Please remove any shaded areas in final copy. They are present as a guide in development of QAP, showing where editing should occur.

Quality Assurance Plan
for
Environmental Field Analysis

(Provided for assistance to comply with the Kentucky Wastewater Laboratory Certification requirements in 401 KAR 5:320)

FACILITY NAME

Date

Version 0

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Quality Assurance Plan

TITLE: The title of the QAP must be distinguishing and describe the intent/purpose of the document.

Prepared By: Name of Agency/Organization developing QAP
Address
Phone/Email

Prepared For: Name of Agency/Organization
Address
Phone/Email

Date: date QAP is prepared

Revision Date: date QAP is revised – also update the 'revision history page'

Revision No.: consecutive number of QAP, starting with 0.0 as the initial document

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Quality Assurance Plan
For << Project Name >>

Signatures: An official QAP must include signatures of all relevant personnel. - Insert additional reviewers or authors as necessary – examples may include laboratory personnel, data reviewers, etc.

Name / QAP Author, Organization	Date
Name / Project Manager/Supervisor, Organization	Date
Name / Project Quality Assurance Officer, Organization	Date
Name / Other, Organization	Date
Name / Other, Organization	Date

(Footer should reflect the document control information, as outlined in footer below. Please fill in Title, creation date and Revision number below)

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Revision and Annual Review History

This page documents the annual review and the revisions over time to the QAP. The most recent iteration should be listed in the first row, with consecutive versions following. Signatures may be required for revised documents.

It is a requirement that this be signed annually.

Date of Revision or Annual Review	Page(s)/Section(s) Revised	Revision Explanation

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1 Introduction

The Quality Assurance Plan (QAP) establishes the planning, implementation, documentation and assessment of environmental analytical testing procedures. This document has been prepared in accordance with EPA's *Quality Standard for Environmental Data Collection, Production, and Use by External Organizations* (2106-S-02.0) **(1)**.

The scope of this QAP is limited to the field analysis of non-potable water for pH, conductivity, turbidity, chlorine, dissolved oxygen and temperature. Methodologies utilized for field analysis must be EPA approved (40 CFR 136) **(2)**. Quality control parameters specified in 40 CFR 136.7 are also addressed. (remove any parameters not performed at Facility)

This document shall be used in conjunction with a field analysis standard operating procedure (SOP) which will provide specific method only information and criteria. This QAP and related SOP(s) must be used for all field analysis of non-potable water for KPDES compliance sample analysis within the Commonwealth of Kentucky.

2 QAP Elements for the Collection of Data by Direct Measurement

2.1 Overview of QAP Elements for the Collection of Data by Direct Measurement

2.2 Project Management

2.2.1 Title, Version and Approval/Sign-Off

This QAP **must be** reviewed annually and if substantive revisions to the document are made then the version number must be updated. Substantive revisions shall also be documented on the revision history page. The approval/signature page must be signed and dated with each updated version.

2.2.2 Document Format and Table of Contents

This QAP utilizes the format established by the Environmental Protection Agency (EPA) in the document titled Guidance on *Quality Assurance Project Plans*, CIO 2106-G-05 QAPP Final Draft 2012 **(3)**. The table of contents is located in the front of this document.

2.2.3 Distribution List

The distribution list contains the titles of key personnel who should receive a copy of the approved QAP in either a hard copy or electronic format, as well as any subsequent revisions. The list of key personnel is located in Section 2.2.4 of this document.

2.2.4 Project Organization and Schedule

The following key personnel are responsible for field analysis of environmental samples as they pertain to this QAP. A brief description of their duties, or roles, is provided. Other duties may also apply or multiple duties assigned to an individual.

Project Manager is the responsible official for this project overseeing overall project operations and budget, as well as tasking personnel with work required to complete this project. The project manager communicates project needs to all applicable personnel.

Quality Assurance Manager is responsible for reviewing and approving the QA Plan. The QA Manager may provide technical input on analytical methodologies and data review. The QA Manager must ensure that the project quality objective (e.g. EPA Data Quality Objectives) and measurement performance criteria are met. The QA Manager is responsible for ensuring that all field technicians receive any specific training requirements or certification.

Field Technician(s) is responsible for all field related activities including the analysis of environmental samples, including but not limited to:

- Instrument care and daily maintenance, including corrective actions
- Instrument calibration in accordance with appropriate methods or manufacturer's instructions
- Analysis and proper documentation of applicable environmental samples
- Analysis and proper documentation of all applicable quality control samples
- Proper maintenance of field log book(s)

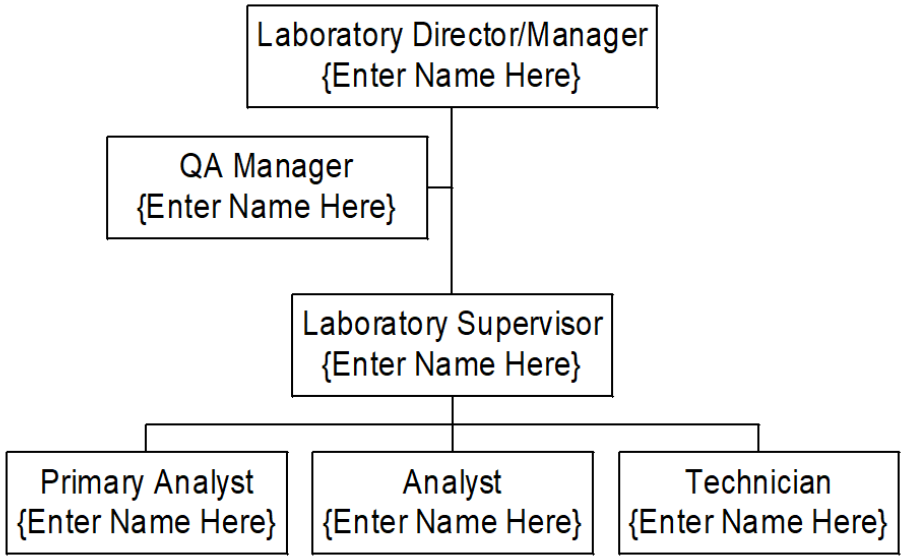
Provide a concise organization chart indicating the relationships and lines of communication among all project participants. Include other data users who are outside of the organization generating the data for whom the data is intended.

BELOW ARE EXAMPLES FOR YOUR USE. CHOOSE WHICHEVER EXAMPLE WORKS BEST FOR YOUR ORGANIZATION, OR USE YOUR OWN CHART (Delete highlighted areas after completion).

Example 1.Laboratory Organization Chart. One person may have more than one title and associated role or responsibility.

Title	Reports To	Role / Responsibility
Laboratory Director/Manager	President	
Laboratory Supervisor	Laboratory Director/Manager	
QA Manager	President	
Primary Analyst	Laboratory Supervisor	
Analyst	Laboratory Supervisor	
Technician	Laboratory Supervisor	
Technician	Laboratory Supervisor	

Example 2. Laboratory Organization Chart. One person may have more than one title and associated role or responsibility.



2.2.5 Project Background, Overview and Intended Use of Data

Analytical results from field analyses will be used for the purposes of Kentucky Division of Water KPDES permit compliance.

2.2.6 Data/Project Quality Objective and Measurement Performance Criteria

Data quality objectives (DQOs) for all field-testing activities associated with this QAP have been established to meet the requirements of the KPDES Permit Number: XXXXXX (if multiple permits please list all that apply. An appendix sheet may be added if desired) and the associated Kentucky DOW Water Quality Standards are fulfilled and that data collected is scientifically verifiable and valid.

The elements for Measurement Performance Criteria are: accuracy, precision, comparability, representativeness and completeness of the field tests. These criteria must be met to ensure that the data are verifiable and that project quality objectives are met.

Accuracy – is a measure of confidence that describes how close a measurement is to its "true" value. INSERT Facility NAME (from cover) HERE ensures field accuracy by field instrument calibration according to the manufacturers' instructions and by using standard and reagents that are current (prior to expiration date), and by following proper sampling, sample handling and field analysis protocols.

Accuracy is determined by the percent recovery of the target analyte in spiked samples and QC samples. Accuracy is calculated using the formula below:

$$Percent\ Recovery\ (\%R) = \left(\frac{Analyzed\ Value}{True\ Value}\right) \times 100$$

Precision – is the degree of agreement among repeated measurements of the same characteristic, or parameter, and gives information about the consistency of methods. Precision can be considered a product of the repetitiveness of effluent monitoring.

Precision is expressed in terms of the relative percent difference (RPD) between two measurements (A and B), and is computed using the formula below:

$$Relative\ Percent\ Difference\ (RPD) = \left(\frac{|A - B|}{(A + B)/2}\right) \times 100$$

Representativeness – is the extent to which measurements actually represent the true environmental condition. Representativeness of data collected was considered in the permit development process and included INSERT Facility NAME (from cover) HERE sample locations.

Comparability – is the degree to which data can be compared directly to similar studies. Using standardized sampling and analytical method and units of reporting with comparable sensitivity ensures comparability. INSERT Facility NAME (from cover) HERE will use EPA approved methods as listed in 40 CFR 136 for effluent standard measurements.

Completeness – is the comparison between the amount of usable data collected versus the amount of data specified in the KPDES permit. INSERT Facility NAME (from cover) HERE will determine completeness by comparing sampling and analyses completed with the requirements in the permit. The goal is to complete 100% of the required monitoring. The permit establishes reporting requirements for non-compliance.

Acceptance criteria for field methods is specified in the associated SOP(s).

2.2.7 Special Training Requirements and Certification

Personnel performing field analysis should be properly trained for the particular task and instrument(s) that they utilize for field activities. Indicate how training is to be provided and documented.

2.2.8 Documentation and Records Requirements

Field personnel utilize a notebook and indelible ink to document all relevant observations and information related to field activities. DATA MAY ALSO BE KEPT ELECTRONICALLY.

INCLUDE THE APPLICABLE FIELD OBSERVATION INFORMATION BELOW

Field observations include the following:

- Date, location, time of sampling (**collection and analysis**), name, organization and phone number of the sampler, and analyses required
- Sample type (grab or composite)
- Container size, container type, preservation, hold time, and condition upon receipt
- Results of field measurements such as pH and DO

All applicable field documents will be stored INSERT WHERE HERE for a period of five (5) years or until the next on-site audit.

2.3 Data Acquisition

The scope of this QAP is limited to the analysis of environmental samples from direct field measurements using EPA approved methods and field instrumentation (as specified in 40 CFR 136). This QAP applies to the following field analysis parameters:

(remove any parameters not performed at Facility)

- pH
- Conductivity
- Turbidity
- Chlorine
- Dissolved oxygen
- Temperature

Sample locations are not specified within the scope of this document. This QAP may be used at any (KPDES permit designated) sampling location(s) for the field analysis of non-potable water for the parameters listed above.

2.3.1 Sample Handling, Custody Procedures and Documentation

All sampling handling, chain of custody procedures and field documentation meet the requirements established in Kentucky's Wastewater Laboratory Certification Manual **(4)**.

2.3.2 Analytical Methods Requirements and Task Description

This QAP is limited to field analysis for pH, conductivity, turbidity, chlorine, dissolved oxygen and temperature. A list of EPA approved methods is provided in Table 1. Any analytical method for compliance purposes must be EPA approved as per 40 CFR 136. (remove any parameters not performed at Facility)

2.3.3 Quality Control Requirements

EPA has specified twelve critical quality assurance quality control elements that must be addressed within this QAP. Table 2 provides a list of the critical elements with explanations regarding the relevancy of each as it pertains to field analysis of compliance samples for KPDES permits. The associated field analysis SOP specifies the type and frequency of quality control samples and their acceptance criteria.

2.3.4 Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables

Field instruments must be verified annually by a third party or a qualified individual. The instrument verification must be documented and maintained for five (5) years. Instruments that do not meet verification acceptance criteria may not be used for the analysis of compliance samples for KPDES permits. Instruments must be calibrated in accordance with the field analysis SOP or the manufacturer's requirements.

2.3.5 Data Management Requirements

Field measurements and pertinent information are recorded in a field notebook. The notebook contains all information related to field activities including:

- Instruments
  - Manufacturer
  - S/N
  - Date purchased (if known)
- Site information where field analysis is performed
  - Facility Name and physical address (including county)
  - Sampling Point Location (unique identifier)
  - All other pertinent information related to the site(s)

Field notebooks are maintained for a minimum of five (5) years. Completed notebooks are stored INSERT FIELD NOTEBOOK STORAGE LOCATION HERE

3 General References

Documents referenced in this QAP are listed below and referenced in parenthesis (e.g. **(5)**)

THE FIRST FIVE (5) REFERENCES INCLUDED BELOW HAVE ALREADY BEEN CITED WITHIN THIS DOCUMENT. Provide all additional citations that you have referenced in the QAP, formatted in standard scientific format. SOPs and other supporting documentation should be included on external media (such as CD), or as appendices to the QAP. IF ADDITIONAL DOCUMENTS DO NOT NEED TO BE REFERENCED IN THIS QAP, SIMPLY DELETE THIS PARAGRAPH.

1. EPA Final Draft. Quality Standard For Environmental Data Collection, Production, and Use By Non-EPA (External) Organizations (EPA CIO 2106-S-02.0). Office of Environmental Information.
2. 40 CFR Part 136 On-line Version (e-CFR) Website; https://www.ecfr.gov.
3. EPA 2012. *Guidance on the Quality Assurance Project Plans*, CIO Guidance 2106-G-05 QAPP, Office of Environmental Information, U.S. Environmental Protection Agency.
4. Commonwealth of Kentucky Wastewater Laboratory Certification Manual (June 2013).
5. ANSI / ASQC S2-1995 Introduction to Attribute Sampling, American Society for Quality, 1995.

4 Useful References

401 KAR 5:320. Wastewater Laboratory Certification Program.

EPA 2002b. *Environmental Data Verification and Validation*, EPA QA/G-8, Office of Environmental Information, U.S. Environmental Protection Agency.

EPA 2006. *Data Quality Assessment: Statistical Methods for Practitioners*, EPA QA/G-9S, Office of Environmental Information, U.S. Environmental Protection Agency.

EPA 2009. *Guidance on the Development, Evaluation, and Application of Environmental Models*. EPA/100/K-09/003, Council for Regulatory Environmental Modeling, U.S. Environmental Protection Agency.

Remove any Parameters and Reference Methods not performed.

Table 1. EPA Approved Methods for Field Analysis of Non-potable Water. 40 CFR 136.3 (as of July 31, 2019)

Parameter	Reference Method	Technology
pH	SM 4500-H^+ B-2011 ASTM D1293-99 (A or B) USGS I-1586-85 AOAC 973.41	Electrometric measurement
Conductivity	EPA 120.1 (Rev. 1982) SM 2510 B-2011 ASTM D1125-95(99)(A) AOAC 973.40 USGS I-2781-85	Wheatstone bridge
Turbidity	EPA 180.1 (Rev. 2.0)(1993) SM 2130 B-2011 ASTM D1889-00 USGS I-3860-85 In-Situ Method 1002-8-2009 Mitchell Method M5331 Orion Method AQ4500	Nephelometric
Chlorine	SM 4500-Cl D-2011 ASTM D1253-08	Amperometric direct
	SM 4500-Cl E-2011	Amperometric direct (low level)
	SM 4500-Cl B-2011	Iodometric direct
	SM 4500-Cl C-2011	Back titration ether end-point
	SM 4500-Cl F-2011	DPD-FAS
	SM 4500-Cl G-2011	Spectrophotometric, DPD
	Residual Chlorine Electrode Model 97-70), Orion Research Inc. (see 40 CFR 136.3 for details)	Electrode
Dissolved Oxygen	SM 4500-O (B through F) -2011 ASTM D888-09(A) AOAC 973.45B	Winkler (Azide modification)

	USGS I-1575-78	
	SM 4500-O G-2011 ASTM D888-09(B) USGS I-1576-78	Electrode
	ASTM D888-09(C) (see 40 CFR 136.3 for details)	Luminescence Based Sensor
Temperature	SM 2550 B-2000	Thermometric
	USGS, "Water Temperature-Influential Factors, Field Measurement and Data Presentation" (see 40 CFR 136.3 for details)	Presentation

Remove any Parameters not performed.

Table 2. Quality Control Critical Elements for Field Analysis. As Specified by 40 CFR 136.7 (as of July 31, 2019)

#	Parameter	Performed (Yes/No)	Field Analysis	Frequency
1	Demonstration of Capability (DOC)	No		
2	Method Detection Limit (MDL)	No		
3	Laboratory reagent blank (LRB), also referred to as method blank (MB)	Yes	Chlorine Turbidity Conductivity	Defined in SOP
4	Laboratory fortified blank (LFB), also referred to as a spiked blank, or	No		
	Laboratory control sample (LCS) [second source standard]	Yes	pH Chlorine Turbidity Conductivity	Defined in SOP
5	Matrix spike (MS) & matrix spike duplicate (MSD), or laboratory fortified matrix (LFM) and LFM duplicate, may be used for suspected matrix interference problems to assess precision	No	Conductivity Turbidity Chlorine	Defined in SOP

	Field Duplicates	Yes	pH Dissolved Oxygen Temperature	
6	Internal standards (for GC/MS analyses), surrogate standards (for organic analysis) or tracers (for radiochemistry)	No		
7	Calibration (initial and continuing), also referred to as initial calibration verification (ICV) and continuing calibration verification (CCV)	Yes	pH Conductivity Chlorine Turbidity	Defined in SOP
8	Control charts (or other trend analyses of quality control results)	No		
9	Corrective action (root cause analysis)	Yes	pH Conductivity Turbidity Chlorine Dissolved Oxygen Temperature	Defined in Wastewater Manual as twenty (20) samples
10	QC acceptance criteria	Yes	pH Conductivity Turbidity Chlorine Dissolved Oxygen Temperature	Defined in SOP
11	Definitions of preparation and analytical batches that may drive QC frequencies	Yes	pH Conductivity Turbidity Chlorine Dissolved Oxygen Temperature	Defined in Wastewater Manual as (20) samples
12	Minimum frequency for conducting all QC elements	Yes	pH Conductivity Turbidity Chlorine Dissolved Oxygen Temperature	Defined in SOP

Table 3. Listed below is the explanation for any critical quality control element in Table 2 that is not being performed by the field laboratory.

#	**Explanation Why QC Element is not performed by Field Laboratory**
1	Not required by Kentucky Wastewater Laboratory Manual.
2	Not required by Kentucky Wastewater Laboratory Manual.
6	Not required by Kentucky Wastewater Laboratory Manual.
8	Not required by Kentucky Wastewater Laboratory Manual.
	USE THIS SPACE FOR ANY ADDITIONAL PARAMETER(S) THAT DO NOT APPLY

Table 4. Data Quality Indicators (EPA 2002).

DQI	Definition	Example Determination Methodologies	QC Samples
Precision	Reproducibility - Measure of agreement among repeated measurements of the same property under identical or near identical conditions. Usually calculated as a range or as the standard deviation.	Use the same analytical instrument to make the same measurement. Split samples in the field, submit to same circumstances of handling, preservation and analysis. Use the same method to make repeated measurements of the same sample within a single laboratory, or use two labs to analyze identical samples with same method.	Field duplicates, laboratory duplicates, matrix spike duplicates, analytical replicates, surrogates
Accuracy	Correctness - Measure of overall agreement between measurements to a known value.	Use a different method under the same conditions. Analyze a reference material to which a material of known concentration has been added. Usually expressed as percent recovery or percent bias.	PT samples, matrix spikes, laboratory control samples, equipment blanks
Bias	Systematic or persistent distortion of a measure-ment process that causes errors in direction.	Use reference materials or analyze spiked samples.	Field spikes, matrix spikes
Representa-tiveness	'the degree to which data accurately and precisely represent an environmental condition' (ANSI/ASQC 1995) **(5)**.	Evaluate whether measurements are made and physical samples collected in a way that the resulting data reflect the environment or condition being studied.	None
Compara-bility	Expresses the measure of confidence that one data set can be compared to another and can be combined for the decision.	Compare the following: sample collection, sample handling, sample preparation, sample analytical procedures, holding times, stability issues, and QA protocols. Describes confidence (expressed qualitatively or quantitatively).	Split samples – with PT samples
Complete-ness	A measure of the amount of valid data needed to be	Compare number of valid samples completed with those established by	All

	obtained from a measurement system.	the project's DQOs or performance criteria.	
Sensitivity	Capability of a method to discriminate between measurement responses of different levels of the variable of interest.	Determine the minimum concentration or attribute that can be measured by a method (method detection limit) by an instrument (instrument detection limit) or by a laboratory (quantitation limit).	lab fortified blanks, method detection limit study, initial calibration standards at quantitative limit

Table 5. Quality Control Checks.

QC Check	Information Provided
Blanks	
bottle blank	cleanliness of sample bottles
field blank	transport, storage and field handling bias
reagent blank	contaminated reagent
rinsate or equipment blank	contaminated equipment
method blank	response of a laboratory analytical system
Spikes	
matrix spike	analytical (preparation + analysis) bias
matrix spike replicate	analytical bias and precision
analysis matrix spike	instrument bias
surrogate spike	analytical bias
Calibration Check Samples	
zero check	calibration drift and memory effect
span check	calibration drift and memory effect
mid-range check	calibration drift and memory effect
Replicates, splits, etc.	
field collocated samples	sampling + measurement precision
field replicates	precision of all steps after acquisition
field splits	shipping + interlaboratory precision
laboratory splits	interlaboratory precision
laboratory replicates	analytical precision
analysis replicates	instrument precision