RPD <25%	If the MS and/or MSD is outside of either accuracy or precision tolerances and LCS results are acceptable, flag MS/MSD results and write QCER.	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if: <ul style="list-style-type: none"> • %R for MS or MSD > UCL • %R for MS or MSD < LCL • MS/MSD RPD > UCL
Equipment blank	10% per site per matrix	< RL	Immediately notify project QA officer or field chemist so they can correct sampling or sample transfer procedures to eliminate contamination. ^c	Apply B to all results for the specific analyte in all samples in the associated analytical batch
Temperature blank	Every cooler	4°C \pm 2°C	Immediately notify project QA officer or field chemist so they can modify sample packing and/or preservation	Apply B to all results for the specific analyte in all samples in the associated

procedures; recollect samples if necessary.

analytical batch

TABLE B-10

QC Acceptance Criteria for Method E350 – Nitrogen, Ammonia (E350.2)

Field duplicate	Minimum 10% of field samples	RPD ~ 50%	Project chemist will evaluate results for possible source of variability; notify data users.	Apply B to all results for the specific analyte in all samples in the associated analytical batch
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^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cIf equipment blank is submitted to the laboratory blind, the corrective action is not applicable

Notes:

RL – Water = 0.3 mg/L

RL – Soil = 15 mg/kg

TABLE B-11

QC Acceptance Criteria for Method E130.2 – Total Hardness

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Titrant standardization	Daily (prior to sample analysis)	None	None	None
Initial calibration verification	After standardization and before sample analysis	Analyzed result within 90-110% of the true value concentration ±	Correct problem then repeat standardization	Apply R to all results for specific analyte(s) for all samples associated with the standardization
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria ^c	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
Method Blank	One per preparation and analytical batch	<RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) in all samples in the associated analytical batch
Laboratory Control Sample (LCS)	One per preparation and analytical batch	QC acceptance criteria ^c	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte(s) in all samples in the associated analytical batch if: <ul style="list-style-type: none"> • The LCS %R > UCL, apply J to all positive results • The LCS %R < LCL, apply J to all positive results, apply R to all nondetects
MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria ^c	None	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if: <ul style="list-style-type: none"> • %R for MS or MSD > UCL • %R for MS or MSD < LCL • MS/MSD RPD > CL
MDL study	Once per year	Detection limits established shall be < the RLs ^c	None	Apply R to all results for the specific analyte(s) in all samples analyzed
Results reported between MDL and RL	None	None	None	Apply F to all results between MDL and RL

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cQuality control acceptance criteria includes the following:

RL – Water = 10 mg/L

Accuracy Water (% R) = 75-125 percent

Precision Water (RPD) = ±25 percent

TABLE B-12

QC Acceptance Criteria for Method SW9030 or E376 – Sulfide

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
Titrant standardization	Daily (prior to sample analysis)	None	None	None
Initial calibration verification (ICV)	After standardization and before sample analysis	Analyzed result within 90-110% of the true value concentration ±	Correct problem then repeat standardization	Apply R to all results for specific analyte(s) for all samples associated with the standardization
Demonstrate ability to generate acceptable accuracy and precision using four replicate analyses of a QC check sample	Once per analyst	QC acceptance criteria ^c	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
Method blank	One per analytical batch	No Sulfide detected > RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte in all samples in the associated analytical batch
LCS for Sulfide	One LCS per analytical batch	QC acceptance criteria ^c	Correct problem then reprep and analyze the LCS and all samples in the affected AFCEE analytical batch	For specific analyte in all samples in the associated analytical batch if: <ul style="list-style-type: none"> • The LCS %R > UCL, apply J to all positive results • The LCS %R < LCL, apply J to all positive results, apply R to all nondetects
MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria ^c	None	For the specific analyte in all samples collected from the same site matrix as the parent, apply M if: <ul style="list-style-type: none"> • %R for MS or MSD > UCL • %R for MS or MSD < LCL • MS/MSD RPD > CL
MDL study	Once per year	Detection limits established shall be < the RLs ^c	None	Apply R to all results for the specific analyte in all samples analyzed
Results reported between MDL and RL	None	None	None	Apply F to all results between MDL and RL

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

^cQuality control acceptance criteria includes the following:

- RL – Water = 2.0 mg/L
- RL – Soil = 20 mg/kg
- Accuracy Water (% R) = 75-125
- Accuracy Soil (% R) = 75-125
- Precision Water (RPD) = ±25 percent
- Precision Water (RPD) = ±25 percent

TABLE B-13A

RLs for Method NWTPH-Hydrocarbon Fraction Analysis of Aromatics and Aliphatics by NWTPH-EPH/VPH

Parameter/Method	Analyte	Water		Soil	
		RL	Unit	RL	Unit
Volatile Petroleum Hydrocarbons (VPH)	VPH Aromatics				
	C8-10	5	µg/L	5	mg/kg
	C10-12	5	µg/L	5	mg/kg
	C12-13	5	µg/L	5	mg/kg
	<i>VPH Aliphatics</i>				
	C5-6	5	µg/L	5	mg/kg
	C6-8	5	µg/L	5	mg/kg
	C8-10	5	µg/L	5	mg/kg
	C10-12	5	µg/L	5	mg/kg
	Extractable Petroleum Hydrocarbons (EPH)	<i>EPH Aromatics</i>			
C8-10		50	µg/L	5	mg/kg
C10-12		50	µg/L	5	mg/kg
C12-16		50	µg/L	5	mg/kg
C16-21		50	µg/L	5	mg/kg
C21-34		50	µg/L	5	mg/kg
EPH Aliphatics					
C8-10		50	µg/L	5	mg/kg
C10-12		50	µg/L	5	mg/kg
C12-16		50	µg/L	5	mg/kg
C16-21		50	µg/L	5	mg/kg
C21-34		50	µg/L	5	mg/kg

TABLE B-13B
 QC Acceptance Criteria for Method NWTPH EPH/VPH

Method	Analyte	Accuracy Water (% R)	Precision Water (% RPD)	Accuracy Soil (% R)	Precision Soil (% RPD)
VPH	VPH all carbon ranges Aromatic and aliphatic	60-140	≤ 30	60-140	≤ 50
EPH	EPH all carbon ranges aromatic and aliphatic	60-140	≤ 30	60-140	≤ 50
	<i>Surrogate:</i>				
VPH	Chlorobenzene	60-140		60-140	
	Octacosane	60-140		60-140	
EPH	Ortho-Terphenyl	60-140		60-140	
	Tricontane	60-140		60-140	

TABLE B-13C
 Summary of Calibration and QC Procedures for Method NWTPH-Quantitative Hydrocarbon Fraction Analysis

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
NWTPH (EPH and VPH)	Volatile and Extractable Total Petroleum Hydrocarbons	Five-point initial calibration for all carbon ranges aromatic and aliphatic. Quantitation is done from the middle carbon in the group, i.e., C11 for CF10-C12	Initial calibration prior to sample analysis	Linear – mean RSD for all analytes $\leq 20\%$ Linear – least squares regression $r \geq 0.995$ Non-linear – COD ≥ 0.990 (six points shall be used for second order, seven points shall be used for third order)	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Second-source calibration verification	Once per five-point initial calibration	Analyzed result within 75-125% of the true value concentration.	Correct problem then repeat initial calibration	Apply R to all results for specific analyte(s) for all samples associated with the calibration
		Continuing calibration verification	Daily, before sample analysis After every 10 samples and at the end of the analysis sequence	All concentration levels of hydrocarbon fractions within $\pm 15\%$ of expected value All concentration levels within $\pm 15\%$ of initial calibration	Correct problem then repeat initial calibration Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Apply R to all results for specific analyte(s) for all samples associated with the calibration Apply R to all results for the specific analyte(s) in all samples since the last acceptable calibration verification
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 13	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst
		Method blank	One per analytical batch	No hydrocarbon fractions detected \geq RL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Apply B to all results for the specific analyte(s) above the RL in all samples in the associated analytical batch

TABLE B-13C

Summary of Calibration and QC Procedures for Method NWTPH-Quantitative Hydrocarbon Fraction Analysis

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action ^a	Flagging Criteria ^b
		LCS for all analytes	One LCS per analytical batch	QC acceptance criteria, Table 13	Correct problem then reanalyze If still out, reprep and reanalyze the LCS and all samples in the affected AFCEE batch	For specific analyte(s) in all samples in the associated analytical batch if: <ul style="list-style-type: none"> The LCS %R > UCL, apply J to all positive results The LCS %R < LCL, apply J to all positive results, apply R to all non-detects
		Surrogate spike	Every sample, spiked sample, standard, and method blank	QC acceptance criteria, Table 13	Correct problem then reextract and analyze sample	For the samples if: <ul style="list-style-type: none"> The %R > UCL for any surrogate, apply J to all positive results The %R < LCL for any surrogate, apply J to all positive results, apply R to all non-detects Any surrogate recovery is < 10%, apply R to all results
		MS/MSD	One MS/MSD per every 20 Air Force project samples per matrix	QC acceptance criteria, Table 13	None	For the specific analyte(s) in all samples collected from the same site matrix as the parent, apply M if: <ul style="list-style-type: none"> %R for MS or MSD > UCL %R for MS or MSD < LCL MS/MSD RPD > CL
		Retention time window calculated	Each initial calibration	calculate retention time based on C10 through C40 alkanes	Correct problem then reanalyze all samples analyzed since the last valid retention time check	Apply R to the results from the sample
		MDL study	Once per 12 month period	Detection limits established shall be $\leq \frac{1}{2}$ the RLs in Table 13	None	Apply R to all results for the specific analyte(s) in all samples analyzed
		Results reported between MDL and RL	None	None	None	Apply F to all results between MDL and RL

^aAll corrective actions associated with AFCEE project work shall be documented, and all records shall be maintained by the laboratory.

^bFlagging criteria are applied when acceptance criteria were not met and corrective action was not successful or corrective action was not performed.

TABLE B-14
Summary of Calibration and QC Procedures for Method EPA 331 or SW6850,
Perchlorate Analysis (Minimum QC Requirements for MS Methods)

Reporting Limits : Groundwater 0.2 µg/L Soil 2 µg/Kg

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/Flagging Criteria	Comments
Holding Time (HT)	All samples	Headspace should be about one-third of the container. HT < 28 days (to be consistent with other EPA requirements) with samples stored at 4 °C +/- 2 °C.	None, qualify data with a Q-flag.	
Method Reporting Limit	With every initial calibration	Documented in the specific matrix of concern, at or below the applicable regulatory limit. Equal to lowest calibration standard.		
Limit of Quantitation (LOQ)	With every initial calibration.	Documented in the specific matrix of concern, at or below the applicable regulatory limit. Equal to lowest calibration standard. At least 3 times the MDL/LOD.	Apply J-flag to all results between LOD and LOQ.	
Method Detection Limit (MDL)	A full MDL study is conducted at initial setup and subsequently once per 12-month period and when major changes occur in the method's operating procedures (addition of cleanup procedures, column changes, mobile phase changes). If no changes have been made to the method, quarterly MDL verification checks may be performed in lieu of the yearly MDL study.	MDL study must be performed in the matrix of interest using a standard at a concentration that is 1 to 10 times the estimated MDL value. MDL must be validated through the analysis of a low-level spike at ~ 2 times MDL taken through the entire preparation process. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or re-perform MDL study.	Samples cannot be analyzed without a valid MDL.
Retention Time (window width calculated for each analyte and internal standard)	At method setup and after major maintenance (e.g., column change).	Width is + 3 times standard deviation for each analyte retention time from 72-hour study.	N/A	N/A

TABLE B-14
Summary of Calibration and QC Procedures for Method EPA 331 or SW6850,
Perchlorate Analysis (Minimum QC Requirements for MS Methods)

Reporting Limits : Groundwater 0.2 µg/L Soil 2 µg/Kg

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/Flagging Criteria	Comments
Retention Time Window (position establishment)	Once per ICAL and at the beginning of the analytical shift	Position shall be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.	N/A	N/A
Initial Calibration (ICAL)	Initial calibration prior to sample analysis.	Minimum of 5 calibration standards to establish linearity (daily), $r > 0.995$ or with an RSD for each analyte (including MRL) of $< 20\%$. The calibration is linear and shall not be forced through the origin. The concentration corresponding to the absolute value of the calibration curve's Y-intercept must be \leq LOD.	Correct problem, then repeat initial calibration. Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until ICAL has passed.
Second Source Calibration Verification (SSCV)	Once after each multipoint calibration, analysis of a second source standard at the midpoint of the calibration.	Value of second source for perchlorate within $+ 10\%$ of expected value (initial source).	Correct problem and verify second source standard. Rerun SSCV. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. No samples may be run until SSCV has passed.
Initial Calibration Verification Standard (ICV)	After initial calibration, daily analysis of a standard at the midpoint of the calibration.	%Difference $< 15\%$ relative to initial value.	Correct problem and rerun ICV. If that fails, correct problem and repeat initial calibration. Flagging criteria are not appropriate. No samples may be run until calibration has been verified.	Problem must be corrected. No samples may be run until calibration has been verified.
Continuing Calibration Verification Standard (CCV)	Analysis of mid-level standard after every 10 samples. All samples should be bracketed by the analysis of a standard demonstrating that the system was capable of accurately detecting and quantifying perchlorate.	%Difference $< 15\%$ relative to initial value.	Correct problem and rerun CCV and all samples analyzed since last successful CCV. If that fails, apply Q-flag to all results in all samples since the last acceptable calibration verification, if reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.

TABLE B-14
Summary of Calibration and QC Procedures for Method EPA 331 or SW6850,
Perchlorate Analysis (Minimum QC Requirements for MS Methods)

Reporting Limits : Groundwater 0.2 µg/L Soil 2 µg/Kg

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/Flagging Criteria	Comments
Limit of Detection Verification Standard (LODV)	Analyze before and directly after every batch of samples is analyzed. It can be analyzed after every 10 samples in order to reduce the reanalysis rate.	Perchlorate spike concentration is approximately 2 times the limit of detection. Recovery within 30% of its true value. If a sample with perchlorate concentration at or between the LOD and RL is bracketed by a failing LODV, it must be reanalyzed. A sample with concentration above the RL can be reported.	Correct problem and rerun LODV and all samples analyzed since last successful LODV. If that fails, apply Q-flag to all results in all samples since the last acceptable calibration verification, if reanalysis is not possible.	No samples may be analyzed until the problem has been corrected.
Interference Check Sample (ICS)	One ICS is extracted with every batch of 20 samples. It verifies the method performance at the matrix conductivity threshold (MCT). At least one ICS must be analyzed daily.	Analysis of a standard containing perchlorate at the RL and interfering anions at the concentration determined by the interference threshold study. Monitor recovery of perchlorate and retention time. Recovery within 30% of the true value.	Correct problem and then reanalyze all samples in that batch. If poor recovery from the cleanup filters is suspected, a different lot of filters must be used to reextract all samples in the batch. If column degradation is suspected, a new column must be calibrated before the samples can be reanalyzed.	No samples may be reported that are associated with a failing ICS.
Method Blanks (MB)	One per batch. Undergoes same pretreatment steps as the samples.	< ½ of the RL.	Correct problem, reprep, then reanalyze method blank and all samples processed with the contaminated blank. Apply B-flag to all results for the specific analytes in all samples in the associated preparatory batch if reanalysis is unsuccessful.	
Laboratory Control Sample (LCS)	Once per analytical batch spiked at the RL. Undergoes same pretreatment steps as the samples.	Recovery within method requirements or laboratory-generated limits, or 85-115% to verify calibration and to check method performance.	Correct problem, then reprep and reanalyze the LCS and all associated samples. If corrective action fails, apply Q-flag to all samples in the associated preparatory batch.	

TABLE B-14
Summary of Calibration and QC Procedures for Method EPA 331 or SW6850,
Perchlorate Analysis (Minimum QC Requirements for MS Methods)

Reporting Limits : Groundwater 0.2 µg/L Soil 2 µg/Kg

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/Flagging Criteria	Comments
Matrix Spikes (MS)	Collect one per 20 samples per matrix, spiked at the RL. Undergoes same pretreatment steps as the samples.	Recovery within 75-125%.	In the parent sample, apply J-flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the limits, the data must be evaluated to determine the source of the difference and to determine if there is a matrix effect or analytical error.
Matrix Spike Duplicates or Laboratory Duplicates (MS and MSD)	Collect one per 20 samples per matrix, spiked at the RL. Undergoes same pretreatment steps as the samples.	Recovery within MS limits, relative percent difference < 20%.	In the parent sample, apply J-flag if acceptance criteria are not met.	Evaluate the data to determine the source of the difference.
Laboratory Reagent Blank	Analyzed prior to calibration and after samples with overrange concentration of perchlorate and after each batch is analyzed.	Concentration < ½ RL.	Reanalyze reagent blank (until no carryover is observed) and all samples processed since the contaminated blank. Apply B-flag to all results not preceded by an acceptable reagent blank if reanalysis is not possible.	
Mass Tuning	Optimize setting of the mass spectrometer daily before sample analysis.	Tuning standards should contain the analytes of interest and meet acceptance criteria outlined in the laboratory SOP.	Retune instrument. If the tuning will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone.	Sample analysis should not proceed without an acceptable tuning.

TABLE B-14**Summary of Calibration and QC Procedures for Method EPA 331 or SW6850, Perchlorate Analysis (Minimum QC Requirements for MS Methods)****Reporting Limits :** Groundwater 0.2 µg/L Soil 2 µg/Kg

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/Flagging Criteria	Comments
Mass Calibration	Instrument must have a valid mass calibration prior to any sample analysis. The mass calibration is updated on an as-needed basis (QC failures, ion masses show large deviations from known masses, major instrument maintenance is performed, or the instrument is moved).	Mass calibration range must bracket the ion masses of interest without greatly exceeding the range. The most recent mass calibration must be used for an analytical run, and the same mass calibration must be used for all data files in an analytical run. Mass calibration must be verified by acquiring a full scan continuum mass spectrum of a perchlorate stock standard. Perchlorate ions should be within ± 0.3 m/z of mass 99, 101, and 107.	If the mass calibration fails, recalibrate. If it still fails, consult manufacturer instructions on corrective maintenance.	No samples may be analyzed under a failing mass calibration.
Isotope Ratio ³⁵ Cl/ ³⁷ Cl	Every sample, spiked sample, and standard and method blank.	Monitor for both the parent ion at mass 99/101 and the daughter ion at mass 83/85 for MS-MS methods or just 99/101 for MS only. Theoretical ratio ~ 3.06. Must fall within 2.3 to 3.8.	If criteria are not met, the sample must be rerun. If the sample was not pretreated, the sample should be reextracted using cleanup procedures. If, after cleanup, the ratio still fails, use alternative techniques to confirm presence of perchlorate (i.e., a post spike sample, dilution to reduce any interference, etc.). Data should be qualified as estimated (J-flag) and should be noted in the case narrative.	Decision to report data failing ratio check should be thoroughly documented in case narrative.
Internal Standard (IS)	Addition of ¹⁸ O-labeled perchlorate to every sample, spiked sample, standard, instrument blank, and method blank.	Measured ¹⁸ O IS area within + 50% of the value from the initial calibration. RRT of the perchlorate ion in a sample is the retention time of the perchlorate ion divided by the retention time of the internal standard. The RRT must be $1.0 \pm 2\%$ (0.98 – 1.02).	Rerun the sample at increasing dilutions until the + 50% acceptance criteria are met. If criteria cannot be met with dilution, the interference are suspected and the sample must be reprepiped using additional pretreatment steps. Data should be qualified as estimated with a Q-flag and should be discussed in the case narrative.	If peak is not within retention time window, presence is not confirmed. Use for quantitation and to ensure identification. Failing internal standard should be thoroughly documented in the case narrative.

TABLE B-14
Summary of Calibration and QC Procedures for Method EPA 331 or SW6850,
Perchlorate Analysis (Minimum QC Requirements for MS Methods)

Reporting Limits : Groundwater 0.2 µg/L Soil 2 µg/Kg

QC Element	Minimum Frequency	Criteria/Requirements	Corrective Action/Flagging Criteria	Comments
Interference Threshold Study	At initial setup and when major changes occur in the method's operating procedures (addition of cleanup procedures, column changes, mobile phase changes).	Measure the threshold of common suppressors (chloride, sulfate, carbonate, bicarbonate) that can be present in the system without affecting the quantitation of perchlorate. The threshold is the concentration of the common suppressors where perchlorate recovery falls outside an 85-115% window.	N/A	This study and site history will determine the concentration at which the ICS suppressors should be set.



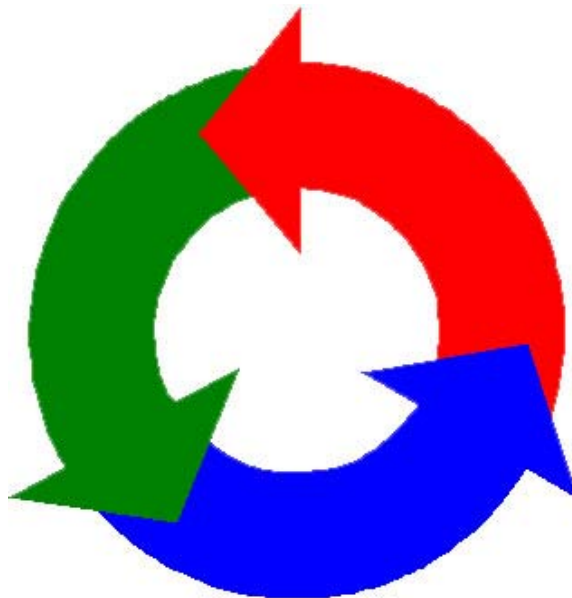
United States Air Force
15th Airlift Wing
Environmental Restoration Program

ENVIRONMENTAL RESTORATION PROGRAM

QUALITY ASSURANCE PROJECT PLAN FOR MULTIPLE PROJECTS FOR THE 15TH AIRLIFT WING

HICKAM AIR FORCE BASE

Oahu, Hawaii



APPENDIX C

Data Management Plan

Appendix C

Data Management Plan

C.1 Introduction

This 15th Airlift Wing (15 AW) Data Management Plan (DMP) was developed to provide operating guidelines to satisfy the data management requirements for large quantities of data. It is intended for use in site characterization and remedial activities on 15 AW installations. Deviations from this DMP will be stated in project-specific Work Plans.

The DMP provides the processes and guidelines for sample tracking, storage, access, delivery, and reporting of new chemical analytical, geologic, and spatial data generated by 15 AW investigation and cleanup operations. In addition, this plan addresses the management of historical data. Key data management objectives are identified and listed below.

- Provide data users with tools that allow relatively simple and rapid access to stored data of various types.
- Provide methods of data entry with known accuracy and efficiency.
- Apply well-documented data validation modifications to the electronic database.
- Manage sample data using a unique sample-identification number.
- Establish a sample inventory of new data collected and provide methods of sample-inventory reconciliation.
- Store and provide sample-specific attributes, including location identifier, sample type, sample media, depth, date, and target study area.
- Provide reporting and delivery formats from a single database source to support data analysis, site characterization, risk assessment, modeling, and spatial analysis.
- Provide the ability to electronically compare results to project-specific reference or screening criteria.
- Identify historical data needs and establish a database of this information when possible. Otherwise, establish a data inventory plan that identifies and catalogues historical data not suited for database entry.

To facilitate information use and decisionmaking, a set of guidelines and specifications has been developed for application development, personnel qualifications, guidelines for delivering data management services, and site characterization and remediation projects.

Included in this DMP are the specifications for the environmental database software application (project database) that will be used by all contractors for 15 AW installation operations. The project database to be used by the contractor will be briefly described in the project-specific Work Plan. Any project database deviations from the database specifications presented in this DMP will be stated in the project-specific Work Plan. The following specifications are provided to ensure compatibility of the project database with the Environmental Restoration Program Information Management System (ERPIMS) database and with 15 AW, 15th Civil Engineer Squadron/Restoration Element (15 CES/CEVR), and Air Force Center for Environmental Excellence (AFCEE) requirements. These specifications include the routines, processes, and guidelines for sample tracking, storage, access, delivery, and reporting of chemical analytical, geologic, and spatial data generated during site characterization, remedial investigation, and remedial action activities on the Base.

Certain historical and field data may not be suited for processing by the same environmental database application, depending on the nature of the data. Special databases will then be developed or adapted for historical data in project directories and will be catalogued for recordkeeping and ease of access.

This DMP also addresses cataloging, distribution, and storage of offsite and onsite laboratory data, field data, and historical data.

The DMP processes supplement the Environmental Restoration Quality Assurance Project Plan (ERP QAPP) for the 15 AW Installation Restoration Plan (IRP).

C.2 Data Management Activities

C.2.1 New Data Management

For new data being generated as part of field and laboratory operations, the data management system revolves around the following six somewhat overlapping phases of activity:

1. **Planning:** The approved sampling plan is used as the basis for incorporating sampling and analysis information into the sample tracking program (STP), which will be built into the project database.
2. **Fieldwork:** Field efforts are carried out according to information in the STP. A computerized STP is installed in the field and is continually updated to reflect real-time information. Field measurements are collected and catalogued for entry into the project database or the appropriate project file to facilitate report writing and generating ERPIMS deliverables.
3. **Sample analysis:** Analyses are performed in accordance with the ERP QAPP. Hardcopy and/or electronic data are delivered to the data management team in the agreed-upon format.

4. Data collection: Hardcopy and electronic data are entered into their respective physical and electronic placeholders, and are tracked, imported, and catalogued as appropriate.
5. Database management and data validation: The electronic data are checked for completeness and consistency with hardcopy data reports. Semi-automated data validation occurs using hardcopy and electronic data. All validation flags and findings will be stored in the project database, resulting in a relational database from sample tracking through validation.
6. Data reduction: ERPIMS files, summary statistics, plots, program-specific interface files, and reports are generated.

C.2.2 Historical Data Management

Some projects might incorporate historical environmental data that have been gathered by various contractors from previous investigations. Managing historical data is complicated by the fact that contractors often have unique data sampling, analysis, and management procedures. The variety of historical data sources and formats, including ecological reports, field data, analytical data, and geographic information system (GIS) data, must be addressed.

Historical data sources could include ERPIMS, Remedial Investigation (RI) reports, ecological reports, or contractor databases. Depending on their procedures, various environmental contractors might upload field data into ERPIMS differently. Because of this, ERPIMS data might be either raw or validated. Similarly, contractor environmental databases could contain both raw and validated data. Only data that have been presented in Air Force-approved reports (approved documents), such as RI reports, are assumed to have been validated.

To manage historical data in a manner that addresses the variety of sources and formats, along with concerns regarding data validation, the following procedures will be implemented:

1. Electronic data submitted to support data from approved documents on original data collection forms, logs, or laboratory reporting sheets will be checked against the appropriate written report to ensure its accuracy.
2. When data gaps occur, the data manager will make the data set as complete as possible by consulting the appropriate approved documents or completed laboratory reporting sheets, or through direct communication with the appropriate environmental contractor or laboratory staff. To the greatest possible extent, data will not be entered without a reliable source.
3. After data entry, the data will be assigned a quality control (QC) level for the data users that corresponds to the level of quality or validation that the data received from known, reliable sources. The QC levels are as follows:
 - Fully validated and qualified
 - Not validated or qualified

4. Program code (for example, table constraints, database triggers, and stored packages of procedures and functions) will be built into the project database to regulate data input and flag data that do not conform to established criteria for completeness, consistency, and uniformity. These data will be identified, corrected, and re-entered.
5. To verify that input regulation is effective, a minimum of 10 percent of the data that have passed these procedures will be randomly selected and checked against source documents. When a data set successfully completes this process, the status flags for the data set will be toggled for viewing by the data users.
6. User-requested changes to these data will be made, as appropriate, by the data manager.

C.2.3 Database Administration

The primary functions of the project data coordinator will be to design, develop, and maintain the project database and back up the data. Database design and development will focus on providing rapid data entry and data retrieval, while promoting data integrity through various automated procedures. Database maintenance will consist of the following:

- Allocating system storage for the database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting the database for more efficient operation
- Upgrading database software as necessary
- Providing for routine backup of the database to tape storage
- Maintaining an approved list of valid values for data consistency
- Maintaining redundancy control to ensure that each data record is unique and consistent with conventions
- Performing routine virus checks on incoming and outgoing data

C.2.4 GIS Integration

Data that can be located on a map is said to have a geographic or spacial reference. Geographical Information System (GIS) software is designed to efficiently manage this kind of information. A GIS provides software applications designed specifically for storing, managing, manipulating, analyzing, and displaying spatially related data. Integrated with other software applications, such as models and facility information management software, a GIS is unparalleled in its ability to support detailed data analysis, decisionmaking, and information display.

GIS capabilities rely on a common “base map.” The map may be available from public sources, from relevant departments at the facility, or may be created specifically for the purposes of supporting the GIS. The scale and reference on the GIS may vary from facility

to facility; however, at any given facility, this needs to be established and remain unchanged for the duration of the project.

From the base map, features are determined and feature coded. Features may be either natural or man made – a river could be identified and coded, or buildings and utility lines could be identified as well.

All spatial data is managed according to the (Tri Services) Spatial Data Standard. All physical locations of sampling activities (such as samples or wells) will be spatially referenced to the standard base map, and will be coded according to the Spatial Data Standard.

The project database will be formatted to provide the capability to generate summary statistics by site, location, and matrix. Wherever possible, the data should be in a format compatible for GIS upload and use.

GIS capabilities enhance the following functions:

- Decision making
- Providing easy data access to a variety of end users
- Developing models
- Making predictions about the behavior of contaminant plumes and other environmental variables
- Performing spatial, statistical, and measurement operations and related analyses
- Generating reports
- Operating graphical display, including three-dimensional display
- Designing and planning ecological activities
- Tracking environmental compliance and monitoring

C.2.5 ERPIMS ERPTools/PC Submittal

Installation Restoration Program (IRP) data will be submitted to the Human Systems Division of the Air Force (HSD) in an electronic format compatible with the latest version of ERPIMS. The ERPIMS ERPTools/PC software program will be used to generate ERPIMS submittals from data in the project database. ERPIMS is a relational database maintained by HSD to store, analyze, and report information used for the Air Force IRP. The reporting requirements and file specifications are detailed in the *ERPIMS Data Loading Handbook* (Handbook) (AFCEE, October 1997).

The project database will contain modules and queries that prepare American Standard Code for Information Interchange (ASCII) files in the correct format for loading into ERPTools/PC for data validation before import into ERPIMS, using the same data that is used for remedial investigation/feasibility study (RI/FS) activities. All data delivered to

HSD will be consistent with the ERPIMS reporting formats and valid values lists. Analytical data used to generate ERPIMS files are exactly as delivered from the laboratories, as required by ERPIMS. Validated data are not used in ERPIMS, in accordance with ERPIMS guidelines.

C.3 Database Management System

The following sections identify the required project databases and their relationships to each other. In addition, they discuss the procedures and tools that maintain data integrity and security through automation of repetitive tasks, data verification through valid values and redundancy control, security and controlled access to the stored data, and file backup.

C.3.1 Project Database Requirements

The project database will be a relational database system that stores information in a series of data tables. Relational database systems are designed so that each piece of information is stored only once. Data tables can then be linked so that duplication of fields in multiple tables is avoided. This architecture saves storage space in the computer, eliminates the need to update the same information in more than one location in the database, speeds up data manipulation for large data files, and avoids potential errors created by updating the same information more than once.

The project database will allow the database user to save a menu of standard queries, forms, and reports that will potentially be repeated many times, as the data contained in the database are updated. Queries are developed by the database operator using a graphical user interface (GUI) provided by the project database. Requested information is output into user-defined reports and forms, and is available for manipulation, interpretation, or export to other data-interpretation tools. The project database should support a number of transfer formats, such as ASCII text files, Microsoft Excel, Lotus 1-2-3, Symphony, rich-text format (.RTF) files for Microsoft Word, and other Windows word processing packages, such as Btrieve, Paradox, and dBase formats.

It is essential for the project database to provide features to enhance data management, such as the following:

- Generation of sample bottle labels, chain-of-custody (COC) forms, and daily field-instruction reports
- Automated electronic loading of laboratory analytical results
- Semi-automated hand entry of analytical results when data are not electronically available
- Built-in quality assurance/quality control (QA/QC) routines to protect against data redundancy and errors

- Routines that electronically compare results to project-specific reference or screening criteria
- Standard but flexible reporting and delivery formats from a single database source in support of data analysis, site characterization, and risk assessment
- Data exported to or linked directly with a variety of GIS or data visualization packages
- Semi-automated data validation using electronic data loaded from offsite and onsite laboratories; this feature facilitates the dissemination of validated data in a timely fashion
- Semi-automated generation of ERPIMS files and interfacing with the ERPIMS Contractor Data Loading Tool to prepare ASCII files in the correct format.

A suggested database structure is described below. It is not mandatory that project databases adhere to this structure, but this example structure is described to suggest how an efficient, automated, relational environmental database can be constructed.

The project database described here consists of four linked database modules. Each module focuses on a different activity in the data life cycle and is menu- and form-driven for ease of use. The four linked database modules are as follows:

1. **Field Data:** This module contains all required information and programming to print daily field work sheets, container labels, COC forms, and to track any deviations in sampling from the approved Sampling and Analysis Plan (SAP). This module performs most of the Sample Tracking Program (STP) field functions. All pertinent information from the SAP is loaded into the Field Data module as a series of tables and is linked to all other modules for later processing. The main data tables would contain all pertinent SAP information and all pertinent real-time COC information.
2. **Analytical Data:** This module contains all required programming to load laboratory data both automatically through laboratory electronic data (EDATA) or manually for certain field laboratory data; verify data completeness and agreement with the data in the Field Data module; provide quality control for valid values; and be the ultimate repository for all validated data. In addition, this module tracks turnaround times, data validation status, simulated invoicing based on contract pricing, and receivable inventories. The main tables would include all analytical data as they arrive from the laboratories, all validation information generated from a validation module (see [3.] below), and all pertinent information for submittals. With linkage to a Field Data Module, these three tables contain the information necessary to do data calculations, generate statistical summaries, generate many of the ERPIMS tables, and provide for Informal Technical Information Report (ITIR) generation and QC summary reports.
3. **Data Quality Evaluation:** This module can include a series of forms that assist in semi-automated data validation. The validation information includes the data validation flags, an explanation of each flag, and a final flag that is the most severe

flag. The main tables are a "Report" table, which includes all explanatory text that is necessary for generating validation reports, and a number of look-up tables that contain project-specific QC acceptance criteria to compare actual QC performance to acceptance criteria. The data validator can be prompted to review exceedances, and if the data validator agrees with the module's conclusions, then validation flags are automatically added to the validation tables in the Analytical Data module through forms and query.

The validation reports are automatically printed at the conclusion of each validation session that summarizes the validation conclusion (report generated by sample delivery group). The validation reports include statistical summaries of flags and flagging reasons using the information in the Analytical Data module validation tables.

4. Standard Report Generator: This module contains all programming routines, forms, and reports necessary for generating project-specific reports and is linked to the tables in the other three modules. This module is used for ERPIMS generation, ITIR and data summary reports, and data calculations and reports. The main tables in this module, , in addition to the standard linked tables, can include, as applicable, those tables needed for risk calculations and comparisons to trigger levels. In addition, this module contains routines and reports to generate boring logs electronically based on data input from ERPIMS files.
5. Custom Report Generator: This module will use a standard report-generating software package (such as Crystal Reports or a competitive product) which will allow the user to extract data from a relational database and generate a user-defined columnar report. Reports which are commonly used may be added to the standard report package. The custom report generator will allow the end user to have read-only access to the data and will maintain the data set intact.

C.3.2 Automation

As described above, nearly all operations are either completely automated or semi-automated. The use of automated routines that have been quality controlled speeds up data entry or processing and improves data consistency and quality. Automation includes the use of proven queries, forms, reports, and statistical modules for entering manual data, controlling electronic data quality, and generating export files or reports.

Streamlined Manual Entry

Manual entry is usually reserved for data such as field screening analytical data, field lithological data, some offsite laboratory data for bioassessment, and corrections to electronic data that are better served by modifying already imported data sets as opposed to deleting and re-importing entire data files. Manual entry can be facilitated by project database data-entry forms that allow only the entry of valid values and can allow two separate technicians to enter the same data and compare the two for accuracy. Prompts and menus would facilitate this process.

Electronic Input

All electronic input of laboratory data can be accomplished in the DAT module through menus and forms that perform various quality control routines. The QC routines include, but are not limited to, routines that compare the received data to the data requested in the FLD module; check valid values or update lab-specific values to valid values; record receipt and prepare draft invoices; and calculate turnaround times for contract compliance. The data format and content requested from the laboratories include all necessary information for risk assessment, data validation, and generation of Group 3 ERPIMS files. AFCEE projects have unique requirements because of the subtle but critical differences in the requirements of the *AFCEE Model Quality Assurance Project Plan, Version 4.0.01* (AFCEE QAPP) (AFCEE, May 2005) and ERPIMS.

All electronic data will have field names in the first row of the comma-delimited ASCII files; valid values for the fields listed above are provided by the project data manager.

C.3.3 Data Verification

Valid Values

Valid values are critical to any large relational database. Inconsistencies in naming conventions, subtle analyte or method spelling differences, and non-standard abbreviations can result in lost data and incorrect conclusions. Most tables and forms in the four project database modules or in any environmental database can use look-up tables for acceptable valid values and will not allow the entry of data that does not conform. Valid value look-up tables are an essential component of ERPIMS generation and originate in the project database.

Redundancy Control

A primary purpose of managing data in the database environment is to ensure that each data record is unique and that the information contained within each field is consistent with conventions defined in other areas of the database. To ensure uniqueness, a key field or fields will be identified for each data record. Key fields define the record as unique.

To maintain consistency with naming conventions used in a database, the project database should allow the establishment of parent-child relationships between database files. These relationships can be facilitated by configuring database tables to “look up” to the proper parent table. Strategies for enforcing parent-child relationships are different for electronic versus manual data entry.

Each set of key data has a placeholder established, usually from the SAP or QAPP data tables for sample-analyses combinations and for QC criteria, for example. As data are entered, the placeholder is toggled and no further entries are possible without user intervention.

Electronic data entry into the database will require that all parent-child relationships be verified following the data input process. For manual data entry, forms and tables utilize a feature that allows only valid entries into a database, including fields that can look up to other fields in a parent table and fields that can be set up to default for a specific value or

only accept certain alphanumeric characters. The followup integrity checks are minimized with these fields constrained.

The key tables could be located in the modules described above. No duplication of tables is required and all tables used between modules are “attached.” That is, the tables reside in one place, but may be accessed by other modules for use in their respective processes. This allows for the segregation of processes without the need for multiple copies of data and redundancy and version control problems.

Table C-1 provides a sample format for laboratory electronic data.

C.3.4 Security and Access

Log In

All data modules (except for the FLD module during the field event) are stored on a secured section of the local area network (LAN) established for a project, with access restricted to those in the data management project team. Each module has the capability of password and capability restrictions that are applied as the project progresses and the team members are finalized. Access to select portions of the database is automatically recorded with name, date, and time. In addition, key forms and processes can have automatic access recording for data entry and changes.

Virus Checking

All files received from subcontractors will be scanned for common viruses using standard, current virus protection programs.

C.3.5 File Backup

All project database files should be backed up daily. These backup files should be saved for up to 6 months. Monthly backups will be kept for a minimum of 10 years. Main project files will be backed up on a secure location and medium monthly.

C.4 Data Flow

C.4.1 Historical Data

Required historical data will be added to the new data tables constructed in the project database, where appropriate. In some instances, these data will not be the type or format for input into the project database system and will have their own unique structures. The historical data process is shown on Figure C-1.

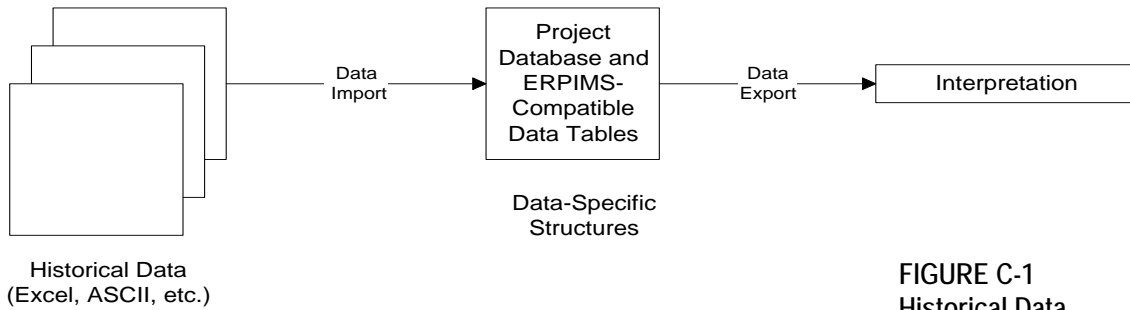


FIGURE C-1
 Historical Data

Data that are not suited for database entry will be stored and cataloged in the most appropriate manner to be determined for each data type. All data in electronic format, or that can be easily put into electronic files, will be stored electronically in a secure data storage area designated for each project.

C.4.2 Planning Data

Planning data are generated during preparation of the Work Plan. Types of planning data that include site identification, location identification, and hydrogeologic classification are used primarily for sample identification and ERPIMS submittals. Site and location information is included on sample labels and CoC forms and is processed through the project database FLD module. Site and location conventions will be defined according to 15 AW expectations and in consultation with ERPIMS. The planning data process is shown in Figure C-2.

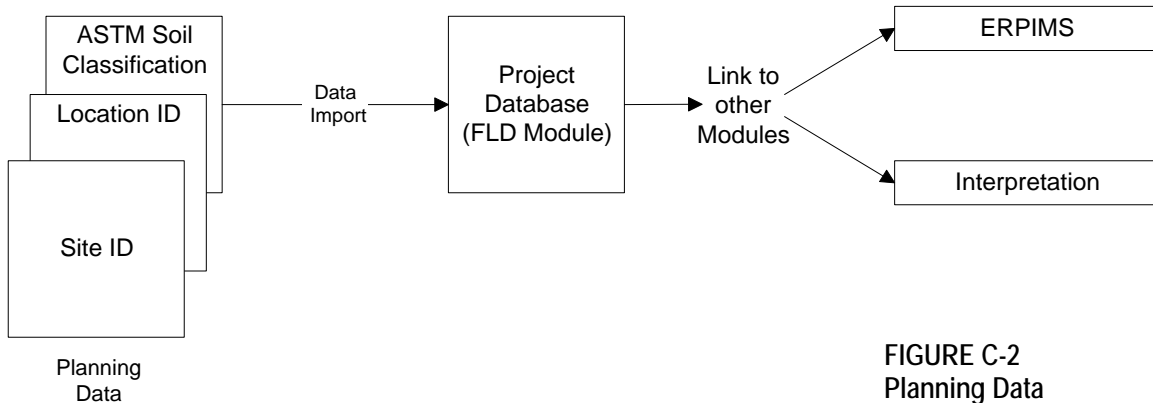


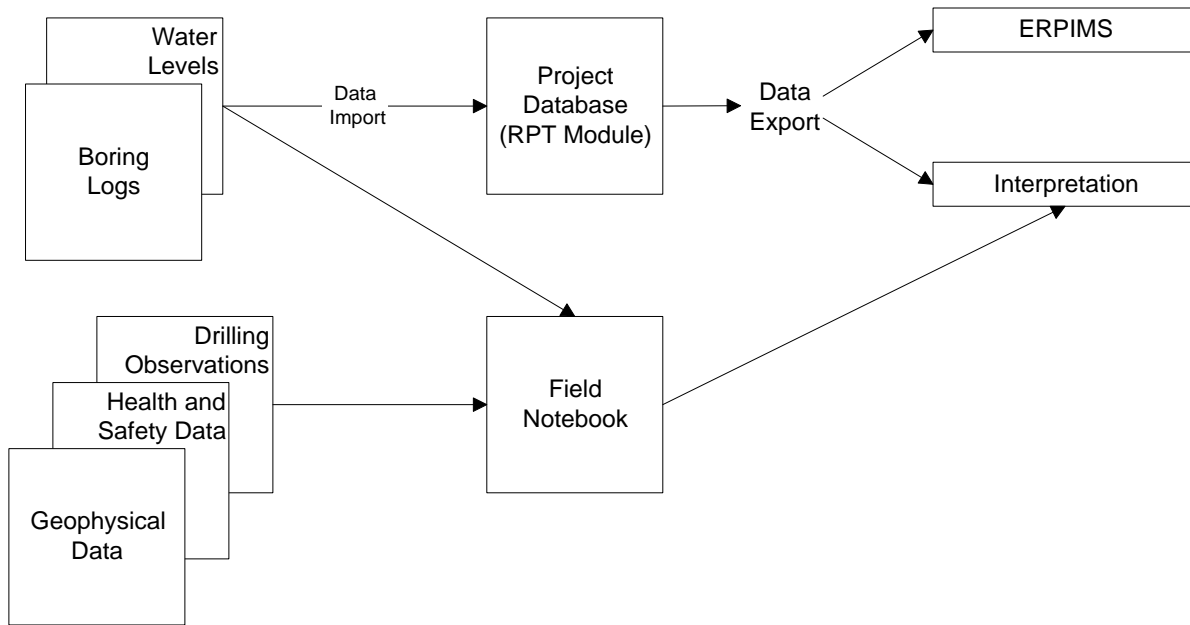
FIGURE C-2
 Planning Data

C.4.3 Soil Boring and Lithologic Data

All of the information collected during the drilling of borings for well or piezometer installation is recorded on soil boring log forms and in field notebooks.

The information recorded manually on the soil boring log form includes: drilling contractor and equipment used, surface elevation and State Plane coordinates of the boring location, start and finish dates for the boring, the personnel responsible for logging the lithology, the

groundwater elevation if encountered, the lithologic description and American Society for Testing and Materials (ASTM) classification codes of soil samples collected during drilling, and organic vapor monitor (OVM) readings. The soil boring and lithologic data process is shown on Figure C-3.



Soil Boring and
Lithologic Data

FIGURE C-3
Soil Boring and Lithologic Data

The ultimate disposition of these data, once they are transmitted back to the office, depends on the data type. The field notebooks, boring log forms, and geophysical logs will be organized into project notebooks and archived in the project files. However, certain types of information will also be extracted and manually entered into the project database for use in ERPIMS and other export files.

C.4.4 Well Construction Data

The data collected during well construction include the physical aspects of the well or the piezometer being constructed. Much of these data are included in the final ERPIMS submittal. This includes the depths of the screen interval, filter pack and sanitary seal, casing and well screen diameter and type, gradation of the filter pack used, and grout mixture used to install the sanitary seal and other parameters. Additional information recorded during well construction includes borehole diameter, information on backfill material used, specifications of any conductor casing installed, and a description of the surface completion of the well. This information is recorded on a well construction log or diagram completed at the time of well construction. The well construction logs are

organized into project notebooks and archived in the project files. The well construction data process is shown on Figure C-4.

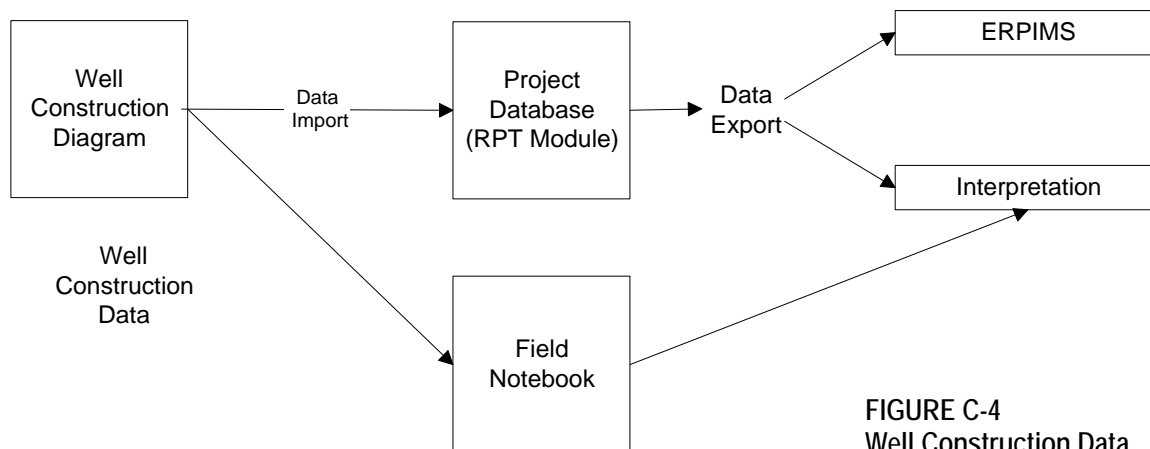


FIGURE C-4
Well Construction Data

C.4.5 Well Development Data

The type of information that is collected during development includes the location in the well screen where surging is performed and the duration of surging, flow rate and duration of development pumping stages, static groundwater elevations in the well and water levels during development pumping, observations made during bailing of sediments from the well or during development pumping, and water quality measurements made on the development water throughout the development process. The water quality parameters measured during development include pH, electrical conductivity (EC), turbidity, dissolved oxygen (DO), and temperature. The information collected during development will be recorded in an Excel well-development spreadsheet. The electronic files will be imported into the database. The well development data process is shown on Figure C-5.

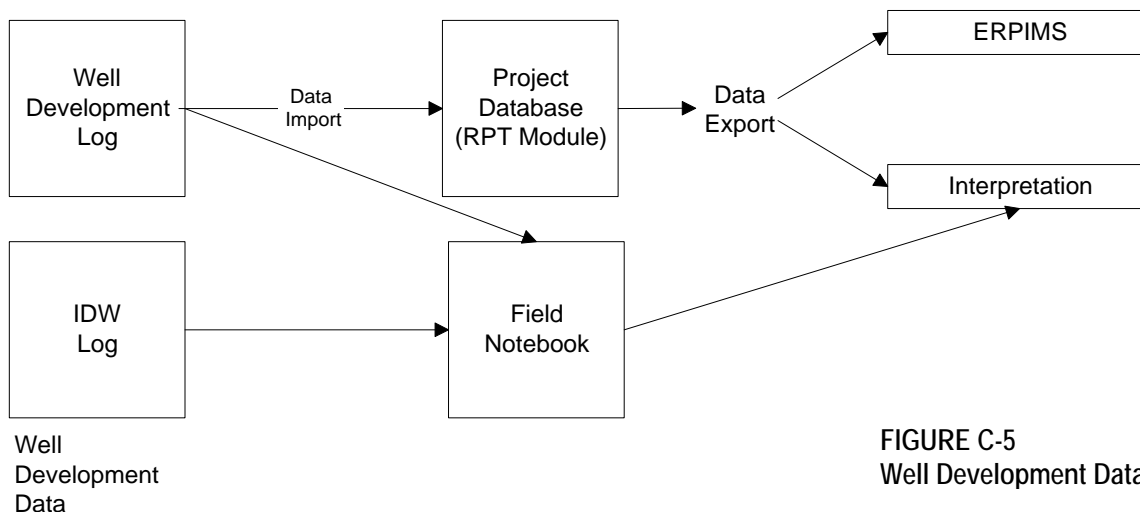


FIGURE C-5
Well Development Data

C.4.6 Sampling Data

All samples collected in the field and submitted to a laboratory for analysis must be accompanied by a COC form. The information included on the COC form will include project name and number, station identification (ID), date and time of sample collection, sample collection method, sample description, number of sample containers, the analyses requested, the date requested for completion of the analysis, the names of personnel collecting the sample, the chain-of-transfers between subsequent personnel handling the sample before it arrived at the lab, and the date and time of any transfers. Most of this information will be automatically included on the COC form (using the FLD module, if one is included in the project database) and the tables therein that are populated with information derived from the approved SAP. The sampling data process is shown on Figure C-6.

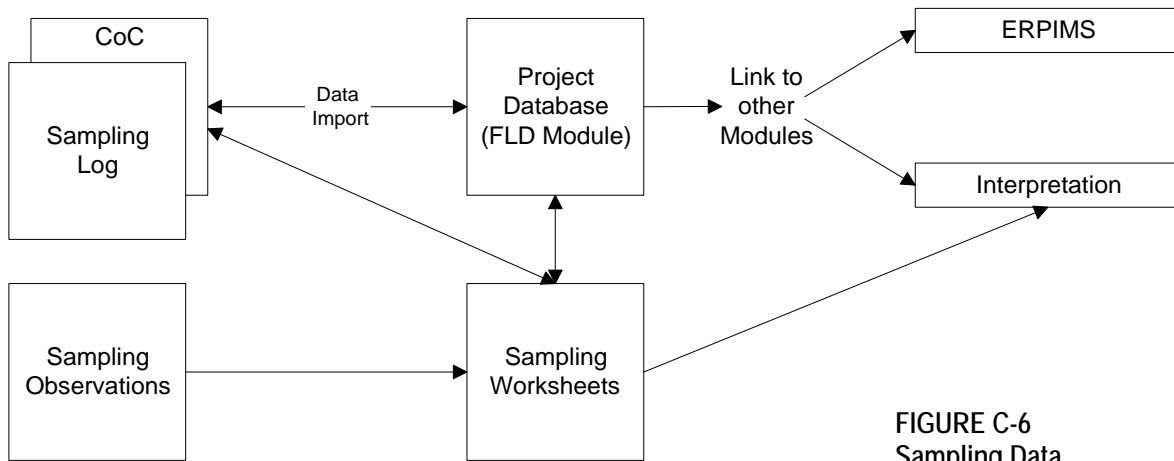


FIGURE C-6
Sampling Data

The information that will be added into the FLD database during sampling would include the actual date and time of sample collection, depth of sample collection, sampler initials, and miscellaneous comments.

C.4.7 Analytical Data

Most analytical data will be imported electronically (in the DAT module, if one is included in the project database) as described above. The COC information (from the FLD module if included) will be downloaded periodically to the project local-area network (LAN). These data will be used to track project progress, turnaround time compliance, and validation scheduling. The analytical data process is shown on Figure C-7.

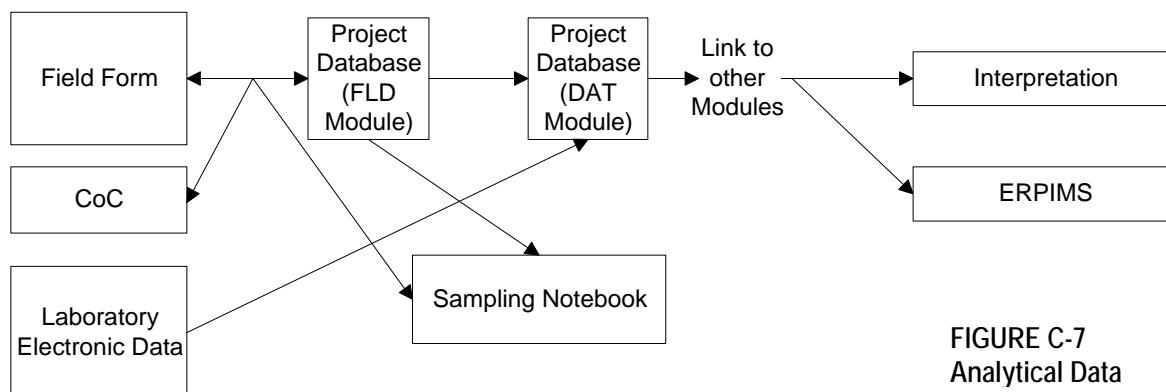


FIGURE C-7
Analytical Data

C.4.8 Analytical Timeliness

The use of the DAT and DV modules allows for the loading and validation of data in a real-time mode. As data are received from the laboratories, loading into DAT verifies the completeness of the data with regards to the analyses requested in FLD. In addition, DAT programming tracks expected delivery dates and notifies the database manager of data that are past their due date. This starts the process of notifying the laboratories and the project team. The project database or its DV module can be designed so that the data quality evaluation process occurs as each set of data is received from the laboratories. This allows for rapid dissemination of validated data to the data users for decisionmaking and “course corrections” in the field, when appropriate. In addition, the rapid data quality assessment allows for modifications of laboratory practices or additional audits to correct analytical problems in time to minimize the effect on the remainder of the project. Throughout the project, validated data, validation reports, and data summaries are constantly made available to the project team.

C.4.9 Mobile Lab (when applicable)

Electronic Data

Whenever possible, all mobile laboratory data will be generated in an electronic format similar, if not identical, to that for the fixed laboratories. This will allow for the timely and efficient incorporation of data into the project database. When data are unavailable electronically, the use of data entry forms will facilitate the entry and QC of manually entered data.

Documents

Documentation of mobile laboratory data will be negotiated with each laboratory. Unlike the fixed laboratories that have the capability to supply data in the format expected by AFCEE, this screening data might be captured in a different hardcopy format. The pertinent QC information will be prescribed by the project-specific QAPP and supporting documentation. All mobile laboratory data will be stored and catalogued in the same manner as the fixed laboratory data.

C.4.10 Additional Field Data

Some field data will be kept in the field project files and not necessarily cataloged or controlled by the data management system.

C.5 Data Analysis

C.5.1 Standardizing the Analytical Results

Data standardization involves identifying and standardizing all units associated with each analytical method. Units might be user-specified depending on cleanup criteria comparison or preference. The project database will identify all versions of units within each matrix and analytical method and will convert units to the project-specific units. All reporting and output is generated from the project database or its RPT module, if included in the database, in constant units using look-up tables where necessary.

C.5.2 Data Exporting and Report Generation

When the project database is constructed to include linked modules, the RPT module is the module most often used for the following functions:

- Exporting electronic data
- Generating statistical results
- Generating Data Visualization or GIS export files
- Generating data tables for evaluation and presentation
- Generating ERPIMS export files

C.6 Project Closeout

C.6.1 Final Backup

Upon completion of the project, the project database modules are backed up onto compact disk (CD) and stored both on and offsite.

Laboratory electronic deliverable diskettes or electronic mail files are logged into a project-specific CD and stored with the project database modules.

Original hardcopy data reports are logged into the project file and assigned a unique filing ID for easy retrieval. Upon project closeout, the data packages will be archived with the project files.

C.6.2 Data Deliverables

In addition to the ERPIMS submittals, data will be supplied to the project team to collect, prepare, publish, and distribute data designated on the AFCEE Contract Data Requirements List (CDRL).

TABLE C-1

Sample Format for Laboratory Electronic Data

EDD Specification Table					
Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
1	VersionCode	text	15	R	Code identifying the version of the EDD deliverable.
2	LabName	text	10	R	Identification code for the laboratory performing the work. This value is used to distinguish among different facilities.
3	SDG	text	8	R	Sample delivery group designation. Always populated for all samples, including QC.
4	FieldID	text	13	R	Client sample ID as appears on COC with optional lab-assigned suffixes and/or prefixes to make it unique. If the sample identifier on the COC and the prefix/suffix is greater than 13 characters, abbreviate the value but make it unique. For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier.
5	NativeID	text	13	R	Client sample ID, exactly as on the COC. No prefix or suffix allowed. Used to identify the native sample from which other samples are derived (e.g., QAQCType = "LR", "MS", or "SD"). For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier. For lab blank spike (and blank spike duplicate) samples, use the FieldID value that was assigned to the associated method blank.
6	QAQCType	text	2	R	This is the code for the sample type. Any field sample that is not used as lab QC and is not otherwise marked on the COC should have the designation of "N" (normal field sample). No suffix allowed (i.e., do not add numbers as suffixes to the QAQCType values as is called for in the ERPIMS guidelines). Note that if all analyses for a given sample are diluted, then the first dilution should be designated as the normal sample. If more dilutions are required, then the next dilution should be designated as the first true dilution with a QAQCType value of "LR" and a LRType value of "DL" (see LRType, below).

TABLE C-1

Sample Format for Laboratory Electronic Data

EDD Specification Table					
Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
7	LRType	text	3	C	<p>This is the code for laboratory replicate sample type. Values are:</p> <ul style="list-style-type: none"> blank (if QAQCType value is not "LR"), "DL" (dilution), "RE" (re-analysis), "D" (inorganic duplicate), "CF" (confirmation). <p>For multiple dilutions or re-analyses of the same sample, append the replicate number after the LRType value (i.e., "RE", "RE2", "RE3", etc.).</p>
8	Matrix	text	5	R	Sample matrix code. Valid values are as follows: "AIR", "WATER", "SOIL", unless otherwise provided by the project data manager and marked on the COC. The use of "liquid", "solid", etc. for lab QC is not allowed.
9	LabSampleID	text	20	R	Laboratory sample ID. Prefix or suffix is allowed. This is where dilutions or re-extractions are noted. Ex: "D97-11111RE" is acceptable.
10	AnalysisMethod	text	20	R	Analysis method code. This is the identifier of the analytical method that was performed on the sample. Example: SW8260A. Generic names such as "EPA" should not be used.
11	ExtractionMethod	text	20	R	Preparation method code. A value in this field is required. If the preparation is described in the method, use "METHOD". If there is no separate preparation required, use "NONE". Note that Total and Dissolved metal analyses are differentiated by the value in this column. Note that Total, TCLP, and SPLP analyses are now differentiated by the value in the LeachMethod column (see below).
12	SampleDate	date		C	Date of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy
13	SampleTime	time		C	Time of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. 24-hour format: hh:mm

TABLE C-1

Sample Format for Laboratory Electronic Data

EDD Specification Table					
Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
14	ReceiveDate	date		C	Date of sample receipt in the lab. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy
15	ExtractDate	date		C	Date of sample preparation (extraction or digestion). Value is required if the ExtractionMethod field value is other than "NONE". Format: mm/dd/yyyy
16	ExtractTime	time		C	Time of sample preparation. Value is required if the ExtractionMethod field value is other than "NONE". 24-hour format: hh:mm
17	AnalysisDate	date		R	Date of sample analysis. Value is required for all records. Format: mm/dd/yyyy
18	AnalysisTime	time		R	Time of sample analysis. Value is required for all records. 24-hour format: hh:mm
19	PercentSolids	number		R	Percent solids within the sample. Should be zero for water samples.
20	LabLotCtlNum	text	10	C	Identifier of an autonomous group of environmental samples and associated QC samples prepared together. For example, its value can be a digestion or extraction batch ID. If there is no separate extraction or preparation performed, leave this field blank.
21	CAS	text	20	C	CAS number of analyte, if available.
22	ParamID	text	12	R	Parameter identifier code for the parameter listed in the Analyte field.
23	Analyte	text	60	R	Name of analyte, chemical name.
24	Result	text	10	R	Result of the analysis. Surrogate analytes will be reported in units of percent. All others will be reported in sample concentration units. If undetected, report the adjusted MDL or adjusted RL, depending on the project. (Reported as a text field to preserve significant figures.)
25	ExpectedValue	number		C	"100" for surrogates; "0" (zero) for blanks; spike level plus parent result for LCS, and MS/MSD; parent value for lab duplicate; etc.
26	Units	text	10	R	Units of measure used in the analysis. Report "PERCENT" for surrogate analytes and concentration units for all others.

TABLE C-1

Sample Format for Laboratory Electronic Data

EDD Specification Table					
Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
27	Dilution	number		R	Total dilution reported in the analysis. Default value should be 1 (one). This value should reflect changes to sample preparation amounts as defined by the method (e.g., less sample used for standard VOC analysis).
28	MDL	number		C	Minimum detection limit adjusted for preparation and dilution. Note that this value may be the method detection limit or the instrument detection limit, depending on the method and the project requirements. This value is <u>not</u> adjusted for percent moisture.
29	RL	number		C	Reporting limit adjusted for preparation and dilution. Value is <u>not</u> adjusted for percent moisture. Equivalent to PQL.
30	LabQualifier	text	6	R	Lab qualifier for the results, as reported on the hard copy. Use "=" as first (or only) qualifier value for detected results.
31	Surrogate	text	1	R	Is the chemical a surrogate? Report "Y" for yes or "N" for no.
32	Comments	text	240	O	Comment field
33	ParValUncert	text	16	C	Radiological parameter value uncertainty.
34	Recovery	number		C	Percent recovery for MS, SD, LCS, and surrogate compounds.
35	LowerControlLimit	number		C	Lower control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34).
36	UpperControlLimit	number		C	Upper control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34).
37	Basis	text	1	R	Weight basis for soil (or solid) sample analysis. Use "D" for dry-weight basis, "W" for wet-weight basis, or "X" if not applicable.
38	ConcQual	text	1	R	Concentration qualifier. Use "=" for detects, "J" for estimated value (value between detection limit and reporting limit), "U" for undetected result, or "E" for exceeded result.

TABLE C-1

Sample Format for Laboratory Electronic Data

EDD Specification Table					
Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
39	MDLAdjusted	number		C	Minimum detection limit adjusted for preparation, dilution <u>and percent moisture</u> . See the description of the MDL field (Field No. 28) for an explanation of the contents of this field.
40	RLAdjusted	number		C	Reporting limit adjusted for preparation, dilution <u>and percent moisture</u> . Equivalent to PQL
41	SampleDescription	text	20	C	Full sample identifier value as it appears on the COC. In some cases, this may be the name of the sampling location instead of the sample. Required for all samples that are either collected in the field and specified on the COC, or derived from samples that are collected in the field and specified on the COC.
42	LeachMethod	text	20	R	Analytical method used for leaching the sample. This applies to TCLP, SPLP, or other leaching or pre-extraction leaching procedures. Use "NONE" if the sample was not leached.
43	LeachDate	date		C	Date that the leaching method was performed (start date for multi-date leaching procedures). Value is required if the LeachMethod field value is other than "NONE". Format: mm/dd/yyyy.
44	LeachTime	time		C	Time that the leaching procedure started. Value is required if the LeachMethod field value is other than "NONE". 24-hour format: hh:mm.
45	LeachLot	text	20	C	Identifier of an autonomous group of environmental samples and associated QC samples leached at the same time. If the sample was not leached, leave this field blank.
46	AnalysisLot	text	20	R	Identifier of an autonomous group of environmental samples and associated QC samples analyzed together. A value in this field is mandatory (i.e., it should not be blank).
47	CalRefID	text	20	C	Identifier of a group of environmental and QC samples linked by a common set of calibration records. All results with the same CalRefID value will have had the same initial calibration run.