

3.0 WATER QUALITY SAMPLING PROCEDURES

3.1 Purpose

The sampling requirements for each project will vary depending on project objectives. A project's scope may range from permit compliance monitoring to an experimental nature. Sample types may include surface water, groundwater, and atmospheric deposition. These samples will be collected by numerous groups and analyzed by numerous laboratories. Despite the sampling and analytical variability, the data generated by these activities will be shared by various groups in order to integrate the environmental restoration efforts. Therefore, all data must meet a minimum level of quality and completeness to assure consistency within the program and to allow effective sharing of data. At the same time, data must be of the right type, quality and quantity to meet project requirements. To attain this goal, projects must follow federal and state regulations for monitoring and sample analysis, as well as meet project specific DQOs and specific CERP guidance.

3.2 Scope

The goals of this chapter of the QASR are to outline the minimum QA requirements for sample and field data collection and to provide specific procedures for performing field activities in the collection of water samples.

The chapter discusses:

- General considerations for water quality sampling;
- General procedures and guidance for selection of field equipment;
- Requirements and procedures for cleaning and decontamination of field equipment;
- Sampling procedures for surface water, groundwater and atmospheric deposition;
- Field measurement procedures and instrument calibration requirements;
- Field Quality Control (FQC) measures and sampling; and
- Field documentation and record retention.

This chapter is not intended to be “prescriptive” as to stifle professional judgment, but is intended to assure that acceptable field methods and QA/QC procedures are used when performing environmental investigations. It is intended to be a dynamic document that will be periodically reviewed and updated.

3.3 Requirements and Regulations

The SOPs and QA/QC procedures in this QASR Manual should be incorporated by reference into any monitoring activity conducted for CERP. General QASR requirements and regulations are provided in **Chapter 2, Administrative Procedures**. If a deviation from this QASR manual occurs as a result of unforeseen field events, then justification for the deviations must be documented in the field notebook(s), or on standardized field data sheets. Alternative or new procedures must be submitted to the CERP QAOT and approved before implementation. This

document does not negate the requirement for Field SOPs, as well as a Field Sampling Quality Manual (FSQM) that is specific for each sampling agency.

In addition to the requirements presented in this chapter, all field sampling and data collection activities performed for CERP projects must conform to the relevant requirements in:

3.3.1 Federal Requirements and Regulations

- USACE EM-200-1-3, 1 February 2001 (for projects contracted by the USACE), Requirements for the Preparation of Sampling and Analysis Plans (SAP)
- CGM 40, Project Level Water Quality and Hydrometeorologic Monitoring Assessment
- EPA QA/G4, Guidance of Systematic Planning using the Data Quality Objectives
- EPA-QA/G5, Guidance for Quality Assurance Project Plans
- CFR, Title 40

3.3.2 State Requirements and Regulations

- FDEP Quality Assurance Rule Chapter 62-160, FAC
- FDEP SOPs for sample collection and quality control FDEP SOPs are available at <http://www.dep.state.fl.us/labs/qa/sops.htm>.

3.3.3 Other Requirements and Regulations

- FSQM
- Any other regulations dictated by project requirements

3.4 Responsibilities of Key Personnel

Each project must have a defined organizational structure describing the person responsible and their responsibilities, as shown in **Table 3.1** Refer to **Chapter 2, Section 2.2** for more information on agency responsibilities.

Table 3.1 Key Responsibilities

Responsible Party	Key Responsibilities
QAOT	Responsible for overseeing CERP QA program, establishing and setting guidance, ensuring compliance, reviewing data quality, and ensuring that data integrity is maintained. Reviews new and alternative methods, request for sampling modifications, and conduct data quality assessment as needed. Serves as an arbiter in data quality issues. Coordinates training related to procedures and data quality.
Project or agency QA Officer (QAO)	Initiate/conduct field audits and ensure that corrective actions are taken to correct any deficiencies. The project QA Officer coordinates and oversees data quality activities, monitors adherence to policies, procedures and corrective actions, and recommends and implements corrective measures. The QA Officer reviews quality control data and the results of systems and performance audits for acceptability and compliance with quality assurance requirements and standard operating procedures. The QA officer conducts quality checks and audits. QA staff may not perform any other duties which might bias the performance of QA responsibilities.

Responsible Party	Key Responsibilities
Project Manager (PM)	Responsible for all aspects of project initiation, field activities, development and implementation, including development of DQOs, ensuring that there are adequate resources to complete the project within time and quality specifications, and performing Data Quality Assessment (DQA). The contractor PM (if applicable) acts as liaisons between the agency/client and the contract sampling organization.
Field Supervisors	Ensure that sample/data collection activities are performed according to methods and protocols specified in the QASR, FSQM, MP, and DEP Field SOPs. They coordinate field activities to assure completion of tasks within established time frames. Field supervisors verify and validate field data, identify quality control problems, and initiate and monitor corrective actions.
Field Sampling Personnel	Perform field measurements and/or collect samples according to the QASR, FSQM, MP, and DEP Field SOPs. Field technicians are responsible for following all documentation requirements, ensuring that the appropriate equipment is used, and implementing any corrective action procedures.

3.5 Training and Personnel Qualification

All personnel involved in data collection activities must have the necessary education, experience and skills to perform their duties. Training activities and demonstration of capabilities must be documented. The training must include expectations on ethical behavior and data integrity.

An effective training program should include an actual field sampling exercise with an experienced sampler. During this training period, under the guidance of the trainer, the new employee should perform all facets of field activities, including trip preparation, equipment maintenance, calibration, sampling, collecting QC samples, and completing the necessary documentation, under the direction and supervision of experienced staff. Training procedures, training records, and demonstration of capabilities must be documented indicating the specific field task, date of training, and proper signatures.

3.5.1 Occupational Safety and Health Administration and Environmental Protection Agency Regulations

Each participating agency and contractor must have a safety plan in place to ensure that all operations are conducted in a manner that instills safety and meets compliance with all Occupational Safety and Health Administration (OSHA) regulations and EPA safety policies. Prior to deploying and authorizing any personnel, operating equipment, or handling chemicals to the project location, personnel must have up-to-date knowledge of the potential and obvious hazards, how to avoid them, and what to do in case of an accident. This should include hazards and safety concerns about the site, the chemicals, and equipment that are to be used for the project. The personnel must be equipped or be provided with the proper and operational safety equipment. Individual agency or contractor is responsible for ensuring that the established safety protocols are complied with at all times. These agencies or contractors are also individually responsible for complying with local, state and federal safety regulations.

Each sampling company or agency must follow all local, state and federal requirements relating to health and safety, including the storage and disposal of any hazardous or investigation-derived wastes. Although the CERP program will not be monitoring hazardous wastes, preservatives,

calibration solutions and all other chemicals must be stored, transported and disposed of following required protocol.

CERP PMs or contract personnel should ensure that safety provisions and responsibilities are included as contract requirements. A field safety plan should be required as a deliverable for contractors.

All personnel must follow agency/company safety requirements related to monitoring activities, including, but not limited to, personal protection equipment, labeling and chemical handling.

3.6 Project Planning and Review

- Guidance and discussion on preparing MPs, refer **Chapter 2, Section 2.7**.
- QAPP guidelines refer to EPA-QA/G5 and **Chapter 2, Section 2.6**.
- Contracting Guidelines refer **Chapter 2, Section 2.9**.
- Technical Project Planning refers to USACE guidance EM 200-1-2.

3.6.1 Data Quality Objectives

DQOs are quantitative and qualitative statements of the overall level of uncertainty that a decision-maker is willing to accept. General QASR guidelines for formulating project-specific DOQs are presented in QASR **Chapter 2, Section 2.5**. Also EPA QA/G-4, Guidance for the DQOs Process outlines a logical step-by-step method of identifying the study objective, defining the appropriate type of data to collect, clarifying the decisions that will be based on the data collected, and considering the potential limitations with alternate sampling designs.

3.6.2 Sampling Strategy

One of the main goals of any investigation is to collect samples that are representative of the site conditions so that an accurate assessment of the study area can be made with a minimum number of samples. A "representative sample" is a sample that reflects one or more characteristics of the population sampled and is defined by the study objectives.

Successful investigations are highly dependent on an effective sampling plan. Development of a sampling plan to characterize a site should follow the fundamentals of the scientific approach and a logical design to allow an evaluation of site sample results in relation to background conditions, vertical extent, horizontal extent, and mobility in various media, i.e., water and soil. Typically, more than one sampling strategy or approach is necessary when several media or types of contamination are under investigation, and most sampling plans employ a combination of sampling strategies. Sampling strategies are developed by the project team to satisfy project-specific data needs. **Table 3.2** summarizes basic descriptions, applications, and limitations for some frequently used sampling strategies.

Types of Sampling Strategies:

- Directed or authoritative approaches typically rely on the judgment and experience of the investigators (or PM), as well as available information on the matrix of concern. It does not necessarily result in a sample that reflects the average characteristics of the entire matrix. The primary advantages are that the designs tend to be quick, simple, and relatively inexpensive to implement. It is ideally for sites where contaminants of concern

greatly exceed, or are significantly below, predetermined action levels. Because the experience of the PM is often the basis for sample collection, personal bias (depending on the study objectives) is a potential problem. However, for preliminary or screening investigations and for certain regulatory investigations, directed sampling may be the most appropriate strategy. There are two types of directed sampling strategies: judgmental sampling and biased sampling.

- Probabilistic or statistical approaches main feature is that each location at the site has an equal probability of being sampled; therefore, statistical bias is minimized. Probabilistic approaches include simple random sampling, stratified random sampling, and systematic grid sampling. Sometimes simple random or systematic grid sampling is used in conjunction with adaptive cluster sampling designs. By using adaptive clustering sampling, additional decision units or sample locations are selected depending on the interpretation of measurements or observations made during an initial survey. Additional sample locations are selected when a contaminant of concern in one or more units exceeds some predetermined action level in the initial survey. Adaptive cluster sampling is a beneficial design for sites where a contaminant of concern is sparsely distributed but highly concentrated.

When an area is evaluated, sampling can be conducted by random, systematic, or biased sampling.

- Biased samples are those collected at locations that were chosen based on historical information, knowledge about the behavior of the target analyte, and/or knowledge about the effects of the physical system on the fate of that analyte.
- Random sampling depends on the theory of random chance probabilities to choose the most representative sample.
- Systematic sampling over time and/or space is useful to evaluate data trends.

Often biased and random sampling techniques can be used together to address an entire area thoroughly. Some samples may be biased to potentially impacted areas. In areas with little available background information, random samples may be used to allow adequate assessment of the entire study area.

To ensure that samples are representative, a statistical approach is often used to design an appropriate sampling strategy and to provide a sound basis for supporting project decisions. Depending on data needed to support project decisions, input from a statistician may be beneficial. In addition, software programs (e.g., DQO Pro, DEFT, DataQuest, and Visual Sampling Plan) are available to CERP personnel to assist in evaluating various sampling scenarios and associated uncertainties.

The sampling design ultimately must meet specific study objectives. Factors to be defined in the sampling design include:

- Selection of site locations
- Determining the types of samples to be collected
- Quantity and frequency of sampling

- Analytical and field parameters to be measured
- Protocols to be used
- Regulations
- Physical site constraints, safety, and cost
- Representative Sampling

Table 3.2 Comparison of Sampling Strategies

Sampling Strategy	Description	Application	Limitations
Probabilistic (or Statistical/Classical) Sampling Strategies			
Simple Random Sampling	Representative sampling locations are chosen using the theory of random chance probability	Site where background information is not available and no visible signs of contamination are present.	May not be cost effective for samples located too close together. Does not take into account spatial variability of media.
Stratified Random Sampling	Site is divided into several sampling areas (strata) based on background or site survey information; each stratum is evaluated using a separate random sampling strategy	Large sites characterized by a number of habitat types, topographic features, past/present uses, or manufacturing/ storage areas.	More difficult to implement in the field and analyze results. Does not take into account spatial variability of habitats.
Systematic Grid Sampling	Most common statistical strategy involves collecting samples at predetermined, regular intervals within a grid pattern.	Best strategy for minimizing bias and providing complete site coverage. Can be used effectively at site where no background information exists.	Does not take into account spatial variability of media.
Hot Spot Sampling	Systematic Grid sampling strategy tailored to search for hot spots	Sites where background information or site survey data indicate that hot spots may exist.	Does not take into account spatial variability of media.
Geostatistical Sampling	Representative sampling locations are chosen based on spatial variability of media. Resulting data are analyzed using kriging, which creates contour maps of the contaminant concentrations and the precision of concentration estimates	More appropriate than other statistical sampling strategies because it takes into account spatial variability of media. Especially applicable to site where presence of contamination is unknown.	Previous investigation data must be available and such data must be shown to have a spatial relationship.
Directed (Non-Statistical) Sampling Strategies			
Biased Sampling	Sampling locations are chosen based on available information as historical information, knowledge about the behavior of the target analyte, and/or knowledge about the effects of the physical system on the fate of that analyte.	Sites with specific known contamination sources.	Contaminated areas can be overlooked if they are not indicated by background information or visual signs of contamination. Best if used with statistical approach, depending on the project objective.
Judgmental Sampling	An individual subjectively selects sampling locations that appear to be representative of average conditions	Homogeneous, well-defined sites.	Not usually recommended due to bias imposed by individual, especially for final investigation.

3.6.2.1 Sample Site Locations

Sampling is usually conducted in an attempt to identify the presence of a contaminant and to define its extent and variability. With such an objective, it is most logical to choose sample locations that will yield the most information about site conditions. Other factors also need to be considered when selecting locations.

Before any sampling, an initial reconnaissance should be made to locate suitable sampling locations. The relevance of site locations is dependent on the objectives of the monitoring program. If the program's objective is to investigate a specific water use, such as a source of water supply, recreation, or other discrete use, then considerations such as accessibility, velocity, and physical characteristics, are not critical from a water quality investigation standpoint. If the objective of the monitoring program is to determine patterns of pollution, provide data for mathematical modeling purposes or to conduct assimilative capacity studies where more than a small area or short stream reach is to be investigated, then these factors need to be considered in sampling location selection.

3.6.2.1.1 Rivers, Streams, and Creeks

Generally, for small streams less than 20 feet wide, a sampling site should be selected where the water is well mixed. In such cases, a single grab sample taken at mid-depth at the center of the channel is adequate to represent the entire cross-section. A sediment sample could also be collected in the same vicinity if applicable.

Select areas with the greatest degree of cross-sectional homogeneity. Sites that are located immediately upstream or downstream from the confluence of two streams or rivers should generally be avoided since flows from two tributaries may not immediately mix, and at times can produce possible backflow that can upset the depositional flow patterns.

When several locations along a stream reach are to be sampled, they should be strategically located:

- At intervals based on time-of-water-travel, not distance
- At the same locations if possible, when the data collected is to be compared to a previous study
- Whenever a marked physical change occurs in the stream channel; and
- To isolate major discharges, as well as major tributaries.

When major changes occur in a stream reach, an upstream station, a downstream station, and an intermediate station should be selected. Tributaries should be sampled as near the mouth as feasible. Care should be exercised to avoid collecting water samples from stratified locations, which are due to differences in density resulting from temperature, dissolved solids, or turbidity.

3.6.2.1.2 Lakes, Ponds, and Impoundments

Lakes, ponds, and impoundments have a much greater tendency to stratify than rivers and streams. The relative lack of mixing generally requires that more samples be obtained. Temperature, dissolved oxygen, and specific conductivity profiles of the water column, as well

as visual observation of lake samples, can often detect the different layers that can be sampled separately.

The number of water sampling stations on a lake, pond, or impoundment will vary with the objective of the investigation, as well as the size and shape of the reservoir. In ponds and small impoundments, a single vertical composite at the deepest point may be sufficient. Dissolved oxygen, pH, temperature and specific conductivity are generally measured for each vertical composite aliquot.

In lakes and larger impoundments that are vertically heterogeneous, several vertical sub-samples should be composited to form a single sample. These vertical sampling locations are often collected along grid or transect. The number of vertical sub-samples and the depths at which sub-samples are taken are usually at the discretion of the PM and field supervisor.

In lakes with irregular shapes and with several bays and coves that are protected from the wind, additional separate composite samples may be needed to adequately determine water quality. Similarly, additional samples should be collected where discharges, tributaries or land use characteristics are suspected of influencing water quality.

3.6.2.1.3 Estuarine Waters

Estuarine areas are zones where inland freshwaters (both surface and ground) mix with oceanic waters. Estuaries are generally categorized into three types, dependent upon freshwater inflow and mixing properties:

Mixed estuary - Characterized by an absence of vertical halocline (gradual or no marked increase in salinity in the water column) and a gradual increase in salinity seaward. Typically, this type of estuary is found in major freshwater sheetflow areas, featuring shallow depths.

Salt wedge estuary - Freshwater inflow that is channeled into a deep estuary. In these estuaries, the vertical mixing forces cannot override the density differential between fresh and saline waters. In effect, a salt wedge tapering inland moves horizontally and back and forth with the tidal phase.

Oceanic estuary - Characterized by salinities approaching full strength oceanic waters. Seasonally, freshwater inflow is small with the preponderance of the fresh and saline water mixing occurring near or at the shoreline.

A reconnaissance investigation should be conducted for each estuarine study unless prior knowledge of the estuarine type is available. The reconnaissance should focus upon the freshwater and oceanic water dynamics with respect to the study objective.

Water sampling in estuarine areas is normally based upon the tidal phases, with samples collected on successive slack tides. All estuarine sampling should include vertical salinity measurements coupled with vertical dissolved oxygen and temperature profiles. A variety of water sampling devices are used, but in general, the Van Dorn (or similar type) horizontal sampler or peristaltic pump are suitable. Samples are normally collected at mid-depth in areas where the depths are less than 10 feet, unless the salinity profile indicates the presence of a halocline (salinity stratification). In that case, samples are collected from each stratum. Depending upon the study objective, when depths are greater than 10 feet, water samples may be collected at the one-foot depth from the surface, mid-depth, and one-foot from the bottom.

Generally, estuarine investigations are two-phased, with study investigations conducted during wet and dry periods. Depending upon the freshwater inflow sources, estuarine water quality dynamics are not normally determined by a single season study.

3.6.2.1.4 Groundwater Sampling

Because of the difficulty and expense of installing groundwater wells, it is essential that sampling objectives be firmly established well in advance of the field activities. These objectives dictate the parameters to be measured, the necessary reliability of the water quality data, analytical methodology, and consequently, the sampling procedures necessary to meet these objectives. Groundwater moves slowly, therefore there is a slow rate of change of water quality and sampling is required less frequently than for surface water. In any groundwater sampling network, knowledge of hydrogeologic framework is important to determine the direction of groundwater movement and geochemical considerations that affect the quality of groundwater. A necessary component of any groundwater monitoring program is sampling of a background (control) site.

3.6.2.2 Sample Collection Types

The type of sample should be designated when selecting a sampling method. Sample collection types are:

- Discrete (grab) sample is a discrete aliquot representative of a specific location at a given point in time. The sample is collected at one particular point in the sample matrix. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.
- Composites are samples composed of two or more specific aliquots (discrete samples) collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and in certain instances can be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask the presence of low level analytes by diluting isolated concentrations that may be present in the environmental matrix.

3.6.2.3 Quantity and Frequency of Sampling

The number of samples required is typically based on several factors such as the sampling strategy, project objectives, properties of the matrix, degree of confidence required, access to sampling points, and resource constraints.

Determination of the number of samples needed to characterize a site depends upon sampling objectives and site-specific conditions. For example, if the objective of the event is to determine whether or not a target analyte is present within the study area, a limited number of samples from properly chosen locations will yield useful information. If, however, a target analyte is known to be present within the study area and delineation is the objective, a greater number of samples may be needed. In many cases, statistical considerations can be helpful in determining sampling strategy. It may also be necessary to strategically plan the timing of sampling. For example,

regulations covering storm water runoff sampling require that sampling be performed during a qualifying storm event.

Classical statistical methods are most applicable to sampling media that are considered fairly homogeneous as ground water and surface water. Statistics can also be used to determine the number of samples required to reach a prescribed level of certainty. However, when statistical calculations result in an unacceptably high number of samples being defined, the use of field analytical technologies or field screening techniques may be pursued to reduce the cost of sample analyses while maintaining a desired level of site coverage.

A related factor to consider is the distribution of a constituent within the environmental medium, and how this may impact the use of the data or what is considered representative. Information on how a constituent was dispersed into the environment may help in assessing whether the constituent is present on a molecular scale (e.g., solvent or solution spills) or on a macroscale (e.g., lead shot, debris, etc.). The latter situation increases the likelihood that samples may exhibit a high short-range heterogeneity, and the challenge of obtaining representative samples becomes even more difficult. The use of compositing and homogenizing techniques can improve representatives of samples (i.e., when amenable to the eventual physical/chemical analyses) by invoking the physical process of averaging.

3.6.2.3.1 Sampling Method Selection

The sampling method is determined by the project goal, purpose of the data (permit compliance or research), required matrices, required analytes, permissible sampling equipment, acceptable equipment construction materials, water body characteristics, site accessibility, transportation mode, and available resources.

Samples collected for permit compliance must be collected using methods specified by the permit. Other samples may be collected by a variety of approved methods and may be found in the specific section of the QASR for the matrix of interest, the FDEP SOPs (DEP-SOP-001/01), and the EPA document EPA/600/2-80/018 (Samplers and Sampling Procedures for Hazardous Waste Streams).

3.6.2.4 Method Evaluation

Methods should be evaluated by the PDT which should include the PM, chemist, biologist/ecologist and geologist to determine the best method suitable for a specific project. Site accessibility and transportation mode must also be considered when selecting and evaluating a sampling method. Available resources may limit the sampling method and should also be evaluated during method selection. It may be necessary to use an auto-sampler and composite the samples instead of collecting discrete grab samples. Choice of equipment may also be limited.

3.6.2.5 Alternative Methods and Procedures

Alternate methods may be used for CERP projects, but must be approved by the QAOT before implementation. Alternative methods must be appropriate for the established project DQOs. The QAOT may facilitate approval of an alternative method when the alternative offers an improvement over the existing procedure. Refer to **Chapter 2, Section 2.3**.

3.7 Procedures

Guidance and specific procedures for implementing the technical and quality procedures to be used under CERP are provided in this section. The information is presented in two major topic areas: technical procedures; and sample handling, receipt and custody procedures.

3.7.1 Technical Procedures

Careful planning and coordination is critical to a successful sampling event. Based on the MP, the sampling team must know the sampling design, sampling stations, number and types of samples to collect, the frequency of collection, source of supplies and equipment, and where the samples will be submitted.

Once the overall project requirements have been addressed, critical details relevant to sampling equipment, field analytical equipment, standard operating procedures and quality assurance must be carefully addressed.

3.7.1.1 Choosing Appropriate Field Sampling Equipment

“Sampling equipment” in this document refers to all equipment in the sample equipment train that has contact with the sample before it is transferred to the sample bottle or jar. Sampling equipment is selected based upon the sampling method, the type of sample(s) required and the parameters of interest. Other factors to consider in selecting the appropriate sampling equipment include:

- Desired sample depth
- Tidal influences
- Sample disturbance
- Sample volume
- Ease of decontamination
- Equipment cost
- Construction materials

The sampling equipment must be constructed of materials appropriate for the collection of the desired sample types and analytes as mandated in Rule Chapter 62-160 FAC. Refer to FDEP FS 1000.

The equipment brought to the field must be pre-cleaned at the base of operations or certified pre-cleaned by the vendor or laboratory. Equipment decontamination must be performed and documented according to the FDEP SOPs and the QASR.

3.7.1.2 Cleaning and Decontamination

The cleaning and decontamination procedures are based on FDEP FC1000. Also refer to FS 1000 for General Sampling Procedures. Alternative procedures to the DEP SOP may only be used upon approval by the QAOT before implementation.

- The specific equipment cleaning procedures to be used are dependent on the construction material of the equipment and the analyte(s) being sampled.

- Heavily contaminated equipment is not expected for CERP projects on a routine basis. If equipment does become heavily contaminated, the equipment will be placed in a tightly sealed untreated plastic bag, separated from clean equipment, and transported back to the base for decontamination. If cleaning must occur in the field, a field cleaned equipment blank must be collected.

3.7.1.3 Water Sampling Procedures

Before beginning a sampling project, a MP, or other project specific document must be written that describes the management, the data generation and acquisition procedures, the assessment and oversight, and the data validation and usability for the project (see EPA Requirements for QAPP, EPA QA/G-5). The sampling agency may reference procedures from their organization's FSQM and the SOPs when writing the SAP, as long as all procedures comply with Chapter 62-160, FAC, and any applicable permit requirements.

General sampling requirements:

- Sampling according to SAP, QASR, DEP SOPs and FSQM.
- Using the appropriate sampling procedures specific for substances of interest
- Using the appropriate equipment based on collected analytes or groups and following cleaning requirements.
- Using the appropriate sample containers as specified in CFR 40 and following cleaning requirements.
- Using the appropriate preservative as specified in CFR 40, only after filtration (if required).

Refer to FDEP SOPs:

- FDEP FS 1000 General Sampling Procedures
- FDEP FS 2000 General Aqueous Sampling
- FDEP FS 2100 Surface Water Sampling
- FDEP FS 2200 Groundwater Sampling

3.7.1.3.1 Sampling Surface Water

This section presents guidelines for collecting representative samples from surface water bodies for CERP projects. Surface water bodies can be classified into two primary types: flowing and standing. Flowing bodies include rivers, canals, streams, or any other water body. Standing bodies include ponds, lakes, or any other lentic water body. Surface water samples can be collected from various depths of the water bodies using the techniques described herein.

Each collection event must be performed so that samples are representative of the media being sampled, are not contaminated, altered from improper handling, or so that the sampling procedure meets federal and state requirements. To accomplish this, follow the procedures presented in the FDEP SOPs (DEP-SOP-001/01):

- FDEP FS 1000 General Sampling Procedures

- FDEP FS 2000 General Aqueous Sampling
- FDEP FS 2100 Surface Water Sampling

Any deviations from these procedures must be approved by the CERP QAOT before implementation.

Sampling Moving (Dynamic) Water

If filtered sample is to be collected from moving sources, such as rivers or streams, or just below the surface, samples may be collected into an intermediate container and filtered with syringe-type or tripod-type filtration units or by using vacuum filtration.

Sampling Static Water

If collecting filtered samples from static surface water sources (i.e., subsurface samples from lakes, ponds, lagoons or ocean) use the sampling protocols that are specified for groundwater since exposure to air can change the concentration of metals in solution. Also when collecting filtered samples for trace metals, filters should be acid washed to minimize contamination of the sample by the filter.

Sampling Marshes

The bottom sediments of many marshes are easily disturbed by foot travel, vehicles and the sample collection process, making it is difficult to obtain a sample free of debris, plants or sediments. When sampling in areas with vegetation, care must be taken not to dislodge detritus, which is attached to the stems or leaves of the vegetation. Materials floating on the surface of the water are not representative of the sample and should not be collected. The sampling device must be carefully inserted and handled to prevent collection of detritus, floating particulates and disturbed sediments. When collecting samples, alligator holes, airboat trails and other non-representative areas should be avoided. The sampling procedure for collecting surface water samples in marsh environments can be found in *A Protocol for Collecting Surface Water Samples in Marshes of the Florida Everglades*, FDEP, November 1995 (revised May 1996).

3.7.1.3.2 Sampling Stormwater Runoff

Stormwater sampling may be required for some CERP projects. Grab and flow-weighted composite sampling techniques could be utilized. It is recommended to refer to Grab Sampling Procedure for Stormwater Runoff. For more information see EPA/833/B-92/001 posted at <http://www.epa.gov/npdes/pubs/owm0093.pdf>.

3.7.1.3.3 Sampling of Groundwater

The following section presents guidelines for collecting representative groundwater samples for CERP projects from temporary and permanent groundwater monitoring wells and, where applicable, from other direct push well screen samplers. Guidance for the installation of temporary wellpoints by direct push methods for sampling groundwater at discrete points may be found in American Society for Testing and Materials (ASTM) D 6001 (<http://www.astm.org/>). Instructions presented herein are intended to include sample collection from wells that have not been completed as production or extraction wells.

All field activity related to the collection of groundwater must meet state requirements as specified in Chapter 62-160 FAC and outlined in the FDEP SOP FS 2200 Groundwater Sampling. Also FS 1000 and FS 2000 are applicable. Project specific requirements, as described in the project MP or in any project SOPs, must also be followed.

- Groundwater samples are typically discrete samples. The sample is collected once at a particular point in the sample matrix. The representativeness of such samples is defined by the nature of the materials being sampled. In general, since analytes in groundwater disperses over time and distance, it will take more grab samples to characterize the groundwater as the time increases.
- Groundwater Sampling Frequency is dependent upon the objectives and the site-specific conditions. Concentrations in groundwater vary across both time and space. Therefore, it is important to consider the potential temporal variability of the data collected. Often statistical considerations can be helpful in determining sampling strategy.
- Groundwater Sampling Techniques involve two major phases: purging the well and collecting the sample. Wells may be purged by centrifugal pump, submersible pump, bladder pump and peristaltic pump. Samples may be collected by submersible pump, bladder pump and peristaltic pump. Note: Bailer with lanyard is not allowed.
- Groundwater Sampling Equipment depends on the depth of the well, the depth to groundwater, the volume of water to be evacuated, the sampling and purging technique, and the analytes of interest

3.7.1.3.4 Sampling Atmospheric Deposition

The purpose of this section of the QASR is to provide procedures for the collection and data assessment of atmospheric deposition data for CERP projects. Even though data will be collected for CERP projects, data must also be collected according to current procedures so that data may be integrated into the atmospheric deposition monitoring program data.

The quality of atmospheric deposition monitoring and analysis for the National Atmospheric Deposition Program (NADP) posted at <http://nadp.sws.uiuc.edu/> is assured by the Atmospheric Deposition Network Quality Assurance Program. The Atmospheric Deposition Network Quality Assurance Program consists of proper site selection, the use of approved sampling and analytical methods, the adherence to both field and laboratory quality assurance protocol, and the quality assessment of network operations.

- Site Selection must be according to NADP guidelines unless sampler location is mandated by permit.
- Sampling Methods for Atmospheric deposition should follow approved procedures as specified by the FDEP SOP, DEP-SOP-001/01. The agency or group performing the sample collection and processing must have a FSQM as well as a SOP in place.
- Follow manufacturer's instructions on maintaining and calibrating the equipment. Document the calibration procedure and results in a calibration logbook.

3.7.1.4 Sampling Procedures Specific to Substances of Interest

Refer to FDEP FS 2000 and FS 2200 for sampling analyte groups.

3.7.1.5 Manual Sampling Procedures

Manual sampling techniques should be used for the collection of grab samples for immediate in-situ field analysis. Manual sampling is preferred over the use of automatic equipment over extended periods of time for composite sampling, especially when it is necessary to observe and/or note unusual conditions. Refer to FDEP FS 2100 for more information of manual sampling.

Types of Manual Sampling:

- Surface Grab Sampling-A grab sample is an individual sample collected over a period of time, usually all in one motion, not exceeding 15 minutes for aqueous samples.
- Grab Sample Directly into Sample Container - Collection directly into the sampling container is possible when the sample is collected at the surface (for shallow depths) and does not require filtration.
- Grab Sample Collection into Intermediate Container - An intermediate container should be used to collect a grab surface sample when the sample can not be collected directly into the sample containers or if the laboratory provides pre-preserved sample containers.
- Grab Sample Collection using a Peristaltic Pump-An advantage of the peristaltic pump is its design, which isolates the sample from the moving part of the pump and allows for easy decontamination by removal or replacement of the flexible tubing. This method can both extend the lateral reach of the sampler and allow sampling from depths below the water surface.

3.7.1.6 Automatic Sampling Procedures

Automatic samplers may be used when several sites are to be sampled at frequent intervals or when a continuous sample is required. Automatic samplers also help reduce human error, specifically in complex sampling activities such as flow proportional sampling, and reduce exposure to potentially hazardous environments. The primary disadvantage to automatic sampling is the cost of the equipment and maintenance requirements. The use of automatic samplers for collecting surface water samples is more applicable to situations where sampling equipment is deployed on-site for long term or dedicated to the site.

A wide variety of automatic samplers are commercially available. Most have the following five interrelated subsystem components:

- Sample intake
- Sample gathering
- Sample transport
- Sample storage
- Controls and power

Automatic sampling equipment must meet the FDEP FC 2100 specific requirements.

3.7.1.6.1 Composite Sampling

An auto-sampler may be used to collect discrete samples and composite samples. A composite sample is a sample collected over time, formed either by continuous sampling or by mixing discrete samples. Composite samples reflect the average characteristics during the compositing period. Composite samples are used when stipulated in a permit or when:

- The water or wastewater stream is continuous;
- Analytical capabilities are limited;
- Determining average pollutant concentration during the compositing period;
- Calculating mass/unit time loadings; or
- Associating average flow data to parameter concentrations.

Composite samples may be collected individually at equal time intervals or they may be collected proportional to the flow rate. The permit or SAP must specify which composite sample type to use, either time composites or flow proportional composites. Complete details on composite methods are in FDEP FS 2000. Select the tubing for the pump head and sampling train according to the analytes of interest and the allowable construction material specified. Different composite sample methods are:

- Time Composite Sample
- Flow Proportional Composite Sample
- Sequential Composite Sample
- Continuous Composite Sample

3.7.1.7 Field Measurement Procedures

This section indicates the procedures to be used for field measurements, including calibration, and documentation.

Field measurements include:

- Field Measurement of Hydrogen Ion Activity (pH) - FDEP FT 1100
- Field Measurement of Oxidation Reduction Potential (ORP) – (FDEP FT 1100 if used a pH meter with mV reading capability to ± 1400 mV)
- Field Measurement of Specific Conductance - FDEP FT 1200
- Field Measurement of Salinity - FDEP FT 1300
- Field Measurement of Temperature - FDEP FT 1400
- Field Measurements of Dissolved Oxygen - FDEP FT 1500
- Field Measurement of Turbidity - FDEP FT 1600
- Field Measurement of Field Light Penetration-Secchi Depth - FDEP FT 1700
- Field Measurement of Sulfite - EPA 377.1

- Field Measurement of Chlorine Residual. FDEP FT 2000 See **Table 3.3**

Table 3.3 Summary of Chlorine Residual Methods Discussed in DEP-SOP

Method	Applicability and Notes
DPD Colorimetric: Spectrophotometric Filter photometric Color wheel comparator	Recommended by FDEP if testing level 0.2 – 4.0 mg Cl/L Measures only Total Residual Chlorine Best suited for polluted waters because it is the method least affected by the presence of organic matter in the sample The color wheel comparator is only approved by drinking water compliance
Titrimetric	Not recommended by FDEP for field sampling unless the expected concentration levels are below the detectability of colorimeters
Selective Ion Electrode	Not recommended for on-site use May only be used if a method detection limit study verifies that the method can achieve the desired permit/regulatory limit Use of this method must be approved by the CERP QA Oversight Team
Standard Addition	Used by wastewater treatment facilities to detect the absence of any chlorine May be used to verify, but not to report the absence of chlorine residual

3.7.1.7.1 Calibration and Documentation Requirements for Field Measurements

Field instruments must meet specifications. The minimum calibration requirements must be followed regardless of the instrument make or model and manufacturer instructions must be followed for operation and maintenance. Field measurements for all CERP projects must meet minimum calibration and quality control requirements indicated in FDEP FT 1000 and FDEP FD 4100. Otherwise, the instrument must be recalibrated using the initial calibration procedure or removed from service. If a calibration check fails to meet the acceptance criteria and it is not possible to reanalyze the sample(s), then the results between the last acceptable calibration check and the failed calibration checks must be reported as estimated (following FDEP data qualifiers, **Chapter 5, Section 5.8.1**). A narrative description of the problem must also be included.

3.7.2 Sample Handling, Receipt and Custody

This section contains guidance and procedures for sample container types and preservation requirements, sample holding time information, and sample custody and transport procedures.

3.7.2.1 Sample Containers

The construction of sample containers must not contaminate or interfere with the sample, while the volume collected must be adequate to analyze all tests. Requirements for sample container types are provided in the FDEP FS 1000. Deviations from the cleaning sample container procedures must be approved by the CERP QAOT before implementation.

3.7.2.2 Sample Preservation

Samples must be preserved according to FDEP FS 1000. Dispose of all preservatives and reagents according to local and federal guidelines.

If the only analyte of interest is Total Phosphorus and the project is unrelated to an NPDES permit, the sample must be chemically preserved with sulfuric acid, but it does need to be cooled to 4°C with wet ice. The acid must be in the container prior to drawing the first composite sample into the container. Auto-samplers using acid preservation and not thermal preservation must be set up to collect samples into discrete bottles and not large five gallon jugs to prevent over or under acidification of the sample. If parameters other than Total Phosphorus are to be analyzed, appropriate additional preservation (e.g., cooling with ice or refrigeration) is required.

If the sampling is required for an NPDES permit, EPA Region four may grant approval to use this preservation method on a case-by-case basis, upon petition by the permit holder.

Refer to FDEP FD 1000 for documentation of sample preservatives.

3.7.2.3 Sample Holding Times

Samples must be analyzed by the laboratory within the time period specified in FDEP FS 1000 and following EPA requirements in 40 CFR Part 136. Failure to meet sample holding times will result in qualifying of the data.

3.7.2.4 Sample Custody

A Chain of Custody (COC) is an unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples (NELAC). Legal COC (a special type of sample custody in which all events such as possession, transport, storage, and disposal, and all time intervals that are associated with a specific sample, must be documented in writing) will not be used for CERP projects. However, careful documentation of sample collection activities and sample transfer to the laboratory, whether direct or via a courier or shipping company, must be maintained. All samples must be maintained reasonably secured under the proper storage conditions, and meet temperature and transportation requirements so that the validity of the data is not compromised. In addition, all samples must be traceable from the time of collection to disposal and data archival.

3.7.2.5 Sample Transport

Sample transport must not adversely affect the samples in terms of causing contamination or violating preservation requirements. If shipping the samples by common carrier, overnight shipping is recommended in order to maintain the samples at the required temperature and to ensure that sample holding times can be met. If the U.S. Postal Service is used, the shipper is responsible for compliance with postal laws and regulations.

Each sample bottle should be labeled and filled out with permanent marker. Each label must include:

- Station ID number or field number;
- Date and time of collection; and
- Sample type/preservation.

All comments and notes pertinent to the samples should be placed on the COC form and not on the sample labels.

3.8 Quality Assurance and Quality Control

3.8.1 Corrective Actions

The QC results must be within the acceptance criteria for the project in order for the data to meet the DQOs. Should FQC results not fall within the predetermined acceptability limits, corrective action must be taken. Corrective action includes investigation to determine the cause of FQC failure and may result in re-sampling (if possible) or qualifying the affected data.

Sample data associated with positive blanks (exceeding criteria) should also be reviewed and validated according to the procedure in **Chapter 5**.

Corrective action may also be initiated based upon audit results, calibration failures, or other measures indicating that field activities may not be producing data of the desired quality level. The CERP QAOT may initiate corrective actions as needed, and has the authority to determine the final outcome of any corrective actions, based upon the findings. The primary goal of corrective action is to determine the cause of the measurement failure, identify the affected data, determine the quantitative effect on the data (if possible), and to qualify the data as necessary. Another goal of corrective action is to prevent further loss of usable data. All corrective action must be documented and submitted to the CERP QAOT for review.

3.8.2 Data Qualification

FQC samples and field measurements are evaluated during data verification and validation. Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. Those performing the activity conduct this type of review in conjunction with the sampling activity.

Data validation determines the analytical quality of a specific data set. This review is performed subsequent to data generating activities and is conducted by those independent of the activities. Data validation determines whether or not the data quality goals established for the project were achieved.

It is necessary to review the FQC results in order to evaluate the effectiveness of the sample collection activities.

When qualifying data, the FDEP qualifiers as specified in Chapter 62-160, FAC must be used. **Table 3.4** lists the minimum criteria for FQC samples and the recommended corrective actions. Laboratory confirmation of the unacceptable FQC is necessary before initiating the suggested field corrective actions. The FQC acceptance criteria may be more stringent if required by the project.

Table 3.4 Field Quality Control Sample Criteria and Corrective Action

FQC	Requirement	Acceptance Limit	Corrective Action
Field Blank (FB)	One per sampling trip if no EB is collected	<MDL	Qualify associated samples up to ten times the contamination level. Investigate environmental conditions, sample bottles, AFW and container, preservatives, shipping, etc.
Pre-cleaned Equipment Blank (EB)	One per sampling trip if no equipment is cleaned in the field, and one per quarter per project For Autosampler, collect one EB each time intake tubing is replaced	<MDL	Qualify associated samples up to ten times the contamination level. Investigate equipment cleaning, AFW and container, sample bottles, environmental conditions, preservatives, shipping, etc.
Field Cleaned Equipment Blank (FCEB)	At least one per sampling trip and at a rate of 10%, if equipment is cleaned in the field	<MDL	Qualify associated samples up to ten times the contamination level. Investigate equipment cleaning, cleaning reagents, AFW and container, sample bottles, environmental conditions, preservatives, shipping, etc.
Field Duplicates or Replicate Samples (FD) or (RS)	Varies per project: at least one per quarter recommended	< 20 % RPD or RSD*	Qualify affected samples. Investigate collection procedure, sample bottles, equipment cleaning, etc.
Trip Blank (TB)	One set per transport container for VOCs, (not to be opened)	<MDL	Qualify affected samples. Investigate shipping, transport containers, laboratory AFW and containers, etc.
Split Samples (SS)	Varies per project: as needed	<20 % RPD or RSD*	Qualify affected samples. Investigate laboratory analyses. Then, evaluate splitting techniques.

*Relative Percent Difference (RPD) is used when comparing two results and Relative Percent Standard Deviation (RSD) is used when comparing three or more results.

3.8.3 Quality Control Requirements and Procedures

CERP data must meet the DQOs for the project and meet the minimum quality requirements for the overall program. To achieve a standard minimum level of quality throughout the CERP program, data quality must be carefully controlled in the laboratory and in the field when performing each activity. FQC is an overall system of technical activities performed during the trip preparation, sample collection, field data collection, and data verification/assessment phases of the data collection process. The goal of FQC activities is to ensure that a representative sample is collected at the correct frequency and site, under proper conditions so that data have stated limits of precision and accuracy, are legally valid, and are not adversely affected by the collection process. FQC is typically, but not always, applied by field personnel. Activities include:

- Collection of the appropriate sample volumes in approved sample containers;
- Use of appropriate sampling and processing equipment;
- Use of appropriate preservatives;
- Observation of sample holding times;
- Use of the appropriate water type;

- Performance of preventive maintenance, calibration and calibration checks when collecting field data;
- Collection of FQC samples;
- Documentation;
- Field data verification and validation;
- Corrective action; and
- Audits of field activities.

The procedures for field preparation, field data collection and sample collection may be found in the QASR, the sampling group's FSQM, the FDEP SOPs, and EPA SOPs. In all cases, state and federal requirements must be adhered to, including Chapter 62-160, FAC. Sampling and field data collection performed for regulatory purposes must meet specific permit and FDEP and EPA requirements. Information pertaining to the project, including collection methods and equipment, sample type and frequency, FQC, may be found in the project MP. No modifications to sampling or field data collection methods may be made without previous approval by the CERP QAOT.

3.8.3.1 Preventative and Routine Maintenance

Preventive maintenance activities are necessary to ensure that the equipment can be used to obtain the expected results and to avoid unusable or broken equipment while in the field. FDEP FS 1000 presents the instrument specific maintenance activities and frequencies for analytical balances and field instruments. Follow the manufacturer's suggested maintenance activities and document all troubleshooting and maintenance activities.

3.8.3.2 Field Quality Control Samples

FQC measures the effectiveness of FQC activities in ensuring that data meet stated limits of precision and accuracy. Three main types of FQC to be used for CERP projects:

- Field quality control blanks;
- Field duplicates; and
- Split samples.

FQC samples must be prepared in the field (except for trip blanks) and treated in the same manner as routine samples, including sample bottle type, preservation, documentation, sample transport and laboratory analysis. Once collected, they must remain with the sample set until the laboratory has received them. All QC samples must be analyzed for the same parameters as the associated samples. Refer FDEP FQ 1000.

3.8.4 Quality Assurance Requirements

Field systems audits should be conducted annually and as needed. The purpose of a field audit is to determine conformance with the QASR, FSQM, SAP, FDEP SOPs and other required standards. A sample audit checklist is presented in **Appendix B**. A determination that field activities do not meet QA/QC requirements, or the activities do not produce data meeting project DQOs, is sufficient cause for initiating corrective actions and may require qualifying/rejecting all or part of the data.

A field audit is an essential tool in assessing compliance with quality documents or measuring the performance of a system. The goal of a field audit is to identify areas of noncompliance, whether quantitative or qualitative, determine the extent of the noncompliance, and to initiate corrective action as needed. If all systems are in compliance or being performed according to predetermined standards, then the audit serves to bracket the data between the latest audit and the previous audit, as having been produced under valid procedures.

3.8.4.1 Field System Audits

Field system audits are essential in order to verify and document compliance with the QASR, MP, and FSQM. System audits must be conducted at least annually for all CERP projects either by the project team member, sampling group, or consultants. PMs must take the cost of and effort involved in field audits into consideration when budgeting for their project or when contracting out work. The CERP QAOT may request and conduct additional field system audits as needed.

Audits follow a standardized audit checklist, either in electronic or hardcopy format. An example audit checklist is included in **Appendix B**. Personnel conducting the audit must not be involved with the field activities in any way that might bias results. The audit involves observing sample collection and field data collection activities, from equipment decontamination procedures to sample custody transfer to the laboratory or shipper.

The sampling technician/field supervisor should be told immediately of unacceptable procedures or problems. The audit report should be available within a reasonable amount of time and forwarded to the QAOT, the project manager, and the field supervisor. Corrective measures must be implemented immediately. Corrective action may include review of previous data and procedures, and may result in data qualification. Audit findings and corresponding corrective actions are summarized in an audit report and sent to the specific field project manager and field supervisor. The field supervisors and field project managers are ultimately responsible for preparing and submitting a corrective action plan and for ensuring that corrective actions are implemented.

3.8.4.1.1 Project Audits

A project audit is a review of all sampling and analytical documentation associated with a specific project or event in order to determine if the resulting data are valid and acceptable according to pre-established validation criteria and DQOs. Enough documentation must be available so that a reviewer is able to reconstruct the history of a sample from time of sample collection (or sample container acquisition) through final results and sample disposal. The QAOT may request and conduct project audits as needed or as a part of routine data quality assessment procedures.

3.8.4.1.2 Performance Audits

A performance audit is where quantitative data are independently obtained for comparison with routinely obtained data in a measurement system and is recommended before allowing new personnel to begin sample collection and data collection activities. Performance audits may include evaluation of field quality control samples and comparison of the results with previous field quality control results and DQOs. If the DQOs are not met or FQC results are different from

previously collected data, then more training is needed before independent sampling may begin. This type of performance audit should be documented in the staff training records.

3.9 Data Management

3.9.1 Documentation Requirements

Thorough documentation of all field sample collection and processing activities is necessary for proper interpretation of results. Since field records are the basis for later written reports, language should be objective, and factual. Once completed, these field records become legal documents and must be maintained as part of the official project files. All aspects of sample collection and handling, as well as visual observations, must be documented in the field logbooks or on standardized field note sheets as appropriate.

All sample collection activities shall be traceable through field records from the person collecting the sample, to the specific piece of sampling equipment (where appropriate) used to collect that sample, the methods to be analyzed for, and the laboratory that the sample(s) were sent. All maintenance and calibration records for sampling equipment (where appropriate) shall be kept so that they are similarly traceable. All records shall be maintained for five years beyond the life of the project, and meet the storage, custody, accessibility, and security standards specified in FDEP SOPs and specific project documents. All sampling references must be available for consultation in the field. FDEP FS 1008 listed some of these documents. Also any other documents applicable as EPA SOPs, FSQM of the sampling agency/company and QASR manual must be available in the field for reference.

FDEP FD 1000 provided detail on documentation procedures for:

- sample label information
- sample identification requirements
- sample transmittal record
- COC
- documentation of field activities
- FQC documentation
- groundwater documentation requirements

3.9.2 Data Review

Field QC samples and field measurements are evaluated during data verification and validation. Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. Those performing the activity conduct this type of review in conjunction with the sampling activity.

Data validation determines the analytical quality of a specific data set. This review is performed subsequent to data generating activities and is conducted by those independent of the activities. Data validation determines whether or not the data quality goals established for the project were achieved.

In addition to these checks, it is necessary to review the FQC results in order to evaluate the effectiveness of the sample collection activities.

3.10 Reporting

Final reported sampling data must be supported by adequate documentation. Adequate documentation is defined as being legible and complete, so that any final result can be independently reconstructed from raw data. Document types and elements are presented in **Table 3.5**.

Table 3.5 Document Types and Elements

Document	Purpose	Documentation Elements
Field Notes	Raw field data	Field measurements and observation data Field equipment information Chain of Custody Forms Completed field sheets
Laboratory Notes	Raw data	Results and associated observations Incorporates applicable qualifiers QA/QC data Summary of non-conformance problems and resolutions
Quality Manual	Organizational level document to stipulate policies and procedures to ensure data quality	Retain copies of applicable laboratory and field QMs that were used to perform data collection activities. Analytical laboratories are required by NELAC to have a QM. Field sampling organizations are required by DEP and this QASR to have a field QM.
SOPs	Process level document to outline procedures for a given method	Retain copies of SOPs used for the project. May follow the format described in EPA document QA/G-6, Guidance for Preparing Standard Operating Procedures.
Method References	Reference document for a given data development method	Each organization must maintain either a SOP or method reference that outlines the procedure used to collect the data reported for the CERP. References and SOPs must be complete, stand-alone documents that describe the actual process used for data development.
Contract SOW	Specifies requirements of the contract and the expected deliverables	Retain copy of each version of the SOW; effective dates must be clearly specified in the document.
Work Plans (MP, SAP, QAPP, project plans)	Provides the details of the work to be done, the project objectives, DQOs, project design, project organization and QA/QC elements.	Retain copy of each version of the work plan. Each version must specify the effective dates for the plan.
Training and Skill Verification Certificates	Documents demonstrated capability.	Date of verification, participating individual, individual administering the verification, applicable parameters, references, criteria used to issue certificate, and projected follow-up verification date.
Equipment Logs	Documents information for each instrument or piece of equipment	Name of item, unique identifier, date received and date placed in service, placement of equipment (where appropriate), copy of manufacturer's instructions, dates and results of calibrations (if applicable), details and dates of maintenance, and dates equipment was out of, and put back in, service.
Reference Standard Logs	Documents information for standard reference	Type of standard reference, source of reference, date of creation of reference, and applicable methodology.

Document	Purpose	Documentation Elements
Reagent Logs	Documents chemicals used in field or laboratory activities	Name of reagent, manufacturer, date of receipt, and expiration date. If applicable: preparation method, date of preparation, date of expiration, and preparer's initials.
Quality Assessment Reports	Report on the quality of activities related to monitoring and assessment	QC results, QC failures and resolutions, audit outcomes and corrective actions.
Audit Reports (Field, Processing, or Laboratory Examination)	To assess the quality of field activities, sample collection, data collection activities, and conformance to documented requirements.	Compares actual field procedures to referenced methods.
COC	Documentation to track specimens from collection through disposal.	Unique identifier, identification link to parent sample, date and time of sample receipt, date of sample disposal, condition of sample on receipt, sample preservation, applicable holding times, sample transmittal and tracking forms.

3.11 Archiving

3.11.1 Data Archives

Incorporate efficient archival design and succinct documentation schemes for all record systems. Ensure that the history of a sample is clearly evident in the retained records and documentation and can be independently reconstructed.

Link any miscellaneous or ancillary records (photographs, videotapes, maps, etc.) to specific sampling events such that these records are easily traceable in the data archives associated with the project, sampling date and sampling source(s). Keep all documentation archives for a minimum of five years after the date of project completion or permit cycle unless otherwise specified, and meet the storage, custody, accessibility, and security standards specified. Refer to FDEP FD1100 and FDEP FD 1200.

Types of the documentation

- Electronic Documentation
- Paper/Hardcopy

3.11.2 Sample Archives

The quality of the archive will be assured through an archiving process checklist, which will be reviewed and signed by the supervisor. Sample custody will be maintained through a sign-out procedure using a COC form.

An archive record book should be maintained that contains information about the archived samples. Each archive sample should be recorded. The record should consist of a line entry that includes:

- Sample set I.D.;
- Box number;
- Archived samples contained in the box;
- Archive sample weight, and

- Archive date.

Additional space should be left for the annotation of future events (such as thawing, sub-sampling, or sample disposal). An example archive record entry is given in **Table 3.6**.

Table 3.6 Example Archive Record Entry

Sample Set I.D.	Box # /#	Samples Contained	Site	Collection Date	Sample Weight	Archive Date	Comments
PIII-98	2/7	PE13B	ES2	8/5/98	20g	9/8/98	

Once samples have been archived, it may become necessary to access a particular sample for reanalysis or for alternative analysis. If and when a sample is accessed, notation should be made about who accessed the sample, when, why, and the amount of sample removed.

Archived samples should be handled using clean-hands protocols. In many cases the freezing process will act to desiccate the sample. It is recommended that the samples be completely thawed and re-homogenized using a spatula before a sub-sample is taken.

3.11.2.1 Archive Maintenance and Routine Inspection

The archive freezer should be kept clean and neat at all times. Archived samples should be kept organized by sample type. The temperature should be maintained at no warmer than 0° Celsius. Temperature should be monitored using a max-min thermometer that is checked during the monthly inspection. This information should be recorded in the archive record book whenever the freezer is accessed. If sample containers are damaged they should be replaced immediately. The entire freezer should be defrosted, cleaned and inspected on a yearly basis. At this time, the following items should be checked:

- Sample container integrity;
- Sample label legibility; and
- Freezer temperature.

These items should also be checked in the event of power failure, (discussed below). All work performed must be documented in the archive record book.

3.11.2.1.1 Failure Modes

The potential exists for the loss of power to the refrigeration unit. To minimize the consequences of power loss, the archive refrigerator should be maintained on an electrical system that includes an automatic emergency generator. However, the emergency generator may fail and, as a result, the archive refrigerator may lose power.

Short-term power failures last usually less than five hours and derive from lightning strikes, downed power lines or rolling brownouts. This class of power loss poses no real threat to sample integrity as long as the lid to the archive refrigerator remains closed.

Mid-term power losses lasting from 5 to 24 hours may compromise samples. If a power loss has persisted for between 5 and 24 hours, the freezer should be kept closed to allow it to return to its

normal operating temperature. If temperatures rise above 10° Celsius, or power loss exceeds 24 hours, then mitigation methods must be implemented.

Mitigation methods include consolidation of samples from other refrigeration units, the use of ice and coolers, and prioritization of samples. In the event of power losses between 24 and 72 hours, bags of ice should be used to keep the samples frozen, or to at least slow their thawing, until appropriate freezer space can be provided.

Long-term power failures last more than 72 hours, and will most likely be the result of a major hurricane. In this situation, it is unlikely that staff will be able to gain timely and regular access to the sample archive. It is therefore suggested that after 72 hours of power loss, if temperatures are unable to be maintained such that the samples remain frozen, then the samples should be disposed of in an appropriate manner.

The freezer may fail in a manner unrelated to power failure. The freezer will be fitted with an alarm that alerts to a condition where the temperature rises above -10°C.

3.11.2.1.2 Sample Disposal of Archived Samples

Due to the number of samples and the limited amount of space in the archive refrigerator, samples can only be archived for a limited amount of time. It is suggested that, following review of the need for continued archiving of a sample set, archived samples that are over five years old be disposed of properly.