



LABORATORY QUALITY MANUAL

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- Validation of spreadsheets used for calculations to verify formulas and logic yield correct results and protection of these cells to prevent unauthorized change.
- Operating system and file access safeguards
- Protection from Computer Viruses
- Regular system backup; and testing of retrieved data

The laboratory's process for software development and testing process includes:

- Verification the software application works as expected and is adequate for use and fulfills compliance requirements, such as the need to record date/time of data generation.
- Change control to assure requests for changes are reviewed and approved by management before the change is made.
- Communication channels to assure all staff are aware of changes made.
- Version Control and maintenance of historical records.

These procedures are detailed in laboratory SOPs ENV-SOP-GBUR-0045 *Spreadsheet Validation*.

5.5 Equipment

5.5.1 Availability of Equipment

The laboratory is furnished with all equipment and instrumentation necessary to correctly perform the tests offered in compliance with the specifications of the test method and to achieve the accuracy and sensitivity required.

5.5.2 Calibration

Equipment and instrumentation is checked prior to use to verify it performs within tolerance for its intended application.

Laboratory management is made aware of the status of equipment and instrumentation and any needs for either on a daily basis. This information is obtained during laboratory walkthroughs (LDM) that are conducted as part of the laboratory's lean program.

5.5.2.1 Support Equipment

The laboratory confirms support equipment is in proper working order and meets the specifications for general laboratory use prior to placement in service and with intermediate checks thereafter. Equipment that does not meet specifications is removed from service until repaired or replaced. Records of repair and maintenance activities are maintained.

Procedures used to carry out and record these checks are outlined laboratory SOP ENV-SOP-GBUR-0041 *Support Equipment*.

5.5.2.2 Analytical Instruments

Analytical instruments are checked prior to placement in service in accordance with SOP ENV-SOP-CORQ-0011 *Method Validation and Instrument Verification*. After the initial



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service date, the calibration of instruments and verification calibration is performed in accordance with local test method SOPs.

The calibration procedures in the test method SOPs comply with the requirements for acceptable calibration practices outlined in corporate document ENV-SOT-CORQ-0026 *Acceptable Calibration Practices*, the reference methods, and any applicable regulatory or program requirements.

5.5.3 Equipment Use and Operation

Equipment is operated and maintained by laboratory personnel that are trained on the test method SOP. Up-to-date instructions and procedures for the use and maintenance of analytical equipment are included in SOPs and/or supplemental documents such as standard work instructions (SWI) or instrument manuals which are made readily accessible in the work area to all laboratory personnel.

5.5.4 Equipment Identification

The laboratory uniquely identifies equipment by serial number or any other unique ID system, when practical. The identifier is included in the equipment list maintained by QA.

5.5.5 Equipment Lists and Records

5.5.5.1 Equipment List

The laboratory maintains a master list of equipment that includes information about the equipment including a description, manufacturer, serial number, date placed in service, condition when received, identity, and the current location in the laboratory. The date of purchase is tracked by the procurement record. The equipment list(s) for each location covered by this manual is provided in Appendix F.

5.5.5.2 Equipment Records

In addition to the equipment list, the laboratory maintains records of equipment that include:

- Verification that equipment conforms with specifications.
- Calibration records including dates, results, acceptance criteria, and next calibration dates.
- Maintenance plan and records
- Records of damage, malfunction, or repair

The laboratory follows an equipment maintenance program designed to optimize performance and to prevent instrument failure which is described in laboratory SOP ENV-SOP-GBUR-0047 *Equipment Maintenance* or individual test method SOPs.

The maintenance program includes routine maintenance activities which are performed as recommended by the manufacturer at the frequency recommended and non-routine maintenance, which is performed to resolve a specific problem such as degradation of peak resolution, shift in calibration relationship, loss of sensitivity, or repeat failure of instrument performance checks and quality control samples.

Maintenance is performed by laboratory personnel or by outside service providers.



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All maintenance activities performed by laboratory personnel are recorded by the individual(s) that performed the activity at the time the maintenance was performed in an instrument maintenance log.

The maintenance record minimally includes the date of maintenance, the initials of the person(s) performing maintenance, a description of the activity performed, why (when the maintenance is non-routine), and the return to analytical control. When maintenance is performed by an external vendor, the laboratory staples the service record into hardcopy maintenance logs or scans the record easy retrieval. The laboratory provides unrestricted access to instrument maintenance logs in order to promotes good instrument maintenance and recordkeeping practices.

If an instrument must be moved, the laboratory will use safe practices for handling and transport to minimize damage and contamination.

5.5.6 Out of Service Protocol

Equipment that has been subjected to overloading, mishandling, gives suspect results, has been shown to be defective, or is performing outside of specified limits is taken out of service and either removed from the work area or labeled to prevent accidental use until it has been repaired and verified to perform correctly.

When analytical equipment is taken out of service, the laboratory examines the potential effect it may have had on previous analytical results to identify any non-conforming work. (See section 4.9).

5.5.7 Calibration Status

The laboratory labels support equipment to indicate calibration status, whenever practicable or otherwise maintains the calibration status in a visible location in the work area. These procedures are described in laboratory SOP ENV-SOP-GBUR-0041 *Support Equipment*.

The calibration status of analytical instruments is documented in the analytical record. Analysts verify on-going acceptability of calibration status prior to use and with instrument performance check standards. These procedures are described in test method SOPs.

5.5.8 Returned Equipment Checks

When equipment or instrument is sent out of the laboratory for service, the laboratory ensures that the function and calibration status of the equipment is checked and shown to be satisfactory before the equipment is returned to service. These procedures are outlined in SOP ENV-SOP-CORQ-0011 *Method Validation and Instrument Verification*.

5.5.9 Intermediate Equipment Checks

The laboratory performs intermediate checks on equipment to verify the on-going calibration status. For example, most test method require some form of continuing calibration verification check and these procedures are included in the test method SOP. Periodic checks of support equipment are also performed; see appendix E for more information.

5.5.10 Safeguarding Equipment Integrity

The laboratory safeguards equipment integrity using a variety of mechanisms that include but are not limited to:



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- Adherence to manufacture's specification for instrument use so that settings do not exceed manufacturer's recommendation or stress the performance of the equipment.
- Established maintenance programs.
- Transparent maintenance records and unrestricted access to maintenance logs.
- Validation and approval of software before use.
- Audits to confirm instrument settings are consistent with SOPs.
- On-the-job training for safe and proper use of laboratory equipment.

5.6 Measurement Traceability

5.6.1 General

Measurement traceability refers to a property of a measurement result whereby the result can be related to a reference through an unbroken chain of calibration, each contributing to the measurement uncertainty. Traceability requires an established calibration hierarchy of equipment (instruments) used during testing including equipment used for subsidiary measurements. The laboratory assures this equipment is calibrated prior to being put into service and that the reference standard and materials used for calibration are traceable to the international standard of units (SI) or national measurement standard.

When strict traceability to SI units cannot be made, the laboratory establishes traceability with the use of reference standards and equipment obtained from competent supplier that provide calibration certificates and/or certificates of analysis (COA).

5.6.2 Equipment Correction Factors

When correction factors are used to adjust results the laboratory will assure that results in computer software are also updated. For example, if the direct instrument or reading output must be corrected based on preparation factor or concentration factors, laboratory management will assure the corrected result is also updated in the software, whenever possible.

5.6.3 Specific Requirements

5.6.3.1 Requirements for Calibration Laboratories

The laboratory does not offer calibration services to customers.

5.6.3.2 Requirements for Testing Laboratories

The laboratory has procedures in place to verify equipment is calibrated prior to being put into service. (See 5.5.2) and ensures the reference standard and materials used for calibration are traceable to the international standard of units (SI) or national measurement standard. When strict traceability to SI units cannot be made, the laboratory establishes traceability with the use of reference standards and equipment obtained from competent suppliers that provide calibration certificates and/or certificates of analysis (COA).

5.6.4 Reference Standards and Reference Materials

5.6.4.1 Reference Standards

The laboratory uses reference standards of measurement to verify adequacy of working weights and thermometers. The working weight is the weight(s) used for daily balance



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calibration checks and the working thermometers are used for temperature measurements on a daily basis.

Intermediate checks of the working reference measurement standards are performed to verify adequacy between calibration from an external calibration laboratory. The measurements from working weights and thermometers are compared to measurement taken by the reference standard which is traceable to SI or a national standard. The reference weights and thermometers are used solely for verification purposes unless the laboratory can prove that daily use does not adversely affect performance of the reference standard.

The laboratory performs intermediate checks of the working weights at least annually.

Working thermometers (glass and digital) are checked against the reference thermometer prior to placement in service to establish a correction factor and then rechecked annually (glass) or quarterly (digital) thereafter.

The calibration of liquid in glass reference thermometers is verified every 5 years and the calibration of digital reference thermometers is verified annually by an ISO/IEC 17025 accredited calibration laboratory or service provider that provides traceability to a national standard.

The calibration of the reference weight(s) is verified every 5 years by an ISO/IEC 17025 accredited calibration laboratory.

If criteria for the intermediate checks or recertification is not acceptable, the impact on previously reported results is evaluated using the process for evaluation of nonconforming work (See 4.9)

See laboratory ENV-SOP-GBUR-0041 *Support Equipment* for more information about this process.

5.6.4.2 Reference Materials

The laboratory purchases chemical reference materials used (also known as stock standards) from vendors that are accredited to ISO 17034 or Guide 34. Purchased reference materials must be received with a Certificate of Analysis (COA) where available. If a reference material cannot be purchased with a COA, it must be verified by analysis and comparison to a certified reference material and/or there must be a demonstration of capability for characterization. COA are reviewed for adequacy and retained by the laboratory for future reference.

The laboratory procedure for traceability and use of these materials is provided in laboratory SOP ENV-SOP-GBUR-0043 *Standard and Reagent Management and Traceability*.

This SOP includes each of the following requirements:

- Procedures for documentation of receipt and tracking. The record of entry includes name of the material, the lot number, receipt date, and expiration date.
- Storage conditions and requirements. Reference materials must be stored separately from samples, extracts, and digestates.



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- Requirements to assure that preparations of intermediate or working solutions are recorded and assigned a unique identification number for tracking. Records of preparation include the lot number of the stock standard(s) used, the type and lot number of the solvent, the formulation, date, expiration date, and the preparer's initials. The lot number of the working standards is recorded in the analytical record to provide traceability to the standard preparation record. The preparation record provides traceability to the COA, which is traceable to SI or the national measurement standard.
- A requirement that the expiration dates of prepared standards may not exceed the expiration date of the parent standard. Standards, reference materials, and reagents are not used after their expiration dates unless their reliability is thoroughly documented and verified by the laboratory. If a standard exceeds its expiration date and is not re-certified, the laboratory removes the standard and/or clearly designates it as acceptable for qualitative/troubleshooting purposes only. All prepared standards, reference materials, and reagents are verified to meet the requirements of the test method through routine analyses of quality control samples.
- The second source materials used for verification of instrument calibration are obtained from a different manufacturer or different lot from the same manufacturer.
- Procedures to check reference materials for degradation and replacement of material if degradation or evaporation is suspected.
- Procedures for labeling. At a minimum the container must identify the material, the ID of the material and the expiration date. Original containers should also be labeled with date opened.

5.6.4.3 Intermediate Checks

Checks to confirm the calibration status of standards and materials are described in laboratory SOPs. These checks, include use of second source standards and reference materials reserved only for the purpose of calibration checks.

5.6.4.4 Transport and Storage

The laboratory handles and transports reference standards and materials in a manner that protects the integrity of the materials. Reference standard and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials. Standards and reference materials are stored separately from samples, extracts, and digestates. All standards are stored according to the manufacturer's recommended conditions. Temperatures colder than the manufacturer's recommendation are acceptable if it does not compromise the integrity of the material (e.g. remains in liquid state and does not freeze solid). In the event a standard is made from more than a single source with different storage conditions, the standard will be stored according to the conditions specified in the analytical method.

See the applicable analytical SOPs for specific reference material storage and transport protocols.



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5.7 Sampling

Sampling refers to the field collection of samples and to subsamples taken by the laboratory for analysis from the field collected sample.

Subsampling procedures are included SOP ENV-SOP-GBUR-0057 *Sample Homogenization and Subsampling* to assure the aliquot used for testing is representative of the field collected sample.

The requirements in the following subsections apply when field sampling is performed by the laboratory.

5.7.1 Sampling Plans and SOPs

When the laboratory performs field collection of samples, sampling is carried out in accordance with a written sample plan prepared by the customer or by the laboratory and by relevant sampling SOPs. These documents are made readily accessible at the sampling location. Sampling plans and SOPs are, whenever reasonable, based on appropriate governing methods and addresses the factors to be controlled to ensure the validity of the analytical results.

5.7.2 Customer Requested Deviations

When the customer requires deviations, additions, or exclusions from the documented laboratory sampling plan and/or procedure, the laboratory records the client's change request in detail with the sampling record, communicates the change to sampling personnel, and includes this information in the final test report.

5.7.3 Recordkeeping

The laboratory assures the sampling record includes the sampling procedure used, any deviations from the procedure, the date and time of sampling, the identification of the sampler, environmental conditions (if relevant), and the sampling location.

5.8 Sample Management & Handling

5.8.1 Procedures

The laboratory's procedures for sample management and handling are outlined in laboratory SOP ENV-SOP-GBUR-0001 *Sample Management*.

The procedures in these SOPs are established to maintain the safe handling and integrity of samples from transport, storage, to disposal and during all processing steps in-between; to maintain client confidentiality, and to protect the interests of PAS and its customers.

5.8.1.1 Chain of Custody

All samples received by the laboratory must be accompanied with a Chain of Custody (COC) record. The COC provides information about the samples collected and submitted for testing and documents the possession of samples from time of collection to receipt by the laboratory.

The COC record must minimally include the following information:

- Client name, address, phone number
- Project Reference
- Client Sample Identification (Client ID)



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- Date, Time, and Location of Sampling
- Samplers Name or Initials
- Matrix
- Type of container, and total number collected each sample
- Preservatives
- Analyses Requested
- Mode of collection
- Any special instructions
- The date and time and signature of each sample transfer from time of collection to receipt in the laboratory. When the COC is transported inside the cooler, independent couriers do not sign the COC. Shipping manifests and/or air bills are the records of possession during transport.

A complete and legible COC is required. If the laboratory observes that the COC is incomplete or illegible, the client is contacted for resolution. The COC must be filled out in indelible ink. Personnel correct errors by drawing a single line through the initial entry so the entry is not obscured, entering the correct information, and initialing, and dating the change.

5.8.1.2 Legal Chain of Custody

Legal chain of custody is a chain of custody protocol used for evidentiary or legal purposes. The protocol is followed by the laboratory when requested by customer or where mandated by a regulatory program.

Legal chain of custody (COC) protocol establishes an intact, continuous record of the physical possession*, storage, and disposal of “samples” which includes, sample aliquots, and sample extracts/digestates/distillates.

Legal COC records account for all time periods associated with the samples, and identifies all individuals who physically handled individual samples. Legal COC begins at the point established by legal authority, which is usually at the time the sample containers are provided by the laboratory for sample collect or when sample collection begins.

*A sample is in someone’s custody if:

- It is in one’s physical possession;
- It is in one’s view after being in one’s physical possession;
- It has been in one’s physical possession and then locked or sealed so that no one can tamper with it; and/or
- It is kept in a secure area, restricted to authorized personnel only.

Refer to laboratory SOP ENV-SOP-GBUR-0001 *Sample Management* and SWI ENV-SWI-GBUR-0038 *Scan to Location* for more information.



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5.8.2 Unique Identification

Each sample is assigned a unique identification number by the laboratory (Lab ID) after the sample has been checked and accepted by the laboratory in accordance with the laboratory's sample acceptance policy (See 5.8.3). The Lab ID is affixed to the sample container using a durable label.

The unique identification of samples also applies to subsamples, and prepared samples, such as extracts, digestates, etc.

The lab ID is linked to the field ID (client ID) in the laboratory's record. Both IDs are linked to the testing activities performed on the sample and the documentation records of the test.

Also see 5.8.4.

5.8.3 Sample Receipt Checks and Sample Acceptance Policy

The laboratory checks the condition and integrity of samples on receipt and compares the labels on the sample containers to the COC record. Any problem or discrepancy is recorded. If the problem impacts the suitability of the sample for analysis or if the documentation is incomplete, the client is notified for resolution. Decisions and instructions from the client are maintained in the project record.

5.8.3.1 Sample Receipt Checks

The following checks are performed:

- Verification that the COC is complete and legible.
- Verification that each sample's container label includes the client sample ID, the date and time of collection and the preservative in indelible ink.
- The container type and preservative is appropriate for each test requested.
- Adequate volume is received for each test requested.
- Visual inspection for damage or evidence of tampering.
- Visual inspection for presence of headspace in VOA vials. (VOA = volatile organic analysis).
- Thermal Preservation: For chemical testing methods for which thermal preservation is required, temperature on receipt is acceptable if the measurement is above freezing but $<6^{\circ}\text{C}$. For samples that are hand-delivered to the laboratory immediately after sample collection, there must be evidence that the chilling process has begun, such as arrival on ice. The requirements for thermal preservation vary based on the scope of testing performed. For example, for microbiology, temperature on receipt is acceptable if the measurement is $<10^{\circ}\text{C}$. Refer to the laboratory's SOP for sample receipt for more information.
- Chemical Preservation
- Holding Time: Sample receiving personnel are trained to recognize tests with tests where the holding time is 48 hours or less and to expedite the log-in of these samples. Except for tests with immediate holding times (15 minutes from time of collection or less), when samples are received out of hold, the laboratory will notify the client and



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request instruction. If the decision is made to proceed with analysis, the final test report will include notation of this instruction.

5.8.3.2 Sample Acceptance Policy

The laboratory maintains a sample acceptance policy in accordance with regulatory guidelines to clearly establish the circumstances in which sample receipt is accepted or rejected. When receipt does not meet acceptance criteria for any one of these conditions, the laboratory must document the noncompliance, contact the customer, and either reject the samples or fully document any decisions to proceed with testing. In accordance with regulatory specifications, test results associated with receipt conditions that do not meet criteria are qualified in the final test report.

All samples received must meet each of the following:

- Be listed on a complete and legible COC.
- Be received in properly labeled sample containers.
- Be received in appropriate containers that identify preservative.
- The COC must include the date and time of collection for each sample.
- The COC must include the test requested for each sample.
- Be in appropriate sample containers with clear documentation of the preservatives used.
- Be received within holding time. Any samples received beyond the holding time will not be processed without prior customer approval.
- Have sufficient sample volume to proceed with the analytical testing. If insufficient sample volume is received, analysis will not proceed without customer approval.
- Be received within appropriate temperature ranges (not frozen but $\leq 6^{\circ}\text{C}$) unless program requirements or customer contractual obligations mandate otherwise. The cooler temperature is recorded directly on the COC. Samples that are delivered to the laboratory immediately after collection are considered acceptable if there is evidence that the chilling process has been started. For example, by the arrival of the samples on ice. If samples arrive that are not compliant with these temperature requirements, the customer will be notified. The analysis will NOT proceed unless otherwise directed by the customer. If less than 72 hours remain in the hold time for the analysis, the analysis may be started while the customer is contacted to avoid missing the hold time. Data associated with any deviations from the above sample acceptance policy requirements will be appropriately qualified.

5.8.4 Sample Control and Tracking

The samples are controlled and tracked using the Laboratory Information Management System (LIMS). The LIMS stores information about the samples and project. The process of entering information into the LIMS is called login and these procedures are described in laboratory SOP ENV-SOP-GBUR-0001 *Sample Management*. After log-in, a label is generated and affixed to each



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sample container. Information on this label, such as the lab ID, links the sample container to the information in LIMS.

At a minimum, the following information is entered during log-in:

- Client Name and Contact Information;
- The laboratory ID linked to the client ID;
- Date and time of sample collection;
- Date and time of sample receipt;
- Matrix;
- Tests Requested.

5.8.5 Sample Storage, Handling, and Disposal

The laboratory procedures for sample storage, handling and disposal are detailed in laboratory SOPs ENV-SOP-GBUR-0001 *Sample Management*.

5.8.5.1 Sample Storage

The samples are stored according to method and regulatory requirements as per test method SOPs. Samples are stored away from all standards, reagents, or other potential sources of contamination and stored in a manner that prevents cross contamination. Volatile samples are stored separately from other samples. All sample fractions, extracts, leachates, and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method.

Refrigerated storage areas are maintained at $\leq 6^{\circ}\text{C}$ (but not frozen) and freezer storage areas are maintained at $< -10^{\circ}\text{C}$ (unless otherwise required per method or program). The temperature of each storage area is checked and documented at least once for each day of use. If the temperature falls outside the acceptable limits, then corrective actions are taken and appropriately documented.

The laboratory is operated under controlled access protocols to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted at all times. Samples are taken to the appropriate storage location immediately after sample receipt and login procedures are completed. All sample storage areas have limited access. Samples are removed from storage areas by designated personnel and returned to the storage areas as soon as possible after the required sample quantity has been taken.

5.8.5.2 Sample Retention and Disposal

The procedures used by the laboratory for sample retention and disposal are detailed in laboratory SOP ENV-SOP-GBUR-0006 *Waste Handling and Management*.

In general, unused sample volume and prepared samples such as extracts, digestates, distillates and leachates (samples) are retained by the laboratory for the period of time necessary to protect the interests of the laboratory and the customer.

Samples may be stored at ambient temperature when all analyses are complete, the hold time is expired, the report has been delivered, and/or when allowed by the customer or program. Samples requiring storage beyond the minimum sample retention time due to



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special requests or contractual obligations may be stored at ambient temperature unless the laboratory has sufficient capacity and their presence does not compromise the integrity of other samples.

After this period expires, non-hazardous samples are properly disposed of as non-hazardous waste. The preferred method for disposition of hazardous samples is to return the excess sample to the customer.

5.9 Assuring the Quality of Test Results

5.9.1 Quality Control (QC) Procedures

The laboratory monitors the validity and reliability of test results using quality control (QC) samples that are prepared and analyzed concurrently with field samples in the same manner as field samples. QC results are always associated to and reported with the field samples they were prepared and analyzed with from the same preparation or analytical batch. See the glossary for definition of preparation and analytical batch.

The results of QC performed during the testing process are used by the laboratory to assure the results of analysis are consistent, comparable, accurate, and/or precise within a specified limit. When the results are not within acceptance criteria or expectations for method performance, correction and corrective action(s) are taken. These actions may include retesting or reporting of data with qualification to alert the end user of the situation.

Other QC measures performed include the use of certified reference materials (see 5.6.2), participation in interlaboratory proficiency testing (see 5.9.1.1), verification that formulae used for reduction of data and calculation of results is accurate (see 5.9.3), on-going monitoring of environmental conditions that could impact test results (see 5.3.2), and evaluation and verification of method selectivity and sensitivity (see 5.4.5).

QC results are also used by the laboratory to monitor performance statistical trends over time and to establish acceptance criteria when no method or regulatory criteria exist. (see 5.9.1.4).

5.9.1.1 Essential QC

Although the general principles of QC for the testing process apply to all testing, the QC protocol used for each test depends on the type of test performed.

QC protocol used by the laboratory to monitor the validity of the test are specified in test method SOPs. The SOP includes QC type, frequency, acceptance criteria, corrective actions, and procedures for reporting of nonconforming work.

These requirements in the SOP conform to the reference method and any applicable regulations or certification and accreditation program requirement for which results of the test are used. When a project requires more stringent QC protocol than specified in the SOP, project specification is followed. When the project requires less stringent QC protocol, the project specification may be followed as an authorized departure from the SOP when the project specifications meet the requirements in the mandated method and any regulatory compliance requirements for which the data will be used.

The following are examples of essential QC for Chemistry:



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5.9.1.1.1 Second Source Standard (ICV/QCS)

The second source standard is a standard obtained from a different vendor than the vendor of the standards used for calibration. It is a positive control used to verify the accuracy of a new calibration relative to the purity of the standards used for calibration. This check is referred to in test method and quality system standards as the initial calibration verification (ICV) or quality control sample (QCS). The second source standard is analyzed immediately after the calibration and before analysis of any samples. When the ICV is not within acceptance criteria, a problem with the purity or preparation of the standards may be indicated.

5.9.1.1.2 Continuing Calibration Verification (CCV)

CCV is to determine if the analytical response has significantly changed since initial calibration. If the response of the CCV is within criteria, the calibration is considered valid. If not, there is a problem that requires further investigation. Actions taken are technology and method specific.

5.9.1.1.3 Method Blank (MB) / Other Blanks

A method blank is a negative control used to assess for contamination during the prep/analysis process. The MB consists of a clean matrix, similar to the associated samples that is known to be free of analytes of interest. The MB is processed with and carried through all preparation and analytical steps as the associated samples.

In general, contamination is suspected when the target analyte is detected in the MB above the reporting limit. Some programs may require evaluation of the MB to $\frac{1}{2}$ the reporting limit or the detection limit. When contamination is evident, the source is investigated and corrections are taken to reduce or eliminate it. Analytical results associated with MB that does not meet criteria are qualified in the final test report.

Other types of blanks that serve as negative controls in the process may include:

- Trip Blanks (VOA)
- Storage Blanks
- Equipment Blanks
- Field Blanks
- Calibration Blanks
- Cleanup Blanks
- Instrument Blanks

5.9.1.1.4 Laboratory Control Sample (LCS)

The LCS is positive control used to measure the accuracy of process in a blank matrix. The LCS is spiked by the laboratory with a known amount of analyte. The spike is a standard solution that is pre-made or prepared from a certified reference standard. The LCS is processed with and carried through all preparation and analytical steps as the associated samples.



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When the percent recovery (%R) of the LCS is within the established control limit, sufficient accuracy has been achieved. If not, the source of the problem is investigated and corrected and the procedure may be repeated. Analytical results associated with LCS that does not meet criteria are qualified in the final test report.

5.9.1.1.5 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

Matrix spikes measures the effect the sample matrix has on precision and accuracy of the determinative test method. The MS and MSD are replicates of a client sample that is spiked with known amount of target analyte.

Due to the heterogeneity of matrices even of the same general matrix type, matrix spike results mostly provide information on the effect of the matrix to the client whose sample was used and on samples of the same matrix from the same sampling site. Therefore, MS should be client-specific when the impact of matrix on accuracy and precision is a project data quality objective. When there is not a client-specified MS for any sample in the batch, the laboratory randomly selects a sample from the batch; the sample selected at random is called a "batch" matrix spike.

The MS/MSD results for percent recovery and relative percent difference are checked against control limits. Because the performance of matrix spikes is matrix-dependent, the result of the matrix spike is not used to determine the acceptability of the test.

5.9.1.1.6 Sample Duplicate (SD)

A sample duplicate is a second replicate of sample that is prepared and analyzed in the laboratory along another replicate. The SD is used to measure precision.

The relative percent difference between replicates are evaluated against the method or laboratory derived criteria for relative percent difference (RPD), when this criterion is applicable. If RPD is not met, associated test results are reported with qualification.

5.9.1.1.7 Surrogates

Surrogates are compounds that mimic the chemistry of target analytes but are not expected to occur naturally in real world samples. Surrogates are added to each sample and matrix QC samples (MS, MSD, SD) at known concentration to measure the impact of the matrix on the accuracy of method performance. Surrogates are also added to the positive and negative control samples (MB, LCS) to evaluate performance in a clean matrix, and included in the calibration standards and calibration check standards.

The percent recovery of surrogates is evaluated against method-specified limits or statistically derived in-house limits. Project-specific limits and/or program-specific limits are used when required. Results with surrogate



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recovery out of limits in samples are reported with qualification. Samples with surrogate failures can also be re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error.

5.9.1.1.8 Internal Standards

Internal Standards are compounds not expected to occur naturally in field samples. They are added to every standard and sample at a known concentration prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. The laboratory follows specific guidelines for the treatment of internal standard recoveries and further information can be found in the applicable laboratory SOP.

5.9.1.1.9 QC Acceptance Criteria and Control Limits

The QC acceptance criteria are specified in test method SOPs. The criteria in the SOP are based on the requirements in the published test method or regulatory program. When there are no established acceptance criteria, the laboratory develops acceptance criteria in accordance with recognized industry standards.

Some methods and programs require the laboratory to develop and use control limits for LCS, MS/MSD and surrogate evaluation. In laboratory developed limits are referred to as “in-house” control limits. In-house control limits represent ± 3 Standard Deviations (99% confidence level) from the average recovery of at least 20 data points generated using the same preparation and analytical procedure in a similar matrix.

See laboratory SOP ENV-SOP-GBUR-0054 *Control Charts and Acceptance Limits* for more information.

5.9.1.2 Proficiency Testing (PT)

The laboratory participates in interlaboratory proficiency testing (PT) studies to measure performance of the test method and to identify or solve analytical problems. PT samples measure laboratory performance through the analysis of unknown samples provided by an external source.

The PT samples are obtained from accredited proficiency testing providers (PTP) and handled as field samples which means they are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results during the duration of the study, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

The laboratory initiates an investigation and corrective action plan whenever PT results are deemed unacceptable by the PT provider.

The frequency of PT participation is based on the certification and accreditation requirements held by the laboratory.



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5.9.2 QC Corrective Action

When the results of QC are not within acceptance criteria or expectations for method performance, correction and corrective action(s) are taken per the specifications in the test method SOP. These actions may include retesting or reporting of data with qualification to alert the end user of the situation.

5.9.3 Data Review

The laboratory uses a tiered system for data review. The tiered process provides sequential checks to verify data transfer is complete; manual calculations, if performed, are correct, manual integrations are appropriate and documented, calibration and QC requirements are met, appropriate corrective action was taken when required, test results are properly qualified, process and test method SOPs were followed, project specific requirements were met, when applicable, and the test report is complete.

The sequential process includes three tiers referred to as primary review, secondary review, and administrative/completeness review.

Detailed procedures for the data review process are described in laboratory SOP ENV-SOP-GBUR-0150 *Data Review*. The general expectations for the tiered review process are described in the following sections:

5.9.3.1 Primary Review

Primary review is performed by the individual that performed the task. All laboratory personnel are responsible for review of their work product to assure it is complete, accurate, documented, and consistent with policy and SOPs.

Checks performed during primary review include but are not limited to:

- Verification that data transfer and acquisition is complete
- Manual calculations, if performed, are documented and accurate
- Manual integrations, if performed, are documented and comply with SOP ENV-SOP-CORQ-006 *Manual Integration*
- Calibration and QC criteria were met, and/or proper correction and corrective actions were taken, and data and test results associated with QC and criteria exceptions are properly qualified
- Work is consistent with SOPs and any other relevant instructional document such as SWI, program requirements, or project QAPP

5.9.3.2 Secondary Review

Secondary review is performed by qualified peer or supervisor. Secondary review is essentially a repeat of the checks performed during primary review by another person. In addition to the checks of primary review, secondary review includes chromatography review to check the accuracy of quantitative analyte identification.

5.9.3.3 Completeness Review



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Completeness review is an administrative review performed prior to release of the test report to the customer. Completeness review verifies that the final test report is complete and meets project specification. This review also assures that information necessary for the client's interpretation of results are explained in the case narrative or footnoted in the test report.

5.9.3.4 Data Audits

In addition to the 3 tier data review process, test reports may be audited by local QA to verify compliance with SOPs and to check for data integrity, technical accuracy, and regulatory compliance. These audits are not usually done prior to issuance of the test report to the customer. The reports chosen for the data audits are selected at random.

If any problems with the data or test results are found during the data audit, the impact of the nonconforming work is evaluated using the process described in Section 4.9.

Also see Section 4.14 for internal audits.

5.10 Reporting

5.10.1 General Requirements

The laboratory reports results of testing in a way that assures the results are clear, and unambiguous. All data and results are reviewed prior to reporting to assure the results reported are accurate and complete.

Test results are summarized in test reports that include all information necessary for the customer's interpretation of the test results. Additional information necessary to clarify the data or disclose nonconformance, exceptions, or deviations that occurred during the analytical process are also reported to the customer in the test report.

The specifications for test reports and electronic data deliverables (EDD) are established between the laboratory and the customer at the time the request for analytical services is initiated. The report specifications include the test report format, protocol for the reporting limit (RL), conventions for the reporting of results less than the limit of quantitation (LOQ), and specification for the use of project or program specific data qualifiers. Information about review of analytical service requests is provided in Section 4.4.

5.10.2 Test Reports: Required Items

Test Reports are prepared by the laboratory at the end of the testing process. The format of the report depends on the level of reporting requested by the customer. The laboratory offers a variety of standardized test report formats and can also provide custom test report formats, when necessary.

The level of detail required in the test report depends on the customer's needs for data verification, validation, and usability assessments that occur after the laboratory releases the test report to the customer. The test report formats offered by the laboratory provide gradient levels of detail to meet the unique needs of each customer. The laboratory project manager helps the customer select the test report format that best meets their needs. When a specific report format or protocol is required for a regulatory or program compliance, the laboratory project manager must ensure the test report selected meets those requirements.

Every test report issued by the laboratory includes each of the following items:



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- a) Title
- b) Name and phone number of a point of contact from the laboratory issuing the report.
- c) Name and address of the laboratory where testing was performed. When testing is done at multiple locations within network (IRWO), the report must clearly identify which network laboratory performed each test and must include the physical address of each laboratory.
- d) Unique identification of the test report and an identifier on each page of the report to link each page to the test report and clear identification of the end of the report.
- e) The name and address of the customer
- f) Identification of test methods used
- g) Cross reference between client sample identification number (Sample ID) and the laboratory's identification number for the sample (Lab ID) to provide unambiguous identification of samples.
- h) The date of receipt of samples, condition of samples on receipt, and identification of any instance where receipt of the samples did not meet sample acceptance criteria.
- i) Date and times of sample collection, receipt, preparation, and analysis.
- j) Test results and units of measurement, and qualification of results associated with QC criteria exceptions, and identification of reported results outside of the calibration range.
- k) Name, title, signature of the person(s) authorizing release of the test report and date of release.
- l) A statement that the results in the test report relate only to the items tested.
- m) Statement that the test report may not be reproduced except in full without written approval from the laboratory.

5.10.3 Test Reports: Supplemental Items

5.10.3.1 Supplemental Requirements

The following items are included in the test report when required or relevant:

- a) Explanation of departure from test method SOPs including, what the departure was and why it was necessary.
- b) Statistical methods used. (Required for Whole Effluent Toxicity)
- c) For solid samples, specification that results are reported on a dry weight or wet weight basis.
- d) Signed Affidavit, when required by client or regulatory agency.
- e) A statement of compliance / non-compliance with requirements or specifications (client, program, or standard) that includes identification of test results that did not meet acceptance criteria.
- f) When requested by the client, statement of estimated measurement uncertainty. In general, for environmental testing, estimated uncertainty of measurement is extrapolated from LCS control limits. Control limits incorporate the expected variation of the data derived from the laboratory's procedure. When the control limits



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are specified by the test method or regulatory program, the control limits represent the expected variation of the test method and/or matrices for which the test method was designed.

- g) Opinions and Interpretations.
- h) If a claim of accreditation/certification is included in the test report, identification of any test methods or analytes for which accreditation/certification is not held by the laboratory if the accrediting body offers accreditation/certification for the test method/analyte. The fields of accreditation/certification vary between agencies and it cannot be presumed that because accreditation/certification is not held that it is offered or required.
- i) Certification Information, including certificate number and issuing body.

5.10.3.2 Test Reports: Sampling Information

The following items are included in the test report when samples are collected by the laboratory or when this information is necessary for the interpretation of test results:

- a) Date of Sampling.
- b) Unambiguous identification of material samples.
- c) Location of sampling including and diagrams, sketches, or photographs.
- d) Reference to the sampling plan and procedures used.
- e) Details of environmental conditions at time of sample that may impact test results.
- f) Any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned.

5.10.4 Calibration Certificates

The laboratory does not perform calibration activities for its customers and calibration certificates are not offered or issued.

5.10.5 Opinions and Interpretations

The laboratory provides objective data and information to its customers of sufficient detail for their interpretation and decision making. Objective data and information is based solely on fact and does not attempt to explain the meaning (interpret) or offer a view or judgment (opinion). Sometimes the customer may request the laboratory provide opinion or interpretation to assist them with their decisions about the data.

When opinions and interpretations are included in the test report, the laboratory will document the basis upon which the opinions and interpretations have been made and clearly identify this content as opinion or interpretation in the test report.

Examples of opinion and interpretation include but are not limited to:

- The laboratory's viewpoint on how a nonconformance impacts the quality of the data or usability of results.
- The laboratory's judgment of fulfillment of contractual requirements.
- Recommendations for how the customer should use the test results and information.



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- Suggestions or guidance to the customer for improvement.

When opinions or interpretations are verbally discussed with the customer, the content of these conversations is summarized by the laboratory and kept in the project record.

5.10.6 Subcontractor Reports

When analytical work has been subcontracted to an organization external to PAS, the test report from the subcontractor is included in its entirety as an amendment to the final test report.

Note: Test results for analytical work performed within the PAS network may be merged into a single test report. The test report issued clearly identifies the location and address of each network location that performed testing and which tests they performed. (See 5.10.2)

5.10.7 Electronic Transmission of Results

When test results and/or reports are submitted to the customer through electronic transmission, follow the procedures established in this manual for confidentiality and protection of data.

5.10.8 Format of Test Reports

The test formats offered by the laboratory are designed to accommodate each type of analytical test method carried out by the laboratory and to minimize the possibility of misunderstanding or misuse of analytical results. The format of electronic data deliverables (EDD) follow the specifications for the EDD.

5.10.9 Amendments to Test Reports

Test reports that are revised or amended by the laboratory after date of release of the final test report to the customer are issued as a new test report that is clearly identified as an amendment or revision and that includes a reference to the originally issued final test report.

The customer is the organization doing business with PAS external to PAS.

Changes made to test results and data before the final test report is issued to the customer are not amendments or revisions, these are corrections to errors found during the laboratory's data verification and review process,

The laboratory's procedure for report amendments and revision are outlined in laboratory SWI ENV-SWI-GBUR-0035 *Reissued Reports*.

6.0 REVISION HISTORY

This Version:

Section	Description of Change
5.11	Removed the org charts.
7.4	Added Greensburg org chart. Added statement regarding Corp org chart.

This document supersedes the following documents:

Document Number	Title	Version
ENV-MAN-GBUR-0001	Quality Manual	02
ENV-MAN-GBUR-0001	Quality Manual	01



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7.0 APPENDICES

7.1 Appendix A: Certification / Accreditation Listing

The certifications / accreditation lists provided in this manual represent those that were held by the named location on the effective date of this manual. This information is subject to change without notice and must not be considered valid proof of certification or accreditation status. Current certificates are maintained by Local QA and a copy of the certificate is posted to PAS's eDMS Portal for access by all PAS employees. External parties should contact the laboratory for the most current information.

7.1.1 PAS-Greensburg

Authority	Certificate Number	Authority	Certificate Number
Alabama	41590	North Dakota	R-190
Arizona	AZ0734	Ohio	41249
Arkansas	NO ID	Oregon	PA200002
California	2950	Pennsylvania	65-00282
Colorado	NO ID	Puerto Rico	PA01457
Connecticut	PH-0694	Rhode Island	65-00282
Delaware	NO ID	S.Dakota	NO ID
DoD (ANAB)	I.2417	Tennessee	2867
Florida	E87683	Texas	T104704188-16-11
Georgia	C040	US Virgin Island	NO ID
Guam	NO ID	Utah	PA014572017-9
Hawaii	NO ID	Vermont	VT-0282
Idaho	NO ID	Virginia-VELAP	460198
Illinois	NO ID	Washington	C868
Indiana	NO ID	West Virginia DEP	143
Iowa	391	WV- DHHR	9964 C
Kansas	E-10358	Wisconsin	NO ID
Kentucky (Rad DW)	90133	Wyoming	8TMS-L
Kentucky (Rad WW)	90133	PaAAEL Membership	3048
L. A. Sanitation	10257	PA RAD License	PA-1057
Louisiana DEQ	4086	Compliance Agreement (PPQ Form 519)	P-Soil-03
Louisiana DHH	LA170007	USDA Soil Permit	P330-17-00091
Maine	PA01457	EPA Region 4 Rad DW	NA
Maryland	308		
Massachusetts	M-PA1457		
Michigan	NO ID		
Missouri	235		
Montana	Cert 0082		
Nebraska	NE-OS-29-14		
Nevada	PA014572017-1		
New Hampshire	2976		
New Jersey (Pace Pitt)	PA051		
New Mexico	PA01457		
New York	10888		
North Carolina	42706		



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7.2 Appendix B: Capability Listing

The capabilities listed in this Appendix were held by the location referenced on the effective date of this manual. This information is subject to change without notice. External parties should contact the laboratory for the most current information.

Table Legend:

- DW = Drinking Water
- NPW = Non-Potable Water
- SCM = Solid and Chemical Materials
- Waste = Non-Aqueous Phase Liquid (NAPL), Oil
- Tissue = Biota and Tissue

7.2.1 PAS-Greensburg

Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Diesel Range Organics (DRO)	EPA 8015B & 8015D			x	x	x	
Polychlorinated Biphenyls	EPA 8082 & 8082A			x	x	x	
Sulfur Cleanup	EPA 3660B			x	x	x	
Sulfuric Acid Cleanup	EPA 36655A			x	x	x	
ETPH (Connecticut Method)	CT ETPH			x	x	x	
EDB & DBCP	EPA 8011			x	x	x	
OC Pesticide Analysis by GC	EPA 8081B			x	x	x	
Determination of Metals by ICP	EPA 200.7 & 6010B/C/D			x	x	x	
Mercury Aqueous Digestion	EPA 245.1 & 7470A			x			
Mercury Prep (Solid & Semi-solid)	EPA 7471A/B				x	x	
Preparation Solid/Semisolid Samples for ICP Analysis	EPA 3050B				x	x	
Preparation of Aqueous Samples for ICP Analysis, Methods	EPA 3005A & 200.7			x			
TCLP/ZHE Extraction Procedure	EPA 1311				x	x	
Percent Moisture in Soils	ASTM D2974-87				x		
Extraction of PCBs from Wipes	EPA 3580A				x	x	
Solid Phase Extraction for TCLP Semivolatile	EPA 3535A				x	x	
Extraction of Organic Waste	EPA 3580A				x	x	
Microwave Extraction of Solid Samples for Organics	EPA 3546				x	x	
Separatory Funnel Extraction	EPA 3510C, 608 & 625			x			
SPLP & ZHE Extraction	EPA 1312				x	x	



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Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
ASTM Leach Extraction	ASTM 3987-12				x	x	
Analysis of samples for Gross Alpha and Gross Beta	EPA 900.0 & SM 7110C		x	x	x		
Analysis of Water Samples for Ra-228 Content	EPA 904.0		x	x			
Analysis of Water Samples for Total Alpha Radium	EPA 903.0 & SM 7500		x	x			
Analysis of Water Samples for Sr90 Content	EPA 905.0		x	x			
Analysis of Water Samples for Ra-226 Content	EPA 903.1		x	x			
Analysis of Samples for Alpha Emitting Actinides and Pu-241	ASTM Method D-3972-90 and HASL 300 Method U-02		x	x	x	x	
Sr-89/90 by Extraction Chromatography	ASTM D5811-08 (2013)			x	x	x	
Ni-59/Ni-63 Analysis Eichrom	Eichrom			x	x	x	
Analysis of Iron-55	ASTM D4922-89			x	x	x	
Analysis of samples for Technetium-99	Liquid Scintillation			x	x	x	
Alpha Spectroscopy Instrument Operation	Alpha Spec			x	x	x	
Tritium in Water - Distillation	EPA 906.0		x	x	x	x	
Liquid Scintillation Counting	Liquid Scintillation			x	x	x	
Gamma Spec Instrument Operations	EPA 901.1		x	x	x	x	
Neutron Dosimeter Wires by Gamma Spec	Gamma Spec			x	x	x	
Neutron Dosimeter Capsules for Cs-137 by Gamma Spec.	Gamma Spec			x	x	x	
Analysis of samples for I-129, Gamma Spec	Gamma Spec				x	x	
Total Uranium by KPA	ASTM D5174		x	x			
State of NJ 48Hr Gross Alpha Analysis	NJ ECLS-R-GA Rev 8		x				
Analysis of C-14	Liquid Scintillation			x	x		
Radon in Water by Liquid Scintillation	SM 7500-Rn B		x				
Dosimetry Foils for Niobium by Liquid Scintillation	ASTM E1297				x		
Gamma Spectroscopy Analysis - Prep	EPA 901.1		x	x	x		
Analysis of Polonium-210	HASL-300, P-01/02-RC Polonium		x	x	x	x	
Analysis of samples for Pb-210	GFPC		x	x	x	x	
Isotopic Radium Analysis in Water; Ra-226 and Ra-223/224 by Alpha Spec	Eichrom			x			
Analysis of Gaseous Samples for Radon	Alpha Scintillation			x			
Analysis of DW Samples for Gross Alpha and Gross Beta - GA EPA	EPA 900.0		x				



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Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Region 4							
Analysis of DW Samples for Ra-228, GA EPA Region 4	EPA 904.0		x				
Analysis of DW Samples for Total Alpha Radium - GA EPA Region 4	EPA 903.0		x				
Total Uranium in DW by KPA - GA EPA Region 4	ASTM D5174		x				
Coprecipitation Method for Gross Alpha Radioactivity in DW - GA EPA Region 4	SM 7110C-00		x				
Semivolatiles by GC/MS	EPA 8270D			x	x	x	
PAH's by SIM	EPA 8270D			x	x	x	
Preparation of EnCore Solid Samples and Terracore solid samples	EPA5035A				x		
Volatile Organic Compounds	EPA 8260B & 8260C			x	x	x	
Gasoline Range Organics (GRO)	EPA 8015B & 8015D			x	x	x	
pH in Water, Soil & Waste	SM 4500-H+B & EPA 9040B/C, 9045C/D			x	x	x	
Phenolics	EPA 420.1 & 9065			x	x		
BOD/CBOD	SM 5210-B-2011			x			
Sulfide	SM4500-S-2 F-2011			x			
Orthophosphate	SM 4500-P E-2011			x			
Hexavalent Chromium	EPA 7196A & SM 3500-Cr B-2011			x	x	x	
Non-Filterable Residue (Total Suspended Solids, TSS)	SM 2540D-2011			x			
Alkalinity	SM 2310B-2011			x			
Acidity - Titrimetric	SM 2320B-2011			x			
Reactive Cyanide and Sulfide	EPA SW-846 Chapters 7.3.3.2 (Cyanide) and 7.3.4.2 (Sulfide)				x	x	
Paint Filter Liquids Test	EPA 9095B					x	
Filterable Residue (TDS)	SM 2540C-2011			x			
Pensky-Martens Closed-Cup Method for Determining Ignitability EPA	EPA 1010A			x			
Turbidity	EPA 180.1			x			
Fluoride	SM4500-F-C-2011			x			
Total Kjeldahl Nitrogen (TKN)	EPA 351.2			x	x		
Color	SM 2120B-2011			x			



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Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
Nitrate, Nitrate/Nitrite	SM4500-NO3-F-2011			x			
Chloride (by Lachat)	SM 4500-Cl E-2011 and EPA 9251			x	x	x	
Chemical Oxygen Demand	EPA 410.4			x			
Ammonia	EPA 350.1			x			
Sulfite	SM 4500-SO32- B-2011			x			
Residual Chlorine	SM 4500-Cl G-2011			x			
Total Solids (TS) and Total Volatile Solids (TVS)	SM 2540B-2011, EPA 160.4			x	x		
Oil & Grease in water by SPE	EPA 1664A			x			
Dissolved Oxygen	SM4500-O G-2011			x			
Settleable Material	SM2540 F-2011			x			
Methylene Blue Activated Substances (MBAS)	SM 5540C-2011			x			
O&G/TPH Soxhlet (hexane)	EPA 9071B				x		
Cyanide: Total and Amenable	EPA Methods 335.4, 9010C, 9012B, 9014 and SM 4500 CN A/B/C/E/G/I			x	x	x	
Nitrite - Smartchem	SM 4500 NO2- B-2011			x			
Thiocyanate	SM4500-CN- M-2011			x			
Sulfate - Smartchem	ASTM D516-11 and EPA 9038			x	x		
Phosphorus - SmartChem	SM 4500-P B (5)-2011, 4500-P E-2011			x	x		
Ferrous Iron -SmartChem	SM3500-Fe B-2011			x			
Anions by Ion Chromatography, EPA 300.0	EPA 300.0			x			
Total Organic Carbon	SM 5310C and EPA 9060A			x			
Specific Conductance	EPA 120.1			x			
Fluoroborate	Manufacturer electrode user guide			x			
Alkaline Digestion for Hex Cr	EPA 3060A				x		
Free Cyanide	ASTM D7237-10			x			
Analysis of Ra-226 for Drinking Water - GA	EPA 903.1						
Volatile Organic Compounds	EPA 624.1			x			
Semivolatiles by GC/MS	EPA 625.1			x			
Pesticide/PCBs by EPA Method	EPA 608.3			x			
Glycols & Alcohols, EPA	EPA 8015D			x	x		
DRO - Sparrows Point	EPA 8015B/8015D			x	x		
Polychlorinated Biphenyls - Sparrows Point	EPA 8082-8082A			x	x		



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Parameter	Method	Matrices					
		Air	DW	NPW	SCM	Waste	Tissue
GRO - Sparrows Point	EPA 8015B			x	x		

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7.3 Appendix C: Glossary

This glossary provides common terms and definitions used in the laboratory. **It is not intended to be a complete list of all terms and definitions used.** The definitions have been compiled mostly from the TNI Standard and DoD QSM. Although this information has been reproduced with care, errors cannot be entirely excluded. Definitions for the same term also vary between sources. When the meaning of a term used in a laboratory document is different from this glossary or when the glossary does not include the term, the term and definition is included or defined in context in the laboratory document.

Term	Definition
3P Program	PAS-The continuous improvement program used by PAS that focuses on Process, Productivity, and Performance.
Acceptance Criteria	TNI- Specified limits placed on characteristics of an item, process, or service defined in requirement documents.
Accreditation	TNI- The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. DoD- Refers to accreditation in accordance with the DoD ELAP.
Accreditation Body (AB)	TNI- The organization having responsibility and accountability for environmental laboratory accreditation and which grants accreditation under this program. DoD- Entities recognized in accordance with the DoD-ELAP that are required to operate in accordance with ISO/IEC 17011, <i>Conformity assessment: General requirements for accreditation bodies accrediting conformity assessment bodies</i> . The AB must be a signatory, in good standing, to the International Laboratory Accreditation Cooperation (ILAC) mutual recognition arrangement (MRA) that verifies, by evaluation and peer assessment, that its signatory members are in full compliance with ISO/IEC 17011 and that its accredited laboratories comply with ISO/IEC 17025.
Accuracy	TNI- The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.
Activity, Absolute	TNI- Rate of nuclear decay occurring in a body of material, equal to the number of nuclear disintegrations per unit time. NOTE: Activity (absolute) may be expressed in becquerels (Bq), curies (Ci), or disintegrations per minute (dpm), and multiples or submultiples of these units.
Activity, Areic	TNI- Quotient of the activity of a body of material and its associated area.
Activity, Massic	TNI- Quotient of the activity of a body of material and its mass; also called specific activity.
Activity, Volumic	TNI- Quotient of the activity of a body of material and its volume; also called activity concentration. NOTE: In this module [TNI Volume 1, Module 6], unless otherwise stated, references to activity shall include absolute activity, areic activity, massic activity, and volumic activity.
Activity Reference Date	TNI- The date (and time, as appropriate to the half-life of the radionuclide) to which a reported activity result is calculated. NOTE: The sample collection date is most frequently used as the Activity Reference Date for environmental measurements, but different programs may specify other points in time for correction of results for decay and ingrowth.
Aliquot	DoD- A discrete, measured, representative portion of a sample taken for analysis.
American Society for Testing and Materials (ASTM)	An international standards organization that develops and publishes voluntary consensus standards for a wide range of materials, products, systems and services.
Analysis	DoD- A combination of sample preparation and instrument determination.
Analysis Code (Acode)	All the set parameters of a test, such as Analytes, Method, Detection Limits and Price.
Analysis Sequence	A compilation of all samples, standards and quality control samples run during a specific amount of time on a particular instrument in the order they are analyzed.
Analyst	TNI- The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.
Analyte	TNI- A substance, organism, physical parameter, property, or chemical constituent(s) for which an environmental sample is being analyzed. DoD- The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family and are analyzed together.



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Term	Definition
Analytical Method	DoD- A formal process that identifies and quantifies the chemical components of interest (target analytes) in a sample.
Analytical Uncertainty	TNI- A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.
Aliquot	DoD- A discrete, measured, representative portion of a sample taken for analysis.
Annual (or Annually)	Defined by PAS as every 12 months $\pm$ 30 days.
Assessment	TNI - The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its system to defined criteria (to the standards and requirements of laboratory accreditation). DoD- An all-inclusive term used to denote any of the following: audit, performance evaluation, peer review, inspection, or surveillance conducted on-site.
Atomic Absorption Spectrometer	Instrument used to measure concentration in metals samples.
Atomization	A process in which a sample is converted to free atoms.
Audit	TNI- A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.
Batch	TNI- Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same quality systems matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours or the time-frame specified by the regulatory program. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples.
Batch, Radiation Measurements (RMB)	TNI- An RMB is composed of 1 to 20 environmental samples that are counted directly without preliminary physical or chemical processing that affects the outcome of the test (e.g., non-destructive gamma spectrometry, alpha/beta counting of air filters, or swipes on gas proportional detectors). The samples in an RMB share similar physical and chemical parameter, and analytical configurations (e.g., analytes, geometry, calibration, and background corrections). The maximum time between the start of processing of the first and last in an RMB is 14 calendar days.
Bias	TNI- The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).
Blank	TNI and DoD- A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results (See Method Blank). DoD- Blank samples are negative control samples, which typically include field blank samples (e.g., trip blank, equipment (rinsate) blank, and temperature blank) and laboratory blank samples (e.g., method blank, reagent blank, instrument blank, calibration blank, and storage blank).
Blind Sample	A sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.
BNA (Base Neutral Acid compounds)	A list of semi-volatile compounds typically analyzed by mass spectrometry methods. Named for the way they can be extracted out of environmental samples in an acidic, basic or neutral environment.
BOD (Biochemical Oxygen Demand)	Chemical procedure for determining how fast biological organisms use up oxygen in a body of water.
Calibration	TNI- A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. 1) In calibration of support equipment, the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI); 2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.



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Calibration Curve	TNI- The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.
Calibration Method	A defined technical procedure for performing a calibration.
Calibration Range	DoD- The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.
Calibration Standard	TNI- A substance or reference material used for calibration.
Certified Reference Material (CRM)	TNI- Reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute.
Chain of Custody	An unbroken trail of accountability that verifies the physical security of samples, data, and records.
Chain of Custody Form (COC)	TNI- Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and type of containers; the mode of collection, the collector, time of collection; preservation; and requested analyses.
Chemical Oxygen Demand (COD)	A test commonly used to indirectly measure the amount of organic compounds in water.
Client (referred to by ISO as Customer)	Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations.
Code of Federal Regulations (CFR)	A codification of the general and permanent rules published in the Federal Register by agencies of the federal government.
Comparability	An assessment of the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.
Completeness	The percent of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is: $\% \text{ Completeness} = (\text{Valid Data Points} / \text{Expected Data Points}) * 100$
Confirmation	TNI- Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: second-column confirmation; alternate wavelength; derivatization; mass spectral interpretation; alternative detectors; or additional cleanup procedures. DoD- Includes verification of the identity and quantity of the analyte being measured by another means (e.g., by another determinative method, technology, or column). Additional cleanup procedures alone are not considered confirmation techniques.
Conformance	An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.
Congener	A member of a class of related chemical compounds (e.g., PCBs, PCDDs).
Consensus Standard	DoD- A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof.
Continuing Calibration Blank (CCB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method.
Continuing Calibration Check Compounds (CCC)	Compounds listed in mass spectrometry methods that are used to evaluate an instrument calibration from the standpoint of the integrity of the system. High variability would suggest leaks or active sites on the instrument column.
Continuing Calibration Verification	DoD- The verification of the initial calibration. Required prior to sample analysis and at periodic intervals. Continuing calibration verification applies to both external and internal standard calibration techniques, as well as to linear and non-linear calibration models.
Continuing Calibration Verification (CCV) Standard	Also referred to as a Calibration Verification Standard (CVS) in some methods, it is a standard used to verify the initial calibration of compounds in an analytical method. CCVs are analyzed at a frequency determined by the analytical method.
Continuous Emission Monitor (CEM)	A flue gas analyzer designed for fixed use in checking for environmental pollutants.
Continuous Improvement Plan (CIP)	The delineation of tasks for a given laboratory department or committee to achieve the goals of that department.
Contract Laboratory Program (CLP)	A national network of EPA personnel, commercial labs, and support contractors whose fundamental mission is to provide data of known and documented quality.



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Contract Required Detection Limit (CRDL)	Detection limit that is required for EPA Contract Laboratory Program (CLP) contracts.
Contract Required Quantitation Limit (CRQL)	Quantitation limit (reporting limit) that is required for EPA Contract Laboratory Program (CLP) contracts.
Control Chart	A graphic representation of a series of test results, together with limits within which results are expected when the system is in a state of statistical control (see definition for Control Limit)
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control. Control limit exceedances may require corrective action or require investigation and flagging of non-conforming data.
Correction	DoD- Action taken to eliminate a detected non-conformity.
Corrective Action	DoD- The action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence. A root cause analysis may not be necessary in all cases.
Corrective and Preventative Action (CAPA)	The primary management tools for bringing improvements to the quality system, to the management of the quality system's collective processes, and to the products or services delivered which are an output of established systems and processes.
Critical Value	TNI- Value to which a measurement result is compared to make a detection decision (also known as critical level or decision level). NOTE: The Critical Value is designed to give a specified low probability α of false detection in an analyte-free sample, which implies that a result that exceeds the Critical Value, gives high confidence ($1 - \alpha$) that the radionuclide is actually present in the material analyzed. For radiometric methods, α is often set at 0.05.
Customer	DoD- Any individual or organization for which products or services are furnished or work performed in response to defined requirements and expectations.
Data Integrity	TNI- The condition that exists when data are sound, correct, and complete, and accurately reflect activities and requirements.
Data Quality Objective (DQO)	Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.
Data Reduction	TNI- The process of transforming the number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more usable form.
Definitive Data	DoD- Analytical data of known quantity and quality. The levels of data quality on precision and bias meet the requirements for the decision to be made. Data that is suitable for final decision-making.
Demonstration of Capability (DOC)	TNI- A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. DoD- A procedure to establish the ability of the analyst to generate analytical results by a specific method that meet measurement quality objectives (e.g., for precision and bias).
Department of Defense (DoD)	An executive branch department of the federal government of the United States charged with coordinating and supervising all agencies and functions of the government concerned directly with national security.
Detection Limit (DL)	DoD- The smallest analyte concentration that can be demonstrated to be different than zero or a blank concentration with 99% confidence. At the DL, the false positive rate (Type 1 error) is 1%. A DL may be used as the lowest concentration for reliably reporting a detection of a specific analyte in a specific matrix with a specific method with 99% confidence.
Detection Limit (DL) for Safe Drinking Water Act (SDWA) Compliance	TNI- Laboratories that analyze drinking-water samples for SDWA compliance monitoring must use methods that provide sufficient detection capability to meet the detection limit requirements established in 40 CFR 141. The SDWA DL for radioactivity is defined in 40 CFR Part 141.25.c as the radionuclide concentration, which can be counted with a precision of plus or minus 100% at the 95% confidence level (1.96σ where σ is the standard deviation of the net counting rate of the sample).
Deuterated Monitoring Compounds (DMCs)	DoD- SIM specific surrogates as specified for GC/MS SIM analysis.
Diesel Range Organics (DRO)	A range of compounds that denote all the characteristic compounds that make up diesel fuel (range can be state or program specific).
Digestion	DoD- A process in which a sample is treated (usually in conjunction with heat and acid) to convert the target analytes in the sample to a more easily measured form.
Document Control	The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.



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Term	Definition
Documents	DoD- Written components of the laboratory management system (e.g., policies, procedures, and instructions).
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate (also known as Replicate or Laboratory Duplicate)	The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results of duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.
Electron Capture Detector (ECD)	Device used in GC methods to detect compounds that absorb electrons (e.g., PCB compounds).
Electronic Data Deliverable (EDD)	A summary of environmental data (usually in spreadsheet form) which clients request for ease of data review and comparison to historical results.
Eluent	A solvent used to carry the components of a mixture through a stationary phase.
Elute	To extract, specifically, to remove (absorbed material) from an adsorbent by means of a solvent.
Elution	A process in which solutes are washed through a stationary phase by movement of a mobile phase.
Environmental Data	DoD- Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology.
Environmental Monitoring	The process of measuring or collecting environmental data.
Environmental Protection Agency (EPA)	An agency of the federal government of the United States which was created for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress.
Environmental Sample	A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows: • Non Potable Water (Includes surface water, ground water, effluents, water treatment chemicals, and TCLP leachates or other extracts) • Drinking Water - Delivered (treated or untreated) water designated as potable water • Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents • Sludge - Municipal sludges and industrial sludges. • Soil - Predominately inorganic matter ranging in classification from sands to clays. • Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.
Extracted Internal Standard Analyte	Isotopically labeled analogs of analytes of interest added to all standards, blanks and samples analyzed. Added to samples and batch QC samples prior to the first step of sample extraction and to standards and instrument blanks prior to analysis. Used for isotope dilution methods.
Facility	A distinct location within the company that has unique certifications, personnel and waste disposal identifications.
False Negative	DoD- A result that fails to identify (detect) an analyte or reporting an analyte to be present at or below a level of interest when the analyte is actually above the level of interest.
False Positive	DoD- A result that erroneously identifies (detects) an analyte or reporting an analyte to be present above a level of interest when the analyte is actually present at or below the level of interest.
Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.
Field Measurement	Determination of physical, biological, or radiological properties, or chemical constituents that are measured on-site, close in time and sPAS to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.
Field of Accreditation	TNI- Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.
Field of Proficiency Testing (FoPT)	TNI- Matrix, technology/method, analyte combinations for which the composition, spike concentration ranges and acceptance criteria have been established by the PTIEC.



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Finding	TNI- An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement. DoD- An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive, negative, or neutral and is normally accompanied by specific examples of the observed condition. The finding must be linked to a specific requirement (e.g., this standard, ISO requirements, analytical methods, contract specifications, or laboratory management systems requirements).
Flame Atomic Absorption Spectrometer (FAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the fact that ground state metals absorb light at different wavelengths. Metals in a solution are converted to the atomic state by use of a flame.
Flame Ionization Detector (FID)	A type of gas detector used in GC analysis where samples are passed through a flame which ionizes the sample so that various ions can be measured.
Gas Chromatography (GC)	Instrumentation which utilizes a mobile carrier gas to deliver an environmental sample across a stationary phase with the intent to separate compounds out and measure their retention times.
Gas Chromatograph/ Mass Spectrometry (GC/MS)	In conjunction with a GC, this instrumentation utilizes a mass spectrometer which measures fragments of compounds and determines their identity by their fragmentation patterns (mass spectra).
Gasoline Range Organics (GRO)	A range of compounds that denote all the characteristic compounds that make up gasoline (range can be state or program specific).
Graphite Furnace Atomic Absorption Spectrometry (GFAA)	Instrumentation used to measure the concentration of metals in an environmental sample based on the absorption of light at different wavelengths that are characteristic of different analytes.
High Pressure Liquid Chromatography (HPLC)	Instrumentation used to separate, identify and quantitate compounds based on retention times which are dependent on interactions between a mobile phase and a stationary phase.
Holding Time	TNI- The maximum time that can elapse between two specified activities. 40 CFR Part 136- The maximum time that samples may be held prior to preparation and/or analysis as defined by the method and still be considered valid or not compromised. For sample prep purposes, hold times are calculated using the time of the start of the preparation procedure. DoD- The maximum time that may elapse from the time of sampling to the time of preparation or analysis, or from preparation to analysis, as appropriate.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Homologue	One in a series of organic compounds in which each successive member has one more chemical group in its molecule than the next preceding member. For instance, methanol, ethanol, propanol, butanol, etc., form a homologous series.
Improper Actions	DoD- Intentional or unintentional deviations from contract-specified or method-specified analytical practices that have not been authorized by the customer (e.g., DoD or DOE).
Incremental Sampling Method (ISM)	Soil preparation for large volume (1 kg or greater) samples.
In-Depth Data Monitoring	TNI- When used in the context of data integrity activities, a review and evaluation of documentation related to all aspects of the data generation process that includes items such as preparation, equipment, software, calculations, and quality controls. Such monitoring shall determine if the laboratory uses appropriate data handling, data use and data reduction activities to support the laboratory's data integrity policies and procedures.
Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)	Analytical technique used for the detection of trace metals which uses plasma to produce excited atoms that emit radiation of characteristic wavelengths.
Inductively Coupled Plasma- Mass Spectrometry (ICP/MS)	An ICP that is used in conjunction with a mass spectrometer so that the instrument is not only capable of detecting trace amounts of metals and non-metals but is also capable of monitoring isotopic speciation for the ions of choice.
Infrared Spectrometer (IR)	An instrument that uses infrared light to identify compounds of interest.
Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a calibration verification standard do not conform to the requirements of the method in use or at a frequency specified in the method.



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Initial Calibration Blank (ICB)	A blank sample used to monitor the cleanliness of an analytical system at a frequency determined by the analytical method. This blank is specifically run in conjunction with the Initial Calibration Verification (ICV) where applicable.
Initial Calibration Verification (ICV)	DoD- Verifies the initial calibration with a standard obtained or prepared from a source independent of the source of the initial calibration standards to avoid potential bias of the initial calibration.
Injection Internal Standard Analyte	Isotopically labeled analogs of analytes of interest (or similar in physiochemical properties to the target analytes but with a distinct response) to be quantitated. Added to all blanks, standards, samples and batch QC after extraction and prior to analysis.
Instrument Blank	A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination.
Instrument Detection Limits (IDLs)	Limits determined by analyzing a series of reagent blank analyses to obtain a calculated concentration. IDLs are determined by calculating the average of the standard deviations of three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day.
Interference, spectral	Occurs when particulate matter from the atomization scatters incident radiation from the source or when the absorption or emission from an interfering species either overlaps or is so close to the analyte wavelength that resolution becomes impossible.
Interference, chemical	Results from the various chemical processes that occur during atomization and later the absorption characteristics of the analyte.
Internal Standard	TNI and DoD- A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
International Organization for Standardization (ISO)	An international standard-setting body composed of representatives from various national standards organizations.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.
International System of Units (SI)	The coherent system of units adopted and recommended by the General Conference on Weights and Measures.
Ion Chromatography (IC)	Instrumentation or process that allows the separation of ions and molecules based on the charge properties of the molecules.
Isomer	One of two or more compounds, radicals, or ions that contain the same number of atoms of the same element but differ in structural arrangement and properties. For example, hexane (C ₆ H ₁₄) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.
Laboratory	A body that calibrates and/or tests.
Laboratory Control Sample (LCS)	TNI- (also known as laboratory fortified blank (LFB), spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes and taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to evaluate the performance of all or a portion of the measurement system.
Laboratory Duplicate	Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.
Laboratory Information Management System (LIMS)	DoD- The entirety of an electronic data system (including hardware and software) that collects, analyzes, stores, and archives electronic records and documents.
Learning Management System (LMS)	A web-based database used by the laboratories to track and document training activities. The system is administered by the corporate training department and each laboratory's learn centers are maintained by a local administrator.
Legal Chain-of-Custody Protocols	TNI- Procedures employed to record the possession of samples from the time of sampling through the retention time specified by the client or program. These procedures are performed at the special request of the client and include the use of a Chain-of-Custody (COC) Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory.



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Limit(s) of Detection (LOD)	TNI- The minimum result, which can be reliably discriminated from a blank with predetermined confidence level. DoD- The smallest concentration of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. At the LOD, the false negative rate (Type II error) is 1%. A LOD may be used as the lowest concentration for reliably reporting a non-detect of a specific analyte in a specific matrix with a specific method at 99% confidence.
Limit(s) of Quantitation (LOQ)	TNI- The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. DoD- The smallest concentration that produces a quantitative result with known and recorded precision and bias. For DoD/DOE projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.
Linear Dynamic Range	DoD- Concentration range where the instrument provides a linear response.
Liquid chromatography/tandem mass spectrometry (LC/MS/MS)	Instrumentation that combines the physical separation techniques of liquid chromatography with the mass analysis capabilities of mass spectrometry.
Lot	TNI- A definite amount of material produced during a single manufacturing cycle, and intended to have uniform character and quality.
Management	Those individuals directly responsible and accountable for planning, implementing, and assessing work.
Management System	System to establish policy and objectives and to achieve those objectives.
Manager (however named)	The individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual.
Matrix	TNI- The substrate of a test sample.
Matrix Duplicate	TNI- A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision.
Matrix Spike (MS) (spiked sample or fortified sample)	TNI- A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.
Matrix Spike Duplicate (MSD) (spiked sample or fortified sample duplicate)	TNI- A replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.
Measurement Performance Criteria (MPC)	DoD- Criteria that may be general (such as completion of all tests) or specific (such as QC method acceptance limits) that are used by a project to judge whether a laboratory can perform a specified activity to the defined criteria.
Measurement Quality Objective (MQO)	TNI- The analytical data requirements of the data quality objectives are project- or program-specific and can be quantitative or qualitative. MQOs are measurement performance criteria or objectives of the analytical process. Examples of quantitative MQOs include statements of required analyte detectability and the uncertainty of the analytical protocol at a specified radionuclide activity, such as the action level. Examples of qualitative MQOs include statements of the required specificity of the analytical protocol, e.g., the ability to analyze for the radionuclide of interest given the presence of interferences.
Measurement System	TNI- A method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s). DoD- A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the sample preparation and test and the operator(s).
Measurement Uncertainty	DoD- An estimate of the error in a measurement often stated as a range of values that contain the true value within a certain confidence level. The uncertainty generally includes many components which may be evaluated from experimental standard deviations based on repeated observations or by standard deviations evaluated from assumed probability distributions based on experience or other information. For DoD/DOE, a laboratory's Analytical Uncertainty (such as use of LCS control limits) can be reported as the minimum uncertainty.
Method	TNI- A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.



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Method Blank	TNI- A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and 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 for sample analyses.
Method Detection Limit (MDL)	TNI- One way to establish a Detection Limit; defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Method of Standard Additions	A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration.
Minimum Detectable Activity (MDA)	TNI- Estimate of the smallest true activity that ensures a specified high confidence, $1 - \beta$, of detection above the Critical Value, and a low probability β of false negatives below the Critical Value. For radiometric methods, β is often set at 0.05. NOTE 1: The MDS is a measure of the detection capability of a measurement process and as such, it is an a priori concept. It may be used in the selection of methods to meet specified MQOs. Laboratories may also calculate a "sample specific" MDA, which indicates how well the measurement process is performing under varying real-world measurement conditions, when sample-specific characteristics (e.g., interferences) may affect the detection capability. However, the MDA must never be used instead of the Critical Value as a detection threshold. NOTE 2: For the purpose of this Standard, the terms MDA and minimum detectable concentration (MDC) are equivalent.
MintMiner	Program used by PAS to review large amounts of chromatographic data to monitor for errors or data integrity issues.
Mobile Laboratory	TNI- A portable enclosed structure with necessary and appropriate accommodation and environmental conditions for a laboratory, within which testing is performed by analysts. Examples include but are not limited to trailers, vans, and skid-mounted structures configured to house testing equipment and personnel.
National Environmental Laboratory Accreditation Conference (NELAC)	See definition of The NELAP Institute (TNI).
National Institute of Occupational Safety and Health (NIOSH)	National institute charged with the provision of training, consultation and information in the area of occupational safety and health.
National Institute of Standards and Technology (NIST)	TNI- A federal agency of the US Department of Commerce's Technology Administration that is designed as the United States national metrology institute (or NMI).
National Pollutant Discharge Elimination System (NPDES)	A permit program that controls water pollution by regulating point sources that discharge pollutants into U.S. waters.
Negative Control	Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.
Nitrogen Phosphorus Detector (NPD)	A detector used in GC analyses that utilizes thermal energy to ionize an analyte. With this detector, nitrogen and phosphorus can be selectively detected with a higher sensitivity than carbon.
Nonconformance	An indication or judgment that a product or service has not met the requirement of the relevant specifications, contract, or regulation; also the state of failing to meet the requirements.
Not Detected (ND)	The result reported for a compound when the detected amount of that compound is less than the method reporting limit.
Operator Aid	DoD- A technical posting (such as poster, operating manual, or notepad) that assists workers in performing routine tasks. All operator aids must be controlled documents (i.e., a part of the laboratory management system).
Performance Based Measurement System (PBMS)	An analytical system wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner.
Physical Parameter	TNI- A measurement of a physical characteristic or property of a sample as distinguished from the concentrations of chemical and biological components.
Photo-ionization Detector (PID)	An ion detector which uses high-energy photons, typically in the ultraviolet range, to break molecules into positively charged ions.



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Term	Definition
Polychlorinated Biphenyls (PCB)	A class of organic compounds that were used as coolants and insulating fluids for transformers and capacitors. The production of these compounds was banned in the 1970's due to their high toxicity.
Positive Control	Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.
Post-Digestion Spike	A sample prepared for metals analyses that has analytes spike added to determine if matrix effects may be a factor in the results.
Power of Hydrogen (pH)	The measure of acidity or alkalinity of a solution.
Practical Quantitation Limit (PQL)	Another term for a method reporting limit. The lowest reportable concentration of a compound based on parameters set up in an analytical method and the laboratory's ability to reproduce those conditions.
Precision	TNI- The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.
Preservation	TNI and DoD- Any conditions under which a sample must be kept in order to maintain chemical, physical, and/or biological integrity prior to analysis.
Primary Accreditation Body (Primary AB)	TNI- The accreditation body responsible for assessing a laboratory's total quality system, on-site assessment, and PT performance tracking for fields of accreditation.
Procedure	TNI- A specified way to carry out an activity or process. Procedures can be documented or not.
Proficiency Testing (PT)	TNI- A means to evaluate a laboratory's performance under controlled conditions relative to a given set of criteria, through analysis of unknown samples provided by an external source.
Proficiency Testing Program (PT Program)	TNI- The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.
Proficiency Testing Provider (PT Provider)	TNI- A person or organization accredited by a TNI-approved Proficiency Testing Provider Accreditor to operate a TNI-compliant PT Program.
Proficiency Testing Provider Accreditor (PTPA)	TNI- An organization that is approved by TNI to accredit and monitor the performance of proficiency testing providers.
Proficiency Testing Reporting Limit (PTRL)	TNI- A statistically derived value that represents the lowest acceptable concentration for an analyte in a PT sample, if the analyte is spiked into the PT sample. The PTRLs are specified in the TNI FoPT tables.
Proficiency Testing Sample (PT)	TNI- A sample, the composition of which is unknown to the laboratory, and is provided to test whether the laboratory can produce analytical results within the specified acceptance criteria.
Proficiency Testing (PT) Study	TNI- a) Scheduled PT Study: A single complete sequence of circulation and scoring of PT samples to all participants in a PT program. The study must have the same pre-defined opening and closing dates for all participants; b) Supplemental PT Study: A PT sample that may be from a lot previously released by a PT Provider that meets the requirements for supplemental PT samples given in Volume 3 of this Standard [TNI] but that does not have a pre-determined opening date and closing date.
Proficiency Testing Study Closing Date	TNI- a) Scheduled PT Study: The calendar date by which all participating laboratories must submit analytical results for a PT sample to a PT Provider; b) Supplemental PT Study: The calendar date a laboratory submits the results for a PT sample to the PT Provider.
Proficiency Testing Study Opening Date	TNI- a) Scheduled PT Study: The calendar date that a PT sample is first made available to all participants of the study by a PT Provider; b) Supplemental PT Study: The calendar date the PT Provider ships the sample to a laboratory.
Protocol	TNI- A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) that must be strictly followed.
Qualitative Analysis	DoD- Analysis designed to identify the components of a substance or mixture.
Quality Assurance (QA)	TNI- An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.
Quality Assurance Manual (QAM)	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality Assurance Project Plan (QAPP)	A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.



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Term	Definition
Quality Control (QC)	TNI- The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality.
Quality Control Sample (QCS)	TNI- A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control.
Quality Manual	TNI- A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality System	TNI and DoD- A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance and quality control activities.
Quality System Matrix	TNI and DoD- These matrix definitions shall be used for purposes of batch and quality control requirements and may be different from a field of accreditation matrix: • Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device • Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts. • Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish or plant material. Such samples shall be grouped according to origin. • Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined. • Drinking Water: Any aqueous sample that has been designated a potable or potentially potable water source. • Non-aqueous liquid: Any organic liquid with <15% settleable solids • Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake. • Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.
Quantitation Range	DoD- The range of values (concentrations) in a calibration curve between the LOQ and the highest successively analyzed initial calibration standard used to relate instrument response to analyte concentration. The quantitation range (adjusted for initial sample volume/weight, concentration/dilution and final volume) lies within the calibration range.
Quantitative Analysis	DoD- Analysis designed to determine the amounts or proportions of the components of a substance.
Random Error	The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.
Raw Data	TNI- The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records.
Reagent Blank (method reagent blank)	A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.
Reagent Grade	Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.
Records	DoD- The output of implementing and following management system documents (e.g., test data in electronic or hand-written forms, files, and logbooks).



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Term	Definition
Reference Material	TNI- Material or substance one or more of whose property values are sufficiently homogenized and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.
Reference Method	TNI- A published method issued by an organization generally recognized as competent to do so. (When the ISO language refers to a “standard method”, that term is equivalent to “reference method”). When a laboratory is required to analyze by a specified method due to a regulatory requirement, the analyte/method combination is recognized as a reference method. If there is no regulatory requirement for the analyte/method combination, the analyte/method combination is recognized as a reference method if it can be analyzed by another reference method of the same matrix and technology.
Reference Standard	TNI- Standard used for the calibration of working measurement standards in a given organization or at a given location.
Relative Percent Difference (RPD)	A measure of precision defined as the difference between two measurements divided by the average concentration of the two measurements.
Reporting Limit (RL)	The level at which method, permit, regulatory and customer-specific objectives are met. The reporting limit may never be lower than the Limit of Detection (i.e., statistically determined MDL). Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting Limit and the MDL. DoD- A customer-specified lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.
Reporting Limit Verification Standard (RLVS)	A standard analyzed at the reporting limit for an analysis to verify the laboratory’s ability to report to that level.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.
Requirement	Denotes a mandatory specification; often designated by the term “shall”.
Retention Time	The time between sample injection and the appearance of a solute peak at the detector.
Revocation	TNI- The total or partial withdrawal of a laboratory’s accreditation by an accreditation body.
Sample	Portion of material collected for analysis, identified by a single, unique alphanumeric code. A sample may consist of portions in multiple containers, if a single sample is submitted for multiple or repetitive analysis.
Sample Condition Upon Receipt Form (SCURF)	Form used by sample receiving personnel to document the condition of sample containers upon receipt to the laboratory (used in conjunction with a COC).
Sample Delivery Group (SDG)	A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently.
Sample Receipt Form (SRF)	Letter sent to the client upon login to show the tests requested and pricing.
Sample Tracking	Procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a chain-of-custody form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.
Sampling	TNI- Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.
Selected Ion Monitoring (SIM)	A mode of analysis in mass spectrometry where the detector is set to scan over a very small mass range, typically one mass unit. The narrower the range, the more sensitive the detector. DoD- Using GC/MS, characteristic ions specific to target compounds are detected and used to quantify in applications where the normal full scan mass spectrometry results in excessive noise.
Selectivity	TNI- The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system.
Sensitivity	TNI- The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.
Serial Dilution	The stepwise dilution of a substance in a solution.
Shall	Denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification as long as the requirement is fulfilled.



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Should	Denotes a guideline or recommendation whenever noncompliance with the specification is permissible.
Signal-to-Noise Ratio (S/N)	DoD- A measure of signal strength relative to background noise. The average strength of the noise of most measurements is constant and independent of the magnitude of the signal. Thus, as the quantity being measured (producing the signal) decreases in magnitude, S/N decreases and the effect of the noise on the relative error of a measurement increases.
Source Water	TNI- When sampled for drinking water compliance, untreated water from streams, rivers, lakes, or underground aquifers, which is used to supply private and public drinking water supplies.
Spike	A known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.
Standard (Document)	TNI- The document describing the elements of a laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies.
Standard (Chemical)	Standard samples are comprised of a known amount of standard reference material in the matrix undergoing analysis. A standard reference material is a certified reference material produced by US NIST and characterized for absolute content, independent of analytical test method.
Standard Blank (or Reagent Blank)	A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.
Standard Method	A test method issued by an organization generally recognized as competent to do so.
Standard Operating Procedure (SOP)	TNI- A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks.
Standard Reference Material (SRM)	A certified reference material produced by the US NIST or other equivalent organization and characterized for absolute content, independent of analytical method.
Statement of Qualifications (SOQ)	A document that lists information about a company, typically the qualifications of that company to compete on a bid for services.
Stock Standard	A concentrated reference solution containing one or more analytes prepared in the laboratory using an assayed reference compound or purchased from a reputable commercial source.
Storage Blank	DoD- A sample of analyte-free media prepared by the laboratory and retained in the sample storage area of the laboratory. A storage blank is used to record contamination attributable to sample storage at the laboratory.
Supervisor	The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses.
Surrogate	DoD- A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.
Suspension	TNI- The temporary removal of a laboratory's accreditation for a defined period of time, which shall not exceed 6 months or the period of accreditation, whichever is longer, in order to allow the laboratory time to correct deficiencies or area of non-conformance with the Standard.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Target Analytes	DoD- Analytes or chemicals of primary concern identified by the customer on a project-specific basis.
Technical Director	Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory.
Technology	TNI- A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.
Test	A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate.
Test Method	DoD- A definitive procedure that determines one or more characteristics of a given substance or product.
Test Methods for Evaluating Solid Waste, Physical/ Chemical (SW-846)	EPA Waste's official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with RCRA regulations.



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Test Source	TNI- A radioactive source that is tested, such as a sample, calibration standard, or performance check source. A Test Source may also be free of radioactivity, such as a Test Source counted to determine the subtraction background, or a short-term background check.
The NELAC Institute (TNI)	A non-profit organization whose mission is to foster the generation of environmental data of known and documented quality through an open, inclusive, and transparent process that is responsive to the needs of the community. Previously known as NELAC (National Environmental Laboratory Accreditation Conference).
Total Petroleum Hydrocarbons (TPH)	A term used to denote a large family of several hundred chemical compounds that originate from crude oil. Compounds may include gasoline components, jet fuel, volatile organics, etc.
Toxicity Characteristic Leaching Procedure (TCLP)	A solid sample extraction method for chemical analysis employed as an analytical method to simulate leaching of compounds through a landfill.
Traceability	TNI- The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical conditions or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.
Training Document	A training resource that provides detailed instructions to execute a specific method or job function.
Trip Blank	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory reagent water and the blank is stored, shipped, and analyzed with its associated samples.
Tuning	A check and/or adjustment of instrument performance for mass spectrometry as required by the method.
Ultraviolet Spectrophotometer (UV)	Instrument routinely used in quantitative determination of solutions of transition metal ions and highly conjugated organic compounds.
Uncertainty, Counting	TNI- The component of Measurement Uncertainty attributable to the random nature of radioactive decay and radiation counting (often estimated as the square root of observed counts (MARLAP). Older references sometimes refer to this parameter as Error, Counting Error or Count Error (c.f., Total Uncertainty).
Uncertainty, Expanded	TNI- The product of the Standard Uncertainty and a coverage factor, k , which is chosen to produce an interval about the result that has a high probability of containing the value of the measurand (c.f., Standard Uncertainty). NOTE: Radiochemical results are generally reported in association with the Total Uncertainty. Either if these estimates of uncertainty can be reported as the Standard Uncertainty (one-sigma) or as an Expanded Uncertainty (k -sigma, where $k > 1$).
Uncertainty, Measurement	TNI- Parameter associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurand.
Uncertainty, Standard	TNI- An estimate of the Measurement Uncertainty expressed as a standard deviation (c.f., Expanded Uncertainty).
Uncertainty, Total	TNI- An estimate of the Measurement Uncertainty that accounts for contributions from all significant sources of uncertainty associated with the analytical preparation and measurement of a sample. Such estimates are also commonly referred to as Combined Standard Uncertainty or Total Propagated Uncertainty, and in some older references as the Total Propagated Error, among other similar items (c.f., Counting Uncertainty).
Unethical actions	DoD- Deliberate falsification of analytical or quality control results where failed method or contractual requirements are made to appear acceptable.
United States Department of Agriculture (USDA)	A department of the federal government that provides leadership on food, agriculture, natural resources, rural development, nutrition and related issues based on public policy, the best available science, and effective management.
United States Geological Survey (USGS)	Program of the federal government that develops new methods and tools to supply timely, relevant, and useful information about the Earth and its processes.
Unregulated Contaminant Monitoring Rule (UCMR)	EPA program to monitor unregulated contaminants in drinking water.
Validation	DoD- The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.



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Term	Definition
Verification	TNI- Confirmation by examination and objective evidence that specified requirements have been met. In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.
Voluntary Action Program (VAP)	A program of the Ohio EPA that gives individuals a way to investigate possible environmental contamination, clean it up if necessary and receive a promise from the State of Ohio that no more cleanup is needed.
Whole Effluent Toxicity (WET)	The aggregate toxic effect to aquatic organisms from all pollutants contained in a facility's wastewater (effluent).

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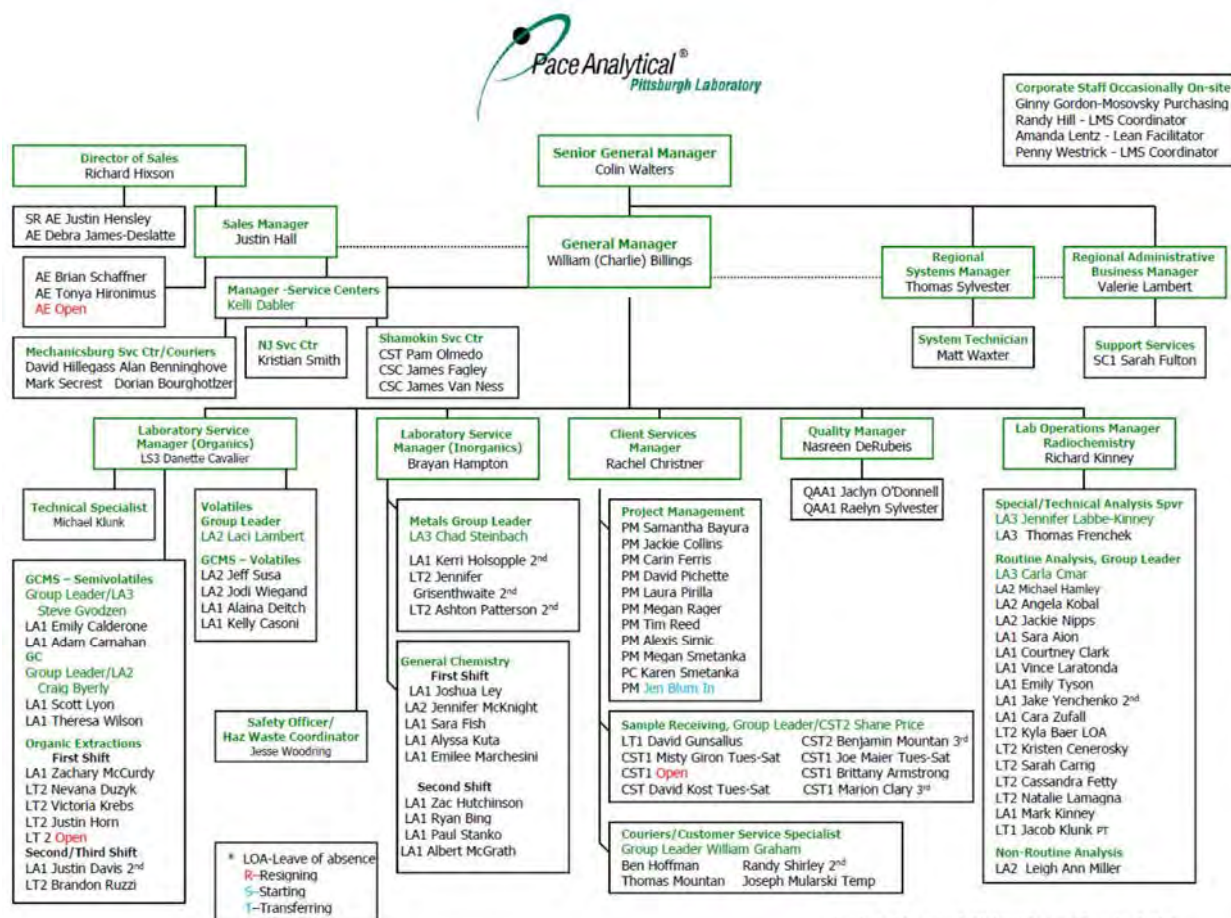
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7.4 Appendix D: Organization Chart(s)

7.4.1 Please contact the laboratory for current organization charts for corporate personnel.

7.4.2 PAS-Greensburg





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7.5 Appendix E: Equipment Listing

The equipment listed represents equipment were held by each location on the effective date of this manual. This information is subject to change without notice. External parties should contact the location for the most current information.

7.5.1 PAS-Greensburg

Equipment List: PAS-Greensburg

Description	Manufacturer	Model No.	Serial Number	Service Date	Condition	Location	Internal ID	Manual location
ICP	CETAC	6500	20090207	2009	New	Metals	ICP-2	At Instrument
ICP	CETAC	6500	1665DC132619	8/27/2013	New	Metals	ICP-3	At Instrument
Mercury Analysis	CETAC	Cetac	Quicktrace M-6100	3/3/2009	New	Metals	30HG1	At Instrument
Microwave	CEM Corp	MDS2100	ZR8160	Unknown	Unknown	Metals	NA	At Instrument
Balance	Mettler-Toledo	XS203S	B08050503	Unknown	Unknown	Metals	30BA13	At Instrument
Refrigerator #8	General Electric Company	TDX15SNSBRWH	AH774278	Unknown	Unknown	QA	NA	NA
IC	Dionex	ICS 1100	98100641E991001	10/1/2016	New	WC	30WTA4	At Instrument
Automated Spectrometer	Lachat	8500	150700001870	Unknown	New	WC	30WTA7	At Instrument
Automated Spectrometer	Lachat	8500	120400001408	NA	New	WC	30WTA5	At Instrument
Automated Spectrometer	Lachat	8500	101200001278	4/10/2019	Used	WC	30WTA9	At Instrument
Automated Spectrometer	SmartChem	Discrete Analyzer	W0602083	2008	New	WC	30WTA1	At Instrument
Spectrophotometer	Milton-Roy	SPEC 21D	3156129024	Unknown	Used	WC	30WET2	Online
Spectrophotometer	Milton-Roy	DR 5000	1259771	Unknown	New	WC	30WETF/30WET9	At Instrument
Rotary Piston Vacuum Pump for O&G	ANVER	PMP-4.3HP	NA	4/21/2017	New	WC	NA	NA
pH/Ion/Conductivity	Accumet	50	C0021230	Unknown	New	WC	30WET1	NA
pH/Ion/Conductivity	Accumet	50	C0019515	1/17/2019	New	WC	30WETH	At Instrument
pH/Ion/Conductivity	Accumet	Accumet AB250	AB92350833	6/16/2017	New	WC	30WETG	At Instrument



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Description	Manufacturer	Model No.	Serial Number	Service Date	Condition	Location	Internal ID	Manual location
pH/Ion/Conductivity	Orion Star	A215	X05092	Unknown	New	WC	30WETC	At Instrument
pH/Ion/Conductivity	Orion Star	A215	X08654	11/22/2019	Used	WC	30WETJ	At Instrument
Flashpoint	Precision	Flash Alert	NA	Unknown	New	WC	30WET6	At Instrument
Flashpoint	Koehler	K16203	K1620310180F	10/8/2019	New	WC	30WETI	At Instrument
MARS 230/60	CEM	907501	MD9413	2008	New	Oprep	NA	Online
TOC	OI Analytical	1030	D750788365	Feb-08	New	WC	30WTA2	At Instrument
TOC	Shimadzu	TOC-V WP	638-91064-12 (autosampler S/N: 638-93141-08)	Not in use	New	WC	30WTA8	Online
TKN block (new)	SCP SCIENTIFIC	HTC 1014220373	TSA1014061434	2015	New	WC	NA	At Instrument
TKN block (new)	SCP SCIENTIFIC	HTC 1014220373	TSA1018462201	7/24/2019	New	WC	NA	At Instrument
Turbidimeter	HF Scientific	Micro 100	200802069	2012	New	WC	30WET8	WC Dept
COD block	HACH	45600-00	910605052	Unknown	New	WC	COD001	None
COD block	HACH	45600-00	940100010288	Unknown	New	WC	COD002	None
Distillation block	NA	NA	NA	Unknown	Unknown	WC	DIST003	WC Dept
Distillation block	NA	NA	NA	Unknown	Unknown	WC	DIST004	WC Dept
Distillation block	NA	NA	NA	2008	New	WC	DIST005	WC Dept
Distillation block	NA	NA	NA	9/15/2017	New	WC	DIST006	WC Dept
TDS screening meter	Control Company	15-078-201	192323801	9/17/2019	New	WC	MTR001	At Instrument
Pressure Cooker	NA	NA	NA	Unknown	Unknown	WC	AC001	None
Pressure Cooker	NA	NA	NA	Unknown	Unknown	WC	AC002	None
Balance	Mettler	ML802	B329563586	Unknown	Unknown	WC	30BAL2	Online
Balance	Sartorius	BS 2105	40248175	Unknown	Unknown	WC	30BAL7	Online
Balance	Mettler	MS204S/03	B510684209	Unknown	Unknown	WC	30BAL8	Online
Balance	Keystone Scale	USS-DB55	1607051	2/25/2019	Used	WC	30BA27	Online
Balance	Keystone Scale	SP2001	B414466893	2/25/2019	Used	WC	30BA28	Online
Oven #3	Fisher Scientific	NA	NA	Unknown	Unknown	WC	OVN003	None
Oven #9	Thelco	NA	NA	Unknown	Unknown	WC	OVN009	None
Oven #10	Fisher Scientific	NA	NA	Unknown	Unknown	WC	OVN010	None
Oven #12	VWR	1350GM	11058409	2/25/2019	Used	WC	OVN012	None
Oven #15	VWR	1350GM	12040109	2/28/2019	Used	WC	OVN015	None
Oven #16	VWR	1350GM	12013609	5/29/2019	Used	WC	OVN016	None
Incubator #1	NA	NA	NA	Unknown	Unknown	WC	INC001	At Instrument
Incubator #7	NA	NA	NA	Unknown	Unknown	WC	INC007	At Instrument
Refrigerator #10	Kenmore	253.6072101	WA14800568	Unknown	Unknown	WC	NA	At Instrument
Refrigerator # 26	Beverage Air	C134	1515739	Unknown	Unknown	WC	NA	None
Freezer#43	Amana	NA	NA	Unknown	Unknown	Receiving	NA	NA
Refrigerator # 27	Kool IT	KSM42	1200WAB2014092	NA	New	Receiving	NA	NA



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Description	Manufacturer	Model No.	Serial Number	Service Date	Condition	Location	Internal ID	Manual location
			6010					
Refrigerator # 29	Kool IT	KSM42	1200WAB20141228055	Unknown	New	WC	NA	None
Refrigerator # 30	Kool IT	KSM42	1200WAB20141228056	Unknown	New	WC	NA	None
Refrigerator # 31	Kool IT	KSM42	KSM42150723001	Sep-15	New	WC	NA	None
Refrigerator # 32	Kool IT	KSM42	KSM42150719007	Sep-15	New	WC	NA	None
Refrigerator # 33	Kool IT	KSM42	KSM42150723008	Sep-15	New	WC	NA	None
Refrigerator # 34	Kool IT	KSM42	KSM42150723002	Sep-15	New	WC	NA	None
Refrigerator # 35	Kool IT	KSM42	KSM42150719028	Sep-15	New	WC	NA	None
Refrigerator # 36	Kool IT	KSM42	KGM42150527007	Sep-15	New	WC	NA	None
GC/MS	Hewlett-Packard	6890/5973	US82321858; oven US00024152	5/1/2002	Used	GCMS Semi	30MSS1	Online
GC/MS	Hewlett-Packard	6890N/5973Network	US01150089; oven US00035050	5/1/2002	Used	GCMS Semi	30MSS2	Online
GC/MS	Agilent	6890N/5973Network	US43146815; oven CN10435024	5/1/2002	Used	GCMS Semi	30MSS3	Online
GC/MS	Hewlett-Packard	6890/5975	US52420703; oven US10248098	10/14	Used	GCMS Semi	30MSS4	Online
GC/MS	Hewlett-Packard	6890A/5975B	US62744417; oven US00037743	10/15	Used	GCMS Semi	30MSS5	Online
GC/MS	Hewlett-Packard	oven model 7890A; MSD model 5975C	oven SN: CN11281016; MSD SN: US11483920	10/16	Used	GCMS Semi	30MSS6	Online
Refrigerator #1	Fisher Scientific	13-988-450RW	30330074	Unknown	Unknown	GCMS Semi	NA	None
Refrigerator #2	Fisher Scientific	TDX155NSBRHW	GH750959	Unknown	Unknown	GCMS Semi	NA	None
Refrigerator / Freezer #41	Isotemp	10FCEEFS	1162937201170920	Unknown	New	GCMS Semi	NA	None
Refrigerator/ new walk-in #42	Cold Vault	3678-3-L	DX1801915-01	5/7/2018	new	Receiving	NA	NA
GC	Hewlett-Packard	7890A	CN10041083	Unknown	Used	GC Semi	30GCS7	Online
GC	Hewlett-Packard	5890A	2643A11529	Unknown	Used	GC Semi	30GCS8	Online
GC	Hewlett-Packard	5890 Ser. II	3029A0193	Unknown	Used	GC Semi	30GCS9	Online



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Description	Manufacturer	Model No.	Serial Number	Service Date	Condition	Location	Internal ID	Manual location
GC	Agilent	6890	US10250070	Unknown	Used	GC Semi	30GCSA	Online
GC	Agilent	7890B	SN: CN14173047	1/17	Used	GC Semi	30GCSB	Online
GC	Agilent	7890B	SN: CN17253167 (Autosampler tray SN: CN17240018, injector SN: CN17240077)	8/10	new	GC Semi	30GCSC	Online
GC	Agilent	7890B	SN: CN17313056 (Autosampler SN: CN8174787)	Not in use	New	GC Semi	30GCSD	Online
Balance	Mettler-Toledo	PL6001E	B651482025	2/23/2017	New	GC Semi	30BA26	Online
GC/MS	Hewlett-Packard	6890/5973	DE00004512/US7 2821154	5/1/2002	Used	GCMS VOA	30MV2A-B	Online
GC/MS	Hewlett-Packard	6890/5973	US00032703/US94 223089	5/1/2002	Used	GCMS VOA	30MV3A-B	Online
GC/MS	Hewlett-Packard	6890/5973	US00007768/US70 820610	11/18/2006	Used	GCMS VOA	30MV4A-B	Online
GC/MS	Hewlett-Packard	6850/5975	CN11004009/US1 0050001	Unknown	Used	GCMS VOA	30MV5A-B	Online
GC/MS	Hewlett-Packard	6890A/5973N MS	US00040634/US10 360153	10/1/2015	Used	GCMS VOA	30MV6A-B	Online
GC/MS	NA	6890N/5975 MS	CN10539039/US5 3921127	7/16	Used	GCMS VOA	30MV7A-B	Online
P&T Autosampler 30MSV2	EST	Centurion	144061104	5/1/2002	Used	GCMS VOA	30MSV2	Online
P&T Concentrator 2-A	EST	Evolution	EV674060115	Unknown	New	GCMS VOA	30MSV2	Online
P&T Concentrator	EST	Evolution	EV675060115	Unknown	New	GCMS VOA	30MSV2	Online
P&T Autosampler 30MSV3	EST	Centurion	CENT233040307	5/1/2002	Used	GCMS VOA	30MSV3	Online
P&T Concentrator 3-A	Tekmar	3000	9924010	Unknown	New	GCMS VOA	30MSV3	Online
P&T Concentrator 3-B	Tekmar	3000	00060005	Unknown	New	GCMS VOA	30MSV3	Online
P&T Autosampler 30MSV4	EST	Centurion	CENT214101206	11/18/2006	Used	GCMS VOA	30MSV4	Online
P&T Concentrator 4-A	Tekmar	3000	94259003	11/18/2006	Used	GCMS VOA	30MSV4	Online
P&T Concentrator 4-B	Tekmar	3000	94264003	11/18/2006	Used	GCMS VOA	30MSV4	Online
P&T Autosampler 30MSV5	EST	Centurion	CENTS397112514	Unknown	New	GCMS VOA	30MSV5	Online
P&T Concentrator 5-A	EST	Evolution	EV234122809	Unknown	New	GCMS VOA	30MSV5	Online
P&T Concentrator 5-B	EST	Evolution	EV623100614	Unknown	New	GCMS VOA	30MSV5	Online
P&T Autosampler 30MSV6	EST	Centurion	CENTS397112514	10/1/2015	Used	GCMS VOA	30MSV6	Online



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P&T Concentrator 6-A	EST	Evolution	EV690070915	10/1/2015	Used	GCMS VOA	30MSV6	Online
P&T Concentrator 6-B	EST	Evolution	EV620092414	10/1/2015	Used	GCMS VOA	30MSV6	Online
P&T Autosampler 30MSV7	EST	Centurion	CENTS460063019	7/16	New	GCMS VOA	30MSV7	Online
P&T Concentrator 7-A	EST	Evolution	EV758063016	7/16	New	GCMS VOA	30MSV7	Online
P&T Concentrator 7-B	EST	Evolution	EV757063016	7/16	New	GCMS VOA	30MSV7	Online
Balance	HRB	1002TL	HR1409140	Unknown	Unknown	GCMS VOA	30BAL15	Online
Balance	Mettler	AE240	K89959	Unknown	Unknown	GCMS VOA	30BAL1	Online
GC	Hewlett-Packard	5890 Ser. II	3033A31116	5/1/2002	Used	GCMS VOA	30GCV1	Online
GC	Hewlett-Packard	6890 N	US10608040	3/16	Used	GCMS VOA	30GCV2	Online
GC	Hewlett-Packard	3890 Ser. II	3121A35926	Unknown	Used	GCMS VOA	No ID	Online
Refrigerator #4	Fisher Scientific	K89959/TB15SPFR	MG732472	Unknown	Unknown	GCMS VOA	NA	None
Refrigerator #18	TRUE	GDM-47	4503580	Unknown	Unknown	GCMS VOA	NA	None
Refrigerator #20 (Walk-in)	American Cooler Tech	NA	NA	Moved to receiving	New	Receiving	NA	NA
Refrigerator #38 (walk in)	Cold Vault	3678-3-L	DX1604122	8/16	New	GCMS VOA	NA	None
Freezer Chest #7	Kelvinator	NA	NA	Unknown	Unknown	GCMS VOA	NA	None
Muffle Furnace	Fisher Scientific	NA	NA	Unknown	Unknown	OPrep	OVN001	None
Refrigerator #40	Frigidaire	FFPA33L2SM	71601377	6/16/2017	New	OPrep	NA	None
Mechanical Shaker	J-Kem Scientific	Max-Q	NA	Unknown	Unknown	OPrep	NA	None
Rotator #1	NA	NA	NA	Unknown	Unknown	OPrep	NA	None
Rotator #2	NA	NA	NA	Unknown	Unknown	OPrep	NA	None
Rotator #3	NA	NA	NA	Unknown	Unknown	OPrep	NA	None
ZHE Tumbler #1	Millipore	34R4BFC1-23	0455NZML0008	Not in use	New	OPrep	NA	None
ZHE Tumbler #2	Millipore	34R4BFC1-23	4555N4003	Not in use	New	OPrep	NA	None
Hot Plate	Thermolyne	Cimarec3	NA	Unknown	Unknown	OPrep	NA	None
TurboVap II #6	Biotage	NA	NA	Unknown	Used	OPrep	NA	Online
TurboVap II #5	Caliper Life Sciences	NA	NA	2/18/2008	Used	OPrep	NA	Online
TurboVap II #3	Zymark	NA	TV9937N9099	2/18/2008	Used	OPrep	NA	Online
TurboVap II #4	Zymark	NA	TV9941N9146	2/18/2008	Used	OPrep	NA	Online
TurboVap II #7	Zymark	TurboVap II	NA	Not in use	Used	OPrep	NA	Online
TurboVap II #10	Zymark	ZW-8002	4045	8/8/2019	Used	OPrep	NA	Online
Centrifuge	Thermo Fisher Scientific	Survall ST-8	720016022706	2016	New	OPrep	NA	Online
Oven #6 (dry weights)	Fisher Scientific	Isotherm 500 Series	NA	Unknown	Unknown	OPrep	OVN006	None



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Description	Manufacturer	Model No.	Serial Number	Service Date	Condition	Location	Internal ID	Manual location
Oven #11	Fisher Scientific	NA	NA	Unknown	Unknown	OPrep	OVN011	None
Microwave 1	Mars Xpress	MARS 230/60/907501	MD9413	Unknown	Unknown	OPrep	NA	Online
Microwave 2	CEM Mars	MARS 6 230/60/910900	MJ5218	Unknown	Unknown	OPrep	NA	Online
Multi-tube Vortexer	Fisher Scientific	NA	170620003	8/15/2017	New	GC & GCMS Semi	NA	Online
Ultrasonic Bath	Fisher Scientific	Ultrasonic Bath 9.5L	BX0041461710	Unknown	Unknown	OPrep	NA	Online
pH/Ion/Conductivity	Accumet	AB15	NA	Unknown	Unknown	OPrep	NA	Online
pH/Ion/Conductivity	Accumet	AB150	AB92350773	6/19/2017	new	OPrep	NA	Online
Balance	Mettler	PL6001E	B614292857	Unknown	Unknown	OPrep	30BA16	Online
Balance	Mettler	ML802	B435978730	Unknown	New	OPrep	30BA12	Online
Balance	Mettler	PL602E	B615334699	Unknown	new	OPrep	30BA17	Online
Balance	Mettler	PL6001E	B725267510	Unknown	new	OPrep	30BA25	Online
Oven #6B	Isotemp	NA	NA	Unknown	Unknown	Rad	NA	NA
Oven #7	Fisher Scientific	NA	NA	Unknown	Unknown	Rad	NA	NA
Oven 13	Grieve	LR-271C	NA	Unknown	Unknown	Rad	NA	NA
Oven #14	VWR	1350GM	10048010	2/25/2019	Used	Rad	OVN014	NA
Refrigerator #22 (out of service)	Haier	10954	Not on Site	Jun-08	used	Rad	NA	NA
Refrigerator #37	Haier	HC17SW20RB	BA0A6VM0100TR FSW0983	1/13/2016	New	Rad	NA	NA
Balance	Denver Instruments	XP300	990366	Jun-08	used	Rad	30BA24	NA
Balance	Mettler	AE163	88919	May-10	used	Rad	88919	Online
Balance	Mettler-Toledo	MS3002S/03	B435969938	5/10/2016	New	Rad	B034176	Online
Balance (AS Area)	AND	GX8K	14900809	Feb-13	used	Rad	501949	NA
Balance (Sample Prep)	AND	GX8K	14900804	Feb-13	used	Rad	30BA19	NA
Balance	Denver Instrument Corp	A160	B034176	Feb-03	used	Rad	B034176	NA
Balance	Mettler	ME204E	B614292248	5/10/2016	New	Rad	30BA20	Online
Balance (Ra-228)	Mettler	ME204E	B610197175	5/10/2016	New	Rad	30BA21	Online
Balance (Ra-228)	Radwag	AS82220R2WIFI	501949	2/23/2017	Good	Rad	501949	NA
Balance (Spare)	Mettler	AE240	NA	Not in use	New	Rad	NA	Online
Balance	Mettler	ME4002E	B618430806	5/10/2016	new	Rad	30BA22	Online
Liquid Scintillation Counter	Packard	Tricarb 2900TR/LL	4CLC01	February-03	used	Rad	#2	Gamma count room
Alpha/Beta Counter	Berthold	LB-770	145103-1058	February-03	used	Rad	Det 1-10	GFPC count room



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Alpha/Beta Counter	Protean Instrument Corp	MPC9604	236529-BO	Jun-04	New	Rad	Det 11-14	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	236528-BO	Jun-04	New	Rad	Det 15-18	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	236527-BO	Jun-04	New	Rad	Det 19-22	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	521665	Aug-05	New	Rad	Det 23-26	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	521664	Aug-05	New	Rad	Det 27-30	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	521663	Aug-05	New	Rad	Det 31-34	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	521662	Aug-05	New	Rad	Det 35-38	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	NPC9604	15289409	Oct-15	New	Rad	Det 39-42	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	NPC9605	15289410	Oct-15	New	Rad	Det 43-46	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	NPC9606	15289411	Oct-15	New	Rad	Det 47-50	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	NPC9607	15289412	Oct-15	New	Rad	Det 51-54	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	16147442	Jun-16	New	Rad	Det 55-58	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	16147443	Jun-16	New	Rad	Det 59-62	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	16147444	Jun-16	New	Rad	Det 63-66	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	16147445	Jun-16	New	Rad	Det 67-70	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	16147446	Jun-16	New	Rad	Det 71-74	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	0619397	Not in use	Used	Rad	Det 75-78	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	320940	Not in use	Used	Rad	Det 79-82	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	06270106	Not in use	Used	Rad	Det 83-86	GFPC count room
Alpha/Beta Counter	Protean Instrument Corp	MPC9604	320939	Not in use	Used	Rad	Det 87-90	GFPC count room



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Description	Manufacturer	Model No.	Serial Number	Service Date	Condition	Location	Internal ID	Manual location
Radium Analysis (Radon Emenation)	Ludlum Measurements Inc.	Model 2200 Scaler	No tag (Detector A)	Feb-03	used	Rad	A	NA
Radium Analysis (Radon Emenation)	Ludlum Measurements Inc.	Model 2200 Scaler	245722 (Detector B)	Feb-03	used	Rad	B	NA
Radium Analysis (Radon Emenation)	Ludlum Measurements Inc.	Model 2200 Scaler	No tag (Detector C)	Feb-03	used	Rad	C	NA
Radium Analysis (Radon Emenation)	Ludlum Measurements Inc.	Model 2200 Scaler	245744 (Detector D)	Feb-03	used	Rad	D	NA
Radium Analysis (Radon Emenation)	Ludlum Measurements Inc.	Model 2200 Scaler	326506 (Detector E)	8/26/2016	New	Rad	E	NA
Radium Analysis (Radon Emenation)	Ludlum Measurements Inc.	Model 2200 Scaler	326509 (Detector F)	8/26/2016	New	Rad	F	NA
Radium Analysis (Radon Emenation)	Ludlum Measurements Inc.	Model 2200 Scaler	324512 (Detector G)	8/26/2016	New	Rad	G	NA
Radium Analysis (Radon Emenation)	Ludlum Measurements Inc.	Model 2200 Scaler	326498 (Detector H)	8/26/2016	New	Rad	H	NA
Radium Analysis (Radon Emenation)	Meter	Model 182	PR227468 (Detector A)	Feb-03	used	Rad	A	NA
Radium Analysis (Radon Emenation)	Meter	Model 182	PR083007 (Detector B)	Feb-03	used	Rad	B	NA
Radium Analysis (Radon Emenation)	Meter	Model 182	PR083010 (Detector C)	Feb-03	used	Rad	C	NA
Radium Analysis (Radon Emenation)	Meter	Model 182	PR261260 (Detector D)	Feb-03	used	Rad	D	NA
Radium Analysis (Radon Emenation)	Meter	Model 182	PR083011 (Detector E)	8/26/2016	Used	Rad	E	NA
Radium Analysis (Radon Emenation)	Meter	Model 182	PR083008 (Detector F)	8/26/2016	Used	Rad	F	NA
Radium Analysis (Radon Emenation)	Meter	Model 182	PR083005 (Detector G)	8/26/2016	Used	Rad	G	NA
Radium Analysis (Radon Emenation)	Meter	Model 182	PR083006 (Detector H)	8/26/2016	Used	Rad	H	NA
KPA	ChemChek	KPA-11	92-45050031	Feb-03	used	Rad	NA	Online
Gamma Counter	Canberra	IGC-4019	2676	Feb-03	used	Rad	Detector 40% A	Gamma count room
Gamma Counter (out of service)	Canberra	GX 5019	9005136	Feb-03	used	Rad	Detector 50% B	NA
Gamma Counter (out of service)	Canberra	GC 6020	9983922	Feb-03	used	Rad	Detector 60% C	NA
Gamma Counter	Canberra	GR 3521	2016166	Feb-03	used	Rad	Detector 35% D	Gamma count room
Gamma Counter	Ortec	GEM-100-S	46-P41426A	Mar-06	New	Rad	Detector #2	Gamma count room
Gamma Counter	Ortec	GEM-100P4-ST	46-TP41365A	Feb-03	used	Rad	Detector #5	Gamma count room