

A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch:

Environmental samples which 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 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. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank:

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. (ASQC)

Blind Sample:

A 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.

Calibration:

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

Calibration Curve:

The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method:

A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard:

A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):

A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30-2.2)

Chain of Custody:

An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC) [5.12.4]

Clean Air Act:

The enabling legislation in 42 U.S.C. 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and enforce them. (NELAC)

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/SUPERFUND):

The enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Compromised Samples:

Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (NELAC)

Confidential Business Information (CBI):

Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:

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

(NELAC)

Conformance:

An affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Corrective Action:

The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:

A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction:

The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency:

An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Detection Limit:

The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

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. (ASQC)

Duplicate Analyses:

The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Environmental Detection Limit (EDL):

The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be established initially and verified annually for each test method and sample matrix. (NELAC Radioanalysis Subcommittee)

Equipment Blank:

Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

External Standard Calibration:

Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA):

The enabling legislation under 7 U.S.C. 135 et seq., as amended, that empowers the EPA to register insecticides, fungicides, and rodenticides. (NELAC)

Federal Water Pollution Control Act (Clean Water Act, CWA):

The enabling legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Blank:

Blank prepared in the field by filling a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Testing:

NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required to submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff). (NELAC)

Finding:

An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding is normally a deficiency and is normally accompanied by specific examples of the observed condition. (NELAC)

Holding Times (Maximum Allowable Holding Times):

The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Inspection:

An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Internal Standard:

A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (NELAC)

Internal Standard Calibration:

Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:

A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Response:

Instrument response is normally expressed as either peak area or peak height however it may also reflect a numerical representation of some type of count on a detector (e.g. Photomultiplier tube, or Diode array detector) and is used in this document to represent all types.

Laboratory:

A defined facility performing environmental analyses in a controlled and scientific manner. (NELAC)

Laboratory Control Sample (however named, such as laboratory fortified blank, 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, taken through all preparation and analysis steps. Where there is no preparation taken for an analysis (such as in

aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), there is no LCS. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Note: NELAC standards allow a matrix spike to be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. (NELAC)

Laboratory Duplicate:

Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Least Squares Regression (1st Order Curve):

The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):

An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory dependent. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit.

Manager (however named):

The individual designed 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. (NELAC)

Matrix:

The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with ,<15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: 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 sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample):

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

Matrix spikes shall be performed at a frequency of one in 20 samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):

A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Matrix spike duplicates or laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document their procedure to select the use of an appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate. (QAMS)

Method Blank:

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. (NELAC)

Method Detection Limit:

The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

National Environmental Laboratory Accreditation Conference (NELAC):

A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP):

The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control:

Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

NELAC Standards:

The plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference. (NELAC)

Performance Audit:

The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS):

A set of processes 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. (NELAC)

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. (NELAC)

Precision:

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. (NELAC)

Preservation:

Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing:

A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC)
[2.1]

Proficiency Testing Program:

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. (NELAC)

Proficiency Test Sample (PT):

A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Quality Assurance:

An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

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. (EAP-QAD)

Quality Control:

The overall system of technical activities which purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample:

An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Manual:

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. (NELAC)

Quality System:

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 QA and QC (ANSI/ASQC-E-41994)

Quantitation Limits:

The maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)

Range:

The difference between the minimum and the maximum of a set of values. (EPA-QAD)

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. (QAMS)

Reference Material:

A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Method:

A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard:

A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Replicate Analyses:

The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement:

Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Resource Conservation and Recovery Act (RCRA):

The enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage, and disposal. (NELAC)

Safe Drinking Water Act (SDWA):

The enabling legislation, 42 USC 300f et seq. (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample Duplicate:

Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:

(Analytical chemistry) the capability of a test method or instrument to respond to a target substance of constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity:

The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

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.

If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number (at a minimum 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.. (NELAC)

Standard:

The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedures (SOPs):

A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM):

A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named):

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. (NELAC)

Surrogate:

A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit):

A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Director:

Individuals(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

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. (ISO/IEC Guide 2-12.1, amended)

Test Method:

An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Toxic Substances Control Act (TSCA):

The enabling legislation in 15 USC 2601 et seq., (1976) that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability:

The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

Uncertainty:

A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

United States Environmental Protection Agency (EPA):

The Federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends. (US-EPA)

Validation:

The process of substantiating specified performance criteria. (EPA-QAD)

Verification:

Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: 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.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Work Cell:

A well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Acronyms:

BS – Blank Spike
BSD – Blank Spike Duplicate
CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
CRS – Change Request Form
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DU – Duplicate
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
MDL – Method Detection Limit
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAC - National Environmental Laboratory Accreditation Conference
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 6.

Laboratory Certifications, Accreditations, Validations

TestAmerica Irvine maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

State	Agency	Program	License Number
CA	DHS-ELAP	HW	1197
CA	DHS-ELAP	WW, HW	17941 ¹
CA	DHS-ELAP	WW, HW	25362
CA	DHS-NELAP	DW, WW, HW	01108CA
AZ	DHS	DW, WW, HW	AZ0671
NV	DEP	DW, WW, RCRA	CA72
UT	DHS-ELCP	DW, WW,HW	DEL9492611022
WA	DOE	WW, HW	C2025
NM	DWB	DW	--
CNMI	DEQ	DW	--
GUAM	EPA	DW	--
HI	DOH	DW	--
--	ACIL	Seal Of Excellence	300
--	USDA	Foreign Soil	S-669307

¹ for Mobile lab (EPA # CA01103)

The certificates and parameter lists (which may differ) for each organization may be found on the corporate web site, the laboratory's public server, the final report review table, and in the following offices: QA, marketing, and project management.

Claims of Accreditation Status

TestAmerica Irvine has agreed to make only valid claims as to its accreditation/certification status by any authority by ensuring that the expiration dates are not exceeded and the method-specific scope or parameter lists are supportable, as required by each. Any false claims would be reported to that authority. The agreement covers the use of the authority's name, such as "Authority-Accredited," logo, or certificate number. The only valid proof of accreditation/certification is the current certificate and scope of the authority. It is the responsibility of the laboratory to make these documents available to all staff, and it is the staff's duty to reference only the current documents.

A report with scope and non-scope analytes may only be presented on the same report if the non-accredited results are clearly and unambiguously identified. No report with non-scope analytes may be associated with the logo, "Authority accredited" phrase, or the certificate number. Only the analytes specified by a unique method are valid within the scope. There shall be no intentional misleading of the users of the laboratory's services in this regard.

No opinions and/or interpretations based on results outside the laboratory's scope may be presented on a document referenced by "Authority-accredited, the logo, or the certificate number. If these are made, they must be written in a separate letter which is not endorsed by the authority.

The "Authority-accredited" logo may only be affixed to equipment calibrated by a laboratory that is accredited by the authority. If calibration labels contain the logo, they must also show the calibration laboratory's name or its certificate number, the instrument's unique identification, the date of the last calibration, and a cross-reference to the last calibration certificate.

Should the company decide to use the "Authority-accredited" logo in marketing activities, no misrepresentation may occur. Only reference to the accredited scope at a specific laboratory site is allowed. If any "Authority-accredited" language is used in proposals or quotations, any non-scope analytes must be clearly denoted as not accredited by that authority. The same is true for any use of laboratory letterhead with the "Authority-accredited" wording or logo. The logo may not be affixed to any material, item, product, part, or packaging, thereby implying accreditation status to that piece. In literature, any use of the logo must be positioned adjacent to the accredited laboratory's name and clearly state that the presence of the logo does not imply certification/approval of the products tested. At no time may the logo appear to suggest that a person is accredited. Misrepresentation of accreditation status is never allowed and must be reported if it occurs. If in doubt, the idea of the logo's use may be presented to the authority for approval.

If accreditation is terminated or suspended, the laboratory will immediately cease to use the "Authority-accredited" wording, the logo, or the certificate number reference in any way and inform clients impacted by the change.

Appendix 7. Data Qualifiers

Qualifier	Text	Usage Comments
-	Negative Ion Balance	
+	Positive Ion Balance	
<	Result is less than the indicated value.	Used only for Flashpoint
>	Result is greater than the indicated value.	Used only for Flashpoint
A-01	[Custom Value]	Type the qualifier in full sentences without abbreviations or uncommon acronyms. DO NOT USE ALL CAPS. AZ requires narrative.
A1	Too numerous to count.	Microbiology only (Put 'TNTC' in CSTM qualifier)
A10	Results based upon colony counts outside the acceptable range.	
A12	Atypical growth	
A13	Atypical growth appears to have a toxic effect on surrounding growth, thus affecting the plate count.	
A2	Sample incubation period exceeded method requirement.	Microbiology only (NDs ONLY)
A3	Sample incubation period was shorter than method requirement.	Microbiology only
A4	Target organism detected in associated method blank.	Microbiology only (NDs ONLY)
A5	Incubator/water bath temperature was outside method requirements.	Microbiology only
A6	Target organism not detected in associated positive control.	Microbiology only
A7	Micro sample received without adequate headspace.	Microbiology only (Coliforms)
A8	Result is greater than or equal to the indicated value.	Microbiology only. Won't really be used, 'CSTM' qualifier is used instead.
A9	Bacterial results confirmed	
B	Analyte was detected in the associated Method Blank.	Requires internal CAR. Flag method blank and all associated samples with positive hits. Do not flag blank for J-flag hits unless regulatory limit has been exceeded..
B-1	Analyte was detected in the associated method blank. Analyte concentration in the sample is greater than 10x the concentration found in the method blank.	20x for organics; Requires internal CAR.
B2	Non-target analyte detected in method blank and sample, producing interference.	Requires internal CAR.
B3	Target analyte detected in calibration blank at or above the method reporting limit.	Requires internal CAR.
B4	Target analyte detected in blank at/above method acceptance criteria.	AZ - Metals and IC only. Requires internal CAR
B5	Target analyte detected in method blank at or above the method reporting limit, but below the trigger level or MCL.	

Qualifier	Text	Usage Comments
B6	Target analyte detected in calibration blank at or above the method reporting limit, but below the trigger level or MCL.	
BQC	Reported for batch QC purposes only. See re-analysis (RE) for final result.	AZ requires narrative.
BQC1	Reported for batch QC purposes only. See original analysis for final result.	AZ requires narrative.
C	Calibration Verification recovery was above the method control limit for this analyte. Analyte not detected, data not impacted.	Flag all affected sample results. Corrective action, such as re-calibration, is required. Not to be used on a continuous basis.
C-1	Calibration Verification recovery was above the method control limit for this analyte, however the average % difference for all analytes met method criteria. See Calibration Summary form. [Custom Value]	Used for NDs unless reanalysis confirms sample causing interference. 8000B series methods only. Flag all affected sample results.
C-2	Calibration Verification recovery was below the method control limit for this analyte, however the average % difference for all analytes met method criteria. See Calibration Summary form. [Custom Value]	Used for NDs unless reanalysis confirms sample causing interference. 8000B series methods only. Flag all affected sample results.
C4	Calibration Verification recovery was below the method control limit for this analyte.	Corrective Action, such as re-calibration, is required. Not to be used on a continuous basis. Requires internal CAR.
C5	Calibration Verification recovery was below the method control limit for this analyte. An additional check standard was analyzed at the reporting limit to ensure instrument sensitivity at the reporting limit. Samples ND.	Corrective Action, such as re-calibration, is required. Not to be used on a continuous basis. CAR not required for 8000 methods if average %R meets criteria. AZ requires narrative.
C6	CCV recovery was below method acceptance limits. The sample could not be reanalyzed due to insufficient sample.	CAR required.
C-7	Calibration Verification recovery was below the method control limit due to matrix interference carried over from analytical samples. The matrix interference was confirmed by reanalysis with the same result.	Re-extraction and/or re-analysis required for all bracketed samples. Needs internal CAR.
C8	Calibration Verification recovery was above the method control limit for this analyte. A high bias may be indicated.	Requires internal CAR.
CBP	Calibration verification recovery for this analyte is outside of limits as stated in BP-GCLN Technical Requirements however the calibration verification meets the requirements as stated in the analytical method.	BP work only.
CE	Sample not homogenous.	
CF1	Confirmatory analysis not performed as required by the method.	Always use with N1
CF2	Confirmatory analysis was past holding time.	
CF3	Confirmatory analysis was past holding time. Original result not confirmed.	

Qualifier	Text	Usage Comments
CF5	The sample was originally analyzed with a positive result, however the reanalysis did not confirm the presence of the analyte.	Use for BP Ethanol Reporting
CIG	The % RSD for this compound was above 20%. The average % RSD for all compounds in the calibration met the 20% criteria specified in EPA method 8000B. See the attached Initial Calibration Criteria form.	For GC or HPLC 8000B series only. Used for NDs only.
CIN	The % RSD for this compound was above 15%. The average % RSD for all compounds in the calibration met the 15% criteria specified in EPA methods 8260B/8270C. See the attached Initial Calibration Criteria form.	For GCMS 8000B series only. Used for NDs only.
cl	Compound reported based on total Chlordane result being less than the reporting limit.	Special qualifier for client specific requirements. Do not use for Arizona clients.
CN1	The cyanide value was greater after chlorination than before chlorination due to the sample matrix. An additional Weak Acid Dissociable Cyanide analysis was performed.	AZ requires narrative.
CN2	The cyanide value was greater after chlorination than before chlorination due to the sample matrix.	AZ requires narrative.
CN3	Reactive sulfide results reported from total determination method.	
CN4	Amenable cyanide results reported from total determination method.	
CR	The carbon range of the fuel found in the sample = [Custom Value]	When requested, enter Carbon range of fuel at the prompt.
CSTM	[Cutom Value]	Use when results need to be reported as '<' or '>' or negative values. Enter exactly as it should appear on the report (e.g "> 50" or "-3.2", or "DNQ")
DNQ	Detected but not quantified.	For Boeing Project to use in conjunction with J flag. PM to add to report.
DR	Sample dried prior to screening.	
E	Concentration exceeds the calibration range and therefore result is semi-quantitative.	Use when re-analysis is for multiple dilutions.
E1	Concentration estimated. Analyte exceeded calibration range. Reanalysis not possible due to insufficient sample.	
E3	Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to holding time requirements.	
E8	Analyte reported to the MDL per project specification. Target analyte was not detected in the sample	
FT	This analysis was performed in the field by the sampler whose name appears on the attached Chain of Custody form.	

Qualifier	Text	Usage Comments
H	Sample analysis performed past method-specified holding time.	Requires client notification prior to release of data. Requires internal CAR.
H-1	Sample analysis performed past the method-specified holding time per client's approval.	MUST HAVE DOCUMENTED CLIENT APPROVAL. Requires internal CAR
H2	Initial analysis within holding time. Reanalysis for the required dilution was past holding time.	Requires client notification prior to release of data.
H3	Sample was received and analyzed past holding time.	Requires client notification prior to release of data.
H4	Sample was extracted past holding time, but analyzed within analysis holding time.	Requires client notification prior to release of data. Requires internal CAR.
H5	The sample was prepared outside of the required 8 hour holding time, however it was stored at >0° and <4°C and prepared within the method allowed 24 hour holding time.	For HPC only
H6	The sample was received at the laboratory either past, or with insufficient time remaining on, the required 8 hour holding time. However, it was stored at >0° and <4°C and prepared within the method allowed 24 hour hold time.	For HPC only
H8	The sample was extracted past the holding time.	
H9	Sample analysis performed past the EPA recommended holding time.	
H10	The holding time calculation is based on a sampling time of 00:00 on the sampling date noted on the Chain of Custody. No sampling time was provided to the laboratory.	For clients that won't give a sampling time
HFT	The holding time for this test is immediate. It was analyzed in the laboratory as soon as possible after receipt.	
HS	HS = Sample container contained headspace.	
HTI	The holding time for this test is immediate. The laboratory measurement, therefore, cannot be used for compliance purposes.	Arizona clients only (at this time). Use for pH, Temperature, Residual Chlorine, Dissolved Oxygen and Free Carbon Dioxide. AZ requires narrative.
I	Internal Standard recovery was outside of method limits. Matrix interference was confirmed.	
I2	Internal Standard recovery was outside of method limits.	Requires internal CAR
ID	Due to the low levels of analyte found in the sample, the analyte was qualitatively identified based on the compound's retention time and the presence of a single mass ion.	For GCMS when 2 mass ions cannot be detected. (e.g. low level TBA) AZ requires narrative.
ID2	Secondary ion abundance outside of method requirements. Identification based on analytical judgment	
J	Estimated value. Analyte detected at a level less than the Reporting Limit (RL) and greater than or equal to the Method Detection Limit (MDL). The user of this data should be aware that this data is	When, on a project specific basis, reporting results down to the MDL is required.

Qualifier	Text	Usage Comments
	of limited reliability.	
K	The sample dilutions set-up for the BOD analysis did not meet the oxygen depletion criteria of at least 2 mg/l. Therefore the reported result is an estimated value only.	
K-1	The sample dilutions set up for the BOD analysis failed to meet the criteria of a residual dissolved oxygen of at least 1 mg/l. Therefore the reported result is an estimated value only.	
K-2	The seed depletion was outside the method acceptance limits. Therefore, the reported result is an estimated value only.	
K-3	The dilution water D.O. depletion was > 0.2 mg/L.	
K-4	The seed depletion was not within method recommended limits. The LCS, which is a means of checking dilution water quality and seed effectiveness, was within acceptance limits. The acceptable LCS demonstrates that the data is valid.	
L	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was above the acceptance limits. Analyte not detected, data not impacted.	Flag all affected sample results. Requires internal CAR.
L1	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was above acceptance limits.	When there are positive hits. Requires internal CAR. Add N-1 or N-2 if for any additional clarification.
L2	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was below acceptance limits.	Use only if samples cannot be reanalyzed. Requires internal CAR. Add N-1 or N-2 if for any additional clarification.
L4	Laboratory Control Sample and/or Laboratory Control Sample Duplicate recovery was below the acceptance limits. A low bias to sample results is indicated.	Generally for BOD only. However it could be used for BP-Amoco if technical requirements are met and local clients are o.k. with it.
L6	Per the EPA methods, benzidine is known to be subject to oxidative losses during solvent concentration.	To be used for high or low recoveries.
M1	The MS and/or MSD were above the acceptance limits due to sample matrix interference. See Blank Spike (LCS).	Flag source sample AND MS and/or MSD only.
M2	The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).	Flag source sample AND MS and/or MSD only.
M-3	Results exceeded the linear range in the MS/MSD and therefore are not available for reporting. The batch was accepted based on acceptable recovery in the Blank Spike (LCS).	Analyte Qualifier in the LCS. AZ requires narrative.

Qualifier	Text	Usage Comments
M4	The sample required a dilution due to matrix interference. Because of this dilution, the matrix spike concentrations in the sample were reduced to a level where the recovery calculation does not provide useful information. See Blank Spike (LCS).	Must be diluted below Reporting Limit.
M5	Due to CCV failure, the MS/MSD results were not available for reporting. The batch was accepted based on acceptable recovery in the Blank Spike (LCS).	Generally a sample qualifier though it could be used as an analyte qualifier if some analytes are to be reported. AZ requires narrative.
M6	Matrix Spike recovery was outside the method control limits.	Do Not Use Anymore
M7	The MS and/or MSD were above the acceptance limits. See Blank Spike (LCS).	Internal CAR required. Add N-2 if Client CAR is needed.
M8	The MS and/or MSD were below the acceptance limits. See Blank Spike (LCS).	Internal CAR required. Add N-2 if Client CAR is needed.
M9	Matrix Spike recovery was high. Data Reported per ADEQ policy 0154.000	AZ Only. Use only if BS/BSD have acceptable Recovery AND RPD.
M10	Matrix Spike recovery was low. Data Reported per ADEQ policy 0154.000	AZ Only. Use only if BS/BSD have acceptable Recovery AND RPD.
M13	The sample spiked had a pH of less than 2. 2-Chloroethylvinylether degrades under acidic conditions.	
MCP	No results were reported for the MS and/or MSD due to a clogged autosampler port. Batch was accepted based on Blank Spike (LCS) recoveries.	Requires internal CAR. AZ requires narrative.
MEN	Unspiked sample results were determined from the sample portion received in an Encore sampler. The sample portions used for the MS/MSD were taken from an additional sample sleeve due to an insufficient number of Encore samplers supplied.	When insufficient Encores are available for MS/MSD. AZ requires narrative.
MHA	Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information. See Blank Spike (LCS).	Sample results > 4x spike level. Use whether or not the QC passes.
MNR	No results were reported for the MS/MSD. The sample used for the MS/MSD required dilution due to the sample matrix. Because of this, the spike compounds were diluted below the detection limit.	Use as sample qualifier on the LCS. AZ requires narrative.
MNR1	There was no MS/MSD analyzed with this batch due to insufficient sample volume. See Blank Spike/Blank Spike Duplicate.	Use when there is not enough sample available to analyze MS/MSD. Use as a sample qualifier on the LCS. LCSD must be analyzed too.
MNR2	Insufficient sample received to meet method QC requirements. See case narrative.	FOR AZ DRINKING WATERS ONLY.
MNR3	Insufficient sample received to meet method QC requirements.	
N1	See case narrative.	

Qualifier	Text	Usage Comments
N2	See corrective action report.	
Neg	The reported result is a negative value.	For Redox Potential only.
NFP	Non-fuel pattern present.	
P	The sample, as received, was not preserved in accordance to the referenced analytical method.	except for metals
P1	Sample received and analyzed without chemical preservation.	
P2	Sample received without chemical preservation, but preserved by the laboratory.	
P3	Sample was received above recommended temperature	
P4	Sample received in inappropriate sample container.	
P5	Insufficient sample received to meet method QC requirements.	
P6	Sample received unpreserved, however the sample was analyzed within 7 days per EPA recommendation.	For EPA 624
P7	Sample filtered in lab.	
P8	Sample unable to be adjusted to correct pH due to matrix.	
P9	This analyte has been shown to degrade upon preservation with HCl and cannot accurately be quantitated.	
P10	Sample received with chemical preservation; pH measured in lab >2	
P12	Sample received with chemical preservation; pH measured in lab >2	
pH	pH = [Custom value]	AZ requires narrative.
P-HS	Sample container contained headspace.	
QB	Quantitated against a Bunker C Oil standard.	Use as "Analyte Qualifier"
QC4	Quantitation begun immediately before the retention time of tert-Butanol (TBA).	Only for TPH when C4 carbon range is requested. Use as Analyte qualifier.
QCM	Quantitation begun immediately following the methanol peak.	Only for TPH when C4 carbon range is requested. Use as Analyte qualifier.
QD	Quantitated against a diesel fuel standard.	Use as "Sample Qualifier"
QG	Carbon range C6-C12 quantitated against a gasoline standard.	Use as "Analyte Qualifier" To be used with the analyte "Volatile Fuel Hydrocarbons".
QG1	Quantitated against a gasoline standard.	Use as "Analyte Qualifier" for any carbon range other than C6-C12
QJ	Quantitated against a jet fuel standard.	Use as "Sample Qualifier"
QM	Quantitated against a motor oil standard.	Use as "Sample Qualifier"
QMS	Quantitated against a mineral spirits standard.	Use as "Analyte Qualifier"
QP	Hydrocarbon result partly due to individual peak(s) in quantitation range.	Use when individual non-HC peaks are present.

Qualifier	Text	Usage Comments
qr	Qualitative result based on chromatographic comparison with a known standard.	
QS	Quantitated against a Stoddard solvent standard.	Use as "Sample Qualifier"
QT	Quantitated against a therminol standard.	Use as "Sample Qualifier"
QU	Unquantitated hydrocarbons present in the sample outside of the reported carbon range.	Use for EFH when there are HCs above the quantitation range.
QV	The molecular weight of 100 was used to convert Volatile Fuel Hydrocarbons from mg/m ³ to ppm by volume (ppmv).	
R	The RPD exceeded the method control limit due to sample matrix effects. The individual analyte QA/QC recoveries, however, were within acceptance limits.	Apply to MSD only
R-1	The RPD between the primary and confirmatory analysis exceeded 40%. Per method 8000B, the higher value was reported.	
R-2	The RPD exceeded the acceptance limit.	Narrative required for AZ. (narrative likely for all). Add N-2 if Client CAR is needed.
R-3	The RPD exceeded the acceptance limit due to sample matrix effects.	
R-4	Due to the low levels of analyte in the sample, the duplicate RPD calculation does not provide useful information.	Duplicates Only. NOT for MS/MSD.
R-6	The RPD calculation does not provide useful information due to varying sample weights when Encore samplers are used.	Encore Samples only.
R-7	LFB/LFBD RPD exceeded the method control limit. Recovery met acceptance criteria.	Apply to LCSD only.
R-9	Sample RPD exceeded the laboratory control limit.	For Sample Duplicates
R-10	The RPD between the primary and confirmatory analysis exceeded 40%. Per method 8000B, the lower value was reported due to apparent chromatographic problems.	
R-11	RPD exceeded the laboratory control limit. See case narrative.	When there are no "Method" Limits.
R-12	The RPD between the primary and confirmatory analysis exceeded 40%. Per method 8000C, the lower value was reported.	For labs referenceing 8000C-series methods.
RL1	Reporting limit raised due to sample matrix effects.	
RL2	Reporting limit raised due to high concentrations of hydrocarbons.	
RL3	Reporting limit raised due to high concentrations of non-target analytes.	
RL4	Reporting limit raised due to insufficient sample volume.	
RL5	Reporting raised due to high single peak analyte.	For TPH (DRO or GRO) only.

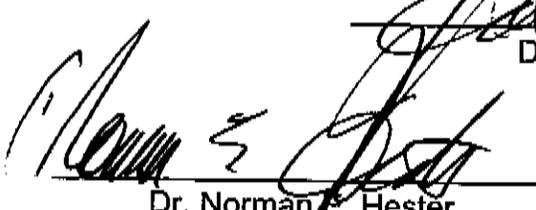
Qualifier	Text	Usage Comments
RL6	Reporting limit raised due to high toxaphene concentrations.	
RL7	Sample required dilution due to high concentration of target analyte.	
S	Analyzed by standard addition.	Will probably only be used for metals in rare instances.
S10	Insufficient sample available for reanalysis.	
SB	Sustained burning when exposed to open flame.	For Ignitability only. For all positive hits.
SC	Analytical results not reliable due to potential sample container contamination.	For low level Volatiles when contamination is the likely cause of the result.
SF	Reactive sulfide results reported from total determination method.	
T1	Method promulgated by EPA, but not by ADHS at this time	AZDHS only
T2	Cited ADHS licensed method does not contain this analyte as part of method compound list.	AZDHS only
T3	Method not promulgated by EPA or ADHS.	AZDHS only
T4	The cited licensed method does not contain this analyte as part of the method compound list.	Not for AZ work
T5	Less than the prescribed sample amount was available to perform the leachate extraction. The volume of extraction fluid was adjusted proportionately based on the method prescribed ratio of extraction fluid to sample weight.	Internal CAR not required if documented in extraction log.
T6	The temperature during the 18 hour TCLP extraction exceeded the 21-25 degrees C range stated in EPA Method 1311. The temperature range during the extraction was [Custom Value] degrees C.	Enter the temperature range during the extraction when prompted (e.g. 20-27)
T7	Tentatively identified compound. Concentration is estimated based on the closest internal standard.	
TMP	Temperature taken in the field at the time of sampling.	Only when lab is reporting temperature into an ELMNT analysis code.
TRM	Per client request, the sample was digested according to section 4.1.4 of "Methods for the Chemical Analysis of Water and Wastes 1983". The sample was subsequently prepared and analyzed by EPA Method 245.1.	Boeing Total Recoverable Mercury ONLY.
TRM	Per client request, the sample was digested according to section 4.1.4 of "Methods for the Chemical Analysis of Water and Wastes 1983". The sample was subsequently prepared and analyzed by EPA Method 245.1.	
TVO	Based on the sum of the concentrations of the compounds in the EPA 8010/8020 list.	Client Specific for special Air test code.
X	Exceeds regulatory limit.	PM to apply as an "Analyte" Qualifier.
X1	Exceeds specified permit limit.	PM to apply as an "Analyte" Qualifier.

Qualifier	Text	Usage Comments
Z	Due to sample matrix effects, the surrogate recovery was below the acceptance limits.	Re-extraction and/or re-analysis required unless chromatographic interference is clearly evident
Z1	Surrogate recovery was above acceptance limits.	AZ requires narrative. Requires internal CAR.
Z2	Surrogate recovery was above the acceptance limits. Data not impacted.	Only use if sample results are ND. Requires internal CAR
Z3	The sample required a dilution due to the nature of the sample matrix. Because of this dilution, the surrogate spike concentration in the sample was reduced to a level where the recovery calculation does not provide useful information.	Only if diuted below calibration range for surrogate. Surrogates in MB and LCS must pass to use this qualifier.
Z5	Due to sample matrix effects, the surrogate recovery was outside acceptance limits. Secondary surrogate recovery was within the acceptance limits.	For PCBs only. AZ requires narrative.
Z6	Surrogate recovery was below acceptance limits.	When reanalysis not performed. Rerquires internal CAR.
Z7	Surrogate recovery was high. Data reported per ADEQ policy 0154.000.	For AZDHS only. Surrogate passes in LCS but not in sample.
Z8	Surrogate recovery was low. Data reported per ADEQ policy 0154.000.	For AZDHS only. Surrogate passes in LCS but not in sample.
Z9	Unable to calculate surrogate recovery due to matrix interference.	Chromatographic interference must be clearly evident.
ZX	Due to sample matrix effects, the surrogate recovery was outside acceptance limits.	Use for High bias. Re-extraction and/or re-analysis required (Narrate for AZ)

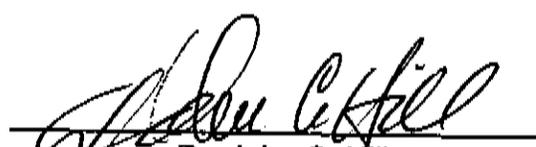
**QUALITY ASSURANCE AND
QUALITY CONTROL MANUAL FOR
ENVIRONMENTAL SAMPLE ANALYSIS**

STANDARD OPERATING PRACTICE

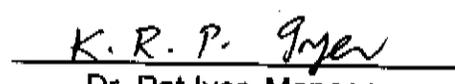
REVISION 13, SEPTEMBER 2006



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ANNUAL REVIEW OF Q.A./Q.C. MANUAL

Date	Reviewer	Revisions Made	
		Yes	No
4/96	Dr. Norman Hester	<input type="checkbox"/>	<input type="checkbox"/>
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9/06	Dr. Pat Iyer	<input type="checkbox"/>	<input type="checkbox"/>
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SECTION 1 – INTRODUCTION

Truesdail Laboratories Inc., has made an ongoing commitment to quality. Throughout our 70 year history, we have always provided the best analytical services. The purpose of this Manual is to describe our Quality Assurance System, specifically as it applies to environmental analyses. It is derived from a combination of a quality assurance project plan originally developed for the U.S. Army Corps of Engineers under regulation ER 1110-1-263, and QAMS-005/80 from the Office of Monitoring Systems and Quality Assurance of the U.S. Environmental Protection Agency and from our general Quality Assurance Manual, which was developed in accordance with ASPR 7-103.SQ and applicable portions of MIL-I-45208A.

Truesdail Laboratories' goal is to maintain both the functions of Quality Assurance and Quality Control in accordance with ISO-17025 and other criteria as set forth by client contracts and/or purchase orders.

The function of Quality Assurance is to provide an operating system under which Truesdail Laboratories can perform services and attest to the reliability of these services. This includes making precision measurements in analyzing, inspecting and testing solutions, materials, products, systems, and/or performing research.

The function of Quality Control is to control the quality of our services so that they meet the needs of all users. This includes methods, samples, control charts and evaluation of data so that the analyst and management can feel confident in their data.

The Quality Assurance and Quality Control Managers of the Laboratory shall establish and maintain the quality systems and all related forms and procedures.

It is the responsibility of the department heads to monitor their department to insure compliance with the instructions and procedures outlined by this manual and the Quality Department, and to insure that all equipment calibration is current.

Management will meet with its Quality Assurance staff and department heads on a regular basis to determine if the policies are implemented, evaluate problems, and make plans for the future as new testing and/or Quality Assurance and Control requirements become known. Findings from management reviews and actions that arise from them shall be recorded. Management shall ensure that the actions are carried out.

It is the responsibility of the Technical Director to oversee the Laboratories and mediate disputes between quality and performance of services.

This manual shall be reviewed annually by the Technical Director or his designee.

SECTION 2 – ORGANIZATION, STRUCTURE AND PERSONNEL

2.1 DESCRIPTION OF THE CORPORATION

Truesdail Laboratories, Inc. was founded in 1931 by Dr. Roger W. Truesdail as an independent consulting, testing, and research organization. Its activities in the fields of Chemistry, Microbiology, Engineering and Forensic Science are designed to benefit its clients by satisfying the clients' needs for professional technical talent and specialized laboratory facilities on an "on call" basis.

The Laboratories and offices occupy 40,000 square feet of floor space. The organization is staffed by chemists, microbiologists, engineers, metallurgists, and support personnel who are thoroughly experienced in the application of their special disciplines to the consulting, testing, and research requirements of our clients.

Professional engineer registration is for California. Memberships are maintained in professional, scientific, and technical societies and organizations including American Society for Testing and Materials (ASTM), and the American Chemical Society (ACS). A science reference library is maintained to provide readily available technical information. This includes books, scientific and technical periodicals, and in-house files of technical data developed in the course of thousands of unique investigations.

An accumulation of approvals from clients and regulatory agencies and a superior evaluation of performance standards have made Truesdail one of the nation's most competent and diversified laboratories.

Truesdail Laboratories, Inc. began as a one-man operation offering consultation, analysis and testing in the field of nutrition and food chemistry. There are now more than 80 employees engaged in a broad scope of activities.

2.2 LOCATION

Truesdail Laboratories, Inc.
14201 Franklin Avenue
Tustin, California 92780

(714) 730-6239, Fax (714) 730-6462, Web site: www.truesdail.com

Facility – 40,000 sq.ft.

2.3 PRIME FUNCTIONS

The Facility provides the space and laboratories for the professional staff members to conduct the analyses, tests, examinations and consultations in their fields of competence.

2.4 GEOGRAPHICAL AREA SERVED

Truesdail staff members have been engaged in field assignments throughout the U.S.A. and foreign countries as far away as Japan and Italy. However, the major portion of our work is in the Southern California area.

2.5 DEPARTMENTS AND LABORATORIES

Administration Group

- Human Resources Department
- Accounting Department
- Word Processing Department
- Purchasing Department
- Marketing Department

Quality Department

- Quality Assurance
- Quality Control

Safety Department

Analytical Services

- Water and Waste
- Instrumental Methods
 - GC/HPLC Laboratory
 - GC/MS Laboratory
 - Extraction Laboratory
- General Chemistry
- Microbiology
- Air Analysis
- Field Services
- Mechanical Testing Department

Racing Chemistry

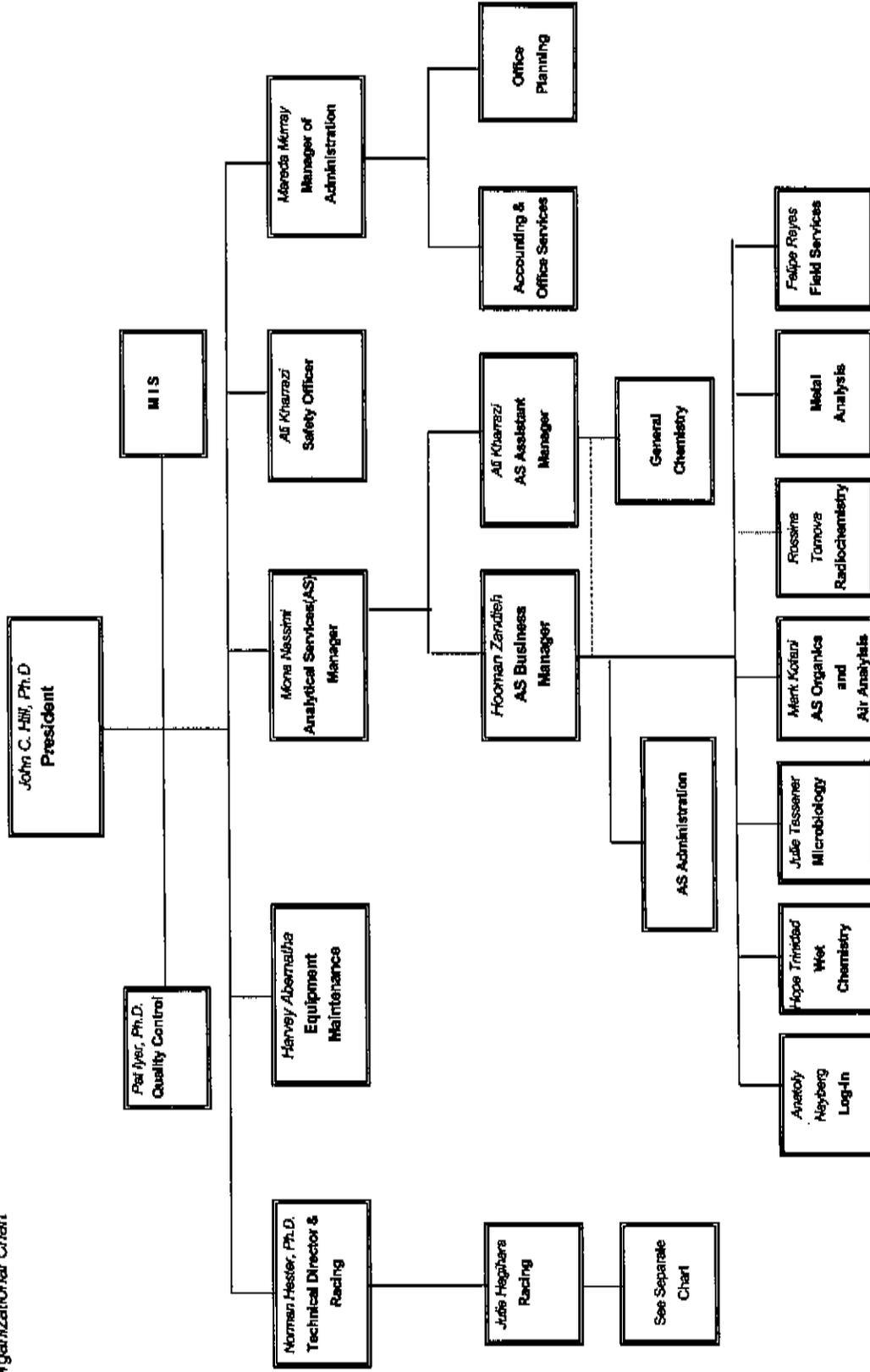
- Chromatography Laboratory
- Immunoassay Laboratory
- GC/MS Laboratory

Forensics Department

Facilities Department

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 ENVIRONMENTAL SAMPLE ANALYSIS

Organizational Chart



2.7 FUNCTIONS OF THE DEPARTMENTS AND LABORATORIES

2.7.1 Human Resources Department

Personnel consultation, and orientation.

2.7.2 Accounting Department

Financial statements, analysis, budgeting, and taxes.

2.7.3 Word Processing

Report processing, proposals, and standard operating procedures.

2.7.4 Purchasing Department

Coordinates ordering and buying lab supplies.

2.7.5 Marketing Department

Customer service and promotional material design.

2.7.6 Forensics

Accident reconstruction, failure analysis, product evaluation, industrial hygiene, mechanical, electrical, metallurgical, and safety investigations.

2.7.7 Safety Department

Safety manual, safety audits, safety meetings, material safety data sheets (MSDS), coordination and disposal of laboratory hazardous waste.

2.7.8 Quality Department

2.7.8.1 Quality Assurance

Preparation and maintenance of quality assurance manual; host for auditors and surveys; quality audits; quality training; review of safety related orders; monitors equipment calibrations.

2.7.8.2 Quality Control

Quality Control maintains contacts with regulatory agencies regarding new methods including EPA, DOHS and NIST, new approvals and renewals of certification processes which involve performance evaluation samples and on site visits. Stays abreast of new method developments and obtains copies of new methods. Quality Control provides Q.C. samples for on-going and normal routine Q.C. within the lab, and buys outside standards "check samples". Quality Control provides blind analytical check samples within the lab if there is a problem with a particular method or process. Monitors training of new analysts and cross training for existing analysts. Provides Q.C. documentation to clients upon request including annual and quarterly Q.C. reports with results of current Q.C. samples, Q.C. charts, written report, and cover letters. Quality Control is responsible for temperature charts and checking that thermometers are calibrated. Coordinates and controls a Q.C. data base, and provides statistical analysis when required. Quality Control performs special assignments such as analysis of complicated data and preparation of proposals.

2.7.9 Racing Chemistry Department

Routine Drug Testing for Equine, canine and human samples. Drug screening for stimulants, depressants, and medications. Special and legal samples.

2.7.10 Water and Waste Laboratory

Analysis and certification of drinking water. Analysis of industrial and municipal effluents for organic and inorganic pollutants. Analysis of soils and solid wastes for hazards. Project Management. Sample Control.

2.7.11 Field Services Department

Pickup and delivery services. Sample collection, flow studies, industrial waste monitoring, NPDES monitoring. Building inspections (ACM). Flow Meter Calibration.

2.7.12 Microbiology Laboratory

Bacteriological examinations, fungus contamination studies, fungus and bacteria resistance. Product efficacy testing. Asbestos determinations. Particle counts. Food contamination studies. Microscopic evaluations.

2.7.13 Instrumental Methods Department

Organic chemical analysis with modern instrumentation. Gas Chromatography, Gas Chromatography/Mass Spectrometry, High Pressure Liquid Chromatography, and UV Spectrometry.

2.7.14 Air Analysis Laboratory

Source testing and process flows of stacks on boilers, dryers and reactors. Efficiency tests on scrubbers, incinerators, precipitators and absorbers.

2.7.15 General Chemistry Laboratory

Routine wet chemistry. Environmental exposure testing. Microanalytical chemistry. Penetrant qualifications. Lubricating oil and fuel analysis. Physical properties. Fourier transform infra-red (FTIR) spectrometry. Special investigations.

2.7.16 Mechanical Testing Department

Physical and chemical properties analysis for metals, wood, rubber, plastics and composites. Product safety and qualification testing for furniture, chairs, service equipment, ladders and other assemblies. Microphotography. Laboratory facilities for consultants and legal investigations.

2.7.17 Facilities Department

Maintenance and repair of building and equipment. Trouble-shoots instruments that are malfunctioning and coordinates service contracts.

2.8 PERSONNEL

The following personnel are directly involved in the process of ensuring the collection of valid data for environmental reports. The "List of Personnel" is maintained in Appendix A. This is non-mandatory information which will be updated upon review.

2.8.1 General Management

President – responsible for company direction, policies, and management protocols.

Controller – responsible for all accounting functions and office procedures. Reports to the President.

Technical Director – oversees all technical and laboratory activities. Reports to the President.

Manager of Analytical Services – responsible for direction of Environmental Services Group which includes the Water and Waste, Instrumental Methods, General Chemistry, Microbiology, Air Analysis, and Field Services Department. Reports to the President.

Chief Racing Chemist – responsible for direction of the Racing Chemistry Department which includes the Racing Laboratory. Reports to the Technical Director.

Chief Microbiologist – responsible for direction of the Microbiology Laboratory. Reports to the Manager of Analytical Services.

Department Manager – responsible for all personnel assigned to his/her department. Reports to the Manager of Analytical Services, except for department manager for racing chemistry, who reports to the Technical Director.

Project Manager – responsible for all jobs accepted or assigned to their area of expertise.

2.8.2 General Personnel

Registered Professional Engineer - Staff engineer responsible for conducting engineering and legal investigations involving special talents. Reports to the Technical Director.

Quality Assurance/Quality Control – Reviews quality related documents requiring the President's signature. Responsible for developing implementing and monitoring quality assurance and control activities, and ensuring conformance with department managers. Reports to the President.

Hazardous Waste Manager – Responsible for guidance in the labeling, storage, disposal, associated paperwork, regulations and permits regarding hazardous waste generated by the laboratories. Reports to the Technical Director and/or the President.

Assistant Manager – Responsible for the operation of his/her respective department and the responsibilities of the Department Manager/Supervisor in his/her absence. Reports to their Department Manager.

Senior Chemist, and Group Leader – responsible for leading and managing other less experienced persons in the best method to use on each assignment.

Test Engineer - responsible for conducting tests as assigned. Reports to the department Manager/Supervisor and/or Assistant Manager.

Chemist – responsible for conducting chemical analysis and tests as assigned. Reports to the department Manager/Supervisor and/or Assistant Manager.

Technician – responsible for applying his special skills to assist those responsible for the assignment. Reports to the department Manager/Supervisor and/or Assistant Manager.

2.9 JOB TRAINING PROGRAMS

Technical employee training is covered by SOP 5.11, rev. 10/98.

2.9.1 New Employee Training

2.9.1.1 Program Administration

New employee training programs are administered by the immediate supervisor of the activity in which the new employee is assigned.

2.9.1.2 Methods of Determining Job Competence

Supervisors will observe and check the work product for errors. Also "special" samples may be assigned to the new employee to check agreement of his data to a known value.

2.9.2 Job Training for Full-time Employees

2.9.2.1 Special Courses and Training Sessions

These will be utilized as required.

2.9.2.2 Quality System

All personnel connected with testing and calibration activities shall familiarize themselves with the quality documentation and implement the policies and procedures in their work.

2.9.2.3 Documentation

It is the responsibility of each employee to document his/her training in new methods and in using new equipment. This is to be done by taking notes and organizing them into a notebook, using a job training notebook, or maintaining them in his/her laboratory data record. The Department Manager shall maintain a file documenting analyst training and proficiency.

2.9.3 Quality Training Program

The Quality Department will meet with the department managers. They will review any quality issues, requirements or problems which the department managers are responsible for, and determine the need for additional training of personnel. They will review how the quality system is working and determine if changes are needed. The Quality Assurance Manager shall keep a log of these meetings and note any discussion pertaining to quality assurance.

2.9.4 Certification Program Training

Individual records of all employees specified in product certification must also be kept. This includes records for managers, and directors involved with the certification program.

2.10 PERSONNEL QUALIFICATION

2.10.1 General Management

Each member of the technical management team shall have a minimum of a bachelors degree in science or engineering with applicable professional license or certificates in one or more fields which he directs. He must demonstrate capability in applicable field. Each is a full time employee of the Laboratory.

2.10.2 Technical Director

The Technical Director shall have as a minimum a Ph.D. degree in the physical sciences with applicable professional license or certificates in one or more fields which he directs and five years or more experience in one or more fields which he directs. Must demonstrate capability in applicable field. Must be a full time employee. Affiliations with technical and professional societies pertinent to field shall be maintained.

2.10.3 Department Manager or Supervisor

A Department Manager or Supervisor shall have a bachelors degree or higher in the physical sciences or biological science, three years or more experience relevant to the technology supervised. They are fulltime employees with affiliations with technical and professional societies pertinent to field.

2.10.4 Scientific Staff

The staff member shall have a bachelors degree or higher pertinent to his field of work. Should be working towards or have achieved any applicable license or certificate. As a minimum, he should have on-the-job training by supervisor or predecessor and demonstrate capability in applicable fields.

2.10.5 Technicians

The Technician shall be qualified by education and/or experience to perform inspections, testing or analysis. Should be high school graduate with some college training. Should strive for any applicable certificates in their field. Should have sufficient on-the-job training and/or trade school. The Technician must demonstrate competence in assigned work.

SECTION 3 – ENVIRONMENTAL QUALITY ASSURANCE PROGRAM

3.1 QUALITY ASSURANCE OBJECTIVES

The laboratory shall determine, where feasible, the accuracy and precision of all analyses performed.

Reporting Limits

Linear calibration ranges (or working calibration ranges) and method detection limits (MDLs) shall be established and statistically verified for each method as a part of the method validation process at least annually and whenever there is a change in methodology or instrumentation, linear calibration ranges and MDLs shall be reestablished and verified. For methods with stated MDLs, demonstration of ability to achieve such MDL is required.

A minimum of three calibration standards which bracket sample concentration and a blank should be used to construct a calibration curve.

Methods for analytical testing shall demonstrate a quantitation limit equal to or less than 20% of the lowest relevant action level or regulatory limit of interest.

3.1.1 Precision and Accuracy

The Quality Assurance objectives for precision, accuracy, and completeness are based on results from the analysis of quality control samples whose values are known. We use standard statistical methods (see Section 3.4) to describe the performance of each measurement system (in terms of accuracy and precision), and the result of each subsequent quality control sample can be used to determine whether the system is performing as it should. Examples of accuracy and precision information are given in Appendix E.

3.1.2 Completeness

Completeness is the percentage of measurements made which are determined to be valid measurements. We use completeness as a measure of how effective our quality assurance program has been, and our goal is to keep completeness as high as possible. Although it makes a nice goal, we do not always expect to achieve 100% completeness. Because all of our control limits are defined statistically, we know that some quality control sample results will be out of control. Some methods will fail to reach 100% completeness for procedural as well as statistical reasons. For methods which are automated, sample analysis proceeds unattended, and control limits are often assessed after field samples have been analyzed. Some wet chemistry methods do not permit analysts to stop after analysis of quality control samples before analyzing field samples, and these methods will also fall below 100% completeness from time to time.

3.1.3 Internal Quality Control Checks

The total proportion of samples analyzed to meet the requirements of internal quality assurance will be 10%. A blank, a spiked blank, and a duplicate spiked blank should be analyzed with each batch of 20 samples or less, or each matrix, or as needed to meet contractual requirements.

Quality assurance requirements sometimes state that field samples must be analyzed in duplicate. Prior to analysis, however, there is no guarantee that any given sample will contain a detectable amount of any parameter of interest. If a clean sample is chosen for duplicate analysis, we cannot monitor the precision of the method. It is more efficient for statistical purposes to spike laboratory blanks in duplicate, so that both the accuracy and precision of the method can be monitored while field samples are being analyzed.

Matrix effects on the method are monitored in different ways. For some methods, a portion of a field sample is spiked with a known amount of a parameter of interest, and the "recovery" of this spiked material is monitored, by comparison with the unspiked portion of the sample. For other methods, "surrogate" parameters may be added directly to all field samples. Surrogate parameters are chemically similar to environmental pollutants, but are not expected to be found in field samples. Again, the recovery of known amounts of surrogate parameters reflects matrix effects.

As part of the quality assurance program for each matrix for which it is accredited, the laboratory shall adhere to all stated QA/QC requirements as published in the method being used.

AIHA specific QA/QC requirements state accuracy and precision at a frequency at 5% per batch of samples. Wipe sampling should be conducted at least quarterly to determine surface levels of lead in the laboratory. Consult the method being used for specific QA/QC acceptance limit.

3.1.4 External Quality Control Checks

We participate in several programs which submit blind samples on a periodic schedule. Our performance in analyzing these samples is compared to other laboratories and to established true values for the parameters in the samples. A listing of various external programs is given in Section 8.

3.2 DEFINITION OF INTERNAL QUALITY CONTROL COMPONENTS

Definitions of the elements of the internal quality control system are given below. Note that some of the elements below are general in nature, while some are mainly applicable to organic or inorganic analysis.

3.2.1 System Blank

The system is run without a sample in the same manner as if a sample were present. It is used to verify that the background due to column or other equipment contamination is below detection limits.

3.2.2 Method/Reagent Blank

A sample of reagent water which is processed exactly as if it were an environmental sample. It is used to monitor the background due to reagents and labware used.

3.2.3 Calibration Blank

A volume of deionized distilled water acidified with HNO₃ and HCl and analyzed directly.

3.2.4 Calibration Standard

A sample prepared using a concentrated standard (certified as traceable to NBS and EPA standards by the manufacturer) which is carefully diluted as directed by the calibration section of the Standard Operating Procedures. These standards are used to quantitate the compound in environmental samples.

3.2.5 Instrument Check Standard

A multi-element standard of known concentrations prepared by the analyst to match the midpoint of the calibration standard series and used to monitor the performance of the instrument on a daily basis.

3.2.6 Quality Control Check Standards

Quality control check standards must be obtained from (1) a second source which is different from the source of the calibration standard or (2) the same source but with a different lot number compared to the lot number of the calibration standard. Results of analysis are compared with calibration standard results. If the relative percent difference is 25% or greater then the instrument must be recalibrated.

3.2.7 Spiked Duplicate

These are prepared by addition to two aliquots of media material (i.e. soil or water), known amounts of the compounds being assayed from a laboratory reagent stock, and analyzing these duplicate samples. The results from analysis of the untreated environmental sample and the spiked environmental sample are used to calculate percent recovery of the spike:

$$P = 100 (A-B)/T$$

Where:

P = percent recovery

A = measured value of the analyte concentration in the spiked sample

B = measured value of the analyte concentration in the untreated environmental sample

T = known amount of compound added expressed as final concentration in the sample

This assumes the volume of the spiked aliquot was not significantly increased during the spiking process. This is assured by using concentrated solutions of spiking compounds. Tolerance limits for acceptable percent recovery are described in Section 3.4.

The results from the analysis of the duplicated spiked aliquots are used to monitor the precision of the measurement system. Precision data are assessed using the equations in Section 3.4.1.

3.2.8 Interference Check Sample

A sample containing both parameters of interest and interfering compounds at known concentrations is used to verify background and inter-element correction factors.

3.2.9 Internal Standards

These are prepared by addition of a known amount of a compound (not expected to be present in the environmental sample) from a laboratory reagent stock. The internal standard is added just prior to analysis of the sample. The internal standard is used to monitor the operation and sensitivity of the analytical system and the effectiveness of the purge and trap apparatus.

3.2.10 Surrogate Compound

A surrogate compound is chemically similar to the analytes. Surrogates are prepared by addition of a known amount of a compound (not expected to be present in the environmental sample) from a laboratory reagent stock. The surrogate compound is added just prior to analysis of the sample (usually mixed with the internal standard). The surrogate compound is used to assess the accuracy and precision of the method. Typically the acceptable surrogate recovery range is 20%.

3.2.11 Control Chart

The basis for objective consideration of analysis results for a control sample is the control chart. Construction of such a chart assumes that the laboratory data approximate a normal distribution. A useful way to plot such data is to let the vertical scale (ordinate) represent the units of analytical results, and to enter the results along the horizontal axis (abscissa) in the order in which they were obtained. The mean and the limits of dispersion, expressed in terms of the standard deviation, are then calculated and plotted. (See Section 3.2.7 and 3.4 for detailed calculations.)

The upper and lower control limits (UCL, LCL) are set at +3 and -3 standard deviations from the mean, respectively, and the upper and lower warning limits (UWL, LWL) at +2 and -2 standard deviations. Results which fall outside the control limits signal an analysis which is out of control and indicate that analytical results for unknown samples obtained in the same run are suspect. See Section 7.2 for out of control procedures. While results which fall outside the warning limits do not require strong action, a response may be necessary when results exceed these limits on a regular basis.

An example of standard control charts along with the data used to generate them are given in Appendix E.