

CHAPTER 2

ELEMENTS OF A SAMPLING PLAN

A sampling plan is a blueprint for how a sampling event or program will be executed. It should provide all the detail needed to ensure that representative samples are collected, handled, analyzed, and reported in a manner that meets the needs and objectives of the sampler (e.g., POTW, regulator, third-party auditors). Implementing a clearly defined and consistently employed sampling protocol reduces the chance that the sampling process will be a source of error.

Inappropriate or inconsistent sampling techniques or procedures have an impact on the accuracy and precision of analytical results. Accuracy is a measure of how closely testing results reflect the actual chemical, physical, and biological properties of the biosolids sampled. Precision is a measure of the variability of data associated with a specific sludge quality parameter. Inaccurate or imprecise analytical data may falsely indicate compliance or violation of regulatory requirements and result in flawed decisions.

Under a National Pollutant Discharge Elimination System (NPDES) permit or a state permit, the owner/operators of a treatment works are ultimately responsible for the quality of the data they report to the permitting authority. Given the potential unintended consequences of poor data quality, the value of using a sampling plan to optimize data integrity is evident.

The United States Environmental Protection Agency (EPA) and many states have developed guidance documents that outline the essential elements of a sampling plan (referred to in some documents as a “sampling and analysis plan” or an “analysis plan”). This document discusses the essential elements of a sampling plan, derived from numerous guidance documents. A sampling plan worksheet is included in Appendix A and an example of a completed sampling plan is included in Appendix B.

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Goals of the Sampling Plan (Chapter 3)

The goals or objectives of a sampling plan should describe what you hope to accomplish by implementing a sampling program. For example: Will the data be used for process control? Are the data intended to demonstrate compliance with state and federal regulations? Is the operator evaluating sludge quality in order to decide on an appropriate sludge management option? In each of these examples, sludge variability and contaminant sources would need to be evaluated or identified.

Description of the Facility Generating Sludge (Chapter 4)

A facility description (including a flow diagram or schematic) should provide an overview of the configuration and operation of the facility that is generating the sludge to be tested. The physical, chemical, and biological properties of the solids produced by a facility are determined by several factors:

- Influent wastewater characteristics and treatment
- Sludge handling (i.e., wasting, mixing, holding, thickening), and dewatering processes
- Treatment methods used to achieve pathogen reduction (PR) and vector attraction reduction (VAR)

If land application is the final solids management option, this section should also include details on how the material is handled prior to land application. For instance, is it stored or stockpiled prior to land application, and if so, how long is it stockpiled, and where and under what conditions is the material stored?

Data Quality Objectives (Chapter 5)

Your data quality objectives should state the standards and specifications for the data you will generate. The primary goal is for the data to be as representative of the actual sludge quality as possible. Determining data quality objectives during the development of a sampling plan may take the most planning and research. It is essential that those preparing the sampling plan are knowledgeable about lab procedures and protocols. In

this regard, it is imperative that you communicate with the laboratory or laboratories that will be conducting the analyses during the development and implementation of the sampling plan.

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The data quality objectives should include the following elements:

- Clear identification and discussion of issues such as detection limits, precision, accuracy, comparability, and completeness
- Analytical protocols required for each test (e.g., metals, fecal coliform, nutrients) that will be performed
- Data reduction, validation, and reporting methods
- Data quality objectives for field measurements or goals for field Quality Assurance/Quality Control (QA/QC)
- Type of sample (i.e., grab or composite) that will be collected at each sampling point
- Process for producing composite samples including how grab samples are weighted
- Sample size or volume of grabs and composite samples
- Frequency and timing of sample collection

Selection and Description of Sampling Points (Chapter 6)

Your sampling point(s) should be accurately and specifically described relative to location and utilization. Accessibility and safety must be considered in the selection of these points. The description should explain how the sampling points were chosen in order to produce a representative sample and how specific points will meet the goals of the sampling program.

Sample Collection Procedures (Chapter 7)

Step-by-step instructions on sample collection procedures must be developed and documented in writing. This written procedure is frequently referred to as a standard operating procedure or “SOP.” SOPs should include detailed information on the following elements:

- Type of equipment used for sampling
- Methods for cleaning and decontaminating sampling equipment
- Sample collection process
- Sample identification and documentation

Sample Handling Procedures (Chapter 8)

This section focuses on sample handling after collection. Sample preservation and holding times, Chain-of-custody procedures, and sample transportation procedures (including shipping and storage) should be described in detail. These parameters must be determined and described for each type of sample and analysis.

Evaluation of Completeness (Chapter 9)

Evaluating data completeness refers to the process of determining whether the goals of the sampling program have been met. This process answers such questions as: Have data quality objectives been met? Were the samples properly preserved and handled? Were reporting requirements satisfied? This process also provides an opportunity to evaluate the sampling plan itself. Does the sampling plan or protocol need revision? Do the data quality objectives need to be adjusted?

Record-Keeping and Reporting Procedures (Chapter 10)

The last section of your sampling plan should describe what data and information will be retained, how it will be stored and retrieved, and for how long it will be retained. Reporting requirements should also be addressed. Is reporting required and by whom? Criteria such as reporting units, data validation procedures, and reporting format should be determined during the development of the sampling program.

The remainder of this document will describe each of these elements in greater detail. Wherever possible, a range of options will be provided, and the benefits or drawbacks of each option will be described.

CHAPTER 2 REFERENCES

An Addendum to the POTW Sludge Sampling and Analysis Guidance Document. Gaines, Cristina and Safavi, Behzad. US EPA, Office of Wastewater Enforcement and Compliance. May 1992.

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Process Design Manual: Land Application of Sewage Sludge and Domestic Septage, EPA/625/R-95/001. US EPA, Office of Research and Development. September 1995

Sampling Manual for Pollutant Limits, Pathogen and Vector Attraction Reductions in Sewage Sludge, 3620-BK-DEP2214, Rev. 12/2000. Pennsylvania Department of Environmental Protection, Bureau of Water Quality Protection, Division of Wastewater Management. December 2000.