AMTEST

LABORATORIES

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Quality Manual

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Approved by:

X _____

Aaron Young
Lab Director/President

X _____

Seth Farb
Lab Manager/Vice-President

X _____

Seth Farb
Quality Manager (QA/QC)

The undersigned have read this Quality Assurance Plan and understand the requirements set forth in it. By signing this document, these individuals acknowledge their responsibility to follow the procedures outlined. The annual review of this manual is mandatory for all employees and will be construed as training for all matters contained within.

Name: (Please Print)	Signature:	Initials:	Date:	Dept.

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Introduction

AmTest Laboratories, Inc. is a full service analytical laboratory that offers a myriad of testing services in the environmental, industrial, biological, and petrochemical fields. AmTest Laboratories provides chemical and microbiological analytical support and consulting services to water & wastewater management districts, local and state agencies, personal and investigative testing, and engineering firms.

Quality Policy Statement

AmTest Laboratories' primary objective is to ensure that all analytical data generated and reported is scientifically valid, legally defensible, and of known accuracy and precision. AmTest Laboratories' management is committed to generating data of the highest quality necessary for fulfilling the mission of the laboratory and satisfying customer expectations. All analyses performed at AmTest meet the following criteria:

- Methods and procedures conform to the specifications and requirements of the appropriate regulatory agencies (EPA, WADOE, FDA, PSDDA, OSHA, WS, L&I). As such, these methods are validated and available in the documents of the EPA, AOAC, ASTM, BAM, and Standard Methods.
- When applicable, all measures of precision, accuracy, representativeness, and comparability are reported in the data package.
- All data is reviewed relative to the quality control plan. Corrective actions and preventative actions are implemented when the analytical data fails to meet established quality control criteria.
- Standard operating procedures are developed and implemented to ensure that quality data is collected.
- All final reports are reviewed to meet the client's objectives with respect to quality, completeness, and price.
- Personnel receive extensive training on laboratory functions to ensure consistently accurate data of the highest quality.

Code of Ethics

Employees of AmTest Laboratories are held accountable for the quality and integrity of the laboratory services they provide. This responsibility requires that employees properly document pertinent laboratory functions and that data produced by them are of known, documented quality. Employees will conduct sample analysis in a manner that is consistent with the accepted scientific methods, while maintaining the highest standards of honesty and integrity. Employees will not artificially fabricate data in any way.

As a responsible independent analytical laboratory, it is crucial that all information pertaining to our clients be kept confidential, as well as treated as proprietary information. From our client's perspective, this code of ethics is no less important than receiving defensible analytical data. The distribution of results, demographic data, or any other exclusive information to the press, a government agency, other clients, or people outside of this laboratory, without the written consent of our client, is prohibited. If any employee of AmTest is found to be involved in this type of activity, he or she will be dismissed immediately.

Customer Service

AmTest Laboratories does its utmost to meet our clients' needs, including (but not limited to):

- Preparing, packaging, and dispatching test materials and reports as required by our customers for verification purposes.
- Advising, guiding, and communicating with our customers on technical matters, providing opinions and interpretations for tests performed, or to be performed.
- Communicating to our customers any major deviations in testing being performed.
- Communicating to customers any delays that may result in the customers not receiving their test results in a timely manner.
- Notifying customers of any event that casts doubt onto the validity of results supplied to them.

The laboratory solicits feedback from its customers using a survey that is available on our website (www.amtestlab.com) or via email. Feedback from our clients by other channels is encouraged throughout the year to improve our operations.

AmTest Laboratories is committed to resolving complaints and implementing suggestions for improvement. All informal complaints, suggestions, or requests for information are directed to the appropriate project manager for resolution. Formal written complaints are directed to the correct project manager and, after investigation and resolution, are responded to in writing.

Laboratory Organization and Responsibilities

Laboratory Director

The laboratory director supervises all administrative and technical activities for AmTest. The laboratory director must have a minimum of a BA or BS in chemistry or a related field and five years of laboratory experience. The director's responsibilities include:

- Future development.
- Fiscal policy.
- Project management.
- Client relations.
- HR policy.
- Hiring and training staff.
- Lab accreditation.
- Produce and certify client reports.

Laboratory Manager

The laboratory manager supervises all administrative and technical activities for AmTest Lab and must have a minimum of a BA or BS in chemistry or a related field and five years of laboratory experience. The lab manager is responsible for:

- Helping lab staff with production issues (workload, troubleshooting, reporting data).
- Technical support to customers.
- Coordinate projects to meet specific customer needs.
- Hiring and training staff.
- Oversees QA/QC performance.
- Lab accreditation.
- Produce and certify client reports.

Quality Manager (QA/QC)

The quality manager must have earned a minimum of a BA or BS in a science or science related field and have two years of laboratory experience. The quality manager reports directly to the laboratory director. The primary responsibility of this office is to independently assess the quality of the data that is generated. This evaluation is made by use of internal quality control check samples and the review of outside performance evaluation studies. Any recommendations to improve the quality assurance program are made directly to laboratory management. Specific responsibilities and authoritative functions of the quality manager include:

- Develops and reviews quality control programs including statistical procedures and techniques, which will help meet the quality control standards at a minimum cost.
- Monitors quality assurance activities to determine conformance with the guidelines established in the laboratory and departmental QA/QC manuals.
- Evaluates new ideas and current developments relative to the fields of quality control and quality assurance and recommends means for their implementation.
- Evaluates data quality and maintains records on related quality control charts and other pertinent information.
- Coordinates and/or conducts quality assurance investigations (intra and inter laboratory programs).
- Oversees the maintenance of department laboratory standards books and reviews them (quarterly) to ensure they are uniform, clear, and traceable to time, action, and person.
- Reviews all QC charts (bi-annually) to ensure that the quality of the data is maintained over time.
- Reviews all laboratory data notebooks (quarterly) to ensure information is uniform, clear, and precise.
- Reviews the Quality Manual annually and updates this document as needed.

Laboratory Safety Coordinator

The laboratory safety coordinator is responsible for ensuring that proper safety equipment and training needs are met for all employees. This person organizes the safety committee and holds elections for new members. The safety coordinator attends monthly committee meetings to discuss any policy updates, safety concerns, and current safety topics/issues. The safety coordinator's responsibilities include:

- Performing internal lab safety audits.
- Taking minutes at the monthly safety committee meetings.
- Holding elections for new committee meetings.
- Performing all new hire and annual all-employee safety training classes.

Laboratory Safety Committee

The laboratory safety committee is comprised of employer-selected and employee-elected members with the latter number being equal to or exceeding the former. The laboratory safety committee is organized by the laboratory safety coordinator and meetings are held monthly (or more frequently if a need arises). These meetings are to be run by the laboratory safety committee chairperson. It is the laboratory safety committee's responsibility to:

- Hold monthly meetings to discuss laboratory safety reports and correct any issues.
- Evaluate accident reports, discuss laboratory safety concerns, and correct any current safety issues.
- Record meeting minutes and preserve them for a minimum of one year.

Laboratory Safety Chairperson

As an elected position, the Laboratory Safety Chairperson will serve as the go-to point of contact for employees' safety concerns. This peer-level position will record, and address safety issues brought to light by employees at the monthly laboratory safety committee meetings. This position must be elected on an annual basis, however, there is no limit to the number of terms an employee can serve. The responsibilities of this position include:

- Running the monthly laboratory safety committee meetings.
- Serving as a point of contact for employees with safety concerns.

Training Coordinator

The training coordinator is charged with organizing the proper training of all employees. They will provide training the paperwork that employees need to complete for both new hire and ongoing analyst training; as well as assigning a trainer with the highest level of qualification available to each trainee. The training coordinator is responsible for tracking employee training progress and keeping records of this training for up to two years after the employee's time at AmTest. It is the training coordinator's responsibility to:

- Coordinate a trainer and the required training paperwork for employees at the time of hire and as needed thereafter.
- Maintain training records for employees.
- Update the lab manager and other key personnel at the annual quality system management review on any missing training documentation or issues.
- Facilitate annual training classes for employees.

Laboratory Analyst

Laboratory analysts must have BA or BS in a science or science related field. Analysts without prior lab experience must have all data reviewed by a fully qualified analyst or lab supervisor during the first six months of their employment. Analysts report to the lab manager. All analysts are responsible for the following parameters regardless of laboratory department:

- General and departmental SOPs and referenced methods must be read.
- Maintain and properly use departmental instruments.
- Keep instrument maintenance, data, and standards notebooks up to date.
- Clean and maintain all labware used.
- Clean and maintain departmental lab area.

- Keep instrument information and data properly filed, so management can locate it quickly and efficiently.
- Method development and maintenance.
- Establishment of all quality control procedures.
- Implementation of the quality assurance program.

Other responsibilities and required training of the technical staff are dependent upon their position in the lab. They are responsible for the production of the lab data using approved analytical methods. It is also the responsibility of the analysts to carry out all the quality control procedures and to pay strict attention to the control limits that are defined by the methods they perform. A thorough understanding of the QA program is a requirement for its overall success. The largest impact upon the quality of the data clearly rests with the individuals that generate it. Personnel who operate ion chromatographs (IC), gas chromatographs (GC), inductively coupled plasmas (ICP), mass spectrophotometers (MS), and other instruments of comparable complexity are required to get specialized training for their instrument by experienced analysts.

Sample Receiving Technician

The sample receiving technician must have received at least a high school diploma and have a valid driver's license. The lab manager supervises the sample receiving technician. Specific duties of the sample receiving technician include:

- Logging in samples (LIMS) and maintaining proper chain of custody protocols.
- Documenting non-conformances in sample receipt, sample control, and sample transfer within the lab.
- Maintaining sample storage facilities.
- Coordinating and upkeeping on sample disposal.
- Providing sample courier services to clients.
- Packing and shipping sample containers to clients.
- Tracking all samples sent to subletting labs.
- Customer contact, education, and service.

Personnel Training

All employees are required to read and become familiarized with the Chemical Hygiene Plan, Employee Manual, Quality Assurance Manual, Accident Prevention Program, Emergency Action Plan, and all Standard Operating Procedures pertinent to their work. Personnel do not perform tests unsupervised without passing minimum training requirements. Training requirements include completing a Demonstration of Capability (DOC) study and successfully analyzing QC samples to demonstrate their ability to produce acceptable results. A record of individualized training received is kept in the personnel training binders. A formal training program is outlined in SOP# 2.06, Lab Training System and Record Management.

AmTest Laboratories actively encourages its employees to expand and refine their job skills and knowledge through participation in a variety of educational programs. Time off may be granted to attend seminars and training sessions put on by instrument manufacturers, regulatory agencies, professional business, and scientific organizations, etc. Additionally, AmTest conducts in-house training on related topics.

Data Integrity and Ethics Training

All employees of AmTest Laboratories are held to high professional ethical standards in the performance of their duties. All employees are required to read, understand, and sign the 'Ethics Statement' attesting to their commitment to honesty and integrity in the performance of their duties. Improper, unethical, or illegal actions will be dealt with according to the AmTest Employee Manual.

All employees are required to attend an annual ethics training class. The annual training includes protocols for reporting ethics issues, providing examples of ethical violations, and reviewing the consequences of unethical behavior and resources where additional information can be referenced. Training is updated each year, if necessary, to address current issues. All attendees of the

training course are required to update their training files signifying they participated in the course. SOP# 2.05 (Lab Ethics) lists additional information on ethics training.

Document Control

General Record Keeping

All records are kept legible, easily accessible, and stored in a manner that will minimize loss, damage, or deterioration. The lab continues to maintain client access to electronic and paper records for a period of not less than 5 years after the completion of the laboratory project.

Entry errors on paper records are not obliterated or erased. Corrections are made by marking a single line through the error so that the error is still legible. The marked error is initialed and dated by the person that made the error in real time and a concise reason for the correction is noted when the cause of the error is not obvious (e.g., a simple transcription/orthographic error).

Technical Records

Technical records are the accumulation of data that allow for the reconstruction of an analysis. Copies of pertinent raw and processed data are maintained in electronic and/or paper format. Records retained include:

- A test method description and reference AmTest Lab Sample ID.
- Instrument identification.
- A reference to the method SOP describing calculations on the raw data, verification of reported results, and QC assessment.
- Method performance and quality control expectations.
- Analysts' signatures, initials, or electronic identification.
- Documentation to support all aspects of sample handling to include preparation, cleanup, incubation periods, weights, and instrument readouts.
- Test results and record of responsible parties for laboratory records.
- Documentation supporting reagent and standard history.
- Calibration/verification records and calibration/verification acceptance criteria.
- Proficiency Test Results.
- Record of demonstration of capability for all analysts.

Most of the data generated by the laboratory during the analytical testing process is in the form of electronic records. This data consists of raw data files generated by analytical instrumentation, chromatography acquisition software, etc. as well as processed and final database records, residing in the Laboratory Information Management System (LIMS).

All raw data files are stored on individual instrument computers. The files are organized by test performed and date of generation and are copied onto backup USB thumb drives at least quarterly. Software and hardware systems will be maintained to ensure that raw data are available for a period of five (5) years after completion of the laboratory project.

The lab manager maintains the computer where LIMS records are stored. A complete backup of the LIMS data is compressed daily and is copied onto a USB thumb drive daily. The records in the LIMS database are maintained to ensure their availability for a period of five (5) years after completion of the laboratory project.

All pertinent paper records are maintained and archived in the laboratory. The archive section of the laboratory is divided into six sections: front office, water chemistry, trace organics, trace metals, microbiology, and login. Paper records are filed chronologically

within their respective departments. The records are maintained to ensure their availability for a period of five (5) years after completion of the laboratory project.

For a description of laboratory records see SOP# 3.21, Records Maintenance and Storage.

Document Approval and Issue
All documents issued to personnel in the laboratory are reviewed and approved for use by management. Authorized copies of the most current documents will be made available at all locations where operations essential to the laboratory are performed. Prior to the authorized annual publication of the Quality Manual, the manual's title page must be signed by the Lab Director, Lab Manager, and Quality Manager.

Standard operating procedures will be reviewed annually to ensure continuing suitability and compliance with applicable methods and requirements. All SOPs will include the date of issue or the revision number and date of revision, the method reference, SOP number, page numbering, total number of pages, a revision record, and the issuing authorities.

Document Changes
To revise an existing document, handwritten notes are made to indicate changes required on a printed copy of the to-be-revised document and submitted to the quality manager. The changes are determined to be minor or major. Minor revisions are those which do not involve modification to the method, while major revisions indicate the method has been altered. A record must include the date of any significant edits and should indicate the pertinent document section(s) that have been edited. The quality manager posts the final document to the laboratory Cloud as a locked Word document. The name of the person(s) authorizing the document (lab manager and quality manager) is noted on the front cover of the document, the revision number, revision date, name of person responsible for changes and description of change(s) are recorded in the Revision Record section. The document expiration date will be set one year from the date the version was revised. The quality manager is responsible for replacing old documents with the new versions. The official versions of documents are those that reside on the laboratory Cloud or with the quality manager.

In cases where a specific SOP version has been certified and subsequently undergoes a major revision, additional steps are required. The analyst submitting the revision must also submit a method validation package and the appropriate paperwork for requesting WADOE certification of the new SOP version. The lab manager is responsible for ensuring that analysts are trained on new or revised SOPs.

AmTest SOP# 2.03, Guidance for Writing Standard Operating Procedures (SOPs), describes how SOPs are created, revised, and approved.

Review of Requests, Tenders, and Contracts

Contract and order review is an integral part of AmTest Laboratories. All contracts and orders are reviewed and accepted only if the requirements are clear and understood, and the laboratory has the capability and capacity to meet full customer expectations. The criteria used to review and accept projects are described below. Upon receiving a request from a client, the AmTest project manager obtains specific project information. The information includes, but is not limited to the following:

- The project description (and purpose if needed).
- The analyses requested.
- The sample matrices.
- The number/frequency of the samples.
- Completion expectations.

The AmTest project manager evaluates the information. If AmTest is able to accept the work, then the AmTest project manager provides the following information to the client:

- A list of the analytical methods the lab will use.
- Information on whether the lab has WADOE certification for the method(s).
- The detection limit and quantitation limits for the method(s).
- The costs of the analyses.
- Additional information upon request, such as proficiency studies and quality assurance/quality control information.

Once the client and the lab mutually agree upon the project, then the AmTest project manager obtains the account information.

- Records of reviews, including any significant changes, are maintained.
- The review will also include information on analyses that need to be subcontracted to another laboratory.
- Communications are maintained with the client from request/quote through commencement of work. This includes informing the client of any deviation from the contract or agreement.

Sample Processing

Collection

Sample collection must adhere to the requirements for container, preservation, and holding times described in SOP# 3.17, Manual on the Collection and Preservation of Samples. Deviations from documented sampling procedures are documented in the field as comments on the submittal form, which is part of the chain-of-custody for the samples. Depending on the nature of the deviation, the change is recorded as a non-conformance and a non-conformance report is included with the sample report. The sample data will be rightfully qualified by the laboratory to accurately reflect the nature of the deviation.

Sample Acceptability

Samples sent to AmTest are received and distributed by the sample receiving technicians. Samples are evaluated at the time of their receipt and must meet a set of requirements to be accepted. If all requirements are not met, it will be noted on the chain of custody and with a qualifying statement on the report noting the unsatisfactory sample submission. Upon receipt, the log-in staff member inspects the samples for the following:

- The temperature (°C) of the sample(s).
- The pH of preserved samples. (Only if the sample was not collected in an AmTest pre-preserved bottle).
- The presence/absence of bubbles in VOC vials.
- That each container has a unique identifier.
- The information on the submittal form coincides with the information on the containers.
- The containers are properly preserved.
- The samples must be collected in the appropriate type of container.
- There is sufficient sample volume for analysis.
- The samples are delivered to the lab within sufficient time remaining for the laboratory to meet analytical holding times.

The samples must be accompanied by a chain of custody form with the following information for each sample:

- A unique sample location/field ID combination.
- The date and time of sample collection.
- The sample collector's name.
- Customer/Project information for billing and report mailing.
- The sample matrix.
- The analyses requested.

If the information provided is insufficient to correctly process the samples, an effort is made to reach the collector first by phone and/or second by email. If the information cannot be obtained in a timely manner, the samples are subject to rejection and proper disposal.

Sample Log-In Protocols
Samples are logged into the LIMS with all the information listed above from the submittal form and with the added following:

- Mode of sample delivery (e.g., common carrier, Federal Express, client, etc.) and delivery date.
- Field comments (if available).
- Lab comments (if available).
- Sample storage location in the laboratory.
- Name of the sample receiving technician performing the sample log-in procedure.
- Sample matrix.
- The temperature (°C) of the samples.

Samples are assigned a unique sample identification number with the format YY-A###### or YY-M######, where "YY" is the last two numbers of the year the sample was submitted, "A" refers to a chemistry lab sample, while "M" refers to a microbiology sample and "######" is an accession number assigned by LIMS starting from 000001. (*Example:* Sample 03-A000425, would be a chemistry sample that was the 425th sample submitted in the year 2003).

Copies of the submittal form and any field sheets are scanned into the LIMS computer and the file is named using the sample ID number. The originals of the submittal form, bench sheet, and other related documents are given to the appropriate project manager to be filed with the report when all associated analyses are complete.

Sample Storage, Environmental Monitoring, and Sample Disposal
Samples are stored under conditions which maintain the viability of the parameters being analyzed. Typically, this involves storage at 4°C for all environmental samples. Samples, sample fractions, extracts, and digestates are stored according to the pertinent method SOPs' storage instructions. The manner of storage prevents cross contamination and isolates the samples from the standards and reagents. See SOP# 1.03, Sample Log-In & Tracking, for further details on sample storage.

The laboratory monitors, controls, and records all relevant environmental conditions that influence the outcome of results. If environmental conditions are inappropriate for the testing of any specific analyte, the analysis will be halted and a root-cause investigation will be conducted to determine if any non-conformances have jeopardized sample results.

Completed samples that have been reviewed and reported, are properly disposed of. Samples are typically disposed after three months from the received date. Samples that have been flagged as hazardous, are disposed of according to Table 4.3. Non-hazardous, aqueous samples are neutralized with sodium bicarbonate (if necessary) and then poured down the sink, flushing with plenty of tap water. Non-hazardous solid samples are disposed of in the garbage. Foreign soils will be disposed of according to SOP# 3.28 Chain of Custody/Final Disposition, Importation of Foreign Soil. Disposal of all samples is documented on the LIMS log-in sheet with the sample receiving technician's name and date.

Subcontracting of Environmental Tests
Samples that need to be sent to a contract laboratory will show transfer to said lab in the LIMS chain-of-custody record. A chain-of-custody form will be filled out with the following information: AmTest project manager's name authorizing the work, a list of sample IDs, requested analyses with requested turnaround times, the date/time the samples were sent out and the identity of the custodian responsible. Samples along with copies of the field information (if available) and chain-of-custody form are delivered to the contract lab. The delivery person and the recipient at the contract lab must sign the chain-of-custody form indicating the transfer date and time. See SOP# 3.02, Sublet Tests, for further details.

Calibration and Maintenance Requirements

All instruments and equipment are operated, maintained, and calibrated according to the manufacturer's guidelines as well as the specifications in applicable methods.

Instrument Calibration

Calibration and standardization procedures, frequencies, and documentation protocols for instrumentation are found in the technical SOPs. It is the laboratory's policy that method calibration requirements will be followed if they are more stringent than those described in this manual.

Calibration standards will be used to bracket the range over which quantitation will occur. Results reported from data that were generated outside the determined range of applicability will be flagged (qualified) as estimates (unless the sample was diluted prior to analysis in order to bring concentrations within the established test method range of applicability).

If a linear calibration protocol is to be used, either **a)** the correlation coefficient of the calibration values plotted against their respective response factors must be greater or equal to 0.995 for inorganic analyses and greater than or equal to 0.990 for organic analyses or **b)** conditions for linearity specified in the applied, published method must be met. If the above conditions are not met, either the linear dynamic range must be decreased until those conditions are met or a non-linear calibration protocol must be used. Whenever a non-linear calibration protocol is utilized, a minimum of 6 calibration points must be defined for a second order fit.

Immediately following calibration, the curve is verified by analyzing a second source standard. A second source standard is used to ensure that the calibration standard has not degraded and that the analyst did not make any errors when preparing the curve.

Support Equipment Calibration

Thermometers and data loggers are verified annually with a NIST traceable reference thermometer. See SOP# 3.14, Thermometers, for a detailed account on how thermometers and data logger calibrations are verified.

Analytical balances are serviced and calibrated annually using ASTM Class 1, NIST traceable weights by an accredited metrology organization. Calibration certificates are maintained by the quality manager.

The calibration of each analytical balance is checked on each day of use. The verification consists of a check of a reference mass at approximately the same nominal mass to be determined using an ASTM Type 1 working weight. Verification records are kept which contain the recorded measurements, balance identification, date, and initials of the user.

Working weights are calibrated annually against reference weights. See SOP# 2.08, Gravimetric Analysis: Analytical Weight and Balance Calibration, for a detailed account of working weight calibration.

Pipettes are calibrated quarterly by the analysts that use them most frequently. See SOP# 3.16, Using and Calibrating Pipettes, for further information.

Any allowable correction factors, e.g., thermometer calibrations, which require the readout to be adjusted, will be clearly labeled, and positioned for easy access by the analyst.

Maintenance

The laboratory ensures that all equipment and associated software used by the laboratory meet the accuracy requirements and specifications of the test methods before being placed into service.

Records are maintained for all equipment and associated software including:

- Identity of the piece of equipment and associated software.
- Checks that equipment meet specifications.
- Location of the equipment.
- Calibration records.
- Maintenance logs.

All maintenance or repair to equipment is documented in that instrument's equipment maintenance file and is noted in the appropriate laboratory notebooks. Documentation includes any documents given to the lab by the repair contractor and a description of the problem(s), work performed, date, and analyst's initials. Equipment function is verified upon return of the item if the piece of equipment left the laboratory to undergo maintenance. Sample analysis plans for instrument failure or maintenance are handled in this order: use backup instrument (if available), delay the analysis if holding time can be met, postpone the scheduled sampling, or send samples to a contract laboratory.

Any equipment found to be unserviceable is tagged with an "Out of Service" tag if it is shared by multiple analysts or will be out of service for an extended period. If the damaged equipment is used only by a single analyst and the condition is temporary (a service call has been made), then the supervisor may elect to notify staff directly rather than tag the equipment.

Data Generation

Data Reduction

Test results are calculated manually and electronically as is specified in the method-specific SOPs. Formulae are contained in the manual testing procedures and algorithms are contained in software controlled procedures. All data and calculations are verified by the analyst and posted to summary reports or the computer system for review by the laboratory manager or laboratory director.

Reduction of laboratory measurements and laboratory reporting of analytical parameters will be in accordance with the procedures specified for each analytical method. Any deviations from the analytical methods are delineated in the SOPs. Analytical parameters are reported in units that are industry acceptable (mg/L, ug/g, CFU/mL, etc.) unless alternative requirements are requested by the client. All of the information relative to the reduction of the data is found in the laboratory notebooks (i.e., sample weights, dilutions) or is inherently a part of the analytical method (i.e., final volumes). The expression of all analytical data conforms to good laboratory practices.

Data Validation

The objective of data validation is to identify any unreliable or invalid laboratory measurements. The process of data validation involves the review of the following:

Laboratory data will be screened for inclusion of and frequency of any and all required quality control information (i.e., initial calibration, calibration verification, continuing calibration, blanks, duplicates, spikes). Lack of or insufficient frequency of the appropriate QC parameters will be cause to invalidate the affected measured data. The quality control information will be reviewed to ensure that the data is inside the established control limits. Any out-of-control data without appropriate corrective action will be cause to invalidate the data set. The acceptable quality control information is further reviewed in terms of accuracy (spike recoveries, SRM's, precision (duplicates, matrix spike duplicates), and contamination (blanks). The function of the review is to qualify any data that may be acceptable, but of less than desirable quality.

The analytical methods that were employed are reviewed in order to ensure that the data is representative and comparable to similar type projects. Finally, the data is reviewed for completeness.

Only after the data has been reduced and verified is it reported. All final reports are reviewed prior to their release by the laboratory manager or project manager.

Data Reporting
Once all the samples within a project have been reviewed by the analysts, the project managers are responsible for reviewing and authorizing the project for release.

Once the review is completed, the report is certified in LIMS. The report contains the results from analyses, any associated quality control information, and a sample compliance check form.

If any analyses or preparations exceed holding time before completion, the results are automatically qualified. Results associated with quality control data that are outside the acceptance criteria are qualified with "#." See SOP# 3.25, Reporting Qualified Data, for the laboratory data qualification policies.

The decision to qualify a result on these factors is at the discretion of the authorizing supervisor and must comply with SOP# 3.25. An appropriate comment is used to qualify results whenever:

- A batch or sample specific quality control result for an analyte cannot be realistically assessed.
- Quality control data indicate the uncertainty associated with the measurement(s) is outside acceptable limits.
- The sample matrix presents an unusual challenge to a method or instrument. The decision to qualify a result on these factors is at the discretion of the authorizing supervisor and must comply with SOP# 3.25.

Significant deviations from the laboratories policies and procedures, as outlined in the Quality Manual and SOPs, are not approved without appropriate non-conformance (CAPA) documentation. Significant deviations from standard policies or practices by the laboratory are reported to the client and documented with the analytical reports. Any samples that are prepared or analyzed beyond accepted holding times have a statement included with the data alerting the client to the fact that tests were conducted after the samples had expired. Also, the failure of any quality control check is communicated with the data, directing the client to the quality control report, for details of the failures.

The invoice, test results, sample compliance check form, data submittal form, and any other associated documents are then scanned as a single document and archived in the LIMS committed database and can be retrieved in the future if necessary. The data submittal form, bench sheet, and invoice are filed in the archive record room.

Quality Assurance

Precision
Precision measures the agreement among a set of replicate measurements. Analytical precision is estimated by analyzing laboratory duplicates and matrix spike duplicates. The most commonly used estimates of precision are the relative standard deviation (RSD) and, when only two samples are available, the relative percent difference (RPD).

Relative standard deviation (RSD):

$$RSD = (100*S)/x$$

where:

x = the arithmetic mean of the measurements

S = the standard deviation of the measurements

Relative percent difference (RPD) when only two results are compared:

$$RPD = \frac{[X1-X2]}{((X1+X2)/2)} \text{ X } 100$$

where: x1 and x2 are measurements of independently prepared aliquots of the same sample or replicate samples.

Accuracy

Accuracy is the closeness of a measured result to an accepted reference value. Accuracy is usually measured as a percent recovery. QC analyses used to measure accuracy include standard recoveries, laboratory control samples, spiked samples, and surrogates. The acceptable range for accuracy is determined by the method or by control charts.

Percent Recovery = $\left(\frac{X}{C}\right) X\ 100$

where:

X = observed concentration of the analyte

C = the true concentration of the analyte

Completeness

Completeness is a measure of the amount of valid data that is obtained, compared to the amount that is expected. For the purposes of this plan, completeness is calculated by dividing the number of samples having valid data by the total number of samples in the project, expressed as a percentage. AmTest's objective for completeness is 100%.

Representativeness

To ensure the reported results are representative of the sample received, a reasonable effort is made to assure that the samples are adequately homogenized prior to sampling for analysis.

Control Charting and Control Limits

Control charts are used to monitor laboratory control samples, surrogate recoveries, matrix spike recoveries, and the RPD of matrix spike/matrix spike duplicate recoveries. The laboratory's control charts are based on Shewhart control charts with ± 3 standard deviations. Warning and control limits are calculated when at least seven or more data points are available. Control charts are updated biannually.

Sensitivity

Sensitivity is an instrument's or method's minimum concentration that can be reliably measured or reported.

MDLs are determined using the method specified in the Federal Register, 40 CFR Part 136 Appendix B. Published MDLs may be set higher than experimentally determined MDLs to **(1)** avoid observed positive interferences from matrix effects or common reagent contaminants or **(2)** for reporting convenience (i.e., to group common compounds with similar but slightly different experimentally determined MDLs).

Practical Quantitation Limits (PQLs) are set at 2 to 5 times the reported MDL unless otherwise noted. Generally, the PQL is not set at less than 3 times the MDL. However, in some instances, systematic bias (e.g., analyte background in reagents, etc.) necessitates that

the reported MDL be elevated to levels that are readily quantifiable. In those instances, the PQL may be set at a level less than 3 times the reported MDL.

Selection of Methods

The laboratory employs published analytical methods or methods that have been recognized to meet the needs of the client and is appropriate for the tests being conducted. Guidance will be provided by the laboratory when there is a question about the test method to be used. The laboratory will notify the client when an inappropriate method is requested. All chosen methods for the client will be provided to them in writing.

When it is necessary to use methods not covered by standard methods, the non-standard method will be subject to agreement with the customer and will include a clear specification of the customer's requirements and the purpose of the test and/or calibration. The non-standard method will be validated following SOP# 2.07, Procedure and Policy for Method and Instrument Validation, to make sure the laboratory can perform to the customer's needs. The laboratory will record the results observed and the procedure used for the validation.

Method Validation

Methods are validated by performing MDL determinations, evaluating precision and bias, analysis of performance test (PT) samples, and employing and achieving method criteria for checks such as mass spectral tuning and retention time windows.

New methods, non-standard methods, and laboratory designed methods are validated to confirm that the methods are fit for the intended use. See SOP# 2.07, Procedure and Policy for Method and Instrument Validation for more information.

Demonstration of Capability

Initial demonstration of capability is performed for all analytes and methods prior to use of the method and if there are any changes in instrument type, personnel, test method, or anytime the test method has not been performed by the laboratory or analyst in a 12 month period, and whenever an analyte is added to an existing accredited test method.

A demonstration of capability is performed by preparing and analyzing at least four (4) laboratory fortified blanks. The average recovery of the four samples must be within a predetermined value that is analyte specific. The test is repeated for either the failed analyte(s) or all of the parameters of interest when there is a failure of one or more of the established test acceptance criteria. Repeated failures trigger corrective actions and preventative actions to remedy any problems with the measurement system.

On-going demonstration of capability is conducted annually (at least once every 12 months) by laboratory analysts by successfully analyzing either:

- Another initial DOC (laboratory fortified blank).
- A blind sample (single blind) or successful analysis of a blind performance sample. (For example, a successful PT sample completion).
- Four consecutive laboratory QC or laboratory control samples (LCS).
- Greater than 95% success rate for all LCS samples (N>20) analyzed in a prescribed period within the previous 12 months; for example, depending on the analysis, the prescribed period could be a month, a quarter (3 months), or 6 months.
- 95% confidence limits for all LCS samples reported by an analyst during a prescribed period within the previous 12 months that fall within the long-term statistical limits established for the method (and within required method performance limits, if available).
- No more than one LCS failure ($5 < N \leq 20$) in the previous 12 months.

Documentation for only one test method is maintained for similar test methods using the same technology. For example, EPA test method 1311 (TCLP) and 1312 (SPLP) are considered similar methods because they differ only in the leaching solution. For some methods it is not feasible or practical to include all analytes in the blind performance samples, LCSs, or an authentic sample. If an analyst is demonstrating on-going capability using one of those samples and an analyte was not added or present in the sample, the analyte must still be reported by the analyst. Acceptability of results for analytes not added or present in on-going capability demonstration sample shall be based on the lab manager's judgment (either using non-detection as a criterion or, if the amount is judged to be a co-contaminant, based on comparability of results produced by other experienced analysts).

Corrective Action, Preventative Action, and Non-Conformance Reporting

Corrective actions and preventative actions (CAPA) are implemented when the analytical data fails to meet established quality control criteria. CAPA are initiated based on internal QC checks, data validation by a reviewing authority, or performance audits. Outside sources such as performance evaluation studies, as well as recommendations by WADOE, may initiate corrective and preventative actions. All non-conformances are investigated to determine the root cause of the issue/s. Non-conformance causes, where identified, are documented in non-conformance reports, and stored within the Laboratory Information Management System (LIMS). Where necessary, re-training and/or changes to SOPs are implemented to address controllable errors. All corrective actions and preventative actions are documented (Access) and monitored to ensure compliance with the laboratory's policies and procedures. The details of identifying and applying corrective actions/preventative actions are detailed in SOP# 3.19, Non-Conformance/Corrective Action-Preventative Action Reporting.

Quality Control

Analytical Batch

An analytical batch usually contains ten samples but can contain up to twenty samples (based on method specific requirements) in addition to any required quality control samples. If more than the method specific number of samples per batch are to be prepared and analyzed, a second batch of quality control samples must be generated and so on.

Method Blanks

Method blanks are analyzed with the same procedure and test conditions as samples and are used to assess possible contamination during the sample preparation and processing steps. Corrective actions and preventative actions associated with a contaminated blank will include reprocessing the associated batch samples or qualifying all of the associated prep batch samples and determining a root cause to prevent further contamination. Method blanks are prepared and analyzed at a minimum of one per analytical batch.

Laboratory Control Sample (LCS)

The LCS is taken through the entire preparation and analysis procedure and the results are compared against established acceptance criteria. Results outside of the acceptance criteria are re-analyzed or qualified. An LCS is prepared and analyzed at a minimum of one per analytical batch.

Matrix Spike

Matrix spiked samples are field samples to which a known amount of the target analyte (or analytes) has been added. The samples are then prepared and analyzed in the same analytical batch in exactly the same manner as routine samples. Matrix spike samples are used to ensure the analyte of interest can be accurately recovered in the sample matrix.

Duplicates and Matrix Spike Duplicates

Sample duplicates and matrix spike duplicates are analyzed to ensure results can be reproduced in a precise manner. The RPD of the duplicates or matrix spike duplicates is calculated and compared to established acceptance criteria or to method requirements.

Surrogates
Surrogates are added prior to extraction and are used for all appropriate tests. The surrogates used represent the chemistries of the targeted compounds of the method. Results are compared to method requirements and historical laboratory performance. Corrective actions and preventative actions include qualifying the individual samples when surrogate recoveries are outside of the established range and performing a root cause investigation to determine how to prevent the issue from happening in the future.

Internal Standards
An internal standard is a pure analyte of a known concentration added to a sample. It is used to measure the relative responses of other method analytes of the same sample. Internal standards are used for GC/MS and ICP/MS methods. The acceptance criteria are specified in each method and SOP.

Source and Preparation of Standard Reference Materials
All reference materials that are received are recorded in the appropriate primary standards notebook with the following information: date received, expiration date, concentration, vendor, date opened, analyte, and standard identification. The standard identification and date opened is recorded on the container.

Working standards are recorded in the appropriate working standards notebook with the following information: date prepared, analyst initials, expiration date, description of the standard, source standards identification, dilutions, and the working standard identification.

Audits

Four types of audits are used to determine the status of lab operations. This includes system audits, performance audits, data quality audits, and management system reviews. SOP# 3.08, Internal Audits, outlines the procedures for performing system audits, data quality audits, and management system reviews.

A technical system audit is completed annually by the quality manager to assess personnel, equipment, facilities, and analytical procedures.

Four performance audits are conducted on an annual basis. The laboratory participates in a Soil Matrix (SM), Underground Storage Tank (UST), Water Supply (WS and MS), and Water Pollution (WP and MP) study annually. A performance audit is ordered for each parameter the laboratory is accredited for within a given matrix.

Data quality audits are conducted quarterly by the quality manager. Components to be audited include, but are not limited to:

- All documentation associated with sample and data handling.
- Use of established approved procedures as outlined in this QM.
- Proper execution of established procedures.
- Sample and data handling activities including:
    - Sample log-in and disposal.
    - Sample preparations.
    - Method calibrations.
    - Sample analysis.
    - Data reduction, validation, and reporting.
    - Preventative maintenance and repair procedures.
    - Standard and reagent preparations and storage.
    - Sample and waste disposal.
    - Container and labware decontamination.
    - Lab space cleanliness and environmental monitoring.

- QC management practices and assessment of analytical precision, accuracy, and sensitivity.

Management system reviews are external audits conducted at AmTest. Washington State Department of Ecology audits AmTest to assess the adequacy of the overall QA Plan, adequacy of facilities, quality control records, performance evaluations, standard operating procedures, and analyst abilities, and submits audit reports to AmTest. These reports and any corrective action-preventative action plans are maintained at the facility. AmTest also makes its facilities available for customer or regulatory agency inspection of Management Systems as well. AmTest's quality manager reviews all MSR reports and recommendations. If reports indicate the necessity for corrective actions-preventative actions, the quality manager or its designee will prepare and implement a Corrective Action-Preventative Action Plan. The Corrective Action-Preventative Action Plan will itemize the specific actions necessary to correct the deficiency and define the time frames and responsible parties for implementation and follow-up.

Purchasing Services and Supplies

Each department maintains an inventory list of chemicals and supplies commonly used for analyses performed in the laboratory. See SOP# 3.04, Purchasing of Supplies. This SOP includes procedures on how to place an order for supplies. SOP# 3.01, Reagents, describes the procedures necessary to ensure the quality of the purchase, checking that the proper quality and quantity was received, and describes how the reagent(s) are stored, if needed, to maintain quality.

Purchased services, supplies, and consumable materials are not used until an inspection is performed to ensure compliance with purchasing specifications. The analyst responsible for ordering the product is held accountable for the inspection. The quality of items being ordered is specified prior to the purchase. This applies to the specifications of durable goods, such as laboratory instrumentation and software. Similarly, the lab orders consumables, such as chemical reagents, of known quality (purity) from reputable vendors. The quality of the chemical is specified by "grades" that conform to industry standards prior to their purchase. For example, the American Chemical Society (ACS) Reagent Grade chemicals, Trace Metal Grade acids, UHP Grade gases, etc.

If a chemical or consumable ordered by the lab is found to be of inadequate quality, the lab will find an alternative supplier that can meet the required specifications.

All purchased reagents and solvents are initialed and dated upon receipt. The reagents and solvents are also dated and initialed by the analyst with the date they are opened. Analysts are responsible for keeping track of expiration dates and when they are getting low on reagents, standards, or solvents. Standards, reference materials, and reagents shall not be used after their expiration dates unless their reliability is verified by the laboratory and documented.

Revision Records

Origination Date 1989 (no electronic copy)

Revisions 1.0 through 6.0
The status of the electronic files and originals of these versions is unknown.

Revision 7.0 February 2009 by Kathy Fugiel
A copy of the Quality Assurance Manual was generated in PDF format and received an updated ethics statement**.**

Revision 7.1 March 2010 by Kathy Fugiel
The Quality Assurance Manual underwent the annual review. The instrument list and approved methods were updated.

Revision 8.0 July 22, 2011 by Kathy Fugiel
The QA/QC Manual underwent a significant upgrade to conform to NELAC as to anticipate future NELAC Accreditation.

Revision 9.0 December 6, 2012 by Heidi Limmer

The manual was entirely re-formatted to follow ISO 17025 and NELAC formats and requirements.

Revision 10.0 December 8, 2014 by Heidi Limmer
Removed unnecessary information from section 4.8 and 4.11.4. Updated SOP section and Appendix D Equipment section.

Revision 11.0 January 26, 2015 by Heidi Limmer
Update Lab Floor Plan, add Micro SOP 8.32 to Appendix C, correct various grammatical errors, update section 4.7.2, 4.13.4, 4.13.3, 4.14.5, 5.8.6, 5.8.7.3 and update Bottle Request Form (Fig 4.2)

Revision 11.5 August 31, 2015 by Heidi Limmer/Kathy Fugiel
Correct address on front page and update Appendix D.

Revision 12.0 June 1, 2016 by Heidi Limmer
Add PT peer review information to Section 4.0 Management Requirements

Revision 13.0 August 24, 2017 by Mackenzie Johnson
Update to sections 4.6.1, 4,15.2, and 5.9.3.

Revision 14.0 September 12, 2018 by Mackenzie Johnson
Update to entire document to remove NELAC requirements and update with WA DOE requirements.

Revision 15.0 April 11, 2019 by Mackenzie Johnson
Updated information pertaining to management system reviews, Appendix C, and update SOP table.

Revision 16.0 January 30th, 2020 by Seth Farb
Updated information in the Document Control section under "Document Approval and Issue" and updated Appendices B, C, D, & E.

Revision 17.0 December 4th, 2020 by Seth Farb
Added the lab's use of sodium bicarbonate in the Sample Storage and Disposal section under "Sample Processing." Updated method references from Standard Methods 2011 to Standard Methods 2017 and the EPA Methods to their latest respective versions in the SOP List. Also archived SOP #'s 7.21 and 7.30 due to lack of use.

Revision 18.0 December 10th, 2021 by Seth Farb
Added the option of using the completion of a successful PT sample as an acceptable annual DOC metric on Page 17 under the "Demonstration of Capabilities" Section. Added a line in the "Selection of Methods" Section on Page 16 indicating that the methods used in a client's analysis will be given as a notification in writing. Added "NSSP" to Quality Policy Statement, Bullet One. Added a bullet point to the 'Data Quality Audits' subsection of the "Audits" Section on Page 19 to include a statement regarding the cleaning of the lab and the monitoring of said cleanliness. Added a line to Page 13 concerning the verification of equipment function upon return, after a piece of equipment leaves the lab for maintenance. (In the section labeled "Maintenance"). Added "Preventative Actions" to the Corrective Actions sections throughout the document. Archived SOP #'s 8.16 and 8.30 due to lack of use. Updated the Training Coordinator's definition of duties to keeping employee training records up to two years after they leave AmTest. Added a section on environmental monitoring on Pg. 12 in the Sample Processing section. Updated wording in the Maintenance section on Pg. 14 regarding the storage of instrument maintenance and repair files in each instruments' maintenance files. Added language throughout the document for added clarity in the understanding and meaning of pertinent information.

Revision 19.0 January 25th, 2023 by Seth Farb
Removed NSSP references throughout the document. Archived SOP #s 4.26, 8.29, 8.31, and 8.34 due to removal of these methods from our available services. Updated entire document indicating the transition of President Kathy Fugiel into retirement and the promotion of Aaron Young to Lab Director and President of AmTest. Cleaned up wording throughout document for clarity. Adjusted definition of 'Analytical Batch' in Quality Control section on Page 18 to include language allowing for method specific requirements. Updated Appendix E to delineate the newly established company organizational hierarchy. Amended recordkeeping requirements from 7 to 5 years per WA DOE and Drinking Water Certification Manual requirements.

Revision 20.0 January 1st, 2024 by Seth Farb
Archived SOP #8.18 LAL Endotoxin and removed reference in Appendix B due to lack of use. Updated the Ion Chromatograph model type in Appendix C to reflect the new IC instrument that is now in use.

Appendix A
Acronyms

AMU	Atomic Mass Unit
AOAC	Association of Analytical Communities
ASTM	American Society for Testing and Materials
BETX	Benzene, Ethyl Benzene, Toluene, and Xylenes
BFB	Bromofluorobenzene used for mass spectral tuning
BOD	Biochemical Oxygen Demand
BNA	Base/Neutral, Acid Extractable
CAPA	Corrective Action-Preventative Action
CBOD	Carbonaceous Biochemical Oxygen Demand
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CHO	Chemical Hygiene Officer
CHP	Chemical Hygiene Plan
CLP	Contract Laboratory Program
cm	Centimeter
COD	Chemical Oxygen Demand
CV	Coefficient of Variation
CVAAS	Cold Vapor Atomic Absorption Spectrometry
DF	Dilution Factor
DOE	Department of Ecology
EPA	Federal Environmental Protection Agency
FDA	Food and Drug Association
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometry
GLP	Good Laboratory Practice
Hz	Hertz
I.D.	Internal Diameter
ICV	Initial Calibration Verification
ID	Identification
IR	Infrared
IS	Internal Standard
IUPAC	International Union of Pure and Applied Chemistry
L	Liter
LCS	Laboratory Control Sample
LFB	Laboratory Fortified Blank

LIMS	Laboratory Information Management System
LM	Laboratory Manager
LOD	Limit of Detection
LOQ	Limit of Quantitation
m	Meter
MDL	Method Detection Limit
MS	Mass Spectrometry
MSD	Matrix Spike Duplicate or Mass Selective Device
MW	Molecular Weight
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute for Standards and Technology
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Units
OSHA	Occupational Safety and Health Administration
PDF	Portable Document Format
ppb	Parts per Billion
ppm	Parts per Million
ppt	Parts per Trillion
PQL	Practical Quantitation Limit
PSDDA	Puget Sound Dredged Disposal Analysis
PT	Proficiency Testing
QA/QC	Quality Assurance/Quality Control
QAP	Quality Assurance Plan
QCS	Quality Control Sample
RF	Radio Frequency; Response Factor
RFA	Rapid Flow Analysis
RL	Reporting Limit
RPD	Relative Percent Difference
RRT	Relative Retention Time
RSD	Relative Standard Deviation
RT	Retention Time
S/N	Signal-to-Noise Ratio
SD	Standard Deviation
SIM	Selective Ion Monitoring
SOP	Standard Operating Procedure
TCLP	Toxicity Characteristic Leaching Procedure
TNI	The NELAC Institute
VOA	Volatile Organic Analysis
VOC/SVOC	Volatile Organic Compound/Semi-Volatile Organic Compound
WADOE	Washington State Department of Ecology
ZHE	Zero Headspace Extraction

Appendix B
Table of SOPs

SOP TITLE	SOP #	METHOD
1 Series - Log-In		
Color	1.00	SM 2120 B, (Standard Methods 24th Ed.)
Conductivity	1.01	SM 2510 B, (Standard Methods 24th Ed.)
pH of Waters and Soils	1.02	SM 4500-H+B (SM 24th Ed.) & EPA 9045 D
Sample Log-In and Tracking	1.03	
Sample Containers and Preparation	1.04	
Sample Storage	1.05	
Turbidity	1.06	EPA 180.1
Procedure to Determine How Corrosive Soil pH is using pH	1.07	AASHTO (T 289-91) & ASTM E29
pH of Soil using a Calcium Chloride Solution	1.08	Department of Sustainable Natural Resources (ASTM 4972)
Reduction-Oxidation Potential by Electrode	1.09	Redox Potential by DK Nordstrom & FD Wilde / ASTM D 1498-76
Sampling of Condensed Steam	1.10	
2 Series – QA/QC		
QC – Inorganic Chemistry	2.00	SM 1020, 2020, 3020, 4020 & 5020 (Standard Methods 24th Ed.)
QC – Microbiology	2.01	SM 9020 (Standard Methods 24th Ed.)
QC – Trace Organics	2.02	SM 6020 (Standard Methods 24th Ed.)
Writing an SOP	2.03	EPA QA/G-6
Code of Ethics	2.05	
Laboratory Training System & Records Management	2.06	
DOC for Methods, Instruments, and Lab Staff	2.07	
Gravimetric Analysis: Analytical Weight & Balance Calibration	2.08	ASTM, EPA
Customer Complaints	2.09	

SOP TITLE	SOP #	METHOD
3 Series - Lab		
Glassware Cleaning	3.00	
Reagents	3.01	
Sublet Tests	3.02	
Purchasing of Supplies	3.04	
Preventative Maintenance Logs	3.05	
Standards Preparation Notebooks	3.06	
Laboratory Notebooks	3.07	
Internal Audits	3.08	
Analytical Reports	3.09	
Final Data Review	3.10	
Security of Data	3.11	
Method Validation	3.12	
Out-of-Control Events for Mechanical Devices	3.13	
Calibration of Thermometers	3.14	AASHTO Guidelines and Policies, SM 9020 B (Equipment)
Data Loggers	3.15	
Using and Calibrating Pipettes	3.16	
Manual for the Collection & Preservation of Drinking Water Samples	3.17	
Tracking Priority Projects	3.18	
Non-Conformance/Corrective Action-Preventative Action (CAPA) Reporting	3.19	
Job Level Authorization Checklist	3.20	
Record Maintenance & Storage	3.21	
Documenting Evidentiary Chain of Custody within AmTest Laboratory	3.22	
Method Detection Limit Verification	3.23	
Estimation of Measurement Uncertainty	3.24	
Reporting Qualified Data	3.25	

SOP TITLE	SOP #	METHOD
Determination of Percent Dry Solids	3.26	SM 2540 G (Standard Methods 24th Ed.)
Vacuum Pump Operation and Maintenance	3.27	
Importation of Foreign Soil	3.28	
4 Series - Water Chemistry		
Acidity	4.00	SM 2310 B (Standard Methods 24th Ed.)
Alkalinity	4.01	SM 2320 B (Standard Methods 24th Ed.)
Chlorophyll A & Pheophytin A	4.02	SM 10150 B (Standard Methods 24th Ed.)
Residual Chlorine	4.03	SM 4500-Cl G (Standard Methods 24th Ed.) & EPA 330.5
Chemical Oxygen Demand (COD)	4.04	EPA 410.4 (1993) & HACH 8000
Surfactants-CTAS	4.05	SM 5540 B & D (Standard Methods 24th Ed.)
Dissolved Oxygen (DO)	4.06	SM 4500-O B & C (Standard Methods 24th Ed.)
Hexavalent Chromium	4.07	SM 3500-Cr B (Standard Methods 24th Ed.) & EPA 7196A (Soil)
Nitrite	4.09	SM 4500-NO_2 B (Standard Methods 24th Ed.)
Ammonia Soil and Available Ammonia	4.10	SM 4500-NH_3 E (Standard Methods 24th Ed.)
Orthophosphate	4.11	SM 4500-P E (Standard Methods 24th Ed.)
Settleable Solids	4.12	SM 2540-Solids F (Standard Methods 24th Ed.)
Silica and Silica-Low	4.13	SM 4500-SiO_2 C (Standard Methods 24th Ed.)
Sulfide	4.14	SM 4500 S^{2-} D (Standard Methods 24th Ed.)
Sulfite	4.16	SM 4500-SO_3^{2-} B (Standard Methods 24th Ed.)
Surfactants-MBAS	4.17	SM 5540 C (Standard Methods 24th Ed.)
Tannin and Lignin	4.18	SM 5550 B (Standard Methods 24th Ed.)
Total Dissolved Solids (TDS)	4.19	SM 2540-Solids C (Standard Methods 24th Ed.)
Total Kjeldahl Nitrogen (TKN) by Titration	4.20	SM 4500-N_{org} C (Solids) (Standard Methods 24th Ed.) & SM 4500-NH_3 C
Total Organic Carbon (Soil)	4.21	EPA 9060 A / PSP
Total Organic Carbon (Water)	4.22	SM 5310 B (Standard Methods 24th Ed.)
Total Solids	4.23	SM 2540-Solids B (Standard Methods 24th Ed.)
Total Suspended Solids (TSS)	4.24	SM 2540-Solids D (Standard Methods 24th Ed.)

SOP TITLE	SOP #	METHOD
Total and Volatile Solids in Soil	4.25	SM 2540-Solids G (Standard Methods 24th Ed.)
Ferrous Iron	4.27	SM 3500-Fe B (Standard Methods 24th Ed.)
Fluoride (Probe)	4.28	SM 4500-F^- C (Standard Methods 24th Ed.) & AOAC 975.04
Determination of Detrimental Material by Leaching/CVAA	4.31	ASTM D 516 and DOD MIL-STD-2041 D, Notice 2, 10/18/02
Volatile Suspended Solids (VSS)	4.33	SM 2540-Solids E (Standard Methods 24th Ed.)
UV Absorption Method 254	4.34	SM 5910 B (Standard Methods 24th Ed.)
TOC DOC UV 254 (SUVA)	4.35	EPA 415.3 Rev. 1 (2003); SM 5310 B; SM 5020; SM 1050 B (Standard Methods 24th Ed.)
Laboratory Minimum Soil Resistivity	4.36	AASHTO Design: T288-12 (2012)
Determination of Inorganic Anions Using Ion Chromatography (IC)	4.37	EPA 300.0 and EPA 9056 D
Flash Point	4.38	EPA 1020 B (2004), ASTM D 3278-96 (1996)
Vector Attraction Reduction (VAR)	4.39	SM 2540 G, EPA 503 B, and EPA 625/R-92/013 Appendix D (1) and (3)
Laboratory Saturated Soil Resistivity	4.40	ASTM G 187-129
Manual Cyanide	4.41	Standard Method 4500-CN^- C, E, G, I (Standard Methods 24th Ed.)
Manual Total Phosphorous	4.42	Standard Method 4500-P E (Standard Methods 24th Ed.)
5 Series - RFA		
Ammonia Nitrogen (NH_3)	5.00	EPA 350.1 Rev. 2 (1993) & SM 4500-NH_3 G (Soils) (SM 24th Ed.)
Nitrate-Nitrite Nitrogen (NO_X)	5.05	EPA 353.2 & SM 4500-NO_3^- F (Soils) (Standard Methods 24th Ed.)
Phenol	5.06	EPA 420.4 (1993) & EPA 9065 (Solids)
Total Phosphorus (TP)	5.07	SM 4500-P F (Standard Methods 24th Ed.)
Total Persulfate Nitrogen (TPN)	5.08	SM 4500-N C (Standard Methods 24th Ed.) & EPA 353.2
Total Kjeldahl Nitrogen (TKN) by Semi-Automated Colorimetry	5.10	EPA 351.2 (1993)
6 Series - Trace Metals		
ICP	6.00	EPA 200.7
ICP-MS	6.01	EPA 200.8
6020 B (Solid) ICP-MS	6.02	EPA 6020 B
Cation Exchange Capacity (CEC)	6.04	EPA 9081

SOP TITLE	SOP #	METHOD
TCLP	6.06	EPA 1311
6010 D (Solid) ICP	6.07	EPA 6010 D
Mercury by Cold Vapor (Water)	6.08	EPA 245.1
Mercury by Cold Vapor (Solid)	6.09	EPA 7471 B
7 Series - Trace Organics		
Extraction HAA – 552.2	7.00	EPA 552.2
GC HAA – 522.2	7.01	EPA 552.2
Extraction 608.3 PCBs and Pesticides	7.02	EPA 608.3
GC 608.3 PCBs and Pesticides	7.03	EPA 608.3
Extraction 615 Herbicides	7.04	EPA 615
GC 615 Herbicides	7.05	EPA 615
Extraction 622 Organophosphorus Pest.	7.06	EPA 622
Extraction 625.1 – Semivolatiles	7.08	EPA 625.1
GC 625.1 – Semivolatiles	7.09	EPA 625.1
Extraction 8081, 8082 PCBs and Pest. (Soil)	7.10	EPA 8081, 8082, 3540
GC PCBs 8082 (Soil)	7.11	EPA 8082 A
Extraction NWTPH-Dx and HCID Water	7.12	WA State DOE, Publication # ECY 97-602
Extraction NWTPH-Dx and HCID Soils	7.13	WA State DOE, Publication # ECY 97-602
GC-NWTPH-Dx	7.14	WA State DOE, Publication # ECY 97-602
GC-NWTPH-HCID	7.15	WA State DOE, Publication # ECY 97-602
GCMS-NWTPH-Gx	7.16	WA State DOE, Publication # ECY 97-602
Extraction 8151 A - Herbicides	7.17	EPA 8151 A
GC 8151 A - Herbicides	7.18	EPA 8151 A
Extraction 8270 E SVOC	7.19	EPA 8270 E
GCMS – 8270 E SVOC	7.20	EPA 8270 E
GCMS – 524.2 VOC DW	7.21	EPA 524.2
GCMS – 624.1 Wastewater	7.22	EPA 624.1
GCMS – 8260 D Soil	7.23	EPA 8260 D

SOP TITLE	SOP #	METHOD
GC 8015 – Mod Glycols	7.24	EPA 8015 B-Mod
GC 8081 Chlorinated Pesticides	7.26	EPA 8081 B (Solids)
Ext. 8141 B Organophosphorus in Soil	7.27	EPA 8141 B & USEPA OLM 4.2
Oil & Grease – 1664 B	7.28	EPA 1664 B
Bomb Preparation Method for Solid and Liquid Samples	7.29	ASTM D 808-81, EPA 5050, Parr Manual No. 205M
Grain Sizing Analysis, ASTM D 422	7.32	ASTM D 422
Documenting Organic Stock Materials	7.33	
Sulfur (TBA) Clean-Up	7.34	EPA 3660 B
Manual Peak Integration	7.35	
Sulfuric Acid/Permanganate Clean-Up	7.36	EPA 3665 A
TCLP Trace Organics	7.37	EPA 1311
8 Series - Microbiology		
Total Coliforms in Water by Membrane Filtration	8.01	SM 9222 B, G, H, & I (Standard Methods 24th Ed.)
Total Coliforms in Water and Solids by MTF using LTB and EC Medium	8.02	SM 9221 B, C, E1 (Fecal), F (E. coli) (Standard Methods 24th Ed.)
Salmonella in Biosolids – EPA 1682	8.04	EPA 1682
Fecal Coliforms in Water by Membrane Filtration	8.05	SM 9222 D (Standard Methods 24th Ed.)
Fecal Coliforms in Biosolids by MTF using A1 Medium	8.06	SM 9221 E2 (Standard Methods 24th Ed.)
Fecal Coliforms in Biosolids by MTF using LTB and EC Medium	8.07	SM 9221 B, C, E1 (Fecal), F (E. coli) (Standard Methods 24th Ed.)
HPC in Water by Membrane Filtration	8.08	SM 9215 D (Standard Methods 24th Ed.)
HPC in Water by Pour Plate	8.09	SM 9215 B (Standard Methods 24th Ed.)
Biochemical Oxygen Demand (BOD)	8.10	SM 5210 B (Standard Methods 24th Ed.)
Autoclave Instructions	8.11	
Washing Supplies and Equipment	8.12	SM 9040 (Standard Methods 24th Ed.)
Enterococcus sp. in Water by IDEXX	8.13	IDEXX Enterolert Method & SM 9230 D3b (Standard Methods 24th Ed.)
Enterococcus sp. in Water by MF	8.14	SM 9230 C3a (Standard Methods 24th Ed.)

SOP TITLE	SOP #	METHOD
Proficiency Testing for Accreditation	8.15	WA Dept. of Ecology
Salmonella in Food and Environmental Samples	8.19	AOAC Method 989.13, BAM Chapter 5 and "Using 1-2 Test" by BioControl Systems
Yeast & Mold by Pour Plate	8.20	BAM Chapter 18
Staphylococcus aureus	8.21	BAM Chapter 12
Aerobic Plate Count by Pour Plate	8.22	BAM Chapter 3
Anaerobic Plate Count by Pour Plate	8.23	BAM Chapter 3
Microbiology Routine Techniques and Procedures	8.24	
Yeast & Mold by Spread Plate	8.25	BAM Chapter 18
Aerobic Plate Count by Spread Plate	8.26	BAM Chapter 3
Anaerobic Plate Count by Spread Plate	8.27	BAM Chapter 3
Listeria in Food & Environmental Samples	8.28	BAM Chapter 10, AOAC method 997.03, VIP Gold Test Kit (BioControl)
Enzyme Substrate Coliform Test (Colisure P/A)	8.32	SM 9223 B (Standard Methods 24th Ed.)
Stock Culture Control & Documentation	8.33	
Legionella pneumophila in Water by IDEXX	8.35	IDEXX Legiolert Method
Pseudomonas aeruginosa in Water by IDEXX	8.36	IDEXX Pseudalert Method
Data Review – Microbiology	8.37	

Appendix C
Equipment

Major Instruments/Equipment include:

GC/MS Agilent Technologies 6890N (Semi-Volatile)
Agilent Technologies 6890N (VOA), Agilent Injector and EST Analytical Centurion Autosampler

GC Hewlett Packard 5890 GC with FID detector (1)
Hewlett Packard 6890 GC with FID detector (1)
Hewlett Packard 5890 GC with ECD detector (1)
Agilent Technologies 6890 GC with ECD detector (2)

ICP/MS Agilent Technologies, 7800 G8421A

CETAC Mercury Analyzer M-7600 with Autosampler

Inductively Coupled Plasma Spectrometer (ICP-OES) Thermo Fisher iCAP6500

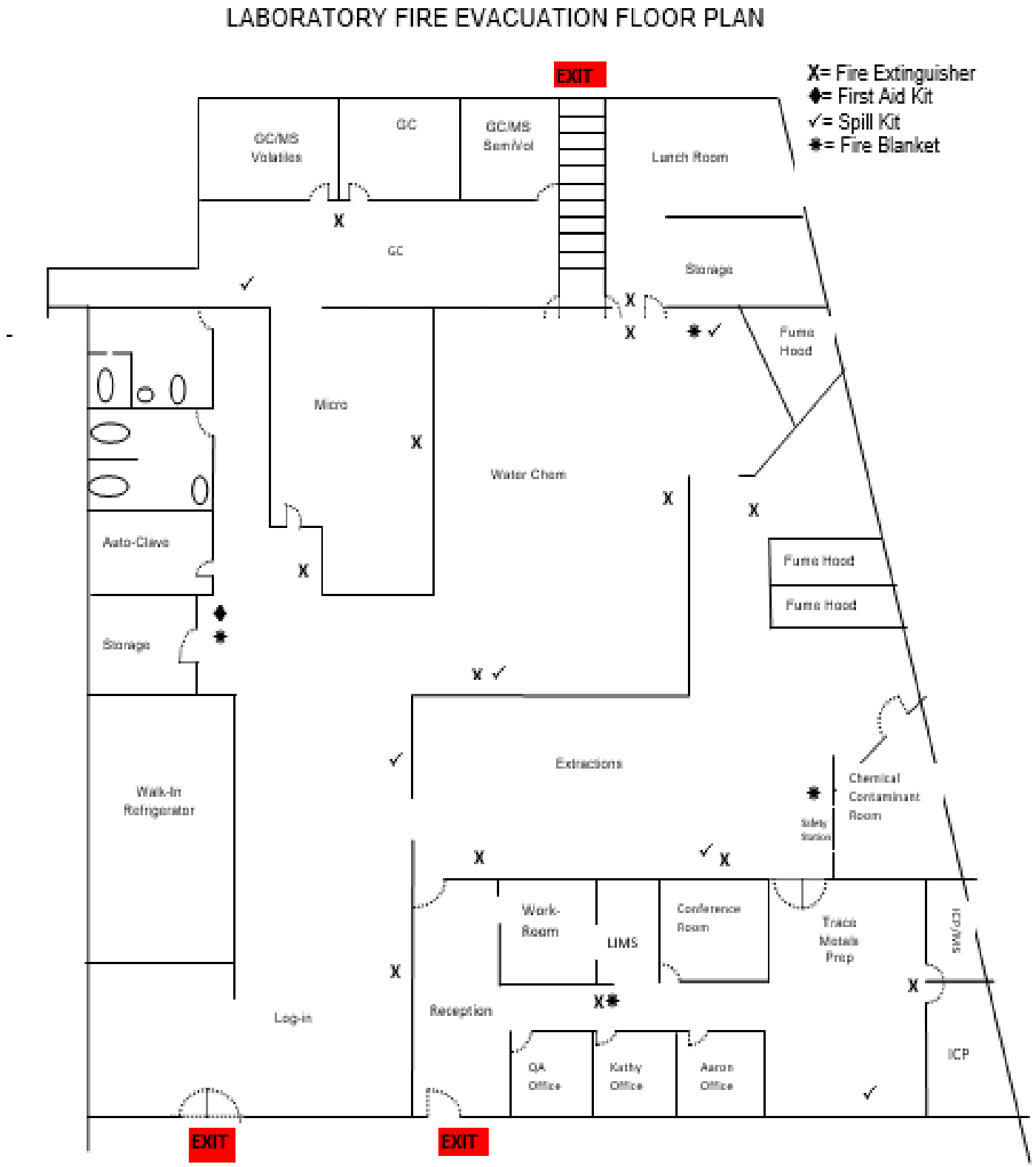
Ion Chromatograph Thermo Scientific Dionex Aquion with Autosampler Dionex AS-DV

Total Organic Carbon Analyzer Shimadzu SSM-5000A (Soil Samples)
Shimadzu TOC-V CSH with Autosampler Shimadzu ASI-V (Water Samples)

UV/VIS Spectrometers Shimadzu UV/VIS 160 Serial #'s 123149 and A11431030397

Flow Analyzer Perstorp/OI Analytical Modules 503 and 509 with Autosampler CETAC ASX-520

Appendix D
Laboratory Floor Plan



Appendix E
Laboratory Organizational Chart