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INTRODUCTION

This manual is intended to aid laboratory personnel in their duties, assure proper documentation in the production of valid data, and maintain policies and procedures necessary to ensure quality assurance occurs.

OBJECTIVES AND COMMITMENT

It is the goal of this laboratory and its management to assure not only accurate results, but legally defensible data. To sustain this objective the laboratory has developed this manual, with the guidance of the The NELAC Institute's (TNI) 2009 Standard. To help in this endeavor the laboratory maintains the following objectives:

1. Internal and external training of personnel to assure competency in their responsibilities.
2. Maintaining accessibility of the laboratory QAP, SOPs, policies and other relevant documentation to all laboratory personnel.
3. Adherence to State and Federal guidelines
4. Documentation of all quality assurance activities, CARs, preventative maintenance, support equipment, instrumentation, chemicals and supplies.
5. The manual should define what is acceptable in the area of quality control
6. Maintenance of the quality assurance manual, by the quality assurance officer or other designee, to assure quality assurance documentation is kept up to date.
7. Documenting the quality of all data reported
8. Assuring sample acceptance procedures are verified, documented and followed.
9. Supervising all laboratory personnel
10. Documenting analytical and operational activities
11. Maintaining a document control system to assure revisions are clearly indicated with effective date. Assign revisions, print date, revised by, and effective date to documents.
12. Support of Top Management for Implementation of the Quality System.

ORGANIZATION AND RESPONSIBILITIES

It is the goal and objective of this section to delineate the authority, inter-relation and responsibilities of each position. In defining these lines of authority, the laboratory hopes to assure proper supervision, sufficient staffing, training, and resources to maintain the production of legally valid data, integrity, and non partial judgment.

The laboratory organization has been developed to help avoid conflicts of interest. The laboratory provides work for the treatment plant but does not report to the plant directly, all communications and reports are forwarded to the District Manager who oversees each unit of the Timpanogos Special Service District.

It is the overall responsibility of all laboratory employees to comply with the laboratory quality assurance program as outlined in its quality assurance manual.

Laboratory Director: The director is responsible for the day-to-day administrative and operational functions of the laboratory. Within this content of responsibility the following responsibilities are absorbed or delegated by the director:

1. Defines the qualifications (experience/skills), maintains a job description detailing responsibilities of all laboratory personnel (maintained in the laboratory office), and certifies that all personnel meet the necessary requirements of their position.
2. Assures all laboratory personnel performing certified work, demonstrates initial and continuing proficiency on an annual basis.
3. Supervises the Quality Assurance Officer
4. Maintains the generation of valid data.
5. Maintains qualifications; resumes, external training certificates; and internal training forms of all laboratory personnel.
6. Oversees the sample acceptance, and assures The NELAC Institute's (TNI) 2009 Standard is adhered too.

Regulatory and Educational requirements: The director must have a minimum of a bachelor's degree in a science field (biology, chemistry or physical), plus two years experience in a certified laboratory. Educational requirements may be substituted for experience. The person fulfilling this position may only be the director of one laboratory, but may also fill the Quality Assurance officer position.

Quality Assurance Officer: Maintains tracks and educates personnel on all aspects of the laboratory quality assurance program to assure compliance with governing regulatory agencies. This position must be responsible for the following areas:

1. Maintaining knowledge of methods performed by the laboratory, and rules governing the laboratory.
2. Communicating to the director and district manager when laboratory policies or practices need to be reviewed and adjusted.
3. Review quality control data and sample results as applicable in an objective manner.
4. Oversee sample receipt policies and procedure that include but are not limited to: sample handling, testing, and reporting.
5. Perform an annual review of technical operations that may affect the production of quality data.
6. Must not analyze routine samples for compliance purposes.
7. Oversees and follows up on corrective actions.

Regulatory and Educational requirements: The educational requirements of this position are documented training in quality control and quality assurance, knowledge of methods performed in the laboratory and past laboratory experience in a certified laboratory.

Laboratory Technical Director: Helps maintain the day-to-day functioning of the laboratory by assuring the following:

1. Analysis are performed in accordance to laboratory policies
2. Performs analysis
3. Assures samples are collected and received in accordance to laboratory policies
4. Maintains the production of quality data
5. Organizes the work schedules and supervises all laboratory employees.
6. Trains analysts in analytical procedures.
7. Places orders for laboratory standards, reagents, supplies, and proficiency tests
8. Maintains quality control is performed, and acceptable
9. Keeps the Director and QA Officer apprized of problems
10. Generates laboratory reports

Regulatory and Educational requirements: The educational requirements of this position is obtaining a grade III wastewater treatment plant license and having a minimum of 2 years supervisory experience. A bachelor's degree in a science field may be substituted for the treatment plant license initially, but the license must be obtained within a year. The main focus is experience and documented training in analytical procedures and calibration techniques of laboratory support equipment.

Laboratory Technician: is responsible for the analysis of samples, and assuring quality control/ traceability occurs at the bench. This position is the first line of defense against problems, early detection here can help eliminate failures before they occur. This position is responsible for the following:

1. Standardization of calibrations, instruments and reagents.
2. Prepares all reagents, standards, and supplies necessary to perform their assigned tests.
3. Assures quality control (spikes, duplicates, and standards) samples are analyzed with each analytical batch.
4. Assure calibration curves and standards are verified with an NIST traceable standard.
5. Prepares laboratory glassware
6. Maintains inventory of supplies, reagents and standards.
7. Calculates all analysis performed
8. May implement corrective actions
9. Notifies supervisor of problems
10. Performs Proficiency tests

Regulatory and Educational requirements: The educational requirements of this position are a minimum of a high school degree, with the ability to apply math skills, and obtain a wastewater treatment plant license.

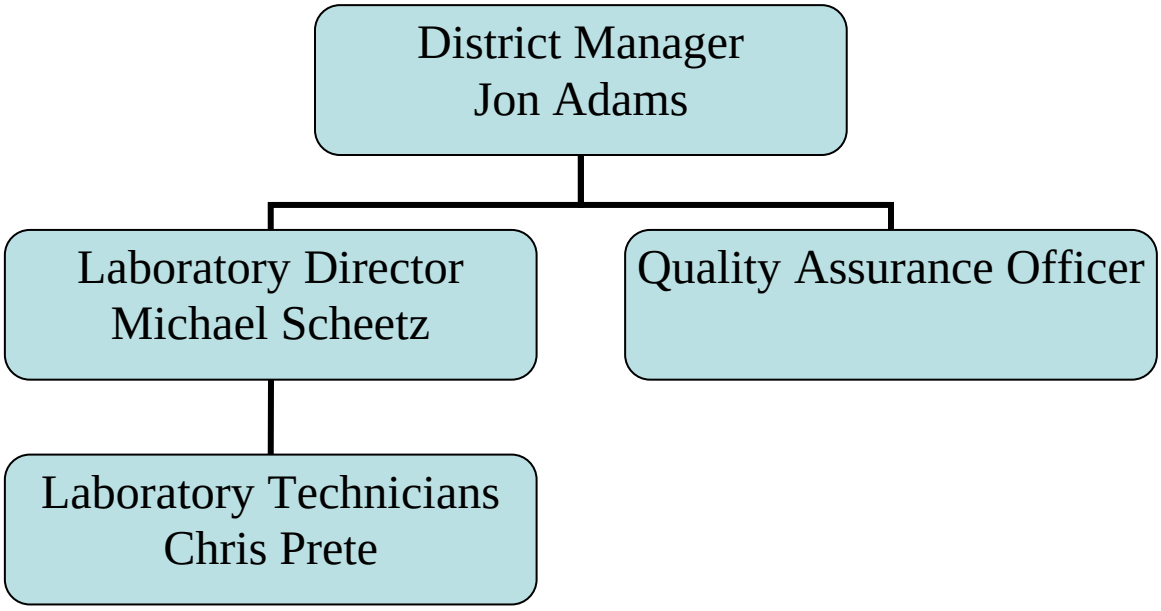
In the event of unexpected absences the following positions will be covered by:

Laboratory Director: District Manager and Technical Director

Laboratory QA Officer: Laboratory Director

Laboratory Technical director: QA Officer and District Manager

Laboratory Organizational Chart:



TRAINING

The Laboratory maintains a training program for its personnel that consist of documented internal and external training events. These training events should include but are or limited to the following.

1. Yearly evaluations of analysts procedures at the bench
2. Training on the laboratory quality assurance manual and updates
3. Proper documentation techniques
4. Demonstration of initial capability
5. Demonstration of continued proficiency
6. New procedures or methodologies
7. Acceptable quality control practices
8. Corrective action policies
9. Ethical responsibilities
10. Manufacturer-sponsored workshops
11. State of Utah-sponsored workshops
12. The use of general lab equipment such as balances and pipettes
13. Maintenance of a signature log of personnel capable of initialing laboratory records.

Technician training is considered up-to-date if personnel files contain evidence that each employee has read, understands, and is using the latest version of the laboratory quality assurance manual.

The laboratory maintains all documentation related to training in two locations, the main office and the laboratory. The main office maintains information pertinent to work records: work history; educational degrees; and certificates of training from outside services. The laboratory maintains information related directly to the laboratory: initial demonstrations of capability (DOC); continuing demonstrations of performance; a general description of responsibilities; ethics agreement; QAP reading form; and laboratory specific training forms. All records associated with the laboratory are maintained for a minimum of five years.

Procedure for Training Documentation

All documentation provided by the laboratory must include the following: who is providing the training; when the event took place; where the event took place if other than the laboratory; who was being trained; and a detailed description of the training.

Laboratory persons receiving training must sign and date a training form stated that they attended and understood the training provided.

If laboratory personnel attend outside manufacturer or organizational training and do not provide a certificate of participation, the laboratory may document the event with who, what, where, and when. This document must be signed and dated by the individuals who attended the training.

PHYSICAL FACILITIES

The physical facility plays an important role in enabling analyst to perform their task efficiently without contamination. Management is dedicated to providing an unencumbered work area that is maintained, environmentally controlled to prevent contamination, and compliant with State and Federal regulations (R444-14, TNI & OSHA).

When introducing new analysis, instrumentation, or additions to the laboratory it is important not to adversely affect surrounding analysis. To avoid potential problems the following concepts should be thoroughly investigated:

1. Will there be adequate lighting, heating, air conditioning, and electrical supplies for the change or will these be affected by the change?
2. Will environmental conditions still be monitored and documented?
3. Will separation of incompatible tests be maintained?
4. Will sample receipt, sample storage, chemical storage, waste storage, and data handling/storage areas be affected, reduced, and maintained as separate areas?
5. Will housekeeping procedures need updating to accommodate the change?
6. Will access to the laboratory still be controlled?

SAMPLE COLLECTION, ACCEPTANCE, RECEIPT AND TRACKING

Sampling location have been predetermined based on regulatory requirements, the different stages of plant treatment, and accessibility. Laboratory personnel are responsible for preparing and collecting samples.

Plant #1 Bioreactor Flow consists of 4 individual ditches, labeled East 1-4 and the East RAS. Samples are collected near the outfall of each tank. A diagram of the sampling location is located in Appendix A.

Plant #2 Bioreactor Flow also consists of 4 individual ditches, labeled West 1-4 and the West RAS on the schematics in Appendix A. The sampling location will be on the outer edges of each tank near their outfall.

These Bioreactor samples are collected by the grab technique, and analyzed for total solids, %volatile solids, pH, and settleability. The RAS is analyzed for total solids and %volatile solids.

Effluent and Influent samples consist of both composite and grab samples.

Composite samples are collected daily with the use of a time proportioned automatic sampler. These samples are analyzed for BOD and TSS on both influent and effluent samples. The sampling technician must remove the collection vessel from the automatic sampler and swirl to mix the content. Once the sample is adequately mixed the sampling technician will pour the sample into the proper containers supplied by the plant laboratory or a subcontracted laboratory. Excess sample is discarded back into the treatment plant system. The collection vessel should be rinsed well and dried before replacing back into the sampler.

Grab samples are collected utilizing the dip method: a long handled collection vessel is placed into the waste stream and then removed. The sample collected is poured into the appropriate containers supplied by the plant laboratory or a subcontracted laboratory. The effluent grab samples are analyzed for e-coli, total residual chlorine, pH, and ammonia. The influent grab samples are analyzed for ammonia and pH.

Pond samples are also collected by the grab technique, and analyzed for temperature, and total residual chlorine.

All samples will be collected in cleaned, and if required, preserved containers. The laboratory follows the guidelines listed below for sample container, preservative, holding and amount collected is given below.

Analyte	Volume (mL)	Container	Preservative	Holding Time
Conductance	100	Plastic or Glass	Cool, 4°C	28 Days
pH	25	Plastic or Glass	None Required	15 Minutes
Filterable Solids	100	Plastic or Glass	Cool, 4°C	7 Days
Non-filterable Solids	100	Plastic or Glass	Cool, 4°C	7 Days
Total Solids	100	Plastic or Glass	Cool, 4°C	7 Days
Volatile Solids	100	Plastic or Glass	Cool, 4°C	7 Days
Settleable Matter	1000	Plastic or Glass	Cool, 4°C	48 Hrs
Temperature	1000	Plastic or Glass	None Required	15 Minutes
Chlorine	200	Plastic or Glass	None Required	15 Minutes
Ammonia	400	Plastic or Glass	Cool, 4°C H_2SO_4 to pH<2	28 Days
DO	300	Plastic or Glass	None Required	15 Minutes
BOD	1000	Plastic or Glass	Cool, 4°C	48 Hrs
E.-coli	100	Sterile P or G	Cool, 4°C, Sod. Thio.	8 Hrs

Plant samples, are collected each morning by laboratory personnel. The person collecting the samples documents the activity on the laboratory sample submission form, assigns the unique identification (date and site) and files the submission form in the laboratory sample log. All plant samples are analyzed the day they are collected (or within the allowable holding time). Documentation of receiving temperature and preservation (if used) are recorded on the sample submission form.

De-chlorination of Microbiological Samples

As long as the following conditions are met, the laboratory does not need to individually screen all micro samples for chlorine.

1. The laboratory uses commercially prepared sample bottles that contain sodium thiosulfate.
2. One sample bottle per lot is checked to ensure efficacy of the sodium thiosulfate to levels in excess of those encountered in plant samples, and the check is documented. If the bottle manufacturer issues CofAs that contain all of the applicable information, a copy of the CofA may be kept on file in lieu of in-house testing, or easily accessible online.
3. Total residual chlorine results are analyzed daily and the concentration is documented.

Sample Collection and Receiving Procedures

The guidelines for sample collection and receiving are:
1) Samples are collected in 4L containers, one for each site, prepared by the laboratory. These containers are washed and reused in the laboratory.

The laboratory washing procedure is rinsing well with tap water and air drying.

2) Composite samples are collected in an automated refrigeration unit in a 10 gallon container. This container is swirled well by the sample collector and poured into the appropriately marked 4L container.

Once the 4L container is full the cap is screwed on tightly and placed in a PVC cage to protect from damage and spilling during transport to the lab.

3) Grab samples are collected at designated areas with a dipstick. The sample is poured into the appropriately marked 4L container until full.

Once the 4L container is full the cap is screwed on tightly and placed in a PVC cage to protect from damage and spilling during transport to the lab

4) All samples are received in the laboratory within minutes of sampling. Grab samples are exposed to environmental conditions meaning all samples are taken and received at ambient temperatures. There is no time allowed for cooling to 4^0C before analysis or during transportation to lab. If analysis is not to begin within 2 hours of return to laboratory, samples will be placed in refrigerated storage at 4^0C. If samples must be stored they will be separated from reagents and standards to prevent contamination.

5) At the time of collection and receipt by the laboratory the sample submission form is completed with the following information:

1. Site Name (Influent, Effluent etc.)
2. ID code
3. Type (Composite or Grab)
4. Matrix
5. Date and time of collection
6. Collector's initials
7. Temperature
8. Analysis required

6) All documentation, memos, written correspondence, and conversations with the sampler or data user will be maintained by the laboratory for a minimum of five years.

Note: If sample integrity is in question, all decisions made and people involved must be documented on the receiving form. If the decision is to still analyze, and results would be considered suspect, the final report must be flagged.

Sample Tracking

Laboratory samples are tracked by their assigned laboratory identification. The unique identification is assigned by: the day of collection and a corresponding unique number for that date in the form of YYMMDD, and site ID code. Containers are labeled with their identification with a permanent marker. Any internal plant correspondence relating to the sample and its analysis will be maintained with the laboratory submission form.

Sample Disposal

Samples are discarded appropriately as listed in their SOPs. Samples may be discarded only when analysis is complete with acceptable quality control results; or when the sample has expired.

Subcontracted Analysis

The laboratory subcontracts several parameters to an outside laboratory. Samples that are to be sent out are collected in containers provided by the subcontract lab and placed in the sample fridge. Preservation and handling after this point is the responsibility of the subcontract lab. A chain of custody form is supplied by the subcontracted laboratory. The sampler will complete all required information on this form and retain a copy at the laboratory.

Requirements for the subcontract lab:

1. Must be a NELAP accredited laboratory.
2. DEQ/EPA must be notified in writing of the use of a subcontracted laboratory on the DMR.

Chain of Custody

Chain of Custody records are used to establish an ongoing record of the possession, storage and disposal of collected samples: aliquots, containers, extracts, and digestates. The laboratory follows the following guidelines when handling Chain of Custody samples.

1. A Sample is in one's custody if:
    a. It is in one's actual physical possession
    b. It is in one's view, after being in one's physical possession
    c. It is in one's physical possession and then locked up in a refrigerator so that no one can tamper with it
    d. It is kept in a secured area (locked), restricted to authorized personnel only
2. The record must document all time periods associated with the sample and transfers: Date and time of sampling event and all transfers.
3. The record must document and identify individuals (signature)who physically handle the individual samples
4. The number of people handling the sample will be minimized; usually the person collecting the sample is the one who maintains possession until relinquishing it to another laboratory.
5. The Chain of Custody document should be limited to 1 form.
6. The Chain of Custody will begin at the time of sampling.
7. The Chain of Custody will remain with the samples during transportation.
8. If the sample or shipping containers have custody seals the Chain of Custody will note their condition: intact or broken.
9. If samples are mailed, return receipts will be requested, if a carrier is used all receipt will be maintained.
10. Samples received by the lab are in the labs possession, and all personnel must be willing to testify that samples were in their possession.

INTERNAL QUALITY CONTROL

Quality control samples are analyzed with each batch of samples as described in the applicable analytical method SOP. A brief description of each QC sample type and the mathematical formula used to evaluate it follow.

Laboratory Control Standards (LCS)

Recoveries of laboratory control standards are used to verify the accuracy of a method. The LCS recovery is calculated using the following formula:

LCS Recovery % = obtained value divided by true value x 100

Continuing Calibration Verification sample (CCV)

Instrument calibration verification shall be performed: at the beginning and end of each analytical batch. If an internal standard is used, only one verification needs to be performed at the beginning of the analytical batch; if the time period for calibration or the most recent calibration verification has expired; or for analytical systems that contain a calibration verification requirement.

Duplicates

The relative percent difference (RPD) of analytical duplicates or matrix spike duplicates is used to verify the precision of a method. The RPD is calculated using the following formula:

RPD = Difference of duplicates (high value minus low value) divided by average of duplicates x 100

Matrix Spikes

Recoveries of matrix spikes (MS) are used to verify that matrix interference did not occur. The MS recovery is calculated using the following formula:

MS Recovery % = obtained value divided by true value x 100

Method Blanks

Method blanks are analyzed where applicable to verify that no contamination occurred during a run. Obtained blank values should meet one of the following criteria:

- Result must be less than the procedure reporting limit
- Result x 10 must be lower than the result of the lowest sample in the batch

Selectivity

It is important that each method performed in the laboratory be designed to measure the analyte requested. Selectivity concerns are addressed in method design and development and are monitored using matrix spike samples and method blanks.

Test Conditions

When required by a particular analytical method, environmental and instrumental conditions will be monitored and documented. Specific requirements are listed in the individual method SOPs.

Frequency

General laboratory internal QC requirements call for the analysis of applicable QC samples for every twenty (20) lab samples, or for each analytical batch if less than twenty (20) samples are analyzed. See laboratory SOPs for specific QA/QC requirements. The following table summarizes the requirements of each method.

Analyte	Blank	Standard	CCV	Duplicate	Spike
Ammonia	X	X	X	X	X
BOD	X	X		X	
TSS				X	
DO				X	
pH		X	X	X	

Acceptance Criteria

QC acceptance criteria for each test parameter are derived according to the following hierarchy:

- If the analytical method quoted specifies limits for evaluation of quality control samples, those limits are used.

- If the method does not list specific QC limits, the limits are derived statistically as follows:
    1. Compile QC data from the most recent 50 analytical runs. If 50 data points are not available, a lesser number may be used; however, at least 15-20 points should be used to obtain statistically valid limits.
    2. Calculate the mean and standard deviation of the data set.
    3. Set preliminary control limits at ±3 standard deviations from the mean.
    4. Discard any statistical outliers and recalculate limits if necessary (3 reiterations maximum).
    5. Round the limits out to a reasonable range, usually the nearest multiple of five.

Once limits are defined, they will remain in place until recalculation is deemed necessary. Limits may be revised after major changes in equipment or methods, excessive occurrence of outliers, certain corrective actions, etc. Quality control acceptance criteria are posted on a chart in the laboratory and listed on the bench data sheets, or in the associated method SOP. All quality control measures will be assessed and evaluated on an on-going basis.

General QC

General quality control consists of documenting operating conditions of instrumentation used to prepare materials or maintain materials during the analysis process.

1. Incubators, ovens, water baths, and refrigerators must have their temperatures documented on each day of use. The coliform incubator is read twice a day with a minimum four hour separation of readings.
    The temperature device must be calibrated annually against a NIST thermometer.
    The temperature device must be tagged with an ID, correction factor, date of calibration, and initials of calibration technician.
2. Microbiological Sample Containers:
    Each lot of bottles received will be verified for sterility, volume accuracy, and chlorine removal efficiency. If the bottle manufacturer issues CofAs that contain all of the applicable information, a copy of the CofA may be kept on file in lieu of in-house testing and are accessible online.
3. Equipment Tolerance Checks:
    Auto pipets must be checked for accuracy.

Instrument Calibration

1. Samples must be bracketed by calibration standards where the instrument is calibrated by standards. If a sample is over the highest calibration standard it must be diluted.
2. The lowest calibration standard must be above the laboratory detection limit.
3. If initial calibration results are outside acceptance limits corrective action must be performed. Data may not be reported that is associated with an unacceptable calibration.

4. If the regulatory method does not specify the number of calibration standard to be analyzed, a minimum of two standards plus the blank must be analyzed.
5. Sample results must be quantitated from the calibration curve and not the CCV.

Variations

Any variations to the documented internal QC procedures or reference methods are subject to approval by the Laboratory Director and QAO. Approval must be obtained in advance of any deviations.

CORRECTIVE ACTION

There are three types of events that are included under the heading of corrective action:

- Non-conformance events
- Non-compliance events
- Customer complaints

Non-Conformance Events

A non-conformance is the type of exception that occurs during an analysis or procedure where a particular result does not conform to requirements and for which a remedy is written into the analysis or the procedure. These exceptions are remedied according to the procedure and documented in an appropriate logbook such as an instrument maintenance log. Non-conformances do not require tracking using the corrective action system.

Non-Compliance Events

A non-compliance is the type of exception where a systematic failure is observed and is the type that generates a corrective action. Non-compliances are remedied through the corrective action process and are documented using a Corrective Action Report (CAR) Form. Any person working in the laboratory may initiate a Corrective Action Report.

Customer Complaints

Customer complaints include any correspondence from clients questioning the results received from the laboratory. In the case of a captive lab, a customer can be an internal authority, a regulatory agency, or an entity serviced by the facility. Customer complaints that can be easily resolved (e.g., there is no error) will be documented on a case by case basis. Customer complaints that reveal a quality assurance system failure will be remedied through the formal corrective action system.

Root Cause

All corrective action shall begin with an investigation to determine the root cause(s) of the exception or problem.

Corrective Action Reports

Corrective action reports (CARs) are initiated and tracked by the Quality Assurance Officer. An electronic database is used to track CARs and generate report hard copies. The Quality Assurance Officer should review the generation, tracking, and closure of CARs monthly. Most CARs should be completed within three months. In instances where equipment must be purchased, new procedures investigated or documented Closure of the Car may take a year.

Reporting of Analytical Data

To the extent possible, samples will only be reported if all quality control measures are acceptable. If data must be reported with quality control parameter exceptions, the data will be flagged or qualified on the final report, or on the QC Summary.

EQUIPMENT, MAINTENANCE, SUPPLIES, AND CALIBRATION

The laboratory maintains all equipment and supplies on-site necessary to perform all analysis of interest to the laboratory, and its regulatory agencies.

All instructions, standards, manuals, policies, and reference data associated with the generation of data will be maintained up-to-date and available to employees.

It is important to the laboratory to keep equipment in working order and track its maintenance occurrences for future assessments. All equipment used in the laboratory have individual manufacturer manuals, detailing operational procedures and necessary maintenance which are located n the laboratory office. Maintenance activities, for all equipment, are documented in a group log also located in the laboratory office. The maintenance logs contain the following information:

1. Name of instrument
2. Manufacturer name
3. Model and serial number
4. Date received and condition when received
5. Date placed in service
6. Current physical location
7. Maintenance activity and repair
8. Dates of calibration or verification will be documented where applicable (bench-sheet or tagged on the instrument or case with NIST documentation located in laboratory files).

Any instrument that shows signs of misuse, or suspicion will be placed out of service until repaired, tagged as such, with all data associated with the item failure reviewed for integrity.

Liquid dispensers including auto pipets will be checked for accuracy on a quarterly basis. Calibration of class A volumetric pipets and glassware are not required. Checks will be documented with results, date, and technician.

Routine laboratory equipment maintenance performed by the laboratory includes:

Total Coliform/ *e.Coli* Incubator

- Frequency – twice daily
- Responsibility – technician
- Method – recording thermometer reading
- Limits – 35°C ± 0.50°C
- Acceptance – same as limits
- Correction – adjust temperature control knob
- Quarterly cleaning

BOD Incubator

- Frequency – daily
- Responsibility – technician
- Method – recording thermometer reading
- Limits – 20^0C ± 1.0^0C
- Acceptance – same as limits
- Correction – adjust temperature control knob
- Quarterly cleaning

Refrigerator

- Frequency – daily
- Responsibility – technician
- Method – recording thermometer reading
- Limits – 1.0°C - 5.0°C
- Acceptance – same as limits
- Correction – adjust temperature control knob
- Quarterly cleaning

Drying Oven

- Frequency – daily
- Responsibility – technician
- Method – recording thermometer reading
- Limits – 103°C - 105°C
- Acceptance – same as limits
- Correction – adjust temperature control knob
- Quarterly cleaning

pH Meter

- Frequency – when used

- Responsibility – technician
- Method – calibration, change filling solution as necessary
- Limits – ± 0.1 pH units and calibration brackets samples
- Acceptance – same as limits
- Correction – adjust control

D.O. Meter

- Frequency – annually
- Responsibility – technician
- Method – replace membrane
- auto calibrate with each use
- Limits – NA
- Acceptance – NA
- Correction – NA

Conductivity Meter

- Frequency – per use
- Responsibility – technician
- Method – check with 0.001M KCL solution
- Limits - ± 0.1 micromhos
- Acceptance – same as limits
- Correction – adjust control

Balance, Analytical

- Frequency – daily and monthly
- Responsibility – technician
- Method – daily check calibration with a class S weight (100mg, 1g, 5g &10g)
- Monthly add 100mg to 10g for sensitivity check.
- Limits - ± 0.5mg
- Acceptance – same as limits
- Correction – re-calibrate balance with built in standards or call for service

Balance, Top loading

- Frequency – daily and monthly
- Responsibility – technician
- Method – daily check calibration with class S weights (100mg, 1g, 5g &10g)
- Monthly add 100mg to 100g for sensitivity check
- Limits - ± 0.02g
- Acceptance – same as limits
- Correction – re-calibrate or call for service

Muffle Furnace

- Frequency – daily
- Responsibility – technician
- Method –record thermistor reading
- Limits – 550°C ± 10°C

Deionized Water System

- Frequency – when meter resistivity is <10 or when conductivity exceeds 2 micromhos/cm at 25°C or when BOD dilution water blanks indicate a problem
- Responsibility – technician
- Method – replace carbon cartridge once a year; replace separate bed when light goes out; install new mixed bed cartridge every 6 months (use service provider).

Desiccator

- Frequency –when desiccant turns blue
- Responsibility – technician
- Method – check, renew or replace as necessary

Calibration

Instrument calibrations occur in the laboratory in two forms: primary and secondary:

A primary calibration is one that interprets readings of samples and compares them against standards. Instruments that require a primary calibration are ion analyzers, spectrophotometers, turbidity meter, and the conductivity meter. The calibration procedures for these instruments are described in the laboratory SOPs.

Secondary calibrations assure accuracy in instrumentation that do not rely on the formation of a curve, but a particular data point. This type of instrumentation includes thermometers, balances, ovens, weights, water baths, and incubators. Thermometers are calibrated annually against an NIST traceable thermometer. Balances are verified daily using class S weights. Reference standards such as the NIST thermometer and Class S weights will only be used for verification of the regularly used equipment. Reference standards will be verified by an outside contractor at no less than the following intervals:

Reference Weights –	Five (5) Years
Reference Thermometers –	Five (5) Years

If traceability to national standards is not applicable, the laboratory will assure accuracy by duplicate analysis with different technicians and or instruments if possible, the performance of blind sample analysis, and comparison of correlation data if possible.

Outside Support

The lab will only use outside services which are of adequate quality to assure defensibility of data. Purchased equipment will not be used until verified to be in compliance by the lab. Documentation proving integrity of outside supplies, equipment and services will be documented and maintained for a minimum of five years.

REAGENTS

In preparing and verifying calibration acceptance, the laboratory is dedicated to using standards and reference materials of high quality, with reagents of analytical grade quality, and traceable to their point of origin and NIST where available. To help maintain traceability of all reagents, standards and material utilized by the laboratory three logs have been created to document important information and assign a unique identification. These logs contain the following information:

Chemical Rec. Log	**Standard Prep Log**	**Reagent Prep Log**
Lab ID	Date & Tech	Date & Tech
Date received	Lab ID	Lab ID
Date opened	Standard	Reagent
Expiration date (original container)	Formula & Volume	Formula & Volume
Manufacture	Lot Number	Lot Number
Lot number	Expiration date	Expiration date
Grade		
Chemical		
Discard or Empty date		

The disposal of purchased/prepared reagents and standards must be in accordance to State and Federal guidelines. Non hazardous substances may be disposed through the laboratory trash or sink in small quantities (small quantity is the amount used during analysis). Bulk supplies must be disposed through a hazardous disposal firm. Items listed as hazardous in their MSDS must be collected and disposed through a hazardous disposal firm.

PROFICIENCY TESTING

1. Proficiency Test (PT) samples are analyzed twice each year for each applicable test parameter. PT samples must be obtained from an approved provider.

2. If a proficiency test is not available for any analysis performed by the laboratory, accuracy and the validation of data will be maintained through general quality control procedures.

3. All correspondence concerning proficiency tests will be made in writing to the laboratory certifying body.

   Necessary correspondences:
   a) Who is the laboratory provider, and changes in the laboratory provider.
   b) Corrective actions concerning failed proficiency tests.
   c) Assuring the laboratory certifying body receives a copy of proficiency results directly from supplier.

4. It is the request and demand of this laboratory that all proficiency tests be handled and reported in accordance to the most recent updates of the Utah Rule R444-14 and The NELAC Institute's (TNI) 2009 Standard.

The rules governing proficiency handling, frequency and reporting are as follows:

1. The laboratory will enroll in a proficiency testing program for each analyte / analyte group it seeks certification.

2. Consecutive annual PT studied must have a window of not less than 5 and not more than 7 months from close date to close date.

3. Once the laboratory has chosen a proficiency testing program, it will notify its certifying body (Utah State Department of Health, Bureau of Laboratory Improvement) of the provider, and have all information regarding results released to the certifying body. If the laboratory changes providers it will notify its certifying body.

4. In order to perform a proficiency test accurately the laboratory must follow the instructions provided by the supplier, and report results by the deadline.

5. The proficiency test shall be treated as all samples received by the laboratory. It will not be given special treatment.

6. Multiple analyses (replicates, duplicates) will not be performed on the proficiency test if they are not normally performed in the course of routine sample analysis.

7. Results will not be averaged, unless specifically required by the method

8. Only laboratory employees who perform analysis will perform a proficiency test

9. The discussion of proficiency test results with other laboratories will not occur.

10. The laboratory will not subcontract proficiency test samples to another laboratory for analysis on its behalf, or perform a proficiency test samples on another laboratories behalf.

11. If the laboratory receives a proficiency test to perform on another laboratory's behalf, it will notify its certifying body within 5 business days.

12. The laboratory will maintain all documentation in receiving, data generation and reporting of a proficiency test.

13. If a proficiency test is failed, a corrective action report will be generated and sent to the laboratories certifying body.

14. The laboratory director will sign and retain a statement stating, "the laboratory followed the provider's instructions for preparing, analyzing, and reporting results as if it were a client sample."

A list of approved PT providers can be found on the TNI website.

QUALITY REVIEWS AND FREQUENCY

The laboratory Quality Assurance Officer is in charge of overseeing all in-house quality reviews of the laboratory and reporting their outcome to the Laboratory Director.

Laboratory reviews may be performed by the Quality Assurance Officer or other entities assigned by the Laboratory Director. These reviews will occur monthly, and annually. Monthly reviews will include: review of data; calculations, transcription, bench sheets, QC results; and corrective actions if applicable. Annual reviews will include but are not limited to: SOPs, overall quality system documentation, and QAP.

Items reviewed by the Quality Assurance Officer on a monthly basis should be documented with the following:

- Purpose of signature "Reviewed By"
- Date of signature
- Initials of reviewer

A monthly summary of QC samples and any appropriate data flags is prepared by the QAO. A copy of this review is kept on file at the laboratory and a signed copy is forwarded to the District Manager for inclusion in DMR reports. Significant deviations observed during an in-house inspection will be documented in a corrective action report. See "Corrective Action" section for more information.

Daily reviews are conducted by the laboratory technicians performing the analysis. They are the laboratories first line of defense in spotting a problem with samples received, methodologies, procedures, and instrumentation. It is the goal of the laboratory to maintain educational training in the production of valid data. A daily review will encompass acceptance criteria of method quality control and correlation of results between analyses performed.

Managerial Review

At least once a year, the QAO or Lab Director will conduct a review of the quality system and its testing and calibration activities to ensure its continuing suitability and effectiveness. The review will take into account reports from managerial and supervisory personnel, the results of recent internal audits, assessments by external bodies, results of proficiency tests, any changes in the volume or type of work performed in the laboratory, corrective actions and any other relevant factors. The laboratory will maintain records of review findings and actions.

RECORD KEEPING AND REPORTS

All Laboratory results are recorded onto bench sheets or in QC records. It is the intention to maintain a documentation system that will allow historical regeneration of all data produced.

All records created by the laboratory are maintained on site (main office vault) for a minimum of five (5) years, with the previous year kept in the laboratory office. In the event of a facility closure, District Management is responsible to ensure that records are maintained by a third party for a minimum of five (5) years after the closure date.

Records stored are: analytical bench sheets; reports; maintenance records; preparation records of standards and reagents; calibration records of all instrumentation including thermometers and balances; receiving records of chemicals and certificates of analysis, supplies, and samples; temperature charts of refrigerators, incubators, ovens, archived SOPs; CARs; PT results and data reviews. Most records generated by the laboratory are maintained in hard copy format, the laboratory is not presently producing electronic data, nor is it automated.

A Microsoft Access database is used for document control to track revisions and distribution of SOPs and the QA Manual.

All analytical results produced by the laboratory will be associated with raw data (bench sheets), through sample ID, date of analysis, test method performed, and analyst initials. This information must be documented and traceable through laboratory Quality Assurance policies. Additional information collected on a sample must also be maintained and reproducible. Examples of additional information that may compromise the validity of results: receiving conditions, hold limits, how sampled, preservation, and container. It is the goal of the laboratory to not deviate from methods, standard operating procedures and policies, without noting it on a report.

The laboratory reports all results produced in the laboratory in a DMR Report form. No other reports to external bodies are generated. Work presently performed in the laboratory is for plant process and discharge monitoring only.

Monthly reports required by The Department of Environmental Quality (DEQ) must be compiled onto a Discharge monitoring Report (DMR) supplied by DEQ. This report does not contain individual results; it contains monthly averages with the minimum and maximum result used to produce the average. The report allows for comments, which would contain notations of plant conditions, process water observations, subcontract laboratory and any results deemed questionable.

The TNI Standard is very specific on what a laboratory record keeping system shall contain. The following is taken directly from TNI, in hopes that if a change in policy occurs, the necessary information is still maintained. The laboratory must maintain and perform the following:

1. The records will include the identity of personnel sampling, sample receipt, preparation, calibration or testing.
2. All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification shall be documented.
3. The record keeping system shall facilitate the retrieval of all working files and archived records for inspection and verification purposes.
4. All documentation entries shall be signed or initialed by responsible staff. The reason for the signature or initials shall be clearly indicated in the records such as sampled by, prepared by, or reviewed by. All data should be recorded directly, promptly and legibly in permanent ink.
5. All data generated shall not be obliterated by methods such as erasures, overwritten files or markings. All corrections to record-keeping errors shall be made by one line marked through the error. The individual making the correction shall sign and date the correction.
6. All records, certificates and reports shall be safely stored, held secure and in confidence to the client. NELAC- related records shall be available to the accrediting authority.
7. All records shall be maintained for a minimum of five years from generation of the last entry in the records. All information necessary for the historical reconstruction of data must be maintained by the laboratory. Records which are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.
8. Records that are stored or generated by computers or personal computers shall have hard copy or write protected backup copies.
9. The laboratory shall establish a record management system for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting.
10. Access to archived information shall be documented with an access log. These records shall be protected against fire, theft, loss, environmental deterioration, vermin and, in the case of electronic records, electronic or magnetic sources.
11. The laboratory shall have a plan to ensure that the records are maintained or transferred according to state and federal requirements during bankruptcy or ownership changes

ANALYTICAL METHODS AND TEST PROCEDURES

The laboratory maintains Standard Operating Procedures (SOPs) for each certified method in the laboratory. The SOPs describe the analytical methods used and are formatted to provide all of the information required in The NELAC Institute's (TNI) 2009 Standard.

SOPs are written to describe the way procedures are performed at TSSD. SOPs should include the experience of the analyst in performing the method so that the experience of the analyst is maintained for the laboratory.

All SOPs clearly state the following information on a cover sheet or the first page of the SOP:
Effective Date of the SOP
Revision Number
Signature of Approval by Lab Director or QAO

Distribution of SOPs is controlled so that all laboratory personnel can be assured that the document they are using is the most recent approved version. A Microsoft Access database is used to track revisions history and distributions of all method SOPs.

The latest revisions of all SOPs and the Quality Manual are kept in a binder that is centrally located in the laboratory and available to all personnel.

ETHICS AND DATA INTEGRITY

The laboratory is required to have in place a program to detect and prevent improper, unethical, or illegal actions. The program in place in the laboratory includes definitions of these types of actions, a description of the program for prevention and detection of these types of actions, and defined consequences for violating this policy. Ethical responsibility, and the need for honesty and full disclosure in all data generation and reporting is critical in maintaining the mission and values of the company. Prevention of improper, unethical, or illegal actions begins with a zero-tolerance philosophy established by management.

Definitions

- Improper actions are defined as deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional.
- Unethical or illegal actions are defined as the deliberate falsification of analytical or quality assurance results, where failed method or contractual requirements are made to appear acceptable.

Prevention

The laboratory management has implemented a variety of proactive measures to promote prevention and detection of improper, unethical, or illegal activities. The following list of components forms the basis of this effort:

- An ethics policy that is read and signed by all personnel in the laboratory
- Annual ethics training
- Internal audits
- Analyst notation of manual changes and deficiencies to raw data
- A no-fault policy that encourages laboratory personnel to come forward and report fraudulent activities

A no-fault policy means that personnel in the laboratory will not be punished for reporting their observation of improper, unethical, or illegal activities to whatever supervisory personnel are appropriate.

Laboratory management is not limited to these items, but may pursue other means of prevention and detection as indicated by a given situation. If laboratory management believes that further investigation of suspect activities is necessary, the District Manager will be notified.

Examples of Improper, Unethical, or Illegal Practices

The laboratory maintains documentation that clearly shows how all analytical values were obtained and will be supplied to the data user when necessary. To avoid miscommunication, the laboratory clearly documents all errors, mistakes, and the basis for any manual changes to the raw data. Notification of errors is made to the appropriate people in the laboratory so that appropriate corrective actions can be initiated and documented. Gross deviations from specified procedures should be investigated for potential improper, unethical, or illegal actions. Findings of fraud should be prosecuted to the fullest extent of the law.

- Intentionally misrepresenting the date or time of analysis (e.g., intentionally resetting a computer system's or instrument's date and/or time) to make it appear that a time/date requirement was met

- Falsification of results to meet method requirements

- Reporting of results without analyses to support those results ("dry-labbing")

- Selective exclusion of data to meet QC criteria (e.g., dropping initial calibration points without technical or statistical justification)

- Misrepresentation of laboratory performance by presenting calibration data or QC limits within data reports that are not linked to the data set reported or QC control limits that are not indicative of historical laboratory performance

- Improper alteration of analytical conditions from standard analysis to sample analysis

- Misrepresentation of QC samples (e.g., adding surrogates after sample extraction, omitting sample preparation steps for QC samples, intentionally misdocumenting the volume of spiking solution added to generate results that appear to be compliant)

- Reporting results from the analysis of one sample for those of another

Consequences

Any suspected infractions of this policy will result in a detailed investigation that could lead to very serious consequences including termination and/or civil or criminal prosecution.

Example Ethics and Data Integrity Agreement

The undersigned attests by their signature that they have read the ethics policy of the laboratory, understand the ethics policy including the consequences of violations of the policy, and that they agree to be bound by the ethics policy of the laboratory.

The undersigned agrees to refrain from actions that are improper, unethical, or illegal.

- Improper actions are defined as deviations from contract-specified or method-specified analytical practices and may be intentional or unintentional.
- Unethical or illegal actions are defined as the deliberate falsification of analytical or quality assurance results, where failed method or contractual requirements are made to appear acceptable.

Examples of these types of behaviors are listed in the laboratory's Quality Assurance Plan.

The undersigned agrees to report all instances of errors in the laboratory using defined documentation systems.

The undersigned is aware that management supports a no-fault policy of reporting observed improper, unethical, or illegal actions. A no-fault policy means that personnel in the laboratory will not be punished for reporting their observation of improper, unethical, or illegal activities to whatever supervisory personnel are appropriate.

The undersigned is aware that the consequences of improper, unethical or illegal behavior include disciplinary action up to and including termination, and may result in civil or criminal prosecution and punishment.

Employee: _____
Print Name

Signed: _____ Date: _____

DEFINITION OF TERMS

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents.

BOD: Biological oxygen demand, an analytical procedure performed by the laboratory.

30 day Average: the mathematical average of all samples collected during a consecutive 30-day period.

7 day Average: the mathematical average of all samples collected during a consecutive 7-day period.

Calibration: To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.

CCV: Continuing Calibration Verification

Calibration Standard: a substance or reference material used to calibrate an instrument.

COD: Chemical oxygen demand, an analytical procedure performed by the laboratory.

COQ: Certificate of Quality

COA: Certificate of Analysis

CRM: Certified Reference Material

COC: Chain of Custody

Composite Sample: A sample collected within a 24 hour period by either an automated or manual mechanical means.

Daily Maximum: the maximum value allowable in a single sample or instantaneous measurement.

DEQ: Department of Environmental Quality

DMR: Discharge Monitoring Report

ELCP: Environmental Laboratory Certification Program

Grab Sample: for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

ICV: Initial Calibration Verification

LCS: Laboratory Control Standard

MS: Matrix spike is a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spike are used to determine the effect of the matrix on a method's recovery efficiency.

MSD: Matrix spike duplicate is a second matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery of each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results of sample analyses.

MDL: Method detection limit is the minimum concentration of a substance (an analyte) 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 containing the analyte (40 CFR Part 136, Appendix B).

MRL: Minimum Reporting Limit

NELAP: National Environmental Laboratory Accreditation Program

NPDES: National Pollution and Discharge Elimination System is the guidelines governing the discharge of wastes into streams, rivers, lakes, holding ponds, and wetlands.

PT: Proficiency Tests are blind audits purchased by the laboratory to meet regulatory requirements.

RPD: Relative Percent Difference used to measure precision of duplicates

TDS: Total Dissolved Solids, an analytical procedure performed by the laboratory.

TMDL: Total Maximum Daily Load

TNI: The NELAC Institute. www.nelac-institute.org

TS: Total Solids, an analytical procedure performed by the laboratory.

TSS: Total Suspended Solids, an analytical procedure performed by the laboratory.

TSSD: Timpanogos Special Service District

VS: Volatile Solids, an analytical procedure performed by the laboratory.

VSS: Volatile Suspended Solids, an analytical procedure performed by the laboratory.

WP: Water Pollution is the blind audit sample purchased by the laboratory, which checks the laboratory efficiency and accuracy in analyzing ground water and wastewater samples.

Appendix A – Equipment List

Appendix B – NELAP Accredited Test Methods