

Standardized Laboratory Training Plan

OVERVIEW

This laboratory training plan is intended to be used by any interested party who would like to gain a greater understanding of one or more of our analytical methods listed on our website, <https://watersciences.unl.edu>. Currently, training is provided on every method, though some advanced methods require sufficient background in mass spectrometry (e.g. – liquid chromatography-mass spectrometry (LC/MS) and stable isotopes instrumentation). Because training requires a substantial investment of both time and effort by the WSL staff, and the trainee, it is important that procedures are in place and understood by everyone participating in the training process.

There are two ways to gain knowledge about the analytical methods performed in the laboratory:

1. Job Shadowing
2. Proficiency Training

During job shadowing, the user will silently observe the analyses being performed by the WSL staff. The technician will answer general questions, but will not be able to engage with the user about the details of the procedure. Observation cannot distract the technician. If the user is interested in learning the procedure, or would like to analyze samples on their own, they would need to move on to proficiency training. During proficiency training, the prospective students and researchers will learn how to become proficient in sample processing and instrumental methods at the Water Sciences Laboratory.

Interested scholars and students will have the option to observe the procedure that they would like to learn by scheduling a time with the Laboratory Manager. After reviewing the procedures, the individual will have the opportunity to participate in the formal training. To schedule the training, the lab manager must be notified a minimum of 6-8 weeks ahead by the student's supervisor.

All WSL users must first complete online and general laboratory proficiency tests before moving on to more advanced tasks. Every effort will be made to accommodate potential user's schedules, but the training cannot interfere with regular staff work schedules.

This plan has been laid out so that students and researchers can be successfully trained in order to enable them to perform chemical analyses of their samples with minimum error. WSL lab staff will make every effort to give each trainee individual and personalized attention during their training period.

TRAINING COST

The training consists of two parts, the basic lab training that is common for all trainees, and then specific training on analytical instruments. The basic lab training will include using different types of

micropipettes, the operation of various analytical balances, good laboratory practices (GLP), and general procedures for making chemical standards and reagents. This will be followed by a written exam and in-lab demonstration. The basic exam will be graded, and the answer key will be provided to the trainee along with the graded exam. This part of the training has no costs, but is a requirement to move forward to the next part of the training process.

Once basic training is complete, the trainee can then proceed with training on an analytical method. This will be followed by a proficiency test, where users will be tested by independently analyzing unknown laboratory-prepared samples. The results of these 8 test samples will be used to demonstrate proficiency, documented in our Laboratory Information Management System (LIMS), and are reported to the supervisor.

There are two ways this proficiency test can be completed and billed:

- 1) The first option is that the proficiency test will be billed at 50% of the normal client user rate (see <https://watersciences.unl.edu/price-list-0> for the client user rate for all methods). Only after a successful proficiency test will individuals be able to schedule instrument time on QReserve, bring in their samples, and begin independent sample analysis.
- 2) The second option of the proficiency test will cost nothing, if the trainee gets trained using some of their own samples, run at the client rate (no discounts) by the lab technician. This involves watching and helping the lab technician throughout the entire process. The trainee must work around the staff schedule during this time. When the trainee is ready, they can then complete the proficiency test at no additional cost. This option is good for supervisors without a separate training budget, users on a deadline, or who would like to practice the method multiple times, on multiple batches of samples. It may not be possible to offer this option for certain complex techniques that will require full attention of the lab technician.

It is expected that users will complete their proficiency tests within two months of their training, thereby showing competence on the instrument, before they are permitted to independently analyze their own samples at the WSL. If the user is unable to analyze their samples within two months of their proficiency test, they will have to perform another refresher proficiency test (at no extra cost) before analyzing their own samples. If the user fails this test, they will have the opportunity to repeat the training again, at the same price as before.

Samples analyzed by a trained user will get a 50% discount on the full client rate. Please note the WSL staff cannot guarantee the quality of results on any samples run by trained users. If the results are undesirable, they will be permitted to repeat the analyses one time at no additional expense. If the tests need to be repeated more than once, then the samples will be charged again at the discounted user rate.

TIME COMMITMENT

Training in the laboratory requires a substantial investment of both time and effort by the trainee. During the training period, users are expected to spend up to 5-10 hours per week in the laboratory, or on training material. The length of time required to complete the training varies, and depends on the method, as well as the user. In order to fully master the materials presented, time may need to be spent in the laboratory after hours, and this time can count towards the hours expected per week.

BASIC TRAINING CHECKLIST

This checklist outlines the training sequence for new users at the Water Sciences Laboratory. All training must be signed off on, dated, and finished **prior to working in the laboratory**, and will be completed in order. The entire training should be completed within the span of two months. The trainee is responsible for contacting the lab to schedule any in-lab trainings or demonstrations.

- _____ **Pre-Training online questionnaire**, available at: <https://watersciences.unl.edu/pre-training-questionnaire>.
- _____ Read through the **WSL User Guide**, available at: <https://watersciences.unl.edu/lab-user-guide>, or from the Laboratory Manager.
- _____ Complete the required **EHS Core Safety Training modules**, available through in-person instruction by EHS, or online at: <http://ehs.unl.edu/training/online>. The required modules are:

1. Core – Injury and Illness Prevention Plan (IIPP)
2. Core – Emergency Preparedness Training
3. Core – Bloodborne Pathogens
4. Core – Chemical Safety Training Unit 1
5. Core – Chemical Safety Training Unit 2
6. Core – Chemical Safety Training Unit 3
7. Core – Chemical Safety Training Unit 4
8. Personal Protective Equipment (PPE)

Please e-mail the certificates of completion, given to you at the end of each module, to the Laboratory Manager.

- _____ Read through the **Equipment Reservation SOP**, available at: <https://watersciences.unl.edu/basic-lab-training>. Follow the instructions to become a member of the Water Sciences Laboratory QReserve page.
- _____ Read through **General WSL Standard Operating Procedures (WSLSOP) and EHS Safe Operating Procedures (EHSSOP)**. The documents that you are required to read are as follows:

1. **Laboratory Safety** – These documents can be found at: <https://watersciences.unl.edu/laboratory-safety>
 - Injury Prevention and Response
 - On-The-Job Injury Flowchart
 - EHS Emergency Eyewash and Shower Equipment SOP
 - EHS Laboratory Hood and Cabinet Identification and Use
 - On-The-Job and Student Injuries
2. **Standard Operating Procedures** – These documents can be found at: <https://watersciences.unl.edu/basic-lab-training>
 - Laboratory Waste Disposal and Management
 - Balances
 - Water

- Micropipette
- Glassware Cleaning
- Sample Bottle Cleaning
- Plastic Cleaning
- Teflon Cleaning
- Equipment reservation
- Sample disposal and handling
- Running batches, accepting batch data and data review
- Method validation

_____ Watch the following **Basic Training Videos**, available at:
<https://watersciences.unl.edu/lab-training-videos>

- Micropipettes
- Analytical Balance
- Labware Cleaning
- Housekeeping
- Laboratory Safety

_____ Complete the **In-Lab Training**. This will take 30 minutes, and allow a technician to physically demonstrate and explain the concepts that have been introduced previously. This is also a time to have any questions answered by a technician.

_____ Complete the **Micropipette Proficiency Test**. The documents needed to complete this proficiency test will be provided during the In-Lab Training. Additional information regarding how to complete the proficiency test can be found in the next section, as well as in the Micropipette SOP. This information will also be reviewed during the In-Lab Training. Once you have completed the Micropipette Proficiency Test, fill out the provided excel sheet. 6-8 selected pipettes from the excel sheet, will be used for this exercise. If all pipetted volumes are within the acceptable range, a completed copy of the excel sheet must be e-mailed to the Laboratory Manager before proceeding.

_____ Complete the **Written Exam**. This exam is given out by the Laboratory Manager, and includes an in-lab demonstration portion. This demonstration portion will take 15-20 minutes, and must be scheduled with a technician at the laboratory.

MICROPIPETTE PROFICIENCY TEST INSTRUCTIONS

Micropipettes are one of the most important tools in the analytical laboratory, and operating them properly is key to getting accurate and precise results. A user can determine whether they are using a micropipette correctly by weighing the amount of distilled deionized water dispensed with the pipette, as 1 g of water equals 1 mL.

Please notify the Laboratory Manager, or lab staff, if any micropipettes continue to dispense inaccurate volumes after 3 attempts, or are inoperable for any other reason.

Steps to complete the micropipette proficiency test:

- Reserve Balance #1 on Qreserve for the duration of time required. This reservation on QReserve is part of the requirement for passing the Micropipette Proficiency Test, and the completion of this step will be checked by the Laboratory Manager.
- Fill a 50 mL beaker up to a height of 3mm with distilled deionized water. Place it on a sufficiently sensitive analytical balance (three decimal places). Fill up a 200 mL beaker with distilled deionized water. This will serve as a water reservoir.
- Complete 10 repetitions of dispensing with the minimum volume and 10 with the maximum volume of six adjustable pipettes. Pipette water from the reservoir to the 50 mL beaker, taring the balance between repetitions. The 50 mL beaker can be emptied out if necessary.
- Compare the results to the limits provided by the manufacturer. These can be found in the excel file given to you by the Laboratory Manager. The average of all 10 dispenses is taken and compared to the maximum permissible error provided by the manufacturer. The column titled 'Acceptance' will indicate whether this value falls within the permissible error by showing either a green 'Accept' or a red 'Reject'.
- If a pipette fails the precision and accuracy test three times, mark pipette with "Failed Calibration Test" using laboratory tape and notify the lab manger that it needs to be serviced
- If there are any 'Reject' outcomes, repeat the procedure for those micropipettes until an 'Accept' outcome is reached. Once complete, the excel file should be sent back to the Laboratory Manager, to be stored as proof of proficiency.

ANALYTICAL METHOD TRAINING CHECKLIST

This checklist outlines the steps that a prospective analyst will need to complete in order to work in the Water Sciences Laboratory and generate results and data. This checklist is meant to follow successful completion of the basic training. Training of individuals on specific instrumentation depends on the level of use. Any individual using WSL equipment is responsible for its calibration and general maintenance. It is the user's responsibility to learn and understand the proper procedures to be followed when using equipment, and to notify the Laboratory Director or Manager of any needed repairs.

Analysts are required to pass a validation test for a particular laboratory method before they are allowed to use that method to generate results and data.

- Read the **Standard Operating Procedure (SOP)** document for the intended method. This is available from the Laboratory Manager, or the member of WSL staff who is in charge of the particular instrument and/or analytical method. Make note of any vocabulary that is not understood, and write down any questions you have while reading through the document. These can be addressed by lab staff during the In-Lab Method Training.
- Complete the **In-Lab Method Training** for that particular method. This involves scheduling time with the relevant member of staff, who will physically and verbally walk through the process. Depending on the analytical method, this may take more than one visit.
- Complete a **Proficiency Test**. This test is made up of 8 test samples, and constitutes a test called the Method Detection Limit (MDL). The MDL is defined as the minimum concentration of a

substance that can be measured and reported with 99% confidence that the constituent concentration is greater than zero.

- a. Fortify a suitable quantity of matrix (reagent water, sand, etc.) with target compound(s) as to be able to run eight or more samples of known concentration at a level near the estimated MDL. (This can be estimated by consulting the MDL values listed in other similar methods, or by multiplying the blank/noise for the method by three to five. MDL values can also be obtained from the technician who runs the instrument in question.)
- b. Analyze eight samples (or portions of the solution) by processing them through all of the steps of the proposed method.
- c. From the determined values, calculate the standard deviation of the eight or more samples.
- d. Multiply the standard deviation of the eight or more samples by the appropriate student t value. Select the value of t for n - 1 degrees of freedom at the 99% confidence level. If eight replicates have been run, the student t value is 2.998. The MDL obtained by the perspective analyst should not be greater than two standard deviations from the mean MDL obtained by other analysts in the laboratory performing the same method.

PROBATIONARY PERIOD

After the successful completion of the proficiency test, new users will be put on a 2 month probationary period. During this time, if certain standards of lab use are not met, or the lab policies are not followed, lab privileges for the user will be revoked. During this period, users must complete at least 5-10 hours of work per week, for both months. After-hours access, or permission to complete scheduled work on the weekends, will be granted to users during this time, based on the sole discretion of the Laboratory Director or Manager.