**SAMPLING AND ANALYSIS PLAN**

**GUIDANCE AND TEMPLATE**

**VERSION 4, Brownfields Assessment Projects August 2018**

This Sampling and Analysis Plan (SAP) guidance and template is intended to assist organizations in documenting the procedural and analytical requirements for Brownfields Assessment projects involving the collection of water, soil, sediment, or other samples taken to characterize areas of potential environmental contamination. It combines, in a short form, the basic elements of a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP). Once prepared and approved it will meet the requirements for any U.S. Environmental Protection Agency (EPA) Region 9 Brownfields project in which environmental measurements are to be taken.

The format is designed to accommodate projects of limited scope and presumes that the work will be going to a laboratory whose analytical services are not funded directly by EPA. This might include, but not be limited to, a private or commercial laboratory, a state laboratory, an in-house laboratory or any other laboratory under contract to the organization writing the SAP. It is intended to be used for projects generating a limited number of samples to be collected over a relatively short time. This template is not intended to be used for on-going monitoring events, or for remediation or removal activities. Exceptions to these requirements will be considered on a case-by-case basis, but they should be discussed with Region 9 QA Section staff before the template is used and before the SAP is submitted for approval. This template may be used by state, municipal and local agencies, contractor, non-profit organizations, and by EPA staff.

This guidance - template provides item-by-item instructions for each section of a SAP. If the sections are appropriate for the project, they may be used verbatim, or modified as needed to reflect project- and sampling-specific requirements. Not all sections will apply to every organization or to every project.

Some sections, such as those describing sampling procedures, contain example language which may be used with or without modification. If these procedures do not meet project needs, the organization may substitute a specific description of sampling procedures or provide copies of the sampling standard operation procedures (SOPs). Other alternatives should be discussed with QA Section staff.

An electronic version of the template is available and may be used to prepare the SAP. The format of the template is as follows:

The two types of shaded text are to be deleted from the final SAP:

1. Tutorial information presented in *italic* type. This information includes definitions and background information pertaining to a given section of the SAP.
2. Specific instructions given inside brackets [in normal type].

Suggested text which may be included in the SAP is presented in normal type. This text can be used, modified, or deleted depending on the nature of the project. For example, if only groundwater will be sampled, delete the discussion of sampling other matrices. If more than one option is presented, pick the appropriate one and delete the others.

If the use of a Standard Operating Procedure (SOP) is appropriate, the SOP should be included as an appendix to the final SAP and referenced in the appropriate section.

An underlined blank area [ \_\_\_\_\_\_\_\_\_\_\_ ] indicates that text should be added. Examples or choices may be provided in [brackets] following the blank. If appropriate, select one and delete the others. The underlining should be deleted.

If a given section does not apply, it is recommended that the section state “Not applicable” or “Does not apply” under the section heading. By including the section, the writer avoids having to renumber sections. However, sections can be removed altogether and the remaining sections renumbered.

Example forms are located in Attachment 1. They should be deleted and organization appropriate ones included in the final SAP.

The U.S. EPA Region 9 Quality Assurance Section is available to provide assistance in completing the SAP. Contact Audrey L. Johnson at 415-972-3431, or Mr. Derrick Williamson at 415-972-3698.

## Sampling and Analysis Plan [Title of Project] SITE [Address]

**Prepared for:**

**[Name of Organization]**

**[Date]**

**Prepared by:**

**[Name of Organization] [Address]**

**APPROVAL PAGE**

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**Approved by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**[Grantee Name] Project Manager Date**

**Approved by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**[Contractor Name] Project Manager Date**

**Approved by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**[Contractor Name] Quality Assurance Officer Date**

**Approved by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Project Officer, USEPA Region IX Date**

**Approved by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Quality Assurance Manager, USEPA Region IX Date**

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Figure 4-1 Proposed Soil Sampling Locations

Figure 4-2 Proposed Groundwater Sampling Locations

Figure 4-3 Proposed Soil Vapor Sampling Locations

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Table 1-1 Key Project Personnel Contact Information

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*Include a list of appendices referred to in the report. The following list can be used as a starting point. Add or delete appendices as appropriate.*

Appendix A Data Quality Objective Worksheet

Appendix B Site-Specific Health and Safety Plan

**Distribution List**

*Add additional names as appropriate.*

[Grantee Name, Title]

[Grantee Address]

[Contractor Name, Title]

[Contractor Address]

[Name, USEPA Project Officer]

[Division or Section]

US EPA Region 9

75 Hawthorne Street

San Francisco, CA 94105

[Name, USEPA QA Manager]

Quality Assurance Section

US EPA Region 9

75 Hawthorne Street

San Francisco, CA 94105

**ABBREVIATIONS AND ACRONYMS**

*Include and define all acronyms and abbreviations used throughout the plan. The following list can be used as a starting point. Add or delete acronyms and abbreviations as appropriate.*

ASTM American Society for Testing and Materials

CERCLA Comprehensive Environmental Response, Cleanup, and Liability Act

CFR Code of Federal Regulations

CHHSL California Human Health Screening Levels

CLP Contract laboratory program

CWA Clean Water Act

DQA Data quality assessment

DQI Data quality indicators

DQO Data quality objectives

EPA U.S. Environmental Protection Agency

ESA Environmental site assessment

ESL Environmental Screening Levels

FSP Field sampling plan

GC/MS Gas chromatography and mass spectrometry

IDW Investigation-derived waste

LCS Laboratory control sample

MDL Method detection limit

MQO Measurement quality objective

MS/MSD Matrix spike and matrix spike duplicate

mg/L Milligrams per liter

µg/L Micrograms per liter

PARCCS Precision, accuracy, representativeness, completeness, comparability, and sensitivity

PE Performance evaluation

PRQL Project-required quantitation limit

QA Quality assurance

QA/QC Quality assurance/quality control

**ABBREVIATIONS AND ACRONYMS (Continued)**

QAPP Quality assurance project plan

QC Quality control

QL Quantitation limit

RCRA Resource Conservation and Recovery Act

RPD Relative percent difference

RSL Regional Screening Level

%R Percent recovery

SAP Sampling and analysis plan (an integrated FSP and QAPP)

SOP Standard operating procedures

SOW Statement of work

SVOC Semi-volatile organic compound

TNI The NELAC Institute

VOC Volatile organic compound

1. **INTRODUCTION**
   1. **SITE HISTORY**

*This section should include a brief description of the project, including the history, problem to be investigated, scope of sampling effort, and types of analyses required. These topics will be covered in depth later so do not include a detailed discussion here. Include tentative sampling dates.*

*For Brownfields projects, the type of grant (Assessment, Cleanup, Revolving Loan Fund or 128(a)) should be specified and whether it is for hazardous substances or petroleum products. Assessment grants should also state whether it is an area-wide or site-specific grant.*

* 1. **SITE NAME OR SAMPLING AREA**

*Provide the most commonly used name of the site or sampling area. Also include the name or abbreviation ( “the Site”), if any, that will be used throughout the plan.*

* 1. **SITE OR SAMPLING AREA LOCATION**

*Provide a general description of the region (residential, commercial, light industrial, mixed, etc.), state or tribal area in which the site or sampling area is located. Include street address, city, state, and postal code, if appropriate. Detailed information should be provided later in Section 2.*

* 1. **RESPONSIBLE ORGANIZATION**

*Provide a description of the organization conducting the sampling.*

## PROJECT ORGANIZATION

*Table 1-1 should be completed. Provide the name, phone number and email address of the person(s) and/or contractor working on the sampling project as listed in the table. The table can be modified to include titles or positions appropriate to the specific project. Delete personnel or titles not appropriate to the project. A brief description of the roles and responsibilities for each key position should be included either in the table (as shown) or within the text of this section.*

*An Organization Chart should be included showing the lines of communication. The above information may also be included on the Organization Chart, if appropriate.*

*It is the responsibility of the Quality Assurance (QA) Officer to oversee the implementation of the Sampling and Analysis Plan, including whether specified quality control (QC) procedures are being followed a described. Ideally, this individual should discuss QA issues with the Project Manager, but should not be involved in the data collection/analysis/interpretation/reporting process except in a review or oversight capacity. If the project is small, another technical person may fulfill this role.*

**Table 1-1**

**Key Project Personnel Contact Information and Responsibilities**

|  |  |  |  |
| --- | --- | --- | --- |
| **Title** | **Name** | **Phone Number**  **Email Address** | **Responsibilities** |
| **EPA Project Manager** |  |  |  |
| **EPA Quality Assurance Officer (QAO)** |  |  |  |
|  | | | |
| **Grantee Project Manager** |  |  |  |
|  | | | |
| **Contractor Project**  **Manager (include Company Name)** |  |  |  |
| **Contractor QAO** |  |  |  |
| **Contractor Field Team Leader** |  |  |  |
|  | | | |
| **Laboratory Quality Assurance Officer (include Laboratory Name)** |  |  |  |

1. **BACKGROUND**

*This section provides an overview of the location, previous investigations, and the apparent problem(s) associated with the site or sampling area.*

* 1. **SITE OR SAMPLING AREA DESCRIPTION**

*Two maps of the area should be provided: the first, on a larger scale, should place the area within its geographic region; the second, on a smaller scale, should mark the sampling site or sampling areas within the local area. Additional maps may be provided, as necessary, for clarity. Maps should include a North arrow, a surface and/or ground water directional flow arrow (if appropriate), buildings or former buildings, spill areas, etc. If longitude or latitude information is available, such as from a Global Positioning System (GPS), provide it.*

*Fill in the blanks.*

The site or sampling area occupies *[acres or square feet*] in a/an

[*urban, commercial, industrial, residential, agricultural, or*

*undeveloped*] area. The site or sampling area is bordered on the north by , on the west

by , on the south by , and on the east by

. The specific location of the site or sampling area is shown in Figure 2.2.

*The next paragraph(s) should describe historic and current on-site structures. These should be shown on one of the figures.*

*Depending on the nature of the project, some of the following sections may not be applicable. If this is the case, do not delete the section. Instead enter “Not Applicable” or other text to indicate that the section does not apply or that the information is not available.*

* 1. **OPERATIONAL HISTORY**

*As applicable, describe in as much detail as possible (i.e., use several paragraphs) the past and present activities at the site or sampling area. The discussion might include the following information:*

* *a description of the owner(s) and/or operator(s) of the site or areas near the site or sampling area (present this information chronologically);*
* *a description of past and current operations or activities that may have contributed to suspected contamination;*
* *a description of the processes involved in the operation(s) and the environmentally detrimental substances, if any, used in the processes;*
* *a description of any past and present waste management practices.*

## PREVIOUS INVESTIGATIONS/REGULATORY INVOLVEMENT

*Summarize all previous sampling efforts at the site or sampling area, including:*

* *the sampling date(s);*
* *name of the party(ies) that conducted the sampling;*
* *local, tribal, state or federal government agency for which the sampling was conducted;*
* *a rationale for the sampling;*
* *the type of media sampled (e.g., soil, sediment, water, soil vapor);*
* *laboratory methods that were used;*
* *a discussion of what is known about data quality and usability.*

*The summaries should be presented in subsections chronologically. Attach reports or summary tables of results, or include in appendices, if necessary. See Table 2-1 for an example. Previous sampling locations can be shown on one of the figures, or additional figures can be included.*

*If results from previous sampling events are being used in a general nature, the results can be summarized (e.g., report the highest hits or the range of the results). If specific results are being used to direct the current sampling effort, those specific results must be reported on an analyte- by-analyte basis.*

## SCOPING MEETING

*Summarize the scoping meeting and/or site visit, including:*

* *the date the meeting was held*
* *who attended*
* *what was discussed*
* *what decisions were made*

*If more than one scoping meeting/site visit was conducted, include the above information for each.*

## GEOLOGICAL/METEOROLOGICAL INFORMATION

*For surface and/or ground water sampling: Provide a description of the hydrogeology of the area. Indicate the direction of flow and include a directional flow arrow on the appropriate figure.*

*For soil sampling: Provide a description of the geology of the area.*

*For air sampling: Provide prevailing wind direction, temperature, etc.*

## IMPACT ON HUMAN HEALTH AND/OR THE ENVIRONMENT

*Discuss what is known about the possible and actual impacts of the potential environmental problem at the site on human health and/or the environment.*

**Table 2-1**

**Contaminants of Concern, Previous Investigations Matrix = xx**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Analytical Parameter**  **(Contaminants of Concern)** | **Date of sampling** | **Sampling contractor** | **Laboratory Analytical Results (units)** | **Regulatory Limit (specify)1** |
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Specify the source of the regulatory limit(s). For example:

DTSC = Calif. Department of Toxic Substances Control RWQCB = Regional Water Quality Control Board

RSLs = EPA Region IX Regional Screening Levels

CHHSLs = California Human Health Screening Levels

ESLs = Environmental Screening Levels

1. **PROJECT AND DATA QUALITY OBJECTIVES**

Data Quality Objectives (DQOs) are qualitative and quantitative statements for establishing criteria for data quality and for developing data collection designs. This section is crucial to SAP approval, since it defines what the data will be used for and what quality of data are needed to make decisions. EPA’s Guidance for Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4, February 2006) should be consulted for more information. The DQO section should cover the following items:

* Concisely describe the problem to be investigated.
* Identify what questions the investigation will attempt to resolve, what actions (decisions) may result, and who the primary decision maker is.
* Identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement(s).
* Define study boundaries and when and where data should be collected.

Most projects utilizing this template are small. Therefore, defining action levels and measurement quality objectives (MQOs) for field and laboratory measurements used on the project are usually sufficient. MQOs define criteria for calibration and quality control (QC) for field and laboratory methods. MQOs are discussed more thoroughly below.

* 1. **PROJECT TASK AND PROBLEM DEFINITION**

Describe the purpose of the environmental investigation in qualitative terms and how the data will be used. Discuss how the site history relates to the problem to be investigated, scope of sampling effort, and types of analyses that will be required. Include all measurements to be made on an analyte specific basis in whatever media (soil, sediment, water, etc.) is to be sampled. This discussion should relate to how this sampling effort will support the specific decisions described in Section 3.2, DQOs, below.

Redevelopment plans, if known, should be included. If the future use of the site is not known, this should be stated.

## DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are quantitative and qualitative criteria that establish the level of uncertainty associated with a set of data. They answer the question: How sure are you that the values of the data are what the analyses have determined them to be? All the elements of the sampling event, from the sampling design through laboratory analysis and reporting, affect the quality of the data. The project manager, or other decision maker identified earlier in the project organization section, must make the decision as to what level of uncertainty is acceptable or appropriate. Depending on what the contaminants of concern are, what effect they may have on human and environmental health, and at what level, data quality may need to be legally defensible or capable of answering only a simple “presence-absence” question. More sophisticated DQO discussions involve defining null testing hypotheses and confidence intervals. These should be considered depending on project decision making needs, but such discussions are generally not expected in one-time event SAPs. (A description of the “Seven Step DQO Process” is included in Attachment A).

This section should describe decisions to be made based on the data and provide criteria on which these decisions will be made. Inclusion of one or more tables is recommended. Tables should contain, at a minimum, the main contaminants of concern, their associated action levels and detection limits, and the source of the action level (regulation, health based criteria, water quality standards, etc.) If a contaminant does not have an action level, or will not be used in decision making, the text should discuss how the data for that contaminant will be used. (See Attachment B for a discussion of the relationship between project action limits (PALs), detection limits (DLs) and quantitation limits (QLs).)

The use of “If...then” statements are recommended. Decisions do not have to involve regulatory or legal action (and for Brownfields projects, few are expected to). Some examples: “If contaminants of concern are not detected above the action limits, then no further action is required.” or: “If one or more contaminants of concern are found above the action level, then recommendations for further action, such as additional assessment, remediation, or removal will be evaluated.”

Discuss Data Quality Objectives, action levels, and decisions to be made based on the data. A table should be constructed which includes the analytes of concern, action limits and detection limits. See Table 3-1 for an example. A separate table should be prepared for each matrix/media to be sampled.

## MEASUREMENT QUALITY OBJECTIVES

Measurement Quality Objectives are criteria established to assess the viability and usability of data. These are based on both field and laboratory protocols that examine whether the data quality indicators (DQIs), i.e., precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS), meet criteria established for various aspects of data gathering, sampling, or analysis activity. In defining MQOs specifically for the project, the level of uncertainty associated with each measurement is defined. Some DQIs are quantitative, others are more qualitative. (See Attachment C for a discussion of the PARCCS parameters.)

The values that are to be assigned to the quantitative data quality indicators (precision, accuracy, completeness and sensitivity) and statements concerning the qualitative indicators (representativeness and comparability) are determined by the answers to the questions in Section 3.2.

Project specific requirements for precision, accuracy, representativeness, completeness, comparability and sensitivity (PARCCS) should be discussed here. Where applicable, precision and accuracy acceptance limits, for both laboratory and field measurements, may be presented in a tabular format. A separate table should be prepared for each matrix or media to be sampled. Otherwise, MQO tables or laboratory SOPs should be included as appendices and referenced. This is discussed in greater detail in Section 5.2.

## DATA REVIEW AND VALIDATION

Region 9 has adopted a tiered approach to data review. Details on validation are available from the QA Office, but a brief summary follows:

* Tier 1 involves a cursory review of the QC data for the project. This is sometimes referred to as a “Summary Forms” review. At a minimum, all data should receive a Tier 1 review.
* Tier 2 involves a selected validation based on several factors which should be defined in the DQOs for the project. Candidates might be a specific area within the sampling area, specific analytes or analyses of concern critical to decision making, or some other factor(s). The review may also focus on anomalies noted during the Tier 1 review.
* Tier 3 involves a traditional full validation. Data reviewed include the raw data, standards log books, extractions logs, instrument printouts, chromatograms (if applicable), mass spectra (if applicable), etc. Calibration data, sample analysis data, and quality control data are all evaluated. Typically, this is a “3rd party review” and isbased on strict protocols, such as the National Functional Guidelines.

There is no requirement that all data adhere to the same Tier; the project can mix and match depending on project needs and requirements. It is recommended that if validation will be a part of the data review process, that SOP(s) from the organization which will perform the validation be attached.

Discuss data review and data validation including what organizations or individuals will be responsible for what aspects of data review and what the review will include. This section should also discuss how data that do not meet data quality objectives will be designated, flagged, or otherwise handled. Possible corrective actions associated with the rejection of data, such as reanalysis or resampling, also need to be addressed.

## DATA MANAGEMENT

Provide a list of the steps that will be taken to ensure that data are transferred accurately from collection to analysis to reporting. Discuss the measures that will be taken to review the data collection processes, including field notes or field data sheets; to obtain and review complete laboratory reports; and to review the data entry system, including its use in reports. A checklist is acceptable.

## ASSESSMENT OVERSIGHT

Describe the procedures which will be used to implement the QA Program. This would include oversight by the Quality Assurance Manager or the person assigned QA responsibilities. Indicate how often a QA review of the different aspects of the project, including audits of field and laboratory procedures, use of performance evaluation samples, review of laboratory and field data, etc., will take place. Describe what authority the QA Manager or designated QA person has to ensure that identified field and analytical problems will be corrected and the mechanism by which this will be accomplished.

# **Table 3-1**

**Contaminants of Concern, Laboratory, and Screening or Action Levels Matrix = xx**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Analytical Parameter**  **(Contaminants of Concern)** | **Laboratory Reporting or**  **Quantitation**  **Limits** | **Screening or Action Levels** | | |
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1. **SAMPLING DESIGN AND RATIONALE**

For each sampling event, the SAP must describe the sampling locations, the media tobe sampled, and the analytes of concern at each location. A rationale should then be provided justifying these choices. This information may be presented in a tabular format. (See Tables 4-1and 4-2 for examples.) This section is crucial to plan approval and should be closely related to previously discussed DQOs.

The following subsections are subdivided on a media specific basis among soil, sediment, and water. Other media should be added as needed. Appropriate figures should be included showing proposed sampling locations.

Information regarding the collection of field duplicates may be included in these sections. Provide a rationale for the selection of these locations. If locations will be determined in the field, the criteria that will be used to make these selections should be provided. Alternatively, field duplicates may be discussed in Section 10.1.2.

Do not include sampling procedures, preservation, etc., as these topics are covered in later sections.

## SOIL SAMPLING

Provide a general overview of the soil sampling event. Present a rationale for choosing each sampling location at the site or sampling area and the depths at which the samples are to be taken, if relevant. If decisions will be made in the field, provide details concerning the criteria that will be used to make these decisions (i.e., the decision tree to be followed). List the analytes of concern at each location and provide a rationale for why the specific chemical or group of chemicals (e.g., organochlorine pesticides) was chosen. Include a figure showing sampling locations.

## SEDIMENT SAMPLING

Provide a general overview of the sediment sampling event. Present a rationale for choosing each sampling location at the site or sampling area and the depths or area of the river, stream or lake at which the samples are to be taken, if relevant. If decisions will be made in the field, provide details concerning the criteria that will be used to make these decisions (i.e., the decision tree to be followed). List the analytes of concern at each location and provide a rationale for why the specific chemical or group of chemicals (e.g., organochlorine pesticides) was chosen. Include a figure showing sampling locations.

## WATER SAMPLING

Provide a general overview of the water sampling event. For groundwater, describe the wells to be sampled or how the samples will be collected (e.g., hydro punch), including the depths at which the samples are to be taken. For surface water, describe the depth and nature of the samples to be collected (fast or slow-moving water, stream traverse, etc.). Present a rationale for choosing each sampling location or sampling area. If decisions will be made in the field, provide details concerning the criteria that will be used to make these decisions (i.e., the decision tree to be followed). List the analytes of concern at each location and provide a rationale for why the specific chemical or group of chemicals (e.g., organochlorine pesticides) was chosen. Include a figure showing sampling locations.

* 1. **SOIL VAPOR SAMPLING**

Describe soil vapor considerations and discuss whether soil vapor may be a potential concern, and if sampling may be warranted at the site. All assessments should consider the potential for vapor intrusion to ensure that any redevelopment activities protect the health of current and future site occupants. Evaluate the site conditions and determine the potential soil vapor intrusion. concerns. State if soil vapor intrusion is a concern at the site based on the flowchart provided below, and if warranted, describe any soil vapor sampling activities.

Below is some suggested language:

*Vapor intrusion is defined as the migration of chemical vapors from contaminated soil and groundwater into existing or planned buildings. Vapor intrusion exposes building occupants to potentially toxic levels of vapors when volatile organic compounds (VOCs) present in contaminated soil or groundwater emit vapors that migrate into overlying buildings. VOCs in contaminated soil and groundwater emit vapors that rise through the pore space of the unsaturated zone above the water table. These vapors can move laterally as well as vertically from the source of contamination. Generally, soil or groundwater contamination within 100 feet (laterally or vertically) of any current or future on-site or off-site buildings contains the potential for releasing hazardous vapors to the indoor air. Any passageway, such as a sand or gravel layer, buried utility line, or animal burrow, may facilitate the flow of soil vapor. Properties with a higher potential for soil vapor intrusion include industrial and commercial areas, such as former manufacturing and chemical processing plants, warehouses, train yards, dry cleaners, and gas stations.*

* 1. **OTHER SAMPLING**

Describe other media that may be sampled. Present a rationale for choosing each sampling location at the site or sampling area and the depths at which the samples are to be taken, if relevant. If decisions will be made in the field, provide details concerning the criteria that will be used to make these decisions (i.e., the decision tree to be followed). List the analytes of concern at each location and provide a rationale for why the specific chemical or group of chemicals was chosen. Include a figure showing sampling locations.

## CULTURAL RESOURCE DISCOVERIES

The disturbance of site soils carries the potential of unanticipated discovery of cultural resources. Cultural resources are artifacts, relics, or other physical traces, regardless of condition, that may be associated with prehistoric or indigenous occupation and use of the site and may possess archeological significance or be of importance to existing tribes. Information describing the steps to be implemented if cultural resources are discovered should be included in this section. Different regions, municipalities, agencies, states, or other organizations, such as a local tribe, may already have an appropriate plan developed. If so, a copy should be included with this document and referenced here.

**Table 4-1**

**Sampling Design and Rationale Matrix = Soil**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sampling Location/ID Number** | **Depth (feet)** | **Analytical Parameter** | **Rationale \*** |
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\* Include rationale for location, depth and analysis.

# **Table 4-2**

**Sampling Design and Rationale**

**Matrix = Groundwater**

|  |  |  |
| --- | --- | --- |
| **Sampling Location/ID Number** | **Analytical Parameter** | **Rationale \*** |
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\* Include rationale for location and analysis.

## REQUEST FOR ANALYSES

This section should discuss the following analytical support for the project: the analyses requested, analytes of concern, turnaround times, available resources, available laboratories, etc. The use of tables is highly recommended. If samples will be sent to more than one organization, it should be clear which samples will be sent to each laboratory. Field analyses for pH, conductivity, turbidity, or other field tests should be discussed in the sampling section. Field measurements in a mobile laboratory should be discussed here and differentiated from samples to be sent to a fixed laboratory. Field screening tests (for example, immunoassay tests) should be discussed in the sampling section, but the confirmation tests should be discussed here and the totals included in the tables.

## ANALYSES NARRATIVE

Complete this subsection concerning the analyses for each matrix. An analytical services table is recommended for each matrix to be sampled. See Tables 5-1 and 5-2 for examples. Each table must include the analytical parameters for each type of sample. Quality Control (QC) samples, such as blanks, duplicates, splits, and laboratory QC samples, should be indicated in the column titled “Special Designation.” The selected analyses must be consistent with earlier discussions concerning DQOs and analytes of concern.

Information on container types, sample volumes, preservatives, special handling, and analytical holding times for each parameter may be included here or on a separate table. See Tables 5-3 and 5-4 for examples.

Include any special requests, such as fast turn-around time (2 weeks or less), specific QC requirements, or modified sample preparation techniques in this section. Provide information for each analysis requested.

Note: Rationale for the selection of duplicate and laboratory QC sample locations is to be provided in Section 10.0.

## ANALYTICAL LABORATORY

When an organization contracts for analytical work it has two options. In Option 1, MQOs for laboratory work are defined in the SAP. The MQOs are provided to the laboratory which then acknowledges that it is capable of meeting these criteria, and also states it is willing to do so. In Option 2, the sampling organization reviews the information from the laboratory on its QA/QC Program and C criteria and determines whether the laboratory can meet project needs.

If the first approach is taken, the organization writing the SAP should include the appropriate QC tables in the SAP. The Region 9 QA Office has MQO tables available for most routine analyses. These tables can be attached to the SAP and referenced in this section. Plan preparers are free to request these tables, review them for their appropriateness for the project, and incorporate all or some of them in original or modified form into their SAP.

If the second approach is taken, the sampling organization must acknowledge that it understands and agrees to the MQOs defined by the contract laboratory which will be used for the project. MQOs or QC criteria for work performed by the laboratory will be found in either the laboratory’s QA Plan and/or its SOPs, which must be included with the sampling plan for review.

Field analyses for pH, conductivity, turbidity, or other field tests should be discussed in the sampling section. Field measurements in a mobile laboratory (for example, the Field Analytical Support Program (FASP) laboratory) should be discussed here and differentiated from samples to be sent to a fixed laboratory. Field screening tests (for example, immunoassay tests) should be discussed in the sampling section, but the confirmation tests should be discussed here and the totals included in the tables.

The narrative subsection concerning laboratory analytical requirements should be completed. Appropriate MQO tables, or the laboratory QA Plan and relevant SOPs for the methods to be performed, must accompany the SAP. EPA does not approve or certify laboratories; however, it will review the laboratory’s QA Plan and provide comments to the SAP’s originator concerning whether the laboratory’s QA/QC program appears to be adequate to meet project objectives. It is recommended that any issues raised be discussed with the laboratory and resolved before work commences. Note that the more the SAP “defaults” to laboratory capabilities, the greater emphasis will be placed on the adequacy of the laboratory’s QA program. If MQO tables, or the equivalent, are used, less emphasis will be placed on the laboratory’s QA Program.

# **Table 5-1 Analytical**

# **Services Matrix = Soil**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample Number** | **Sample Location** | **Depth (feet)** | **Special Designation** | **Analytical Methods** | | | |
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| **Total number of Soil Samples, excluding QC:** | | | |  |  |  |  |
| **Total number of Soil Samples, including QC:** | | | |  |  |  |  |

**Table 5-2**

**Analytical Services**

**Matrix = Groundwater**

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| --- | --- | --- | --- | --- | --- | --- |
| **Sample Number** | **Sample Location** | **Special Designation** | **Analytical Methods** | | | |
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|  |  |  |  |  |  |  |
| **Total number of samples, excluding QC** | | |  |  |  |  |
| **Total number of samples, including QC** | | |  |  |  |  |

## FIELD METHODS AND PROCEDURES

In the general introductory paragraph to this section, there should be a description of the methods and procedures that will be used to accomplish the sampling goals, e.g., “...collect soil, sediment and water samples.” It should be noted that personnel involved in sampling must wear clean, disposable gloves of the appropriate type. The sampling discussion should track the samples identified in Section 4.0 and Analytical Services table(s). A general statement should be made that refers to the sections containing information about sample tracking and shipping (Section 7). Provide a description of the sampling procedures. Example procedures are provided below, but the organization’s own procedures can be used instead. In that case, attach a copy of the applicable SOP. Some sampling procedures are available from EPA. Contact the QA Office or visit the Region 9 laboratory’s web page.

## FIELD EQUIPMENT

## List of Equipment Needed

List all the equipment that will be used in the field to collect samples, including decontamination equipment, if required. Discuss the availability of back-up equipment and spare parts. This information can be presented in a tabular format. See Table 6-1 for an example.

## Calibration of Field Equipment

Describe the procedures by which field equipment is prepared for sampling, including calibration standards used, frequency of calibration and maintenance routines. Indicate where the equipment maintenance and calibration record(s) for the project will be kept. See Table 6-2 for an example.

## FIELD SCREENING

In some projects a combination of field screening using a less accurate or sensitive method may be used in conjunction with confirmation samples analyzed in a fixed laboratory. This section should describe these methods or reference attached SOPs. Analyses such as XRF or immunoassay kits are two examples.

Describe any field screening methods to be used on the project, including how samples will be collected, prepared, and analyzed in the field. Include in an appendix, as appropriate, SOPs covering these methods. Confirmation of screening results should also be described. The role of field screening in decision making for the site should also be discussed here if it has not been covered previously.

## SOIL SAMPLING

* + 1. **Surface Soil Sampling**

Use this subsection to describe the collection of surface soil samples that are to be collected within 6-12 inches of the ground surface. Specify the method (e.g., hand trowels) that will be used to collect the samples and then transfer samples to the appropriate containers, or reference the appropriate sections of a Soil Sampling SOP. If SOPs are referenced, they should be included in an appendix.

If exact soil sampling locations will be determined in the field, this should be stated. The criteria that will be used to determine sampling locations, such as accessibility, visible signs of potential contamination (e.g., stained soils, etc.), and topographical features which may indicate the location of hazardous substance disposal (e.g., depressions that may indicate a historic excavation) should be provided.

Include this paragraph first if exact sampling locations are to be determined in the field; otherwise delete.

Exact soil sampling locations will be determined in the field based on accessibility, visible signs of potential contamination (e.g., stained soils), and topographical features which may indicate location of hazardous substance disposal (e.g., depressions that may indicate a historic excavation). Soil sample locations will be recorded in the field logbook as sampling is completed. A sketch of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to the reference points will be given.

If surface soil samples are to be analyzed for volatile organic compounds (VOCs), use this paragraph; otherwise delete. It is Region 9 policy that soils collected for volatile and gasoline analyses be collected in hermetically sealed sampling devices (such as EnCore samplers) and analyzed within the holding time specified in EPA Method 5035, or immediately preserved by one of the processes specified in EPA Method 5035. A rationale should be provided if more than one preservation method is specified. Collection in brass tubes, even if subsequently preserved, is not acceptable.

Samples to be analyzed for volatile organic compounds will be collected first. Surface soil samples for VOC analyses will be collected as grab samples (independent, discrete samples)

from a depth of 0 to \_\_\_\_ inches below ground surface (bgs). Surface soil samples will be

collected using [specify the type of sampling device], and will be collected in triplicate. Samples will be sealed and placed in a zip lock bag. See Section 7.1 for preservation and shipping procedures.

If surface soil samples are to be analyzed for compounds other than volatiles, use this paragraph; otherwise delete.

Surface soil samples will be collected as grab samples (independent, discrete samples) from a depth of 0 to inches below ground surface (bgs). Surface soil samples will be collected using a stainless-steel hand trowel. Samples to be analyzed for [list all analytical methods for soil samples except for volatile organic compounds] will be placed in a sample-dedicated disposable pail and homogenized with a trowel. Material in the pail will be transferred with a trowel from the pail to the appropriate sample containers. Sample containers will be filled to the top, taking care to prevent soil from remaining in the lid threads prior to being closed to prevent potential contaminant migration to or from the sample. [Alternatively, samples will be retained in the brass sleeves in which collected until samples preparation begins.] See Section 7.1 for preservation and shipping procedures.

## Subsurface Soil Sampling

Use this subsection for subsurface soil samples that are to be collected 12 inches or more below the surface. Specify the method (e.g., hand augers) that will be used to access the appropriate depth and then state the depth at which samples will be collected and the method to be used to collect and then transfer samples to the appropriate containers, or reference the appropriate sections of a Soil Sampling SOP. If SOPs are referenced, they should be included in an Appendix.

If exact soil sampling locations will be determined in the field, this should be stated. The criteria that will be used to determine sampling locations, such as accessibility, visible signs of potential contamination (e.g., stained soils), and topographical features which may indicate the location of hazardous substance disposal (e.g., depressions that may indicate a historic excavation) should be provided. There should also be a discussion concerning possible problems, such as subsurface refusal.

Include this paragraph first if exact sampling locations are to be determined in the field; otherwise delete.

Exact soil sampling locations will be determined in the field based on accessibility, visible signs of potential contamination (e.g., stained soils), and topographical features which may indicate location of hazardous substance disposal (e.g., depressions that may indicate a historic excavation). Soil sample locations will be recorded in the field logbook as sampling is completed. A sketch of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to the reference points will be given.

If subsurface samples are to be analyzed for volatile organic compounds, use this paragraph; otherwise delete

It is Region 9 policy that soils collected for volatile and gasoline analyses be collected in hermetically sealed sampling devices (such as EnCore samplers) and analyzed within the holding time specified in EPA Method 5035, or immediately preserved by one of the processes specified in EPA Method 5035. A rationale should be provided if more than one preservation method is specified. Collection in brass tubes, even if subsequently preserved, is not acceptable.

Samples to be analyzed for volatile organic compounds will be collected first. Subsurface samples will be collected by boring to the desired sample depth using \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Once the desired sample depth is reached, soil samples for VOC analyses will be collected as independent, discrete samples. Surface soil samples will be collected using [specify the type of sampling device], and will be collected in triplicate. Samples will be sealed using the Encore sampler and placed in a zip lock bag. See Section 7.1 for preservation and shipping procedures.

If subsurface soil samples are being collected for compounds other than volatiles, use these paragraphs; otherwise delete.

Subsurface samples will be collected by boring to the desired sample depth using \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Once the

desired sample depth is reached, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[hand- or power-operated device, such as a shovel, hand auger, hollow-stem auger or split-spoon sampler] will be inserted into the hole and used to collect the sample. Samples will be transferred from the [sampling device] to a sample-dedicated disposable pail and homogenized with a trowel. Material in the pail will be transferred with a trowel from the pail to the appropriate sample containers. Sample containers will be filled to the top taking care to prevent soil from remaining in the lid threads prior to being sealed to prevent potential contaminant migration to or from the sample. See Section 7.1 for preservation and shipping procedures.

Include this as the final paragraph for subsurface soil samples.

Excess set-aside soil from the above the sampled interval will then be repacked into the hole.

## SEDIMENT SAMPLING

Use this subsection if sediment samples are to be collected. Specify the method (e.g., dredges) that will be used to collect the samples and at what depth samples will be collected. Describe how samples will be homogenized and the method to be used to transfer samples to the appropriate containers, or reference the appropriate sections of a Soil Sampling SOP. If SOPs are referenced, they should be included in an appendix.

If exact sediment sampling locations will be determined in the field, this should be stated. Describe where sediment samples will be collected, e.g., slow moving portions of streams, lake bottoms, washes, etc.

Include this paragraph first if exact sampling locations are to be determined in the field; otherwise delete.

Exact sediment sampling locations will be determined in the field, based on

[describe the criteria to be used to determine sampling locations]. Care will be taken to obtain as representative a sample as possible. The sample will be taken from areas likely to collect sediment deposits, such as slow-moving portions of streams or from the bottom of the lake at a minimum depth of 2 feet.

The final paragraph describes sample homogenization, which is especially important if the sample is to be separated into solid and liquid phases, and container filling. Include this paragraph, or a modified form of it, for all sediment sampling. It is assumed that sediment samples will not be analyzed for volatile compounds. If sediment is to be analyzed for volatile organic compounds, the samples to be analyzed for volatile compounds should not be homogenized, but rather transferred directly from the sampler into the sample container. If feasible, a hermetically sealed sampling device should be used.

Material in the sampler will be transferred to a sample-dedicated disposable pail and homogenized with a trowel. Material from the pail will be transferred with a trowel from the bucket to the appropriate sample containers. Sample containers will be filled to the top taking care to prevent soil from remaining in the lid groves prior to being sealed in order to prevent potential contamination migration to or from the sample containers. See Section 7.2 for preservation and shipping procedures.

## WATER SAMPLING

* + 1. **Surface Water Sampling**

Use this subsection if samples are to be collected in rivers, streams, lakes and reservoirs, or from standing water in runoff collection ponds, gullies, drainage ditches, etc. Describe the sampling procedure, including the type of sample (grab or composite - see definitions below), sample bottle preparation, and project-specific directions for taking the sample. State whether samples will be collected for chemical and/or microbiological analyses. Alternatively, reference the appropriate sections of attached SOPs.

Grab: Samples will be collected at one time from one location. The sample should be taken from flowing, not stagnant water, and the sampler should be facing upstream in the middle of the stream. Samples will be collected by hand or with a sample bottle holder. For samples taken at a single depth, the bottle should be uncapped and the cap protected from contamination. The bottle should be plunged into the water mouth down and filled 6 to 12 inches below the surface of the water. If it is important to take samples at depths, special samplers (e.g., Niskin or Kemmerer Depth Samplers) may be required.

Time Composite: Samples are collected over a period of time, usually 24 hours. If a composite sample is required, a flow- and time-proportional automatic sampler should be positioned to take samples at the appropriate location in a manner such that the sample can be held at 4oC for the duration of the sampling.

Spatial Composite: Samples are collected from different representative positions in the water body and combined in equal amounts. A Churn Splitter or equivalent device will be used to ensure that the sample is homogeneously mixed before the sample bottles are filled. Volatile organic compound samples will be collected as discrete samples and not composited.

If exact surface water sample locations will be determined in the field, this should be stated. Describe the criteria that will be used to determine where surface water samples will be collected.

Include this paragraph first if exact sampling locations are to be determined in the field; otherwise delete.

Exact surface water sampling locations will be determined in the field based on

[describe the criteria to be used to determine sampling locations]. Sample locations will be recorded in the field logbook as sampling is completed. A sketch of the sample location will be entered into the logbook and any physical reference points will be labeled. If possible, distances to the reference points will be given.

Use this paragraph if samples are to be collected in rivers, streams, lakes and reservoirs, or from standing water in runoff collection ponds, gullies, drainage ditches, etc. Describe the sampling procedure, sample bottle preparation, and project-specific directions for taking the sample, or reference the appropriate sections of a Water Sampling SOP. If SOPs are referenced, they should be included in an appendix.

Samples will be collected from [describe the sampling location]. The sample will be taken from flowing, not stagnant water. The sampler will face upstream in the middle of the stream. Samples will be collected by hand or with a sample bottle holder. For samples taken at a single depth, the bottle should be uncapped and the cap protected from contamination. The bottle should be plunged into the water mouth down and filled 6 to 12" below the surface of the water. If it is important to take samples at depths, special samplers (e.g., Niskin or Kemmerer Depth Samplers) may be required. See Section 7.3 for preservation and shipping procedures.

## Groundwater Sampling

This subsection contains procedures for water level measurements, well purging, and well sampling. Relevant procedures should be described under this heading with any necessary site- specific modifications, or reference sections of an appropriate SOP. If SOPs are referenced, they should be included in an appendix.

## *Water-Level Measurements*

The following language may be used as is or modified to meet project needs.

All field meters will be calibrated according to manufacturer's guidelines and specifications before and after every day of field use. Field meter probes will be decontaminated before and after use at each well.

If well heads are accessible, all wells will be sounded for depth to water from top of casing and total well depth prior to purging. An electronic sounder, accurate to the nearest +0.01 feet, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column; the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water and most electronic water level sounders have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. Total well depths will be measured by lowering the weighted probe to the bottom of the well and recording the depth to the nearest 0.1 feet.

Water-level sounding equipment will be decontaminated before and after use in each well. Water levels will be measured in wells which have the least amount of known contamination first. Wells with known or suspected contamination will be measured last.

## *Purging*

Describe the method that will be used for well purging (e.g., dedicated well pump, bailer, hand pump), or reference the appropriate sections in a Ground Water SOP. If SOPs are referenced, they should be included in an Appendix. Note: A combination of purging methods may be used.

Include this paragraph if dedicated well pumps will be used; otherwise delete.

All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using the dedicated well pump.

Include this paragraph if hand pumps, submersible pumps, bailers, or other sampling methods will be used; otherwise delete.

All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using [specify sampling method]. When a submersible pump is used for purging, clean flexible Teflon tubes will be used for groundwater extraction. All tubes will be decontaminated before use in each well. Pumps will be placed 2 to 3 feet from the bottom of the well to permit reasonable draw down while preventing cascading conditions.

The following paragraphs should be included in all sample plans.

Water will be collected into a measured bucket to record the purge volume. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as:

## V = πd2 h / 77.01

where: **V** is the volume of one well casing of water (1ft3 = 7.48 gallons);

**d** is the inner diameter of the well casing (in inches);

**h** is the total depth of water in the well (in feet).

It is most important to obtain a representative sample from the well. Stable water quality parameter (temperature, pH and specific conductance) measurements indicate representative sampling is obtainable. Water quality is considered stable if for three consecutive readings:

* + - * + temperature range is no more than +1C;
        + pH varies by no more than 0.2 pH units;
        + specific conductance readings are within 10% of the average.

The water in which measurements were taken will not be used to fill sample bottles.

If the well casing volume is known, measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If the well casing volume is NOT known, measurements will be taken every 2.5 minutes after flow starts. If water quality parameters are not stable after 5 casing volumes or 30 minutes, purging will cease, which will be noted in the logbook, and ground water samples will be taken. The depth to water, water quality measurements and purge volumes will be entered in the logbook.

If a well dewaters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80% of the static water column and dewatered once more. After water levels have recharged to 80% of the static water column, groundwater samples will be collected.

## *Well Sampling*

Describe the method that will be used to collect samples from wells. (This will probably be the same method as was used to purge the wells.) Specify the sequence for sample collection (e.g., bottles for volatile analysis will be filled first, followed by semivolatiles, etc.). State whether samples for metals analysis will be filtered or unfiltered. Include the specific conditions, such as turbidity, that will require samples to be filtered. Alternatively, reference the appropriate sections in the Ground Water SOP and state in which appendix the SOP is located.

The following paragraph should be included in all sample plans.

At each sampling location, all bottles designated for a particular analysis (e.g., volatile organic compounds) will be filled sequentially before bottles designated for the next analysis are filled (e.g., semivolatile organic compounds). If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis for both sample designations will be filled sequentially before bottles for another analysis are filled. In the filling sequence for duplicate samples, bottles with the two different sample designations will alternate (e.g., volatile organic compounds designation GW-2, volatile organic compounds designation GW-4 (duplicate of GW-2), metals designation GW-2, and metals designation GW-4 (duplicate of GW-2). Groundwater samples will be transferred directly into the appropriate sample containers with preservative, if required, chilled if appropriate, and processed for shipment to the laboratory.

If samples are to be collected for volatiles analysis, the following paragraph should be added; otherwise delete.

Samples for volatile organic compound analyses will be collected using a low flow sampling device. A [specify type] pump will be used at a flow rate of . Vials for volatile organic compound analysis will be filled first to minimize the effect of aeration on the water sample. See Section 7.3 for preservation and shipping procedures.

If some samples for metals (or other) analysis are to be filtered, depending upon sample turbidity, the following paragraph should be added; otherwise delete.

After well purging and prior to collecting groundwater samples for metals analyses, the turbidity of the groundwater extracted from each well will be measured using a portable turbidity meter. A small quantity of groundwater will be collected from the well, transferred to a disposable vial, and a turbidity measurement will be taken. The results of the turbidity measurement will be recorded in the field logbook. The water used to measure turbidity will be discarded after use. If the turbidity of the groundwater from a well is above 5 Nephelometric Turbidity Units (NTUs), both a filtered and unfiltered sample will be collected. A [specify size]-micron filter will be used to remove larger particles that have been entrained in the water sample. A clean, unused filter will be used for each filtered sample collected. Groundwater samples will be transferred from the filter directly into the appropriate sample containers with a preservative and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, an unfiltered sample will be collected. A sample number appended with an “Fl” will represent a sample filtered with a [specify size]-micron filter. See Section 7.3 for preservation and shipping procedures.

If samples are to be filtered for metals (or other) analysis regardless of sample turbidity, the following paragraph should be added; otherwise delete.

Samples designated for metals analysis will be filtered. A [specify size]-micron filter will be used to remove larger particles that have been entrained in the water sample. A clean, unused filter will be used for each filtered sample collected. Groundwater samples will be transferred from the filter directly into the appropriate sample containers to which preservative has been added and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the filter to the sample container. After the filtered sample has been collected, an unfiltered sample will be collected. A sample number appended with an “Fl” will represent a sample filtered with a [specify size]-micron filter. See Section 7.3 for preservation and shipping procedures.

## OTHER SAMPLING

Describe the collection of other media, if any.

## DECONTAMINATION PROCEDURES

Specify the decontamination procedures that will be followed if non-dedicated sampling equipment is used. Alternatively, reference the appropriate sections in the organization’s Decontamination SOP and state in which appendix the SOP is located.

The decontamination procedures that will be followed are in accordance with approved procedures. Decontamination of sampling equipment must be conducted consistently as to assure the quality of samples collected. All equipment that comes into contact with potentially contaminated soil or water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. All sampling devices used, including trowels and augers, will be steam-cleaned or decontaminated according to EPA Region 9 recommended procedures.

The following, to be carried out in sequence, is an EPA Region IX recommended procedure for the decontamination of sampling equipment.

Use the following decontamination procedures; edit as necessary.

* + - Non-phosphate detergent and tap water wash, using a brush if necessary
    - Tap-water rinse
    - 0.1 N nitric acid rinse [For inorganic analyses, include an acid rinse. Otherwise, delete.]
    - Deionized/distilled water rinse
    - Pesticide-grade solvent (reagent grade hexane) rinse in a decontamination bucket [For organic analyses, include a solvent rinse. Otherwise, delete.]
    - Deionized/distilled water rinse (twice)

Equipment will be decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered.

NOTE: If a different decontamination procedure is used; a rationale for using the different approach should be provided.

# **Table 6-1**

**Field and Sampling Equipment**

|  |  |  |
| --- | --- | --- |
| **Description of Equipment** | **Material (if applicable)** | **Dedicated**  **(Yes/No)** |
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# **Table 6-2**

**Field Equipment/Instrument Calibration, Maintenance, Testing, and Inspection**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Analytical Parameter** | **Field Equipment/ Instrument** | **Calibration Activity** | **Maintenance and Testing/ Inspection Activity** | **Frequency** | **Acceptance Criteria** | **Corrective Action** |
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## SAMPLE CONTAINERS, PRESERVATION, PACKAGING AND SHIPPING

This section describes the types of containers to be used and the procedures for preserving, packaging and shipping samples. Some of this information may have been presented in tabular form previously. See Tables 5-1 and 5-2 for examples. The organization responsible for adding preservatives should be named.

The number and type of sample containers, volumes, and preservatives are listed in [specify table(s)]. The containers are pre-cleaned and will not be rinsed prior to sample collection. Preservatives, if required, will be added by [name of agency/organization doing the sampling] to the containers prior to shipment of the samples to the laboratory.

## SOIL SAMPLES

Include this subsection if collecting soil samples; otherwise delete.

Include the following paragraphs, as appropriate; otherwise delete. Modify if necessary.

VOLATILE ORGANIC COMPOUNDS: Soil samples to be analyzed for volatile organic compounds will be stored in their sealed Encore samplers for no more than two days prior to analysis. Samples will be chilled to 4C immediately upon collection.

Include these sentences if samples will be frozen or preserved; otherwise delete. Frozen Encore sampler samples will be stored for no more than 4 days prior to analysis. If samples are preserved by ejecting into either methanol or sodium bisulfate solution the holding time is two weeks.

OTHER ORGANIC COMPOUNDS: Soil samples for [include all requested analysis(ses)] will be homogenized and transferred from the sample-dedicated homogenization pail into 8-ounze wide-mouth glass jars using a trowel. A separate container will be collected for each laboratory. [Alternatively, samples will be retained in the brass sleeve in which collected until sample preparation begins.] The samples will be chilled to 4C immediately upon collection.

METALS: Surface soil samples to be analyzed for metals will be homogenized and transferred from the sample-dedicated homogenization pail into 8-oz, wide-mouth glass jars. A separate container will be collected for each laboratory. Samples will not be chilled. Subsurface samples will be retained in their original brass sleeves or other container unless transferred to bottles.

## SEDIMENT SAMPLES

Include this subsection if collecting sediment samples; otherwise delete.

Include the following paragraphs, as appropriate; otherwise delete. Modify if necessary.

VOLATILE ORGANIC COMPOUNDS: Sediment samples to be analyzed for volatile organic compounds will be stored in their sealed Encore samplers for no more than two days prior to analysis. Samples will be chilled to 4C immediately upon collection.

Include these sentences if samples will be frozen or preserved; otherwise delete. Frozen EnCore samples will be stored for no more than 4 days prior to analysis. If samples are preserved by ejecting into either methanol or sodium bisulfate solution the holding time is two weeks.

OTHER ORGANIC COMPOUNDS: Soil samples for [include all requested analysis(ses)] will be homogenized and transferred from the sample-dedicated homogenization pail into 8-ounze wide-mouth glass jars using a trowel. A separate container will be collected for each laboratory. [Alternatively, samples will be retained in the brass sleeve in which collected until sample preparation begins.] The samples will be chilled to 4C immediately upon collection.

METALS: Sediment samples, with rocks and debris removed, which are to be analyzed for metals will be homogenized and transferred from the sample-dedicated homogenization pail into 8-ounze, wide-mouth glass jars. A separate container will be collected for each laboratory. Samples will not be chilled.

## WATER SAMPLES

Include this subsection if collecting water samples; otherwise delete.

Include the following paragraphs, as appropriate; otherwise delete. Modify if necessary.

VOLATILE ORGANIC COMPOUNDS: Low concentration water samples to be analyzed for volatile organic compounds will be collected in 40-ml glass vials. 1:1 hydrochloric acid (HCl) will be added to the vial prior to sample collection. During purging, a test vial will be filled with sample at each sample location and the pH will be measured using a pH meter or pH paper to ensure that sufficient acid is present to result in a pH of less than 2. If the pH is greater than 2, additional HCl will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial(s) will be discarded. The sample vials will be filled so that there is no headspace. The vials will be inverted and checked for air bubbles to ensure zero headspace. If a bubble appears, the vial will be discarded and a new sample will be collected. The samples will be chilled to 4C immediately upon collection. Three vials of each water sample are required for each laboratory.

METALS: Water samples collected for metals analysis will be collected in 1-liter polyethylene bottles. The samples will be preserved by adding nitric acid (HNO3) to the sample bottle. The bottle will be capped and lightly shaken to mix in the acid. A small quantity of sample will be poured into the bottle cap where the pH will be measured using pH paper. The pH must be <2. The sample in the cap will be discarded, and the pH of the sample will be adjusted further if necessary. The samples will be chilled to 4C immediately upon collection. One bottle of each water sample is required for each laboratory.

OTHER PARAMETERS: [e.g., Anions, Pesticides, Semivolatile Organic Compounds]

If requested analyses require preservation, include this paragraph; otherwise delete. A separate paragraph should be included for each bottle type.

Water samples to be analyzed for [specify what parameters are included] will be collected in [specify size and type of container]. The [specify analysis(ses)] samples will be preserved by adding [describe preservative appropriate to each sample type] to the sample bottle. The bottle will be capped and lightly shaken to mix in the preservative. A small quantity of sample will be poured into the bottle cap where the pH will be measured using pH paper. The pH must be within the appropriate range. The sample in the cap will be discarded, and the pH of the sample will be adjusted further if necessary. Samples will be chilled to 4C immediately upon collection.

If requested analyses do not require preservation, include this paragraph; otherwise delete. A separate paragraph should be included for each bottle type.

Water samples to be analyzed for [specify analysis(ses)] will be collected in

[specify bottle type]. No preservative is required for these samples. The samples will be chilled to 4C immediately upon collection. Two bottles of each water sample are required for each laboratory.

## OTHER SAMPLES

If samples of other media (e.g., soil gas) are to be collected, specify the analyses that will be performed and the containers and preservatives required.

## PACKAGING AND SHIPPING

The following paragraphs provide a generic explanation and description of how to pack and ship samples. They may be incorporated as is, if appropriate, or modified to meet any project-specific conditions.

All sample containers will be placed in a strong-outside shipping container .The following outlines the packaging procedures that will be followed for low concentration samples.

1. When ice is used, pack it in zip-lock, double plastic bags. Seal the drain plug of the cooler with fiberglass tape to prevent melting ice from leaking out of the cooler.
2. The bottom of the cooler should be lined with bubble wrap to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of the sample bottles with indelible ink.
4. Secure bottle/container tops with clear tape and custody seal all container tops.
5. Affix sample labels onto the containers with clear tape.
6. Wrap all glass sample containers in bubble wrap to prevent breakage.
7. Seal all sample containers in heavy duty plastic zip-lock bags. Write the sample numbers on the outside of the plastic bags with indelible ink.
8. Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid.
9. Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Vermiculite should also be placed in the cooler to absorb spills if they occur.
10. Ice used to cool samples will be double sealed in two zip lock plastic bags and placed on top and around the samples to chill them to the correct temperature.
11. Each ice chest will be securely taped shut with fiberglass strapping tape, and custody seals will be affixed to the front, right and back of each cooler.

## DISPOSAL OF RESIDUAL MATERIALS

This section should describe the type(s) of investigation-derived wastes (IDW) that will be generated during this sampling event. EPA recognizes that IDW may not be generated in all sampling events, in which case this section would not apply. Use the language below or reference the appropriate sections in a Disposal of Residual Materials SOP and state in which appendix the SOP is located. Depending upon site-specific conditions and applicable federal, state, and local regulations, other provisions for IDW disposal may be required. If any analyses of IDW are required, these should be discussed. If IDW are to be placed in drums, labeling for the drums should be discussed in this section.

In the process of collecting environmental, the sampling team will generate different types of potentially contaminated IDW that include the following:

* + Used personal protective equipment (PPE)
  + Disposable sampling equipment
  + Decontamination fluids
  + Soil cuttings from soil borings [Include this bullet when sampling soils; otherwise delete.]
  + Purged groundwater and excess groundwater collected for sample container filling [Include this bullet when sampling groundwater; otherwise delete.]

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. The sampling plan will follow the *Office of Emergency and Remedial Response (OERR) Directive 9345.3-02* (May 1991), which provides the guidance for the management of IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

Listed below are the procedures that should be followed for handling the IDW. The procedures have enough flexibility to allow the sampling team to use its professional judgment as to the proper method for the disposal of each type of IDW generated at each sampling location. The following bullet is generally appropriate for site or sampling areas with low levels of contamination or for routine monitoring. If higher levels of contamination exist at the site or sampling area, other disposal methods (such as the drumming of wastes) should be used to dispose of used PPE and disposable sampling equipment.

* Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill. Any PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster.

Include this bullet if sampling for both metals and organics; otherwise delete.

* Decontamination fluids that will be generated in the sampling event will consist of dilute nitric acid, pesticide-grade solvent, deionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground or into a storm drain. Pesticide-grade solvents will be allowed to evaporate from the decontamination bucket. The nitric acid will be diluted and/or neutralized with sodium hydroxide and tested with pH paper before pouring onto the ground or into a storm drain.

Include this bullet if sampling for metals but not organics; otherwise delete.

* Decontamination fluids that will be generated in the sampling event will consist of nitric acid, deionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground or into a storm drain. The nitric acid will be diluted and/or neutralized with sodium hydroxide and tested with pH paper before pouring onto the ground or into a storm drain.

Include this bullet if sampling for organics but not metals; otherwise delete.

* Decontamination fluids that will be generated in the sampling event will consist of pesticide-grade solvent, deionized water, residual contaminants, and water with non- phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and water with detergent) will be poured onto the ground or into a storm drain. Pesticide- grade solvents will be allowed to evaporate from the decontamination bucket.

Include this bullet if sampling soils; otherwise delete.

* + Soil cuttings generated during the subsurface sampling will be disposed of in an appropriate manner.

Include this bullet if sampling groundwater; otherwise delete.

* + Purged groundwater will be

Depending upon the degree of groundwater contamination, site-specific conditions, and applicable federal, state, and local regulations, disposal methods will vary. Disposal methods can also vary for purge water from different wells sampled during the same sampling event.

## SAMPLE DOCUMENTATION

## FIELD NOTES

This section should discuss record keeping in the field. This may be through a combination of logbooks, preprinted forms, photographs, or other documentation. Information to be maintained is provided below.

## Field Logbooks

Describe how field logbooks will be used and maintained.

*Use field logbooks to document where, when, how, and from whom any vital project information was obtained. Logbook entries should be complete and accurate enough to permit reconstruction of field activities. Maintain a separate logbook for each sampling event or project. Logbooks should have consecutively numbered pages. All entries should be legible, written in black ink, and signed by the individual making the entries. Use factual, objective language.*

At a minimum, the following information will be recorded during the collection of each sample:

Edit this list as necessary.

* + - * Sample location and description
      * Site or sampling area sketch showing sample location and measured distances
      * Sampler's name(s)
      * Date and time of sample collection
      * Designation of sample as composite or grab
      * Type of sample (soil, sediment or water)
      * Type of sampling equipment used
      * Field instrument readings and calibration
      * Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
      * Preliminary sample descriptions (e.g., for soils: clay loam, very wet; for water: clear water with strong ammonia-like odor)
      * Sample preservation
      * Lot numbers of the sample containers, sample identification numbers and any explanatory codes, and chain-of-custody form numbers
      * Shipping arrangements (overnight air bill number)
      * Name(s) of recipient laboratory(ies)

In addition to the sampling information, the following specific information will also be recorded in the field logbook for each day of sampling:

Edit this list as necessary.

* + - * Team members and their responsibilities
      * Time of arrival/entry on site and time of site departure
      * Other personnel on site
      * Summary of any meetings or discussions with tribal, contractor, or federal agency personnel
      * Deviations from sampling plans, site safety plans, and QAPP procedures
      * Changes in personnel and responsibilities with reasons for the changes
      * Levels of safety protection
      * Calibration readings for any equipment used and equipment model and serial number

A checklist of the field notes, following the suggestions above, using only those that are appropriate, should be developed and included in project field notes.

## Photographs

If photographs will be taken, the following language may be used as is or modified as appropriate.

Photographs will be taken at the sampling locations and at other areas of interest on site or sampling area. They will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the logbook or recorded in a separate field photography log:

* + - * Time, date, location, and weather conditions
      * Description of the subject photographed
      * Name of person taking the photograph
  1. **SAMPLE LABELING**

The following paragraph provides a generic explanation and description of the use of labels. It may be incorporated as is, if appropriate, or modified to meet any project-specific conditions.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. A copy of the sample label is included in [specify appendix]. The samples will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: station location, date of collection, analytical parameter(s), and method of preservation. Every sample, including samples collected from a single location but going to separate laboratories, will be assigned a unique sample number.

## SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

The following paragraphs provide a generic explanation and description of the use of chain-of- custody forms and custody seals. They may be incorporated as is, if they are appropriate, or modified to meet any project-specific conditions.

All sample shipments for analyses will be accompanied by a chain-of-custody record. A copy of the form is found in [specify appendix]. Form(s) will be completed and sent with the samples for each laboratory and each shipment (i.e., each day). If multiple coolers are sent to a single laboratory on a single day, form(s) will be completed and sent with the samples for each cooler.

The chain-of-custody form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is in someone's custody if it is either in someone’s physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of \_\_\_\_\_\_\_\_\_\_\_\_ [name of agency/ organization conducting sampling]. The sampling team leader or designee will sign the chain-of-custody form in the “relinquished by” box and note date, time, and air bill number.

A self-adhesive custody seal will be placed across the lid of each sample. A copy of the seal is found in [specify appendix]. For VOC samples, the seal will be wrapped around the cap. The shipping containers in which samples are stored (usually a sturdy picnic cooler or ice chest) will be sealed with self-adhesive custody seals any time they are not in someone’s possession or view before shipping. All custody seals will be signed and dated.

## QUALITY CONTROL

This section should discuss the quality control samples that are being collected to support the sampling activity. This includes field QC samples, confirmation samples, background samples, laboratory QC samples, and split samples. Wherever possible, the locations at which the samples will be collected should be identified and a rationale provided for the choice of location. Frequency of collection should be discussed. All samples, except laboratory QC samples, should be sent to the laboratory blind, wherever possible. Laboratory QC samples should be identified and additional sample (e.g., a double volume) collected for that purpose.

## FIELD QUALITY CONTROL SAMPLES

Field quality control samples are intended to help evaluate conditions resulting from field activities and are intended to accomplish two primary goals, assessment of field contamination and assessment of sampling variability. The former looks for substances introduced in the field due to environmental or sampling equipment and is assessed using blanks of different types. The latter includes variability due to sampling technique and instrument performance as well as variability possibly caused by the heterogeneity of the matrix being sampled and is assessed using replicate sample collection. The following sections cover field QC.

## Assessment of Field Contamination (Blanks)

Field contamination is usually assessed through the collection of different types of blanks. Equipment blanks are obtained by passing distilled or deionized water, as appropriate, over or through the decontaminated equipment used for sampling. They provide the best overall means of assessing contamination arising from the equipment, ambient conditions, sample containers, transit, and the laboratory. Field blanks are sample containers filled in the field. They help assess contamination from ambient conditions, sample containers, transit, and the laboratory. Trip blanks are prepared by the laboratory and shipped to and from the field. They help assess contamination from shipping and the laboratory and are for volatile organic compounds only.

Region 9 recommends that equipment blanks be collected, where appropriate (e.g., where neither disposable nor dedicated equipment is used). Field blanks are next in priority and trip blanks next. Only one blank sample per matrix per day should be collected. If equipment blanks are collected, field blanks and trip blanks are not required under normal circumstances.

* + - 1. ***Equipment Blanks***

In general, equipment (rinsate) blanks should be collected when reusable, non-disposable sampling equipment (e.g., trowels, hand augers, and non-dedicated groundwater sampling pumps) are being used for the sampling event. Equipment blanks can be collected for soil, sediment, and ground water samples. A minimum of one equipment blank is prepared each day for each matrix when equipment is decontaminated in the field. These blanks are submitted “blind” to the laboratory, packaged like other samples and each with its own unique identification number. Note that for samples which may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. HPLC water, which is often used for equipment and field blanks, can contain VOCs if it is not purged.

If equipment blanks are to be collected describe how they are to be collected and the analyses that will be performed. A maximum of one blank sample per matrix per day should be collected, but at a rate to not exceed one blank per 10 samples. The 1:10 ratio overrides the one per day requirement. If equipment rinsate blanks are collected, field blanks and trip blanks are not required under normal circumstances. Use the language below or reference the appropriate sections in a Quality Control SOP and state in which appendix the SOP is located.

Include this subsection if equipment blanks are to be collected, otherwise, delete.

Include this paragraph if blanks will be analyzed for both metals and organic compounds; otherwise delete.

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring High Performance Liquid Chromatography (HPLC) organic-free (for organics) or deionized water (for inorganics) over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for [include names of target analytes, e.g., metals, total petroleum hydrocarbons, volatile organic compounds, etc.].

Include this paragraph if blanks will be analyzed only for organic compounds; otherwise delete.

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring High Performance Liquid Chromatography (HPLC) organic-free water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for [include names of target analytes, e.g., volatile organic compounds, total petroleum hydrocarbons, etc.].

Include this paragraph if blanks will be analyzed only for metals; otherwise delete.

Equipment rinsate blanks will be collected to evaluate field sampling and decontamination procedures by pouring deionized water over the decontaminated sampling equipment. One equipment rinsate blank will be collected per matrix each day that sampling equipment is decontaminated in the field. Equipment rinsate blanks will be obtained by passing deionized water through or over the decontaminated sampling devices used that day. The rinsate blanks that are collected will be analyzed for metals.

Always include this paragraph.

The equipment rinsate blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory.

* + - 1. ***Field Blanks***

Field blanks are collected when sampling water or air and equipment decontamination is not necessary or sample collection equipment is not used (e.g., dedicated pumps). A methanol field blanks should also be collected when methanol is used as a preservative. A minimum of one field blank is prepared each day sampling occurs in the field, but equipment is not decontaminated. These blanks are submitted “blind” to the laboratory, packaged like other samples and each with its own unique identification number. Note that for samples which may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. HPLC water which is often used for equipment and field blanks can contain VOCs if it is not purged.

Include this subsection if field blanks will be collected; otherwise delete. Only one blank sample per matrix per day should be collected. If field blanks are prepared, equipment rinsate blanks and trip blanks are not required under normal circumstances.

Include this paragraph if blanks will be analyzed for both metals and organic compounds; otherwise delete.

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring High Performance Liquid Chromatography (HPLC) organic-free water (for organics) and/or deionized water (for inorganics) into a sampling container at the sampling point. The field blanks that are collected will be analyzed for

[include names of target analytes, e.g., metals, volatile organic compounds, etc.].

Include this paragraph if blanks will be analyzed only for organic compounds; otherwise delete.

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to ambient conditions or from sample containers. Field blank samples will be obtained by pouring High Performance Liquid Chromatography (HPLC) organic-free water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for [include names of target analytes, e.g., volatile organic compounds, total petroleum hydrocarbons, etc.].

Include this paragraph if blanks will be analyzed only for metals; otherwise delete.

Field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling due to contamination from sample containers. Field blank samples will be obtained by pouring deionized water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for metals.

Always include this paragraph.

The field blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory.

* + - 1. ***Trip Blanks***

Trip blanks are required only if no other type of blank will be collected for volatile organic compound analysis. If trip blanks are required, one is submitted to the laboratory for analysis with every shipment of samples for VOC analysis. These blanks are submitted “blind” to the laboratory, packaged like other samples and each is assigned its own unique identification number. Note that for samples which may contain VOCs, water for blanks should be purged prior to use to ensure that it is organic free. HPLC water, which is often used for trip blanks, can contain VOCs if it is not purged.

Include this subsection if trip blanks will be collected; otherwise delete. Only one blank sample per matrix per day should be collected. Trip blanks are only relevant to volatile organic compound (VOC) sampling efforts.

Trip blanks will be prepared to evaluate if the shipping and handling procedures are introducing contaminants into the samples, and if cross contamination in the form of VOC migration has occurred between the collected samples. A minimum of one trip blank will be submitted to the laboratory for analysis with every shipment of samples for VOC analysis. Trip blanks are 40-ml vials that have been filled with HPLC-grade water that has been purged so it is VOC free and shipped with the empty sampling containers to the site or sampling area prior to sampling. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same cooler with the samples collected for volatile analyses. The trip blanks will be preserved, packaged, and sealed in the manner described for the environmental samples. A separate sample number and station number will be assigned to each trip sample and it will be submitted blind to the laboratory.

* + - 1. ***Temperature Blanks***

Include this paragraph with all plans.

For each cooler that is shipped or transported to an analytical laboratory a 40-ml VOA vial will be included that is marked “temperature blank.” This blank will be used by the sample custodian to check the temperature of samples upon receipt.

* + 1. **Assessment of Field Variability (Field Duplicate or Collocated Samples**

Duplicate samples are collected simultaneously with a standard sample from the same source under identical conditions into separate sample containers. Field duplicates will consist of a homogenized sample divided in two or else a collocated sample. Each duplicate portion should be assigned its own sample number so that it will be blind to the laboratory. A duplicate sample is treated independently of its counterpart in order to assess laboratory performance through comparison of the results. At least 10% of samples collected per event should be field duplicates. At least one duplicate should be collected for each sample matrix, but their collection can be stretched out over more than one day (e.g., if it takes more than one day to reach 10 samples). Every group of analytes for which a standard sample is analyzed will also be tested for in one or more duplicate samples. Duplicate samples should be collected from areas of known or suspected contamination. Since the objective is to assess variability due to sampling technique and possible sample heterogeneity, source variability is a good reason to collect collocated samples, not to avoid their collection.

Duplicate soil samples will be collected at sample locations [identify soil sample locations from which duplicate or collocated samples will be collected]. Duplicate samples will be collected from these locations because . Add sentence(s) here explaining a rationale for collecting duplicate samples from these locations; e.g., samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.

Include this paragraph if collecting soil samples and analyzing for compounds other than volatiles; otherwise delete.

Soil samples to be analyzed for [list all analytical methods for this sample event except for volatiles] will be homogenized with a with a trowel in a sample-dedicated 1-gallon disposable pail. Homogenized material from the bucket will then be transferred to the appropriate wide-mouth glass jars for both the regular and duplicate samples. All jars designated for a particular analysis (e.g., semivolatile organic compounds) will be filled sequentially before jars designated for another analysis are filled (e.g., metals).

Include this paragraph if collecting soil samples and analyzing for volatiles; otherwise delete.

Soil samples for volatile organic compound analyses will not be homogenized. Equivalent Encore samples from a collocated location will be collected identically to the original samples, assigned unique sample numbers and sent blind to the laboratory.

Include these paragraphs if collecting sediment samples. If volatile organic compound analysis will be performed on sediment samples, modify the above paragraph for soil sample volatile analyses by changing “soil” to “sediment.”

Duplicate sediment samples will be collected at sample locations[identify

sediment sample locations from which duplicate or collocated samples for duplicate analysis will be obtained]. Duplicate samples will be collected from these locations because . Add sentence(s) here explaining a rationale for collecting duplicate samples from these locations; e.g., samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.

Sediment samples will be homogenized with a trowel in a sample-dedicated 1-gallon disposable pail. Homogenized material from the bucket will then be transferred to the appropriate wide- mouth glass jars for both the regular and duplicate samples. All jars designated for a particular analysis (e.g., semivolatile organic compounds) will be filled sequentially before jars designated for another analysis are filled (e.g., metals).

Include this paragraph if collecting water samples.

Duplicate water samples will be collected for water sample numbers [water

sample numbers which will be split for duplicate analysis]. Duplicate samples will be collected from these locations because . Add sentence(s) here explaining a rationale for collecting duplicate samples from these locations; e.g., samples from these locations are suspected to exhibit moderate concentrations of contaminants or previous sampling events have detected moderate levels of contamination at the site or sampling area at these locations.

When collecting duplicate water samples, bottles with the two different sample identification numbers will alternate in the filling sequence (e.g., a typical filling sequence might be, VOCs designation GW-2, VOCs designation GW-4 (duplicate of GW-2); metals, designation GW-2, metals, designation GW-4, (duplicate of GW-2) etc.). Note that bottles for one type of analysis will be filled before bottles for the next analysis are filled. Volatiles will always be filled first.

Always include this paragraph.

Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. A separate sample number and station number will be assigned to each duplicate, and it will be submitted blind to the laboratory.

## BACKGROUND SAMPLES

Background samples are collected in situations where the possibility exists that there are native or ambient levels of one or more target analytes present or where one aim of the sampling event is to differentiate between on-site and off-site contributions to contamination. One or more locations are chosen which should be free of contamination from the site or sampling location itself, but have similar geology, hydrogeology, or other characteristics to the proposed sampling locations that may have been impacted by site activities. For example, an area adjacent to but removed from the site, upstream from the sampling points, or up gradient or cross gradient from the groundwater under the site. Not all sampling events require background samples.

Specify the sample locations that have been designated as background. Include a rationale for collecting background samples from these locations and describe or reference the sampling and analytical procedures which will be followed to collect these samples.

## FIELD SCREENING, INCLUDING CONFIRMATION SAMPLES, AND SPLIT SAMPLES

For projects where field screening methods are used (typically defined as testing using field test kits, immunoassay kits, or soil gas measurements or equivalent, but not usually defined as the use of a mobile laboratory which generates data equivalent to a fixed laboratory), two aspects of the tests should be described. First, the QC which will be run in conjunction with the field screening method itself, and, second, any fixed laboratory confirmation tests which will be conducted. QC acceptance criteria for these tests should be defined in these sections rather than in the DQO section.

## Field Screening Samples

For projects where field screening methods are used, describe the QC samples which will be run in the field to ensure that the screening method is working properly. This usually consists of a combination of field duplicates and background samples. The discussion should specify acceptance criteria and corrective action to be taken if results are not within defined limits. Discuss confirmation tests below.

## Confirmation Samples (Field Screening)

If the planned sampling event includes a combination of field screening and fixed laboratory confirmation, this section should describe the frequency with which the confirmation samples will be collected and the criteria which will be used to select confirmation locations. These will both be dependent on the use of the data in decision making. It is recommended that the selection process be at a minimum of 10% and that selection criteria include checks for both false positives (i.e., the field detections are invalid or the concentrations are not accurate) and false negatives (i.e., the analyte was not detected in the field). Because many field screening techniques are less sensitive than laboratory methods false negative screening is especially important unless the field method is below the action level for any decision making. It is recommended that some “hits” be chosen and that other locations be chosen randomly.

Describe confirmation sampling. Discuss the frequency with which samples will be confirmed and how location will be chosen. Define acceptance criteria for the confirmation results (e.g., RPD<25%) and corrective actions to be taken if samples are not confirmed.

## LABORATORY QUALITY CONTROL SAMPLES

Laboratory quality control (QC) samples are analyzed as part of standard laboratory practice. The laboratory monitors the precision and accuracy of the results of its analytical procedures through analysis of QC samples. In part, laboratory QC samples consist of matrix spike/matrix spike duplicate samples for organic analyses, and matrix spike and duplicate samples for inorganic analyses. The term “matrix” refers to use of the actual media collected in the field (e.g., routine soil and water samples).

Laboratory QC samples are an aliquot (subset) of the field sample. They are not a separate sample, but a special designation of an existing sample.

Include the following language if soil samples are to be collected for other than volatiles; otherwise delete.

A routinely collected soil sample (a full 8-oz sample jar or two 120-mL sample vials) contains sufficient volume for both routine sample analysis and additional laboratory QC analyses. Therefore, a separate soil sample for laboratory QC purposes will not be collected.

Include the following language if soil samples are to be collected for volatiles; otherwise delete.

Soil samples for volatile organic compound analyses for laboratory QC purposes will be obtained by collecting double the number of equivalent Encore samples from a collocated location in the same way as the original samples, assigned a unique sample numbers and sent blind to the laboratory.

Include the following language if water samples are to be collected. Otherwise delete.

For water samples, double volumes of samples are supplied to the laboratory for its use for QC purposes. Two sets of water sample containers are filled and all containers are labeled with a single sample number. *For volatile samples this would result in 6 vials being collected instead of 3, for pesticides and semivolatile samples this would be 4 liters instead of 2, etc.*

The laboratory should be alerted as to which sample is to be used for QC analysis by a notation on the sample container label and the chain-of-custody record or packing list.

At a minimum, one laboratory QC sample is required per 14 days or one per 20 samples (including blanks and duplicates), whichever is greater. If the sample event lasts longer than 14 days or involves collection of more than 20 samples per matrix, additional QC samples will be designated.

For this sampling event, samples collected at the following locations will be the designated laboratory QC samples:

If a matrix is not being sampled, delete the reference to that matrix.

* For soil, samples [List soil sample locations and numbers designated for QA/QC.]
* For sediment, samples [List sediment sample locations and numbers designated for QA/QC.]
* For water, samples [List water sample locations and numbers designated for QA/QC.]

1. **FIELD VARIANCES**

It is not uncommon to find that, on the actual sampling date, conditions are different from expectations such that changes must be made to the SAP once the samplers are in the field. The following paragraph provides a means for documenting those deviations, or variances. Adopt the paragraph as is, or modify it to project-specific conditions.

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the QA Office will be notified and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented in the sampling project report.

1. **FIELD HEALTH AND SAFETY PROCEDURES**

Describe any agency-, program- or project-specific health and safety procedures that must be followed in the field, including safety equipment and clothing that may be required, explanation of potential hazards that may be encountered, and location and route to the nearest hospital or medical treatment facility. A copy of the organization health and safety plan may be included as an Appendix and referenced in this section.

**EXAMPLE FORMS**

# **Table 1-1**

**Key Project Personnel Contact Information and Responsibilities**

|  |  |  |  |
| --- | --- | --- | --- |
| **Title** | **Name** | **Phone Number Email Address** | **Responsibilities** |
| **EPA Quality Assurance Officer (QAO)** |  |  |  |
|  |  |
| **EPA Project Manager** |  |  |  |
|  |  |  |  |
| **Grantee Project**  **Manager** |  |  |  |
|  |  |  |  |
| **Contractor Project**  **Manager (include Company Name)** |  |  |  |
| **Contractor QAO** |  |  |  |
| **Contractor Field Team**  **Leader** |  |  |  |
|  |  |  |  |
| **Laboratory Quality Assurance Officer (include Laboratory Name)** |  |  |  |

**Table 2-1**

**Contaminants of Concern, Previous Investigations Matrix = Soil**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Analytical Parameter (Contaminants of**  **Concern)** | **Date of sampling** | **Sampling contractor** | **Laboratory Analytical Results**  **(units [µg/kg])** | **Regulatory Limit (specify)1** |
| Benzene | 06/24/01 | ABC, Co. | 200 | 50 |
|  |  |  |  |  |
|  |  |  |  |  |
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|  |  |  |  |  |

µg/kg = micrograms per kilogram

1 DTSC = Calif. Department of Toxic Substances Control

# **Table 3-1**

**Contaminants of Concern, Laboratory, and Screening or Action Levels Matrix = Soil**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Analytical Parameter**  **(Contaminants of Concern)** | **Laboratory Reporting or Quantitation**  **Limits** |  | **Screening or Action Levels** |  |
| **EPA Residential**  **RSLs** | **DTSC Residential**  **RSLs** | **RWQCB**  **Residential ESLs** |
| **Volatile Organic Compounds by Method 8260 (µg/kg)** | | | | |
| Benzene | 10 | 640 | NA | 440 |
| Tetrachloroethylene (PCE) | 10 | 480 | NA | 87 |
| Toluene | 10 | 520000 | NA | 3300 |
| **Metals by Method 6010/7470 (mg/kg)** | | | | |
| Arsenic | 1 | 0.07 | 0.07 | Background |
| Chromium | 2 | 210 | 0 | 1000 |
| Lead | 2 | 150 | 150 | 150 |

RL = Reporting Limit

EPA = US Environmental Protection Agency

DTSC = Calif. Department of Toxic Substances Control

RWQCB = Regional Water Quality Control Board

µg/kg = micrograms per kilogram mg/kg = milligrams per kilogram

RSLs = Regional Screening Levels

ESLs = Environmental Screening Levels

NA = Not available or Not applicable

# **Table 4-1**

**Sampling Design and Rationale Matrix = Soil**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sampling**  **Location/ID Number** | **Depth (feet)** | **Analytical Parameter** | **Rationale \*** |
| SB1 | 0-1.5  2-4, 6-8 | TPH-g/d, metals TPH-g/d, VOA & metals | Assess environmental conditions at the former UST and former fuel pump island locations. Volatiles will not be collected from the shallow soil due to probable weathering effects. |
| SB2 | 0-1.5  2-4, 6-8 | TPH-g/d, metals TPH-g/d, VOA & metals | Assess the potential presence of contaminants in undocumented fill materials at the Site. Volatiles will not be collected from the shallow soil due to probable weathering effects. |
|  |  |  |  |

\* Include rationale for location, depth and analysis.

TPH –g/d = total petroleum hydrocarbons as gasoline and diesel VOA = volatile organic analyses

# **Table 4-2**

**Sampling Design and Rationale**

**Matrix = Groundwater**

|  |  |  |
| --- | --- | --- |
| **Sampling**  **Location/ID Number** | **Analytical Parameter** | **Rationale \*** |
| SB1 | TPH-g/d, VOA,  metals | Assess the potential migration of contaminants to the groundwater at the former UST and former fuel pump island  locations. |
| SB2 | TPH-g/d, VOA,  metals | Assess the potential migration of contaminants to the  groundwater from the fill materials located on the Site. |
|  |  |  |
|  |  |  |

\*Include rationale for location and analysis.

TPH –g/d = total petroleum hydrocarbons as gasoline and diesel

VOA = volatile organic analyses

# 

# **Table 5-1**

**Analytical Services**

**Matrix = Soil**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample Number** | **Sample Location** | **Depth (feet)** | **Special Designation** | **Analytical Methods** | | | |
| **SW846**  **Method 8015B**  **(TPH as gasoline)** | **SW846**  **Method 8015B**  **(TPH as diesel)** | **SW846**  **Method 8260B**  **(volatiles)** | **SW846**  **Method 6010/7470**  **(metals)** |
| SB-01-05 | SB1 | 0-1.5 |  | X | X |  | X |
| SB-01-24 | SB1 | 2-4 | MS/MSD | X | X | X | X |
| SB-01-68 | SB1 | 6-8 |  | X | X | X | X |
| SB-02-05 | SB2 | 0-1.5 |  | X | X |  | X |
| SB-02-24 | SB2 | 2-4 |  | X | X | X | X |
| SB-02-68 | SB2 | 6-8 |  | X | X | X | X |
| SB-01-10 | SB2 | 6-8 | Duplicate of  SB-02-68 | X | X | X | X |
| Total number of Soil Samples, excluding QC: | | | | 6 | 6 | 4 | 6 |
| Total number of Soil Samples, including QC: | | | | 7 | 7 | 5 | 7 |

TPH = total petroleum hydrocarbons

MS/MSD = matrix spike/ matrix spike duplicate

# **Table 5-2**

**Analytical Services**

**Matrix = Groundwater**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sample Number** | **Sample Location** | **Special Designation** | **Analytical Methods** | | | |
| **SW846**  **Method 8015B**  **(TPH as gasoline)** | **SW846**  **Method 8015B**  **(TPH as diesel)** | **SW846**  **Method 8260B**  **(Volatiles)** | **SW846**  **Method 6010/7470**  **(Metals)** |
| SB-01 | SB1 | MS/MSD | X | X | X | X |
| SB-02 | SB2 |  | X | X | X | X |
| SB-03 | SB2 | Duplicate of  SB-02-68 | X | X | X | X |
| **Total number of Soil Samples, excluding QC:** | | | 2 | 2 | 2 | 2 |
| **Total number of Soil Samples, including**  **QC:** | | | 3 | 3 | 3 | 3 |

TPH = total petroleum hydrocarbons

MS/MSD = matrix spike/ matrix spike duplicate

# **Table 5-3**

**Analytical Method, Container, Preservation, and Holding Time Requirements**

**Matrix = Soil**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Analytical Parameter and/or Field Measurements** | **Analytical Method Number** | **Containers (number, type, size/volume)** | **Preservation Requirements (chemical, temperature, light**  **protection)** | **Maximum Holding Times** |
| Volatiles | SW-846 Method  8260B | Two EnCore  Samplers | Chill with ice to 4oC | 48 hours |
| Metals | SW-846 Method  6010/7470 | 4 oz glass jar | Chill with ice to 4oC | <180 days/<28 days  for Hg |
|  |  |  |  |  |

**Table 5-4**

**Analytical Method, Container, Preservation, And Holding Time Requirements**

**Matrix = Groundwater**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Analytical Parameter and/or Field Measurements** | **Analytical Method Number** | **Containers (number, type, size/volume)** | **Preservation Requirements (chemical, temperature, light**  **protection)** | **Maximum Holding Times** |
| Volatiles | SW-846 Method  8260B | 3 x 40-ml VOA | Chill with ice to  4oCpH<2 with HCl | 14 days |
| Metals | SW-846 Method  6010/7470 | 1 L HDPE | Chill with ice to 4oC  pH<2 with HNO3 | 6 months |
|  |  |  |  |  |

VOA = volatile organic analysis

HDPE = high density polyethylene Hg = mercury

HCL = hydrochloric acid

HNO3 = nitric acid

**Table 6-1**

**Field and Sampling Equipment**

|  |  |  |
| --- | --- | --- |
| **Description of Equipment** | **Material (if applicable)** | **Dedicated (Yes/No)** |
| Sampling sleeves | Acetate or equivalent | Yes |
| Hand auger | Hardened steel | No |
| EnCore® samplers | Plastic | Yes |
| Sampling trowel | Plastic or stainless steel | Yes |
| Bailer | Plastic or stainless steel | Yes |
| Conductivity meter | NA | No |
| Peristaltic pump with dedicated  tubing | Tygon or HDPE tubing | no |
|  |  |  |

NA = not applicable

HDPE = high density polyethylene

# **Table 6-2**

**Field Equipment/Instrument Calibration, Maintenance, Testing, and Inspection**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Analytical Parameter** | **Field Equipment/ Instrument** | **Calibration Activity** | **Maintenance and Testing/ Inspection Activity** | **Frequency** | **Acceptance Criteria** | **Corrective Action** |
| Temperature (sensor) | Multimeter Manufacturer X, Model Y | Annual check of endpoints of desired temperature range (0oC  to 40oC) versus NIST thermometer | See manufacturer’s manual | Annually | ±0.2oC of true value at both endpoints (i.e., manufacturer’s listed accuracy for the sensor) | Remove from use if doesn’t pass calibration criteria |
| pH (electrode) | Multimeter Manufacturer X,  Model Y | Initial: two-point calibration bracketing expected range (using  7.0 and either 4.0 or  10.0 pH buffer, depending on field conditions); followed by one-point check  with 7.0 pH buffer  Post: single-point check with 7.0 pH  buffer | See manufacturer’s  manual | Initial: beginning of each day  Post: end of each day | Initial: two-point calibration done electronically; one-point check (using 7.0 pH buffer) ±0.1 pH unit of true value  Post: ) ±0.5 pH unit of true value with both 7.0 pH and other “bracketing” buffer (and either  4.0 or 10.0 pH) | Recalibrate  Qualify data |

## Attachment A Seven Step DQOs Process

The following information can be found in “Guidance on Systematic Planning Using the Data Quality Objectives Process” (EPA QA/G-4, February 2006).

“The U.S. Environmental Protection Agency (EPA) has developed the Data Quality Objectives (DQO) Process as the Agency’s recommended planning process when environmental data are used to select between two alternatives or derive an estimate of contamination. The DQO Process is used to develop performance and acceptance criteria (or data quality objectives) that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.”

“Various government agencies and scientific disciplines have established and adopted different variations to systematic planning, each tailoring their specific application areas. For example, the Observational Method is a variation on systematic planning that is used by many engineering professions. The Triad Approach, developed by EPA’s Technology Innovation Program, combines systematic planning with more recent technology advancements, such as techniques that allow for results of early sampling to inform the direction of future sampling. However, it is the Data Quality Objectives (DQO) Process that is the most commonly-used application of systematic planning in the general environmental community. Different types of tools exist for conducting systematic planning. The DQO Process is the Agency’s recommendation when data are to be used to make some type of decision (e.g., compliance or non-compliance with a standard) or estimation (e.g., ascertain the mean concentration level of a contaminant).”

“The DQO Process is used to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the

goals of a study. The DQO Process consists of seven iterative steps. Each step of the DQO Process defines criteria that will be used to establish the final data collection design.”

## Step 1 - State the Problem

* + Give a concise description of the problem
  + Identify the leader and members of the planning team
  + Develop a conceptual model of the environmental hazard to be investigated

## Step 2 - Identify the Goal of the Study

* + Identify the principal sturdy question(s)
  + Consider alternative outcomes or actions that can occur upon answering the question(s)
  + For decision problems, develop decision statements, organize multiple decisions
  + For estimation problems, state what needs to be estimated and key assumptions

## Step 3 - Identify Information Inputs

* + Identify types and sources of information needed to resolve decisions or produce estimates
  + Identify the basis of information that will guide or support choices to be made in later steps of the DQO Process
  + Select appropriate sampling and analysis methods for generating the information

## Step 4 - Define the Boundaries of the Study

* + Define the target population of interest and its relevant spatial boundaries
  + Define what constitutes a sampling unit
  + Specify temporal boundaries and other practical constraints associated with sample/data collection
  + Specify the smallest unit on which decision or estimates will be made

## Step 5 - Develop the Analytical Approach

* + Specify appropriate population parameters for making decisions or estimates
  + For decision problems, choose a workable Action Level and generate an “If… then…else” decision rule which involves it
  + For estimation problems, specify the estimator and the estimation procedure

## Step 6 - Specify Performance or Acceptance Criteria

* + For decision problems, specify the decision rule as a statistical hypothesis test, examine the consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors
  + For estimation problems, specify acceptable limits on estimation uncertainty

## Step 7 - Develop the Detailed Plan for Obtaining Data

* + Compile all information and outputs generated in Steps 1 through 6
  + Use this information to identify alternative sampling and analysis designs that are appropriate for your intended use
  + Select and document a design that will yield data that will best achieve your performance or acceptance criteria

## Attachment B

**Project Action Levels (PALs), Detection Limits (DLs), and Quantitation Limits (QLs)**

The Project Action Limits (PALs), as introduced and defined in Section 1.7, will help target the selection of the most appropriate method, analysis, laboratory, etc. (the analytical operation) for your project. One important consideration in this selection is the type of decision or action you may wish to make with the data, depending on whether you generate results in concentrations below, equal to, or above the PALs. In order to ensure some level of certainty of the decisions or actions, it is recommended that you consider choosing an analytical operation capable of providing quality data at concentrations less than the PALs.

When choosing an analytical operation, you will come across terms such as Detection Limit (DL) and Quantitation Limit (QL). These terms are frequently expressed by other terminology, but the two key words to look for are “detection” and “quantitation” (sometimes referred to as “quantification”). The following describes the differences between these terms:

* + - **Detection Limit** or **DL** - This is the minimum concentration that can be detected above background or baseline/signal noise by a specific instrument and laboratory for a given analytical method. It is not recognized as an accurate value for the reporting of project data. If a parameter is detected at a concentration less than the QL (as defined below) but equal to or greater than the DL, it should be qualified as an estimated value.
    - **Quantitation Limit** or **QL** - This is the minimum concentration that can be identified and quantified above the DL within some specified limits of precision and accuracy/bias during routine analytical operating conditions. It is matrix and media-specific, that is, the QL for a water sample will be different than for a sediment sample. It is also recommended that the QL is supported by the analysis of a standard of equivalent concentration in the calibration curve (typically, the lowest calibration standard).

(Note: The actual “real time” sample Reporting Limit or RL is the QL adjusted for any necessary sample dilutions, sample volume deviations, and/or extract/digestate volume deviations from the

standard procedures. It is important to anticipate potential deviations to minimize excursions of the RL above the PAL, whenever possible.)

For any analytical operation, the relationship between the PAL, QL, and DL terms can be represented as:



0

–

+



DL



QL



PAL

A standard general rule of thumb is to select an analytical operation capable of providing a QL in the range of 3-10 times lower than the PAL and 3-10 times higher than the DL. Some additional considerations for selecting an analytical operation with the most appropriate relationship for your data needs may include the following:

* + - When critical decisions will be made with project data exceeding the PALs, you may wish to have a greater level of certainty at the PAL concentration level. To accomplish this, you may want to select an analytical operation capable of providing a QL towards the lower end of the range (closer to values 5-10 times lower than the PAL). This would result in a greater distribution of concentrations that could be reported with certainty, both less than and approaching the PAL.
    - When you’re looking to minimize uncertainty of the project data reported at the QL, you may choose to select an analytical operation where the QL is much greater than the DL (closer to values 5-10 times higher than the DL). This would help to ensure less background noise impacts on the data.

Careful consideration of the PAL/QL/DL relationship should be given when balancing your data quality needs with project resources to get the most appropriate data quality for the least cost. For example, the PAL for one analytical parameter may be 10 g/l based on the Federal Water Quality Standard, and you have a choice between an expensive state-of-the-art analytical

technology providing QL = 1 g/l and DL = 0.5 g/l, a moderately-priced standard method with QL = 5 g/l and DL = 1 g/l, or an inexpensive field measurement with QL = 15 g/l and DL = 8 g/l. These choices may be represented as follows:



0.5 g/L 1 g/L

10 g/L

0 More Expensive

DL QL

PAL



1 g/L

5 g/L

10 g/L

0 Moderately Priced

–

DL

QL

PAL

+



8 g/L 10 g/L

15 g/L

0

Less Expensive

DL

PAL

QL

If you are attempting to identify whether the analytical parameter exceeds the Federal Standard, the moderately priced method may serve your needs. However, if the parameter is known to be present and you’re attempting to further identify the boundaries of those areas minimally impacted by low levels (for example, you’re suspecting lower concentrations may pose a risk to some aquatic species of concern in the area), you may opt for the more expensive analysis with the lower QL and DL. In both of these examples, the inexpensive field measurement may not be appropriate to meet your project needs, as the lowest concentration that would be reported (15 g/l) exceeds the PAL. However, if you are just trying to get a handle on whether some specific locations within your study region grossly exceed the PAL, data generated from the inexpensive field measurement may suit your project needs.

## Attachment C

**Data Quality Indicators (DQIs) and Measurement Performance Criteria (MPC) for**

**Chemical Data**

Identifying Data Quality Indicators (DQIs) and establishing Quality Control (QC) samples and Measurement Performance Criteria (MPC) to assess each DQI, as introduced in Section 1.7, are key components of project planning and development. These components demonstrate an understanding of how “good” the data need to be to support project decisions, and help to ensure there is a well-defined system in place to assess that data quality once data collection/generation activities are complete.

When faced with addressing data quality needs in your QA Project Plan, one of the first terms you may come across is Data Quality Indicators (DQIs). DQIs include both quantitative and qualitative terms. Each DQI is defined to help interpret and assess specific data quality needs for each sample medium/matrix and for each associated analytical operation. The principal DQIs and a brief summary of information related to assessing each DQI is as follows:

## Precision

Questions answered: How reproducible do the data need to be? How good do I need to be at doing something (such as sample collection, sample prep/analysis, etc.) the same way two or more times?

Expressed in terms of “*relative percent difference*” (for the comparison of 2 data points). Quantitative vs. Qualitative term: Quantitative.

QC samples (may include):

* + Field duplicates - To duplicate all steps from sample collection through analysis;
  + Laboratory duplicates - To duplicate inorganic sample preparation/analysis methodology; and/or
  + Matrix spike/matrix spike duplicates - To duplicate organic sample preparation/analysis methodology; to represent the actual sample matrix itself.

Acceptance criteria or MPC: May be expressed in terms of Relative Percent Difference (RPD) between two data points representing duplicates and defined by the following equation:

*RPD*  100

*X*1  *X* 2

*X*1  *X* 2 / 2

where,

*RPD* = Relative Percent Difference (as %)

*X* 1  *X* 2

= Absolute value (always positive) of *X1 – X2*

*X1* = Original sample concentration

*X2* = Duplicate sample concentration

For field duplicate precision, an RPD of ≤20% might serve as a standard rule of thumb for aqueous samples.

For laboratory QC sample precision, information provided in the analytical methods might be found to be adequate to meet your data quality needs.

Expressed in “*relative standard deviation*” or other statistical means for comparison of 3 or more data points - Follow a similar thought process as described above and include appropriate calculations.

## Accuracy/Bias

Questions answered: How well do the measurements reflect what is actually in the sample? How far away am I from the accepted or “true” value, and am I above this value or below it?

Expressed in terms of *“Recovery”*

Quantitative vs. Qualitative term: Quantitative.

QC samples (may include)

* Matrix spikes - To monitor sample preparation/analysis methodology, as well as, to represent the actual sample matrix itself;
* Standard reference materials and/or laboratory control samples - To monitor sample preparation/analysis methodology and often of a similar media (such as water, soil, sediment) as the field samples; and/or
* Performance Evaluation (PE) samples – (may be appropriate for complex analyses) To serve as an external check on sample preparation/analysis methodology, as samples of known concentration are prepared external to the laboratory and submitted for analysis as “blind” or unknown samples.

(NOTE: The concentrations of these QC samples are typically near the middle of the calibration range.)

Acceptance criteria or MPC: MPC are typically expressed in terms of % Recovery of a known or accepted/true amount and defined by the following equation:

%*R*  *X* 100

*K*

where,

*%R* = Recovery (as %)

*X* = Measured value or concentration

*K* = Known or accepted/true value or concentration

For matrix spikes, the % Recovery calculation typically takes into account correcting the matrix spike concentration for the naturally occurring amounts (as measured in the unspiked sample). The calculation may be represented by the following equation:

%*R*  ( *A*  *B*) 100

*K*

where,

*%R* = Recovery (as %)

*A* = Measured value or concentration in the matrix spike

*B* = Measured value or concentration in the unspiked sample

*K* = Known or accepted/true value or concentration in the matrix spike without native amounts present

For laboratory QC sample accuracy/bias, information provided in the analytical methods might be found to be adequate to meet your data quality needs.

For PE sample accuracy/bias, information is available from the PE sample vendor. Expressed in terms of *“Contamination”*

Quantitative vs. Qualitative term: Quantitative.

QC samples (may include):

* + Field blanks - To assess the effect of any potential sample collection contaminant sources on the associated sample data; and
  + Laboratory blanks - To assess the effect of any potential laboratory preparation/analysis contaminant sources on the associated sample data.

Acceptance criteria or MPC: MPC are typically expressed in reference to the QL (as defined in Appendix A). MPC are often set at <QL for field blanks and <QL or some fraction of the QL (such as <1/2 QL) for laboratory blanks.

## Representativeness

Questions answered: How well do the sample data reflect the environmental conditions? Is my 500mL sample representative of all the water in that lake? Is my sample still the same after that hot, bumpy truck ride to the laboratory?

Quantitative vs. Qualitative term: May include both.

*If quantitative*:

QC samples (may include):

* + QC samples for other DQIs - To serve as overall checks of representativeness; and/or
  + Temperature blanks (water samples that travel with samples from transport in the field to the laboratory) - To serve as a QC check for temperature-related sample preservation.

Acceptance criteria or MPC: For temperature blanks, MPC may be expressed in relation to an acceptable temperature range. For example, for field samples requiring preservation at 4C, the MPC may be 4C +/- 2C.

*If qualitative*:

QC samples (may include): None.

Acceptance criteria or MPC: Assessing this DQI may include plans to verify that documented sample collection and analytical methods (including sample handling & chain-of-custody procedures, sample preservation, and sample holding times protocols) were followed to ensure the data reflects the environmental conditions. Assessing may also include a review of the sampling design to determine whether samples collected were representative of the environmental conditions and extent of physical boundaries, especially if the sampling design was based on judgmental sampling and not on statistical means.

## Comparability

Questions answered: How similar do the data need to be to those from other studies or from similar locations of the same study, same sampling locations but at different times of the year, etc.? Are similar field sampling and analytical methods followed to ensure comparability? If variations are noted in field conditions (such as a stream bed being somewhat dry resulting in more turbid water samples), do these observations support poor comparability of associated data?

Quantitative vs. Qualitative: Qualitative.

QC samples (may include): None.

Acceptance criteria or MPC: Assessing this DQI may include plans to compare sample collection and handling methods, analytical procedures, and QA/QC protocols between studies, study locations, sampling time of year, etc. along with the associated data. Additionally, comparison of concentration units, types of equipment used, and weather/seasonal variations may be assessed.

## Completeness

Questions answered: What amount (typically expressed in percentage) of the data you plan to collect is necessary to meet your project objectives? And, are there any data points that are absolutely critical and therefore may warrant re-sampling and/or re-analysis if not attained? After all the things that went wrong do I still have enough acceptable information and data to make a decision?

Quantitative vs. Qualitative: May include both.

*If quantitative:*

QC samples (may include): None.

Acceptance criteria or MPC: MPC are typically expressed in terms % Completeness between the amount of usable data collected versus the amount of data planned to be collected for the study. Completeness is defined by the following equation:

%*C*  *N* 100

*T*

where,

*%C* = Completeness (as %)

*N* = Number of usable results

*T* = Targeted number of samples planned to be collected

Typical MPC may fall somewhere in the range of 75 - 90% completeness, depending on how critical it is to supporting project decisions.

*If qualitative*:

QC samples (may include): None.

Acceptance criteria or MPC: Assessing this DQI may include ensuring that any data points (locations and/or analyses) that were defined as being absolutely critical to the project have in fact produced usable data and, if not, have set plans in motion to re-sample and/or re-analyze.

## Sensitivity

Questions answered: Are the field and/or laboratory methods sensitive enough to “see” or quantify your parameters of concern at or below the regulatory standards or your PALs? Are the QLs low enough to answer the question(s) you are asking? How low can I measure and still have confidence in the results?

Quantitative vs. Qualitative: Quantitative.

QC samples (may include):

* Calibration verification - To assess the ability to accurately quantify data at the low end of the calibration curve; and/or
* Laboratory QC samples (such as laboratory control samples, laboratory fortified blanks, etc.) - To ensure accurate quantifying of data at the QL.
* (NOTE: The concentrations of these samples are typically at or near the QL which is typically defined by the lowest point on a calibration range.)

Acceptance criteria or MPC: MPC may be expressed in terms of the laboratory’s acceptable performance criteria for their QC checks. This is typically expressed as QL +/- some defined acceptable concentration value deviation.

Another way of approaching this material is through a systematic process broken down into several steps (for each sample medium and associated analytical operation:

**Step 1** - Identify the most critical Data Quality Indicators (DQIs) for your project. (For example, sensitivity may be more critical than another DQI and would drive your selection of a sampling or analytical method.) DQIs should be associated with each sample medium/matrix and each sampling & measurement/analysis scheme planned. The principal DQIs include: precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity (as described above).

**Step 2** - Determine which of the DQIs will be assessed quantitatively (typically, these may include precision, accuracy/bias, and sensitivity) and which are more qualitative in nature (typically, these may include representativeness, comparability, and completeness).

**Step 3** - Describe how each DQI will be assessed. Identify pertinent quality control (QC) samples that will serve as checks on data quality, and discuss how these QC samples will be evaluated.

**Step 4** - For the DQIs that can be assessed quantitatively:

* + Identify the QC samples selected for assessing each DQI. The QC samples, as discussed previously, may include both field QC samples (such as field duplicates, field/equipment blanks, etc.) and measurement/analysis QC samples (such as laboratory duplicates, method blanks, matrix spikes/matrix spike duplicates, laboratory control samples, etc.).
  + Provide the calculation(s) that will be used to define the acceptance criteria or Measurement Performance Criteria (MPC) for each DQI.

(NOTE: These equations are generally included in Section 1.7 of the QA Project Plan. If they are presented in another section, Section 1.7 should clearly state where they will be found.)

* + Identify the Measurement Performance Criteria (MPC) for each DQI and the associated QC samples selected for assessing whether the MPC was met. The MPC for your project may be defined by several options. The two primary options include:
  + Project team defines project-specific criteria; or
  + Project team defaults to QC criteria already defined by a sampling, field measurement, or analytical method once reviewed and deemed acceptable to meet the data needs of the project.

Types of QC Samples and MPC to consider include:

Field QC Samples - MPC to be assessed by field QC samples are generally defined by the project team. For example: If analyzing sodium in a surface water sample, you may collect field duplicate samples at a frequency of 1 duplicate for every set of 20 samples or less. These QC samples would be used to assess the precision encompassing both sample collection and analytical methods. In this case, the analytical parameter is sodium, the sample matrix is surface water, the DQI is precision of field plus analytical methods, and the MPC set might be Relative Percent Difference (RPD) < 20% between the results of the field duplicate pair.

Field Measurement QC – MPC and associated QC samples are generally defined by the project team in conjunction with any information provided in the associated field instrument manuals.

Analytical QC - For laboratory measurements, the selected laboratory is often helpful in providing information on its internal quality control (QC) measures and criteria that may be “accepted” by (or defaulted to) the project team. It’s important that the project team reviews the laboratory information and decides whether the criteria are rigorous enough for its use. To do this, you will need to identify a lab, make contact with it, and ask for its QA Manual and relevant standard operating procedures (SOPs). Within the QA Manual and SOPs, you will need to look for QC acceptance criteria usually in the form of numerical values. (NOTE: Some lab QA plans lack specific QC acceptance criteria. Instead, these plans may provide marketing information and

simply “say” the laboratory is good for the reasons they will list. In this case, the pertinent QC information is probably included in the SOPs.) Alternatively, you may choose to specify the criteria you’re expecting the laboratory to meet. If you choose to do this, you will need to have the associated laboratory contract criteria ready to insert into the QA Project Plan.

(NOTE: The MPC and associated field, measurement, and/or analytical QC samples are generally provided in Section 1.7 of the QA Project Plan. If they are presented in another section of the QA Project Plan, Section 1.7 should clearly state where they will be found. This information can very easily be combined with Section 2.5 Quality Control Requirements and summarized in a table similar to Table 2-4 of the QA Project Plan Template included in Module

1. If the project team has reviewed the QC acceptance limits summarized in Table 2-4 and has selected to accept these as the MPC meeting the data quality needs of the project, this needs to be clearly stated within Section 1.7.)

**Step 5** - For the DQIs that will be assessed qualitatively, discuss the plans to assess each DQI and support the assurance that the quality of the data generated will be acceptable for making project decisions. Some examples to consider include:

Representativeness - Discuss how you will follow standardized and well-accepted sampling and analytical methods for ensuring the data collected reflects the environmental conditions. Describe the importance of any pertinent chain-of-custody procedures, sample preservation, and/or maximum sample holding times.

Comparability - Discuss if/how similar the project data need to be to those from other studies, similar locations within the same study, same sampling locations at different times of the year, etc. Compare sample collection and handling methods, analytical procedures, and QA/QC protocols as pertinent.

Completeness - Describe the amount, usually expressed in percentage, of data you plan to collect that is essential/necessary to meet your project objectives. Identify any data points (locations and/or measurements/analyses) that are absolutely critical and therefore may warrant re-sampling and/or re-analysis if not attained.

## Attachment D

**Selecting an Environmental Laboratory**

In order for an environmental monitoring program or single sampling event project to be successful, it is usually necessary to locate and hire an environmental laboratory. The guidance in this module is designed to provide perspective on a number of the areas you may want to consider in selecting a laboratory to support the data quality needs of your project. The information is presented as a starting point. For additional assistance, feel free to consult with the Region’s U.S. EPA QA staff, talk with other Grantees regarding laboratories they may be familiar with, and/or, if necessary, consider hiring a consultant.

Careful selection of laboratories and analytical methods is critical to the success of your project. Many routine laboratory procedures may not be able to support your data quality needs and/or report data to low enough limits to support decisions for your specific project. Following a review of a laboratory’s qualifications and credentials, you may end up selecting a different laboratory and/or analytical method than originally considered. This decision point is critical to the success of your project. If an inappropriate laboratory and/or analytical procedure are selected, you may end up having to repeat your entire study.

There are several factors to consider when selecting a commercial laboratory including:

## Technical and Logistical Qualification

* + Experience with sample media/matrices and analyses
  + State certification and/or TNI accreditation
  + Laboratory capacity
  + Laboratory location and support services
  + Experience with other tribal projects
  + Cost

## Quality System Documentation

* + Laboratory Quality Assurance Plan (or Manual)
  + Standard operating procedures
  + Personnel resumes
  + Cost of QC
  + Chain-of-custody
  + Archiving data

## Other Factors

* + Data review procedures
  + Laboratory report content
  + Sample retention and disposal
  + Laboratory subcontracts

Additional guidance on these factors is provided in the subsections that follow.

## Technical and Logistical Qualifications:

Experience with sample media/matrices and analyses - *Does the laboratory have experience analyzing the types of samples* (e.g., water, drinking water, waste water, sediment, soil, fish tissue, plant materials, etc.) *that you want analyzed? Does the laboratory perform the specific analyses that you require?* Some laboratories may specialize in analyses based on either a particular matrix (e.g., drinking water, fish tissue, etc.) or a particular type of analysis (e.g., pesticides, dioxin, etc.). Others are full service organizations that can handle many types of matrices/media and analyses.

It is important that you determine what matrices/media and analyses you require while you are planning your project (and prior to writing your QA Project Plan). Usually laboratories have a business manager, client services manager, sales representative, etc. who will work with you to determine whether they can provide the particular analyses required for your project. Most laboratories will perform routine surface or ground water analyses. Two types of water analyses not always available at every laboratory include: organic chemistry methods for drinking water compliance analyses (as these methods require a laboratory to handle reporting at the low detection limits); and dioxin analyses (as these methods require special reagents, instruments, and expertise).

Lack of prior experience should not necessarily disqualify a laboratory, but should lead to a more thorough investigation of the laboratory’s qualifications.

State certification and/or TNI accreditation - *Does the laboratory have state certification in the state in which your grantee resides? Does the certification include the types of sample media/matrices and analyses of interest for your project?* It is important to note that all states do not run their certification program the same way. Some state certifications include only drinking water, while others may include many different media (e.g., waste water, hazardous waste, tissue, etc.). Even laboratories within a given state seldom are certified for exactly the same media or analytical parameters. Laboratories are certified for specific media and analyses depending on their interest to pursue specific certification categories, as well as their ability to demonstrate compliance with the associated qualifications. State certification by itself does not guarantee that good quality work will be produced, but it may provide a good starting point to help you evaluate a laboratory’s ability to support your project needs.

*Does the laboratory have TNI accreditation? Does the accreditation include the types of sample media/matrices and analyses of interest for your project?* Many states, independent of size, also participate in TNI (The NELAC Institute).

This program attempts to ensure a national uniformity in accreditations (similar in intent to certifications), and involves a more detailed review than that provided historically by many state certification programs.

*Has the laboratory successfully analyzed all recent performance evaluation (PE) samples?* Usually state certification and/or TNI accreditation requires regular participation in some kind of PE program. Although these PE programs do not cover all analyses or all possible analytes, they usually cover many of the most common analytes of interest to water monitoring programs. It is recommended that you request the laboratory’s most recent (last two years is good) PE results. If there have been recent problems, you should inquire about the results of the laboratory’s investigation of the problem and its corrective actions to ensure the problem was fixed.

*Do you know the current status the laboratory’s state certification or TNI accreditation?* You may want to request the certification/accreditation audit reports, although the laboratory is not obligated to share them with you (as their availability may be dictated by company or laboratory confidentiality policy). The state certification/TNI accreditation agency will, however, tell you the media/matrices, analytes, and methods the laboratory is certified/accredited for, as well as whether the laboratory is in good standing with regards to its certification/accreditation.

Laboratory capacity - *Does the laboratory have the capacity to handle your samples (and all related sample preparation and analyses) on the schedule you need?* Do they have sufficient instruments (and back-up instruments in case of instrument failure) and personnel to handle the anticipated sample load?

If you are not generating a large number (typically, less than 40) of samples, most laboratories can handle this sample load without problem. However, if your project will generate a large number samples at one time and/or you have samples to be analyzed for a variety of analytical

parameters, you need to ensure that the laboratory can handle the work load in all of its departments. For example, a laboratory may have capacity to analyze 60 metals analyses (as these are relatively fast and involve minimal preparation), but they might not be able to analyze 60 pesticide or semivolatile organic compound analyses (as these require more time consuming sample preparation steps, as well as longer analysis time) in a specific time frame.

Make sure you discuss sample capacity loads, sampling holding times, and data deliverables with the laboratory and then make plans to schedule your sample collection accordingly; or, find a different laboratory that can handle your samples when they need to be analyzed, if you cannot be flexible in your sample collection and shipping schedule.

Laboratory location and support services - *Is the laboratory location convenient?* A local laboratory may be advantageous to your project as it may more easily facilitate transferring your samples directly to the laboratory the same day as collected, either hand-delivered by a project team member or picked up by a laboratory courier service. This may be especially critical if your project’s analytical methods require that your samples be analyzed within a short time frame (after collection) to ensure sample integrity. However, with overnight courier services, shipping samples within a state or even to another state doesn’t necessarily mean that processing of the samples will start any later than if they were delivered to a local laboratory.

*What support services does the laboratory provide, and what is its sample receipt policy?* You also need to discuss with the laboratory how it typically receives samples and what support it might provide in this regard. For example, the laboratory may provide coolers for shipping, chain-of-custody forms, free pre-cleaned/certified sample bottles and preservatives, courier service, etc. Some laboratories have staff available to receive samples after hours or on Saturdays, but not all do.

Cost - *Are the laboratory’s prices reasonable?* Shop around and find the laboratory that best meets your needs and look for a competitive price. Sometimes there are economies by making a longer-term commitment (e.g., for all four quarterly monitoring events in a year) or in sending all your samples to one laboratory facility (e.g., rather than splitting up samples submitted for various analyses to two or more individual laboratories).

## Quality System Documentation:

Laboratory Quality Assurance Plan (or Manual) - *Does the laboratory have a written Quality Assurance (QA) Plan, and is it adequate to meet your project’s data quality needs?* Almost all laboratories will have some form of QA Plan, but these documents may vary considerably in terms of their content.

Some QA Plans are designed to provide general information as a form of marketing tool. These plans might describe the laboratory’s capabilities, identify any state certifications or accreditations, discuss the QA program in place (in a general sense), list the methods it performs, describe the matrices it typically handles, list personnel and their qualifications, and provide an overview of the organization. This type of QA Plan may be supplemented with additional information available in other laboratory documentation, such as standard operating procedures (SOPs). However, acquiring this additional information may require you to “dig deeper” and ask more questions.

The other end of the spectrum might be a QA Plan containing similar types of information (as discussed above), while being much more detailed in scope. For example, this type of QA Plan might include lists of analytes associated with each method (rather than just listing the methods alone), as well as the reporting limits and/or method detection limits for each analyte for each

method. Rather than merely stating it has a QA program, this type of plan might provide specifics with respect to: the types of QC samples run; the frequency with which they are run; the sources and concentrations of specific spiking solutions that are used (in preparing surrogate spikes, matrix spikes, and/or laboratory control sample mixtures); the acceptance criteria associated with each type of QC check (on an analyte-specific basis); and the corrective actions taken when these criteria are not met. Details on calibration criteria and associated corrective action criteria may also be included in this type of plan.

Standard operating procedures - *Does the laboratory have written standard operating procedures (SOPs) for all of its operations?* Most full-service laboratories are divided up into departments or sections that include: sample receipt; organic sample preparation; inorganic sample preparation; metals analysis; general chemistry analyses; gas chromatography/mass spectrometry (GC/MS) analyses (often including separate volatile and semivolatile organic compound analysis areas); and gas chromatography (GC) analyses (often including separate pesticide, polychlorinated biphenyl (PCB), and total petroleum hydrocarbon analysis areas). Some laboratories also offer microbiological analyses or toxicity testing, while others may provide analysis of tissue or foliage samples.

Each laboratory department or section should document its procedures in written SOPs. SOPs for each analytical method should include detailed step-by-step procedures, as well as specific QC requirements, frequency, acceptance criteria, and corrective actions (to be taken if these criteria are exceeded) associated with that method. It is important to remember that a “published method” is not an SOP. In general, published methods such as EPA methods or those in Standard Methods vary considerably in their method description and may need to be supplemented with specific QC requirements, calibration criteria, reporting limits and/or method detection limits, etc. At times, the published methods may be modified to improve performance if necessary to meet a project objective.

Personnel resumes - *Are the resumes of key personnel available for review, if necessary?* Sometimes this information is found in the laboratory’s QA Plan, while other times resumes are kept confidential unless requested specifically. State certification agencies typically have minimum experience and/or educational requirements for management and supervisory positions, and they may review the laboratory’s general qualifications as part of

the certification process. However, you may want to review specific resumes if there are concerns related to a critical analysis area, especially for the more complex analyses.

Cost of QC - *What QC samples are analyzed and typically reported by the laboratory on a routine basis, and what QC samples may will require an additional cost to the grantee?*

Unless requested otherwise, most laboratories will perform their QC analyses on a batch basis. A batch is a set number of samples (frequently, 20) of a similar matrix/medium. The batch may be comprised of samples from a single client or include small groups of samples from multiple clients. The intent of batching samples is for the laboratory to avoid performing an overall disproportionate number of QC sample analyses. For example, a grantee may submit 5 samples and another client may submit 10 samples for the same type of analysis. But, as the laboratory typically performs analysis of the associated QC check samples (that may include a laboratory blank, a matrix spike, laboratory duplicate and possibly a laboratory control sample) at a rate of one for every 20 samples, the laboratory may combine the grantees samples and the other clients’ samples into one batch and report the same batch QC results to both clients. This is logical from a laboratory perspective, as the laboratory typically absorbs the cost of these QC samples. But, this batching could result in generating results of matrix spike and lab duplicate samples that may not be representative of the grantees samples. Thus, they provide information about the laboratory’s performance, but not necessarily about the grantees sample matrix/medium. In most cases, batch QC is sufficient for tribal purposes, but in some cases having one of the grantees samples designated to serve as the matrix spike, laboratory duplicate, and/or matrix spike duplicate may be desirable. Some laboratories may batch an individual client samples together (even if just a small group) and not combine samples from different clients. If that is the case, they may use the grantees samples as a basis for the QC samples without any additional charge.

It is recommended that you engage the laboratory in discussions regarding what QC samples it runs routinely for each analysis (as they may differ from method to method), the frequency of those QC sample analyses, as well as which are performed at client versus laboratory expense. Samples sent blind to the laboratory, such as field duplicates and field blanks, will always be at client expense.

Chain-of-custody - *If there are legal considerations to the data, does the laboratory have a well- documented, internal chain-of-custody system?* Oftentimes this is done electronically or with a combination of electronic and logbook documentation.

Archiving data - *Does the laboratory have a system in place to track, store, and archive raw data and old data reports?* Most laboratories have retention policies, but you should know and understand what they might be. With the increasing use of electronic data, but ever changing formats, a permanent hard copy may be the only way to ensure data is available for any future use (such as if the client loses their data, a complete data package including raw data was not requested by the client but needed later on, etc.).

## Other Factors:

Data review procedures - *Does the laboratory have defined procedures in place covering administrative tasks such as sample receipt and check in, as well as for the reporting and processing of data?* It is important to understand the level of review associated with these tasks. Most laboratories will have SOPs in place covering these tasks. Some specific questions to consider include:

* + Does the QA Officer (or some individual independent of performing the actual activity) review all data or a fraction of the data in real time (prior to providing the data to the client)?
  + Is there an automated data review system in place? Does the data review SOP describe the review system satisfactorily?
  + Are data flagged for the client to review? How are data flagged? Is the system clear?
  + Will all data reports contain a narrative explaining any problems?

Laboratory report contents - *What are the contents of a typical laboratory report?* It is recommended that you request to see a typical data report (to ensure the laboratory will provide the information you will need) prior to selecting your laboratory, and that you specify the laboratory QC data you need to be reported with its data (so that you will have the information necessary to perform at least a minimum QC check on your project data). You should ensure you have a clear understanding of the criteria by which the QC data were evaluated for inclusion in

your QA Project Plan (especially if this is not to be summarized in the data report). For example, seeing a matrix spike recovery of 50% might look unacceptable, but for certain difficult compounds this may be an excellent recovery justified by the laboratory QA Plan and/or analytical SOP.

In some cases, it may be desirable or necessary to have the laboratory provide a complete data package, sometimes called a data validation package. Basically, this data package includes all the data and sample information used to generate a sample result. It may include, but not be limited to, chain-of-custody and sample receipt records, sample preparation logs, analysis logs, standards logs, raw data from the instrument for both sample and QC sample analyses, calibration information for initial and continuing calibration analyses, sample analysis results, QC sample results, and all information related to sample processing (for example, results of manual integrations of results, etc.). (Note: For an example of items to consider for inclusion in a complete data package, visit the EPA Region 9 QA website at: <http://www.epa.gov/region9/qa> and download the document entitled *Draft Laboratory Documentation Requirements for Data Validation, R9QA/004.2, August 2001*) “Complete” data packages are typically required for litigation. This type of data package may cost an additional $50-100 or more per sample batch, if they are even offered as an option from a given laboratory (which is information you would want to know about up front). Such packages are usually considerably cheaper if ordered when the samples are analyzed. Asking the laboratory to generate this data package after the fact may cost considerably higher.

Sample retention and disposal - *What are the laboratory’s policies with respect to retention and disposal of samples?* The grantee should be reassured that there is no future liability associated with providing samples to the laboratory.

Laboratory subcontracts - *What are the laboratory’s policies with respect to subcontracts, and what samples might be subcontracted for your project?* The laboratory should have a system in place to evaluate its subcontractor’s quality system. It should be reviewing subcontractor data as if it was its own, since it will be reported as such. It is important to note that a subcontractor does introduce another variable into the quality system, one that you may not be able to evaluate directly. Thus, it is important that you are comfortable with whatever samples might be sent out.

If considered critical to a project’s success, you may need to request documentation (such as an SOP) from the subcontract laboratory, so that it too can be evaluated.