

Disclaimer

The Model “Small Wastewater Lab Quality Assurance Plan” (QAP) has been compiled and reviewed by the Illinois Water Environment Association Laboratory Committee. This document is intended as guidance only and not a detailed explanation of the accreditation rules. Review does not indicate the contents of the Model QAP reflect the official positions, policies or practices of the Illinois Water Environment Association or the Illinois Environmental Protection Agency. This manual has not been officially reviewed or approved by the Illinois EPA. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Illinois Water Environment Association.

QUALITY ASSURANCE PLAN
FOR
(fill in blank) **WASTEWATER TREATMENT**
FACILITY
LABORATORY

This plan including the current revisions have been prepared and approved by:

_____ xx/xx/xx *(fill in)*
title *(fill in blank)* Date

This cover page shall reflect the most recent changes to this manual. This Quality Assurance Plan (QAP) provides a written plan of operation for the laboratory that insures the accuracy, precision, and reliability of laboratory analyses and that data produced in the laboratory meets or exceeds user requirements. The plan documents daily quality activities in the lab.

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Section 1 Organization and Responsibilities

1.1 Laboratory Position within *(insert name of organization here)*

The Laboratory operates as a *(insert department and organization name here)*. The laboratory performs analyses on *(insert sample types here)*.

1.2 Staff Responsibilities

(Insert) describe the laboratory position and list the main responsibilities.

1.3 Current Personnel

(Insert) the laboratory analyst title, employee's name.
The name and position of the plant's chain of command.

Section 2 Sample Control and Documentation

2.1 Introduction

Laboratory analyses are performed to produce data representative of the conditions under which the sample was obtained. To provide representative samples for analysis, sample collectors must adhere to all steps required.

(Insert the sampling and testing requirements of the NPDES permit)

2.2 Sample Locations

A plant diagram that lists all sample points of the plant is listed as Appendix A *(Draw a diagram of your facility, number the sample locations and provide a key to NPDES and process sample locations)* Attach appendix A behind the last page of this plan.

2.3 Sample Collection

Sampling equipment is pre-cleaned to preserve sample integrity and eliminate contamination. Field blanks can be analyzed to determine contamination. Duplicate samples are also collected to verify a consistent representative sample. Log or bench sheets include date and time of sample, person taking sample, and type of sample (composite or grab). Samples are collected and preserved according to the guidelines outlined in 40CFR, 136, Table two. These include:

REQUIRED CONTAINERS,
PRESERVATION TECHNIQUES & HOLDING TIMES

<u>Parameter Name</u>	<u>Container</u>	<u>Preservation</u>	<u>Maximum Holding Time</u>
Ammonia	Polyethylene	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days
Biochemical Oxygen Demand	Polyethylene	Cool, 4°C	48 hours
Chlorine, total residual	Polyethylene	None required	Analyze immediately
Fecal Coliform	Polyethylene or glass	Cool, 4C, 0.008% Na ₂ S ₂ O ₃	6 hours
pH	Polyethylene	None required	Analyze immediately
Total Suspended Solids	Polyethylene	Cool, 4°C	7 days
Temperature	Polyethylene	None required	Analyze immediately

The operator collects samples from the composite sampler by replacing the filled container with a clean plastic container and taking the sample directly to the lab. The sample compositor is equipped with a refrigeration unit to maintain the sample temperature at 4 deg C. The temperature of the automatic sampler is recorded when the samples are collected.

Grab samples are collected by the operator and taken directly to the lab. Fecal Coliform samples are collected in a separate sterile container. Chlorine and pH samples are tested immediately (within 15 minutes).

Samples collected for analysis at an outside laboratory are placed in containers supplied by the commercial lab with the proper preservative. Samples are stored at 4 deg. C in the lab refrigerator. At that time the samples are transferred to a cooler and packed with ice. The cooler is shipped to the commercial lab with a completed Chain of Custody Record. The purpose of the chain of custody is to supply a detailed record of the sample description, collection information, and any transfer of custody from sample collection through sample receipt into the laboratory.

2.4 Contamination Control

Every effort is made to prevent or minimize introduction of interferences during sample collection and in the laboratory. Precautions include:

- a. All sample containers are carefully cleaned with a detergent and then double rinsed after each use. Clean sample containers are stored with the lids on to prevent contamination.

- b. Sample bottles are permanently labeled for their designated use.
- c. Collected samples are well mixed before a portion is withdrawn.
- d. Wear gloves and appropriate protective equipment as needed.

2.5 Documentation

Sample log-in information shall include:

- a. The name of the sample (or description) should be recorded along with the time, date, and individual who performed the sampling.
- b. The date, time, and the individual who received the samples in the lab.
- c. The type of sample (*composite or grab*).
- d. List the chain of custody procedure for samples analyzed at the lab and those shipped to an outside lab.

Section 3 SOP PROCEDURES FOR ANALYTICAL METHODS

3.1 Standard Operating Procedures

Standard Operating Procedures (SOP) are needed for each test performed. They may be taken from the approved “Standard Methods” edition or the EPA Analysis Manual. You must list the method exactly as it is performed in your lab. The SOP for each method used will include the test title, method analysis number, and date of current version. Provide the method reporting level and appropriate units for each test.

Section 4 Training Requirements

4.1 Analyst Training

- 4.1.1 It is recommended that an analyst hold a minimum of (*fill in blank- a high school diploma minimum suggested*) or, its equivalent.
- 4.1.2 The analyst should serve at a minimum a (*fill in blank- two-week period suggested*) of apprenticeship under an experienced trained analyst.

4.2 Analyst Requirements

- 4.2.1 The analyst should demonstrate the ability to properly perform the tests run by the laboratory for regulatory monitoring purposes.
- 4.2.2 The analyst must have enough training to have an understanding of quality control in order to determine if results are accurate and acceptable for regulatory monitoring purposes.

Section 5 Equipment Maintenance and Calibration Procedures

5.1 Equipment Maintenance and Calibration Documentation

- 5.1.1 Documentation is maintained for all maintenance, calibration and instrument operation activities. This documentation consists of *(fill in blank- suggested: a bound notebook kept in the laboratory where the temperature of all refrigerators, ovens, incubators and water baths are logged for every business day. Also, there is a bound notebook kept in the laboratory for documenting all laboratory equipment maintenance and calibration.)*
- 5.1.2 All defective equipment is removed from service and is not placed back in operation until repaired and shown by calibration, certification or test to perform satisfactorily.

5.2 Equipment Maintenance and Calibration

- 5.2.1 Balances - The laboratory has *(insert #)* analytical balances with a sensitivity of 0.1 mg. All analytical balances are placed on a stable base. Each balance is checked at least *(insert frequency)* with two or more ASTM type 1 or 2 weights covering the effective range of the balance's use. A service contract is maintained which requires that analytical balances be serviced and calibrated at least annually by a qualified service representative. The service representative issues the laboratory a certificate of calibration with weights traceable to national standards.
- 5.2.2 pH Meters - All pH meters have an accuracy of at least plus or minus 0.1 pH unit and provide for temperature correction of pH measurements. Calibrations are performed with a minimum of two standardization buffers in the appropriate pH range.
- 5.2.3 Thermometers - The laboratory has one certified thermometer traceable to national standards, with 1 centigrade degree or finer subdivisions and a range which spans the various requirements of the analytical methods, equipment temperature monitoring, and checking for thermal preservation. This thermometer, traceable to national standards is recalibrated a minimum of every five years. Certificates of calibration are maintained which identify trace-ability of the calibration to national standards. All thermometers are calibrated against thermometers traceable to national standards at the temperatures they are used. Liquid-in-glass and digital thermometers are calibrated annually. Metal and continuously monitoring thermometers are calibrated at least quarterly. Calibration factors are employed based upon the most recent calibration.
- 5.2.4 Refrigerators - The refrigerator is uniquely identified. The refrigerator is provided with a uniquely identified thermometer graduated in increments no larger than 1 degree centigrade. Thermometer readings are monitored and recorded each day the laboratory is in operation. The monitoring logs include refrigerator identification, thermometer identification, date, temperature, initials of the responsible person, and the acceptable temperature range. Samples which require thermal preservation are stored under refrigeration which is +/-2 degrees centigrade of the specified preservation temperature

unless method specific criteria exist. For samples with a method specified storage temperature of 4 degrees centigrade, a temperature of 0.1 degrees to 6 degrees centigrade is acceptable.

- 5.2.5 Incubators - The incubator is uniquely identified. The incubator is provided with a uniquely identified thermometer graduated in increments no larger than 1 degree centigrade. Thermometer readings are monitored and recorded each day the laboratory is in operation. The monitoring logs include incubator identification, thermometer identification, date, temperature, initials of the responsible person, and the acceptable temperature range.
- 5.2.6 Ovens - The oven is uniquely identified. The oven is provided with a uniquely identified thermometer graduated in increments no larger than 10 degrees centigrade for muffle furnaces and 1 degree centigrade increments for oven and warm air incubators. Temperatures are recorded daily. The monitoring logs include; oven identification, thermometer identification, date, temperature, initials of the responsible person and the acceptable temperature range.
- 5.2.7 Water Baths - The laboratory monitors and controls method specific temperature requirements for water baths, etc. The laboratory also maintains documentation of the results. The monitoring logs include; water bath identification, thermometer identification, date, temperature, initials of the responsible person and the acceptable temperature range.
- 5.2.8 Pipetters - Pipetters of sufficient accuracy are used for some applications in place of pipets. The delivery volumes are checked gravimetrically on a regular (*or insert frequency*) basis.
- 5.2.9 Laboratory grade water - The laboratory shall have a readily available source of distilled or deionized water with a conductivity less than 2.0 umhos/cm at 25° C.

Section 6

Calibration Procedure and Detection Limits

6.1 Calibration Procedure

- 6.1.1 An initial calibration is performed on all instrumentation and equipment as specified in the test method. Calibration standards are traceable to a national standard, where available.
- 6.1.2 The procedures for calibration verification and maintenance are found in the analytical method SOPs or the sample preparation SOPs. Manufacturers operation manuals may be referenced in the method SOPs where when they are the source for calibration or maintenance procedures.

- 6.1.3 An adequate number of standards are used to define the calibration curve. The test method SOP states if the calibration curve is linear or non-linear.
- 6.1.4 All sample results for test methods utilizing a calibration curve are reported within the highest calibration standard, or within the linear dynamic range where the test method requires determination of the linear dynamic range.

6.2 Method Detection Limits (MDL)

- 6.2.1 MDLs for each analyte of interest are determined by the test method procedure specified in 40 CFR, Part 136, Appendix B, unless the test method specifies another procedure for MDL determination. Some test methods, such as total suspended solids, total volatile solids, total solids, pH, temperature, and dissolved oxygen, do not require the determination of an MDL.
- 6.2.2 The laboratory analyzes a minimum of seven replicates to determine the MDL. If seven replicates are analyzed, the laboratory uses all analytical results when calculating the MDL. If the laboratory analyzes more than seven replicates, the laboratory only excludes analytical results which the laboratory determines are outliers by utilizing a statistical outlier test.
- 6.2.3 The laboratory determines MDLs for each approved test method annually; and when there is a change in instrument type.
- 6.2.4 The laboratory may, in lieu of the annual determination of the MDL, annually verify the MDL by the preparation and analysis of a minimum of one matrix spike sample, spiked at the current MDL. An MDL is considered verified and acceptable for continued use if the results of the analysis of the matrix spike sample is within the 95% confidence interval as set forth in 40 CFR, Part 136, Appendix B. If an MDL cannot be verified, a new MDL is determined.
- 6.2.5 MDL replicate percent recovery acceptance criterion is defined by the range of the percent mean recovery ± 2 times the percent relative standard deviation (%RSD) found for the seven replicates. If any of the seven replicates fails this acceptance criterion, then the analyst discards all results and performs another set of seven replicates.
- 6.2.6 The spiking concentrations used to determine an MDL are between 1 and 10 times the calculated MDL.

Section 7

Corrective Actions

7.1 Overview

The following policies and procedures are used when any analysis or reporting discrepancies are detected, or when any deviation from the policies and procedures in this manual occur. A corrective action is taken to eliminate the causes of out-of-control situation in order to prevent recurrence.

7.2 Identification of Discrepancies

7.2.1 Discrepancies or deviation shall be defined as, but not limited to, any of the following:

- quality control sample results outside control limits;
- reporting sample results in wrong units;
- using un-approved analytical procedures;
- data which appears to be erroneous to current trends;
- instrument failure (lack of calibration)
- standard/reagent preparation (i.e. expired Standard/Reagent, in-correct chemical)
- contamination (i.e. dirty glassware)

7.2.2 Each analytical procedure SOP should reference quality control criteria to use in determining discrepancies and accepting data.

7.3 Investigation and Corrective Action

7.3.1 Anyone may detect discrepancies. Once a discrepancy is detected, it is to be investigated and reviewed. Data that has discrepancies should not be recorded and should be reviewed and determined if the data is valid.

7.3.2 Once a discrepancy is established, one should proceed with one or more of the following:

- re-run samples, if available and holding time permits;
- document results as invalid and note on any reports;
- investigate discrepancy; document cause and corrective action taken and include with data.

7.3.3 When investigating the discrepancy review sample and quality control results, integrity of quality control samples and technique. If a quality control result does not meet method or laboratory criteria, it shall be documented on the analysis bench sheet and quality control chart.

7.3.4 A review of sampling procedures and preservation, washing of glassware and any sources of contamination to samples or quality control standards should also be done.

- 7.3.5 Corrective actions are performed to eliminate any of the fore mentioned possible causes for data discrepancies. Examples of corrective actions are: review of proper procedures, quality control standard preparation, changes to procedures or sampling protocol, and improving analyst technique. If the investigation cannot determine a known cause for invalid results, retraining and procedure review are the appropriate corrective actions.
- 7.3.6 For each data discrepancy event, the investigation and corrective action shall be documented. Remember: If it isn't written down and documented, it didn't happen.

7.4 Documentation and Review of Corrective Action

It is important to review raw data, reports, quality control data, discrepancies, and corrective actions on a regular basis. This review establishes any recurring problems that require further investigation and action. It is very important to document your corrective action review. It can be a good troubleshooting reference and a good source to determine if more training or a piece of lab equipment needs to be replaced.

Section 8 Quality Control and Calculations

8.1 pH

- 8.1.1 Daily standardize your pH meter with at least 1 standard, preferably 2 standards.
- 8.1.2 After standardizing the pH meter, analyze a known pH standard. Keep a log of your results.
- 8.1.3 If the pH reading of the known standard is $> \pm 0.05$ units, recalibrate the pH meter.
- 8.1.4 Be sure to note the expiration date of the standard. Do not use expired standards.
- 8.1.5 pH probe – make sure the KCI is filled in the probe to a proper level and maintain a clean probe. The probe should be checked for damage prior to use (cracked bulb or damaged cable)

8.2 Total Suspended Solids (TSS)

With each run of TSS analyses – do the following as a minimum as quality control.

- 8.2.1 QC Tare Weight Crucible
Designate a QC crucible. You weigh the crucible along with your other TSS crucibles and it is dried with the other crucibles, desiccated and weighed again. The difference of the tared wt. crucible should not $> \pm 0.0005$ mg\l.

8.2.2 TSS Standard:

Analyze a TSS standard with every TSS run. The TSS standard should be within the acceptable range designated on certificate of analysis.

8.2.3 Duplication - for important samples i.e. NPDES plant discharge effluent sample – it is strongly recommended to duplicate the TSS sample to ensure accuracy and precision of the result.

8.2.4 Daily record the oven temperature – make sure the oven temperature is between 101-104⁰c.

8.2.5 Weighing Scale – Check often the level bubble of the scale to make sure it is level and have the scale checked at least annually with certified weights.

8.2.6 Make sure to put TSS crucibles in the desiccator to cool before weighing. Keep an eye on the desiccate stones in desiccator – if color of the stones indicates they are absorbing too much humidity/moisture – change them.

8.3 Ammonia-Nitrogen Test

8.3.1 Everyday you analyze an ammonia nitrogen sample - the ammonia meter should be calibrated. It should be calibrated with at least 2 known standards and verified with a third.

8.3.2 The third ammonia nitrogen standard should be made at a value between the two standards used for calibration. The results must be within the acceptable range before proceeding with the sample testing.

8.4 Fecal Coliform

Each time you analyze for fecal Coliform, do the following as a minimum as quality control:

8.4.1 Work area countertop should be wiped down with disinfectant prior to beginning the fecal Coliform analyses.

8.4.2 Make sure every piece of equipment is sterile.

8.4.3 Do a first and last plate when doing a filtering process.

- a. The first plate – sterile water is run through the filtration funnel through sterile water, then placed on a FC media and incubated with the sample plates. No growth (colonies) is to be on the first plate – this proves all your micro-equipment was sterile.

- b. The last plate is after filtering your wastewater samples, do another filtration with sterile distilled water, place on FC media and label and incubate with the sample plates. No growth (colonies) is to be on the last plate – this proves your procedure was correct – no containment carried over from one sample to another and the equipment remained sterile.

8.4.4 Sterilization of Micro Equipment

When autoclaving equipment- use heat-pressure sensitive tape on the wrapped equipment to verify the equipment has reached the sterilizing temperature and pressure to ensure sterilization.

- 8.4.5 Daily record the incubator temperature. Make sure the incubator is at $44.5^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$.

8.5 **Biochemical Oxygen Demand (BOD)**

With each BOD, set as a minimum the following-

- 8.5.1 Duplicate the blank – set up 2 bottles for the BOD blank.
- 8.5.2 Perform a BOD standard*; the result should be within the acceptable range.
*Several commercial BOD standards are available. Be sure to watch the expiration date they have a limited shelf life. North Central Lab Supply in Wisconsin is one source of a pre-made BOD Standard.
- 8.5.3 The blank should not deplete more than 0.2 mg/l. If it is more than this, review the BOD dilution water preparation procedure.
- 8.5.4 Set-up at least 2 dilutions for each sample.
- 8.5.5 Be sure to record the temperature and pH of the buffered water on your worksheet.
- 8.5.6 Make sure you are using the correct reagents to buffer the BOD dilution water. Check expiration of the reagents.

Section 9 Performance Audits

9.1 **Performance Evaluation (PE) Testing/Performance Audits**

- 9.1.1 Samples are analyzed for this laboratory facility as appropriate for the mandatory US EPA DMR-QA Laboratory Performance Valuation Study. If the facility normally uses a commercial laboratory, then the commercial laboratory should perform the PE analysis for the facility.

- 9.1.2 PE samples are analyzed once per year for each test method listed on the POTW's NPDES permit.
- 9.1.3 PE samples are processed without any extraordinary care as the results obtained will be considered typical of the laboratory's performance. All directions are followed without change for sample preparation, dilution or analysis.
- 9.1.4 The US EPA DMR-QA Studies have several deadlines every year. Be sure to know the deadlines.
- 9.1.5 All unacceptable results for PE samples are investigated by a standardized procedure. Refer to the Corrective Action section. Appropriate corrective actions are implemented where assignable error was found. When assignable error is not found corrective actions are focused on review of the procedure and improvement of test method execution. The test procedure is re-validated by successful analysis of a second source standard or reference material.

9.2 Inter-laboratory Comparison (Round Robins)

- 9.2.1 it's a good idea to participate in inter-laboratory comparison studies (round robins). There are a few round robin programs available in IL. PDC labs in Peoria have an affordable program that you check your lab against others in the area.
- 9.2.2 Round robin samples analyzed by this laboratory are from environmental sources and analyzed for a variety of parameters the lab routinely performs.
- 9.2.3 Review round robin analysis results and look for any discrepancies.

9.3 Standard Reference Materials

The laboratory should use standards traceable to Standard Reference Materials (SRMs), where available.

9.4 Internal Quality Control Programs

- 9.4.1 Statistical Process Control is generally used to establish batch acceptance criteria for analytical test results. The test results for the laboratory control standard are evaluated annually to set limits for control charts. Warning limits are set at +/-2 standard deviation from the mean recovery, and control limits are set at +/-3 standard deviation.
- 9.4.2 When a control limit is exceeded, the analyst is required to respond in a manner that assumes something is wrong with the measurement system. Whenever possible, a response to an exceeded control limit includes the following:
- Stop the analysis of samples, if possible.

- Conduct a systematic investigation as soon as possible to locate the source of the problem.
- Take appropriate corrective action when a problem is located.
- Rerun samples to the last good laboratory control standard whenever possible.
- Document the control limit event, including the details of the occurrence, whether a problem was detected, and any corrective actions taken.
- Maintain a state of increased vigilance.

9.4.3 Warning limit trend exceedance occurs when two or more consecutive results for the laboratory control standard exceed the warning limit. A general response to a trend exceedance includes the following.

- Inform the immediate supervisor of the warning limit trend exceedance.
- Conduct a systematic investigation as soon as possible to locate the source of the problem.
- Take appropriate corrective action when a problem is located.
- Document warning limit exceedance, including the details of the occurrence, whether a problem was detected, and any corrective actions taken.

9.4.4 SOPs for test methods and lab procedures are reviewed on a regular basis.

Section 10

Evaluating Data for Precision and Accuracy

10.1 Introduction

The quality assurance objectives are to provide analytical data of known quality, to produce defensible analytical data and to produce data which meets all Federal and State permit requirements.

Data quality is assessed for precision, and accuracy on a daily basis. Data quality is also assessed for these objectives by the analysis blind studies; such as the USEPA DMR Performance Evaluation Study conducted annually.

10.2 Precision

Precision is defined as the repeatability of a measurement. Replicate analysis is performed regularly after every 20 samples. The difference between the results of duplicate analyses is used to assess the precision of the test method. The range “R” is calculated as follows:

$$R = |(\text{sample result}) - (\text{replicate result})|$$

The | | around the equation indicate the absolute value of the result.

The absolute value is always positive. The range then is the difference between two sample results that is always positive.

The average range (<R>) can be calculated when at least 20 replicate pairs have been analyzed.

$$\langle R \rangle = \frac{\text{sum of all } R}{n = \text{number of replicates}}$$

A control chart can then be calculated for warning and control limits

$$\text{Control limit (CL)} = 3.27 \text{ times } \langle R \rangle$$

$$\text{Warning limit (WL)} = 2.51 \text{ times } \langle R \rangle$$

10.3 Accuracy

Accuracy is a measure of the systematic error of the analysis. This refers to the way the lab performs the method. It refers to the degree of difference between the true concentration of an analyte in the sample and the observed concentration. Accuracy is evaluated through the use of laboratory control samples and matrix spikes. A matrix spike is a portion of sample which has a known quantity of analyte added to it. Spiked samples are analyzed at a frequency of 1 per 20 samples analyzed. Matrix spikes are used for ammonia testing. The amount of analyte should be between 1 and 5 times the known value of the sample.

$$\text{Spike Percent (} R \text{)} = \frac{100 (A - B)}{C}$$

Where: A = the concentration measured in spiked sample (mg/L)

B = the concentration measured in the unspiked sample (mg/L)

C = the concentration of the spike added to the sample (mg/L)

10.4 Comparability

The generation of comparable data is the goal of any analytical program. This characteristic implies strict adherence to published analytical protocols and use of standard reporting units. The QA objective is that all data resulting from these analyses be comparable with other measurements made by another organization.

Section 11

Reporting and Record Keeping

11.1 Reporting

Analytical results are calculated to appropriate concentration units which are dictated by the analytical method. Data is recorded on bench sheets. Where required by method, blank correction is applied. Calculations are independently verified by appropriate laboratory staff. The data is then placed in a number of reports that are required by the NPDES permit and other sludge requirements. The data included must be reviewed by the plant operator submitting the report for compliance with effluent limits, Discharge Monitoring Reports must be signed by (*insert: the facility supervisor other authorized individual*) and submitted to the Illinois Environmental Protection Agency.

11.2 Record Keeping

All records are kept for at least 3 years (5 years for sludge data). These records include equipment calibration and maintenance, sampling, analysis, and quality control. It is important to keep all raw data. Monitoring information shall include:

- a. The date, exact place, time, and individual who performed the sampling or measurements
- b. The date and the individual who performed the analysis
- c. The analytical techniques or methods used; and the results of analysis

Any handwritten records shall be recorded in black ink. Correction fluid of any type must not be used. If a correction to a data entry is need, a single line should be drawn through the entry. The corrected entry is then written above and initialed.

Section 12

Definition of Terms

Accuracy - a measure of the degree of agreement between an observed value generated by a specific procedure and a true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyte of interest - the chemical element, chemical compound, or physical property for which the laboratory is performing an analysis.

Analytical standard - a pure compound or a mix of pure compounds used to calibrate an instrument or a single piece of equipment. An analytical standard may be traceable to a national standard or reference material.

Bias - the systematic of persistent distortion of a measurement system which causes errors in one direction resulting in measured values that are consistently less than or greater than the true value.

Blind sample - a sample submitted for analysis whose composition is known to the submitter, but unknown to the analyst. The Annual USEPA Performance Studies are one example of a blind study.

Chain-of-Custody - an unbroken trail of accountability that ensures the physical security of samples, data, and records.

Corrective action - an action taken by the laboratory to eliminate or correct the causes of an existing nonconformance in order to prevent the reoccurrence of the nonconformance.

Document - any written or pictorial information describing, defining, specifying, reporting, or certifying any activities, requirements, procedures, or results.

Environmental samples - samples, excluding any laboratory generated quality control samples such as matrix spikes, duplicates, and laboratory control samples, for which the laboratory analytical results will be reported.

Inorganic - all parameters not included in organic parameters.

Laboratory - a facility that is equipped and used for the testing of samples.

Laboratory control sample - an uncontaminated sample matrix with known quantities of analytes. The analytes shall be obtained from a second source. The laboratory control sample is analyzed exactly like a sample to determine whether the measurement system is performing as expected using, depending on the test method, either acceptance criteria contained in the method or laboratory generated.

Linear calibration range - the range of standards used for calibration between which a linear relationship exists between the amount of material introduced into the instrument and the instrument's response.

Matrix - the predominant material of which the sample to be analyzed is composed. Sample matrices include wastewater liquids and sludges.

Matrix spike - an aliquot of matrix, fortified (spiked with known quantities of specific analytes and subject to the entire analytical procedure in order to determine the effect of the matrix on the recovery of a test method).

Matrix spike duplicate - a replicate matrix spike that is prepared and analyzed in order to determine the precision of the test method.

Method - a procedure or technique for performing an activity (for example sample preparation and sample analysis).

Method blank - a sample which does not contain an analyte of interest above an acceptable level and which is processed simultaneously with, and under the same conditions as samples being analyzed or analytes of interest.

Method detection limit - the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

NPDES - National Pollutant Discharge Elimination System, a USEPA program designed to control discharges of wastewater and wastewater effluents into surface and ground wastes.

Organic - all analytes analyzed by all forms of gas chromatography, and high pressure liquid chromatography (excluding ion chromatography).

Out-of-Control - out of statistical control and is a single measurement, quality control data point, series of measurements or series of quality control data points which fall outside expected limits as determined by the statistical analysis or historical data or in compliance with test method specified limits.

Performance evaluation program - the process of providing rigorously controlled and standardized sample to a laboratory for analysis, reporting of results, statistical evaluation of the results in comparison to peer laboratories.

Performance evaluation sample - a sample provided by a performance evaluation study to test whether the laboratory can produce analytical results within specified performance limits.

Precision - the measure of mutual agreement among individual measurements of a sample, usually under prescribed similar conditions, usually expressed as the standard deviation, variance, or range, in either absolute or relative terms.

Quality assurance plan (QAP) - the laboratory's written plan of operation that will ensure that the accuracy and precision as well as the overall reliability of laboratory results, meets or exceeds the needs and expectations of those for which laboratory data is produced. Management, administrative, statistical, investigative, preventative, and corrective techniques will be employed to maximize reliability of data.

Quality control - The overall system of technical activities whose purpose is to measure and control the quality of laboratory data so that it meets the permit requirements and the needs of all users.

Quality control acceptance limits - the statistically determined or test method specified limits within which a single measurement, quality control data point, series of measurements or series of quality control data points will fall when the analytical process is producing data of satisfactory quality.

Quality control chart - a graphical plot of data points used to demonstrate statistical control and monitor a measurement process. The charts have a vertical scale plotted in units of the analytical results, a horizontal scale, in units of time, or sequence of results, and lines within which or around which the data points are expected to lie.

Quality control check sample - an aliquot of the method blank fortified with a solution of the analytes of interest of known concentration prepared from a standard obtained from an outside source. The quality control check sample is used to check either laboratory or instrument performance.

Replicate sample - two or more equal aliquots taken from the same sample container and analyzed independently for the same analytes.

Sample any solution or media introduced into an analytical instrument on which an analysis is performed excluding calibration standards, initial calibration verification check standards, calibration blanks, and continuing calibration verification check standards.

Sample duplicate - a second sample aliquot taken and carried through all steps of the analytical procedures in an independent and identical manner. Sample duplicates are used to assess variance of the total method including sampling and analysis.

Sample tracking - an unbroken trail of accountability that ensures the physical security of samples, data, and records.

Spike concentration - a specified amount of an analyte of interest in a matrix spike, laboratory control sample, or quality control check sample.

Standard Operating Procedure (SOP) - a written laboratory specific document which details the method of an operation, analysis of action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Standard Methods - Standard Methods for the Examination of Water and Wastewater.

Traceability – The comparison of a laboratory standard or calibration to a national standard that will substantiate its accuracy.

True Value - the accepted or actual value of the quantity being measured.

USEPA - the United States Environmental Protection Agency.

NOTE: ADD A PLANT DIAGRAM AND YOUR SAMPLE LOCATIONS AT THE END OF YOUR MANUAL. THIS WILL BE APPENDIX A