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IX Quality Assurance Program

For

McCampbell Analytical Incorporated

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A. Organization, Responsibility and Goals

McCampbell Analytical currently has a staff of approximately fifty. The lab director Edward Hamilton, lab manager Angela Rydelius, QC Officer Shino Hamilton, and shift supervisors Oanh Cao & Phuong Doan share final responsibility for all decisions.

Our goal is generate scientifically valid & reproducible data using published technical protocols, including EPA, SSSA, AOAC, ASTM & other methodologies. When discrepant data arises, that is data that is serially inconsistent or is inconsistent with different but related test methodologies, we will investigate the cause, including reanalysis & re-extraction of the sample, until arriving at a conclusion as to the cause of the discrepancy & the probability of which data are correct. If there is a probability of lab error we will revise our published data. If there is a probability of sampling error we will inform the sample submitter. If there is a probability of sample inhomogeneity we will average the data & we will publish either the entire data or averaged value & flag the data as such. Our goal to generate scientifically valid & reproducible data & these procedures guide our lab towards publishing only unbiased & scientifically valid data that is free from third party influence.

The lab and QA managers are also responsible for data review and have the authority to approve or disapprove specific analyses and final reports. Periodically lab and QA managers will review internal documents including but not limited to SOP's, Published methods, etc and if and when deemed necessary will revise and or update to ensure continuing suitability and compliance with applicable requirements. In addition, any documents that are outdated and or superceded will be replaced by the updated document; the superceded document will be stored in our "Obsolete" folder and will no longer be used within the laboratory; this in effort of diminishing any unintended use. Obsolete documents are stored in the "Obsolete" folder and are available at any time for review at the request of an interested party. Lab and QA managers are responsible for advising on all aspects of QA/QC including: assuring proper QA/QC procedures are employed during data generation; periodically reviewing QA/QC procedures; and, if problems are detected, making recommendations to ensure that appropriate corrective actions are taken. Our QA officer reviews all QC data prior to its release to our clients.

The Supervisory Chemists are considered competent and proficient in a wide variety of analyses and instrument troubleshooting / repair and serve as technical advisors to the less experienced technicians and chemists. They are responsible for training new employees and ensuring that analytical methods and instruments are working properly. Other chemists and technicians may also be experienced and proficient enough to conduct training and instrument troubleshooting and maintenance but are generally knowledgeable in fewer analyses.

Veteran employees train the new employees. Training includes hands-on instrumental operation, becoming familiar with the appropriate SOPs and completing a satisfactory initial demonstration of proficiency. In addition, the trainer



will review the trainee's data until proficiency has been established. Proficiency is defined as being able to independently and satisfactorily perform an analysis error free for a period of two weeks to one month.

The pursuit of quality is one of the primary goals of this laboratory and this document outlines some of the specific steps taken to achieve this goal. While no QA program can achieve absolute perfection, the identification of problems and subsequent corrective actions will move the laboratory steadily towards this goal.

B. Chain of Custody for Samples

Samples shall be delivered to the lab by the contractor or a third party, and will not be collected in the field by McCampbell Analytical personnel. The chain of custody will record the following:

- a) the time and date of sampling and the sampler's signature,
- b) the time and date when the samples were relinquished to the lab,
- c) the signatures of persons who relinquished and received the samples,
- d) a description of each sample matrix,
- e) a unique identifier for each sample,
- f) the type of analysis requested,
- g) a description of the condition of the samples, for example, whether or not they were kept cool, the presence of head space, preservatives, or the smell of fuel products, and,
- h) client name;
- i) for bacteriological tests the sample type (repeat positive, repeat invalid,...) water type (drinking, surface, effluent, recreational – marine, 'not-for-compliance') and collection time to the minute shall be recorded because they are required for protocol compliance;
- j) for drinking water testing, the name of the drinking water facility must be given;
- k) any initial in lab processing or testing of the sample, such as filtration, addition of preservative, confirmation of low pH or the absence of chlorine, shall be recorded on the COC.

Additional useful information includes Client Contact name, Project ID, TAT, billing, phone, fax and email information.

Clients shall be informed immediately of any sample identity discrepancies between the COC and actual sample container, or if hold time, preservatives, or containers are invalid, or if sampling times are not present on the COC, or if testing instructions are ambiguous.

Samples may be couriered to the lab by a third party service. In such instances, the courier must formally receive and relinquish the samples by signing the COC. Some courier companies such as FedEx, UPS and CA Overnight will not participate in the chain of receiving and relinquishing and MAI recommends that the client seal the cooler with a tamper



proof seal prior to shipment. In such instances, MAI personnel will note on the COC the name of the courier service, and if found true by observation, that the samples were received sealed and intact.

Our laboratory shall note the following on the sample's chain of custody: ice, head space, appropriate containers, preservative, sample handling procedures prior to sample storage such as dechlorination and filtration, and approximate sediment content of each water sample. The sediment content of a water sample is based upon observation of one randomly chosen or more of its clear and transparent containers. Dissolved metals rather than total metals shall be assumed for the analysis of water samples containing significant sediment unless otherwise specified on the COC. It will be noted on the chain of custody if samples are removed from the lab.

Log In staff shall clarify with client ASAP any ambiguities they find upon receipt of new COCs. They shall determine whether a particular test will be performed in house or sub-contracted to another lab, & shall ascertain by consultation with the lab manager or staff chemists whether we have the capability and capacity to meet the clients analytical needs & TATs.

Each sample will be assigned a unique number, which will be used to identify it within the laboratory. Once the sample is given a lab ID, the sample is either refrigerated when required by method or given to our extraction department, depending upon the flow of work within the lab. When the extraction department is finished with the sample it is returned to a refrigerator or other appropriate storage area. Our staff is trained to not allow any sample requiring refrigeration to remain un-refrigerated longer than is necessary, with a maximum time of 2 hours. Samples are handled in accordance with regulations set forth by the State of California and the federal government, the EPA, the LUFT manual, SW-846 and other publications.

Samples will be stored for a minimum of one month, and are stored separately from the standards. Water and soil blanks will be placed in refrigerators that contain samples in order to assess the possibility of vapor phase cross contamination. Samples will be discarded in accordance with local, state and federal regulations.

C. Maintenance and Calibration of Simple Machines

Refrigerator and Freezer temperatures will be recorded daily and drying ovens as used. The thermostats of these appliances will be adjusted as necessary to maintain their working range, or the equipment repaired or replaced.

The accuracy of the gravimetric balance will be checked monthly against class S weights and a record kept of these measurements. The manufacturer will be consulted for corrective action if discrepancies greater than 2% are observed.

All pipettes will be tested for accuracy monthly. Pipettes with an error greater than 2% will be refurbished or replaced.

Method specified rotation rates (rpms) will be verified annually for rotating extraction devices.

Autoclaves will be tested periodically for sterility, maximum temperature and timer accuracy. Results will be recorded and corrective action taken if necessary.



Incubators will be tested periodically for sterility and temperature accuracy. Results will be recorded and corrective action taken if necessary.

All measuring devices used to record temperatures, weights & volumes, including thermometers, balances & volumetric devices, shall be periodically calibrated against traceable standards, and this calibration documented.

D. Analytical Procedures

The analytical procedures and methodologies that are used here are described in EPA SW-846, 600/4-79-020, 600/4-84-017, 600/4-82-057, CFR40 (parts 260-299), Standard Methods for the Examination of Water & Wastewater, the California LUFT manual, and California State Title 22 as well as other published paper and internet documents. When ambiguity exists in these sources, common sense and good scientific practices are followed.

1. GC, GC-MS, HPLC, IC and IR Analyses

TPH (g/ss) (8015), volatile aromatics (8020/ 602), volatile halocarbons (8021/ 8010/ 601/ 502) and VOCs (8240/ 8260/624/ 524) solids and liquids are direct loaded or extracted with methanol, polyethylene glycol or other suitable solvents. Semi-volatiles including TPH (d/k/mo) (8015), Oil & Grease (SM5520), TRPH (418.1), EDB-DBCP-TCPA (504.1/8011), endothall (548), phenyl ureas (532), Diquat-Paraquat (549.2), PNAs (550/ 550.1/ 8310), HAAs (552.1/ 552.2), aldehydes / carbonyls (554/ 8315), anions (300.0/ 300.1), hexachrome (218.6), perchlorate (314.0), chlorinated pesticides and PCBs (8082/ 8081/ 608/ 505/ 508), SVOCs (8270/ 625/ 525/ 526/ 528), NP pesticides (8141/ 507), nitroaromatics & nitramines (8330), chlorinated herbicides (8151/ 515) solids and liquids are solid-liquid, liquid-liquid, or liquid-SPE extracted with methylene chloride, hexane, diethylether, acetone, MTBE, deionized water, or trichlorotrifluoroethane according to EPA methods 3510, 3520, 3550, 418.1 or the relevant analytical method and derivitized when proscribed by the method. Volatiles are analyzed using purge & trap (EPA method 5030) or whole container (EPA method 5035) methodology. Aqueous samples testing for acrolein-acrylonitrile-acrylamide (8316), glyphosate (547), carbamates (531.1/ 8318), anions (300.0/ 300.1) or hexachrome (218.6) are filtered and directly loaded for HPLC analysis; glyphosate and carbamates, as proscribed by method, are derivitized on line prior to detection. These procedures are documented in our company SOPs, which are derived from published methods.

Two separate standards, each made from a stock standard having a different lot number or manufacturer, are utilized. One stock standard is used to calibrate the instrument and to prepare daily matrix spikes and LCS QC, and may be used for the CCV if a second source standard (ERS) is also analyzed. The CCV will be run daily to confirm that the instrument is still within calibration. This system ensures high quality data by spotting inaccurately prepared (by the manufacturer or analyst) or “aged” standards. A standards logbook will be kept detailing the preparation of working standards and uniquely identifying them.



The variability of gasoline and diesel preclude the use of multi-source standards. However the constancy over time of the FID detector's response is assessed by comparison of the historical calibration to the daily standard and to the matrix spikes.

CCV acceptance criteria vary by method; for example hexachrome (218.6) is $\pm 5\%$, EPA GC 8000 series are $\pm 15\%$, drinking water chromatography range from $\pm 10\text{-}20\%$, and are found in their respective SOPs.

The GC's are calibrated using a minimum of five concentrations of the same standard. The highest concentration defines the upper working range of the calibration while the lowest concentration equals the working instrumental detection limit. A linear calibration is typically used for all compounds and is considered acceptable if the %RSD of the CF or RF of each target analyte is $\leq 20\%$ as required by the CA DHS and federal EPA. Alternatively, a non-linear calibration may be used. A non-linear calibration is considered acceptable if the coefficient of determination (COD) for each target analyte is ≥ 0.99 .

Many GC / LC methods, especially those pertaining to drinking water (504.1, 505, 508, 508.1, 515.x, 524.2, 525.2) but also 8081, 8260, 8270, 314.0 & others, require special LPC (Laboratory Performance Check standards) to be analyzed and passed prior to the analysis of samples. The procedural details, acceptance criteria and corrective actions are found in the relevant SOPs.

A blank shall be run initially and a daily mid-level standard (continuing calibration verification standards) initially and approximately every 10 samples or 12 hours and evaluated against method criteria. Corrective action includes re-analysis and/ or the instrument re-calibration.

Surrogate standards, when known, are added prior to extraction; this encompasses most of these analyses. Matrix spike and surrogate recoveries must fall within the ranges outlined in the method or corrective action will be taken.

The techniques for quantitating and resolving complex chlorinated mixtures are detailed in EPA method 8081. Dual column confirmation will be done on all positive pesticide samples and will be done on positive volatile analytes (non-GC-MS methods) by request. Dual detector confirmation (example PID-FID or PID-ELCD) is present for most volatile analytes.

EPA methods 8240/ 8260/ 624/ 524 shall be run as follows. A historical five-point calibration shall be conducted. Three surrogates and three internal standards are added to each injection. The system performance check compounds, SPCCs (chloromethane, 1,1-dichloroethane, bromoform, 1,1,2,2-tetrachloroethane, chlorobenzene) must have RRFs $\leq 0.1, 0.1, 0.25, 0.3, 0.3$, respectively, and the calibration check compounds, CCCs (1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene, ethylbenzene, vinyl chloride) must have %RSDs $< 30\%$ in order that the calibration be valid.



On a daily basis, the MS is tuned and the mass ratios shown in method 8240 for BFB must be met initially and after every 12 hours (8 hours for 524) of analysis. A mid-range daily standard will be run after 12 hours of analysis; the above-mentioned SPCC criteria must be met and the CCCs must be within 20% of their daily calibration values for the run to continue. Additional continuance criteria are that any internal standard's retention time must not have changed by more than 30 seconds or its area by a factor of two from that last daily calibration unless by design (tuning or column shortening). Criteria for qualitative and tentative identification and quantitation of a compound are detailed in EPA method 8240. Each analyst will demonstrate their capability through a precision and accuracy study of four QC samples as outlined in the method. Matrix spike and surrogate recoveries must fall within the ranges outlined in the method or corrective action will be taken.

EPA methods 8270/ 625/ 525/ 526/ 528 shall be run as follows. A historical five-point calibration shall be conducted. Each injection will contain the six recommended internal and six recommended surrogate standards. The MS will be tuned to fulfill the method criteria for DFTPP before a run can be initiated. The system performance check compounds, SPCCs (N-nitroso-di-n-propylamine, hexachlorocyclopentadiene, 2,4-dinitro-phenol, 4-nitrophenol) must have RRFs ≥ 0.05 , and the calibration check compounds, CCCs (see method 8270) must have % RSDs $< 30\%$ in order that the calibration be valid. On a daily basis, the MS is tuned and the mass ratios shown in method 8270 for DFTPP must be met initially and after 12 hours (8 hours for 525/ 526/ 528) of analysis. A mid-range daily standard will be run after 12 hours of analysis; the above-mentioned SPCC criteria must be met and the CCCs must be within 20% of their daily calibration values for the run to continue. Additional continuance criteria are that any internal standard's retention time must not have changed by more than 30 seconds or its area by a factor of two from that last daily calibration unless by design (tuning or column shortening). Criteria for qualitative and tentative identification and quantitation of a compound are detailed in EPA method 8270. Each analyst will demonstrate their capability through a precision and accuracy study of four QC samples as outlined in the method or corrective action will be taken.

For GC and IR analyses in general, a daily LCS and LCSD (and matrix spike and spike duplicate when sufficient sample containers are provided) will be analyzed every 20 samples for each matrix being analyzed on a given instrument. The quantitated value of LCS, LCSD, spike and spike duplicate must be within 60-140% recovery or the method acceptance criteria, whichever is more stringent. One method blank must also be run initially for that day's sequence. A volatiles water/air blank is reagent grade water defined as tap water that has been brought to a rolling boil for 30 minutes, cooled and continuously purged with N_2 . Method blanks must contain less than the reporting limit of each method analyte. In the event that any of the CCVs or QC samples fail their criteria they should be immediately reanalyzed. If they continue to fail, an investigation must be conducted to determine the root cause and the sequence scrutinized for validity by an independent QA officer. Some data may be usable depending on the type and severity of the problem. Corrective action should be taken to resolve the problem and the instrument recalibrated if necessary. If it is determined that there is unusable data, the affected samples will need to be reanalyzed in a new sequence.



The failure of standards, surrogates or QC to fall within accepted ranges is not the only criteria for rerunning samples. The suspicion of contamination arising from the previously injected sample, the previous sample in the same purge & trap vessel / port position, or contamination that exists instrument-wide in flow pathways or valves, or the analyte concentration being greater than the highest calibration standard will necessitate that the effected sample(s) be rerun.

The statistical analysis of replicate samples will be used to determine the minimum detection limit for each individual and group analyte and for external standard methods to determine relative retention time windows, as outlined in chapter one and method 8000 of SW-846. An initial demonstration of proficiency will be conducted for each instrument to assess the precision and accuracy of the instrument and operator. On a daily basis, precision and accuracy are found by comparison of the spike and spike duplicate or a chosen sample and its duplicate.

Records shall be kept of all this data for each instrument and updated as new information is generated. This data will be analyzed for trends that may indicate the onset of problems.

2. Metals

Soil, sludge and water samples for metals analysis are digested using EPA methods (200.7, 200.8, 200.9, 3005, 3010, 3020, 3040, 3050, 6020B method 245.2/ 7470/ 245.7/ 1631F for mercury) and analyzed according to EPA methods in 600/4-79-020, SW-846 and elsewhere and documented in our company SOPs.

In general, MAI uses EPA 200.7/ 200.8/ 200.9 for metals in water matrix and 7010/ 6010B/ 6020A for analyzing metals in solids, sludge, and other non-aqueous matrices. EPA 1631E (AFS) is used for ultra low level Hg in water.

All atomic absorption methods (FAA, GFAA, HGAA, CVAA) will run in the following manner. Each run will be preceded by a minimum three-point calibration and a blank, followed by an independent check standard ($\pm 15\%$ of the calibration curve), followed by samples. A mid-point calibration standard will be run after each set of 10 samples and at the end of each run. A matrix-spike, spike-duplicate, reagent-blank and one serial dilution will be analyzed with each batch (or 20 samples). Background correction will be used unless it is known to degrade the quality of results. All GFAA standards and samples will be matrix matched to whenever possible.

ICP will be run as follows. An initial 5-point calibration will be performed for each metal to define its range of linearity. On a daily basis, a single mid-point standard will be run to “re-slope” the calibration curve, followed by a blank and an instrument performance check standard. The instrument performance check standard must be within 5% of its true value before the run can proceed. A matrix-spike, spike-duplicate and reagent-blank will be analyzed with each batch (or 20 samples). A mid-point calibration standard and calibration blank will be run after each set of 10 samples and at the end of each run. The standard must be $\pm 10\%$ of the true value and the calibration blank must be below the RL for all



elements for the run to proceed. An ERS standard must be analyzed once per run and must be $\pm 10\%$ of the true value. Appropriate background corrections will be made for each element.

ICP-MS will be run as follows. On a daily basis, a tune must be performed for all three modes and each pass the relevant criteria outlined in the SOP for 6010B. A 5-point calibration will be performed for each metal at the beginning of each sequence to define its response factor and range of linearity. A minimum of 3 IS must be used for a full mass range scan and each must exhibit 60-125% recovery of the values found in the calibration blank (200.8). If the IS recovery is $<30\%$ “and the cause is not due to instrument drift” then the sample must be diluted and reanalyzed until $>70\%$ IS recovery is achieved (6020B). An internal standard should be no more than 50 amu removed from the analyte. A CCV must be analyzed initially, after every 10 samples, and at the end of the run to verify the calibration curve, and must be within 10% of its true value. It is followed in each instance by a reagent blank which must be below the RL for each element. At a minimum 3 replicates of each standard and sample must be analyzed and averaged. An LCS-LCSD ($\pm 15\%$ for 200.8 / waters, $\pm 25\%$ & $RSD < 20\%$ for 6020B / solids), MS-MSD ($\pm 30\%$ if spike $> 30\%$ of sample for 200.8 / waters, $\pm 25\%$ & $RSD < 20\%$ for 6020B / solids), and reagent-blank will be analyzed with each batch (or 20 samples). A mid-point calibration standard and calibration blank will be run after each set of 10 samples and at the end of each run. The standard must be $\pm 10\%$ of the true value and the calibration blank must be below the RL for all elements for the run to proceed. An ERS standard must be analyzed once per run and must be $\pm 10\%$ of the true value. For each element, all interfering masses must be monitored and isobaric correction equations used when appropriate. The Interference check standard, ICS (see 6010B SOP), must be analyzed initially and every 12 hours to demonstrate the magnitude of elemental and molecular ion isobaric interferences and the adequacy of any corrections used. The percent of interference correction applied to reported data using an interference equation must be stated in the analytical report. One dilution test (1:5 serial dilution) must be included for each batch of each matrix and must be within 10% agreement. HCl must be integral to all digestions that are analyzed for Hg.

EPA 1631E, Hg by AFS, will be run as follows. A statistical MDL study must be performed initially and yield an MDL < 0.2 ng/L or MDL $< 1/3$ regulating limit, whichever is greater. An initial precision and recovery (IPR) should be performed by analyzing 4 replicates of the calibration standard at a concentration of 5 ng/L Hg in reagent water. Percent recoveries must be 79-121% and $RSD \leq 21\%$. MAI will test one new bottle blank per lot.

A batch is a set of up to 20 samples oxidized with the same batch of reagents, and analyzed during the same 12-hour shift. Each batch must be accompanied by 3 system blanks (< 0.50 ng/L Hg) which precede the calibration. The calibration must contain a minimum of 5 non-zero points (ex: 0.5, 5, 25, 50, 100 ng/L) and the results of analysis of 3 system blanks, and must be performed at a minimum every 12 hours. The lowest calibration point must be at the minimum level (ML). If the average $RSD \leq 15\%$ and the recovery of the lowest standard is in the range of 75-125%, the calibration is acceptable.



Analyze 5 ng/L CCV (=OPR) solution prior to the analysis of each analytical sample batch, every 12 hours, and at the end of each analytical sequence. The recovery must be 77-123% for the run to proceed. The ERS (=QCS) should be analyzed at the beginning of each batch following the CCV. At least 3 method blanks (<0.5 ng/L) should be analyzed per batch and there must be 1 MS and 1 MSD sample for every 10 samples (71-125% recovery, RPD 71-125% but may exceed this range if the subsequent OPR (=CCV) passes. The RPD for MS-MSD pair must be $\leq 24\%$, but may exceed this range if the subsequent CCV passes. Field blanks are required at a frequency no less than 1 per 10 samples. Field duplicates, if taken, should have RPD < 20% or the sampling personnel should be alerted

The statistical analysis of replicate samples will be used to determine the minimum detection limit for each individual and group analyte. Records shall be kept of all QC data for each element and updated as new information is generated. This data will be analyzed for trends that may indicate the onset of problems.

E. Wet Chemistry Tests

Acidity, alkalinity, ammonia, BOD, TOC, NPOC, IC, titrimetric Cl⁻, residual chlorine, COD, color, cyanide, dissolved O₂, MBAS, hardness, Karl Fisher water, colorimetric nitrate-nitrite, TKN, total N (combustion, UV-persulfate, summation of forms), odor, total P, paint filter test, phenolics, physical properties, RCI, redox potential, settleable solids, sulfide, TDS, TSS, TS, TVS, turbidity, UV₂₅₄, pH, 5520 Oil & Grease, specific conductivity, colorimetric hexachrome, ignitability and other miscellaneous tests that are conducted here are performed in accordance with their methods outlined in EPA SW-846, 600/4-84-017, 600/4-82-057, CRF40 (parts 260-299), Standards Methods for the Examination of Water & Wastewater, the California LUFT manual, and the California State Title 22 and detailed in our SOPs. In general, for all QC, a matrix-spike, spike-duplicate and blank are analyzed every 20 samples. The quantitated value of both spike and spike duplicate must be within 60-140% recovery. One method blank must also be run for each matrix being analyzed on that day's sequence and must be less than the reporting limit. Where the analytical technique or sample is not amenable to spiking then one out of every ten samples will be analyzed in duplicate or by serial dilution.

When the analysis requires a calibration curve (cyanide, TOC, NPOC, ammonia, etc) a five point calibration is performed with low standard defining the minimum RL and the high standard the upper working range and a CCV is analyzed every 10 samples and at the end of the run. Acceptance criteria are generally $\pm 15\%$ for the CCV but method specific values are given in their respective SOPs. An initial MDL study and operator precision package are performed and statistically analyzed for the IDOC.

F. Bacteriological Testing (SM 9020-9060, SM9223B, Idexx SIM plate, Idexx Enterolert)

The type of water, such as drinking (chlorinated or non-chlorinated specified), ground water, effluent, waste water for disposal, surface waters (lacustrine, estuarine, marine, fluvial, urban), recreational waters (marine or fresh), storm water



run off, etc. must be specified because hold time and analytical protocols may follow. The sample category, whether routine, repeat, repeat positive, or repeat invalid should be recorded on the COC.

If chlorinated, samples must be dechlorinated at the time of sample collection by having a dechlorinating agent (100mg/L sodium thiosulfate) present in the sample container.

Samples must be stored at $<10^{\circ}\text{C}$ for transit times > 1 hour and refrigerated for lab storage. Potable waters (drinking water) must be analyzed within 30 hours of collection for coliform and 8 hours for HPC for compliance purposes. Non-potable water (source water, stream pollution, recreational water, waste water) has a maximum specified transport time of 6 hours from time of collection and should be processed by the lab within 2 hours of receipt for an 8 hour total hold time. Other water types for non-compliance purposes are to be held at $<10^{\circ}\text{C}$ during transport and storage and analyzed within 24 hours of collection. The date and time that the analysis was begun MUST be on the report for the purposes of hold time compliance.

Conduct 'Use test' for each new batch of materials, for sterility, and for inhibitors as described in the SOP, in particular monitor each new sample container lot, EST (Enzyme Substrate Technology) container lot, and reagent lot.

Each water sample MUST be shaken vigorously about 25X before analysis. Monitor incubator temperature 2X daily, > 4 hours apart. Perform duplicate analyses on at least 10% of the samples or one time per week if less than 10 samples per week are analyzed. Include known positive culture as QC tests, once per quarter if no sample positives.

For HPC always analyze a sterility control with each batch. Bottled water must be incubated for 72 rather than 48 hours.

Invalid samples (hold time, technical problems) MUST be repeated, sampled within 24 hours for compliance purposes.

G. Data Reduction and Reporting

Data will be acquired from all instruments using the manufacturers software, Agilent ChemStation or a LIMS system and analyzed by user-set methods. Formula for external and internal standard calculations are used that is identical to those found in method 8000 of SW-846. The chromatograms are scrutinized and the quantitations are reviewed before being reported in a run log or sent on to the LIMS. High values are double-checked for calculation mistakes and low values for the possibility of contamination. Raw data is converted to standard reporting units by the usual method of numerator and denominator unit cancellation. The lab manager gives the report the final review, before the data is sent via mail, email or faxed to the client.

It is our standard procedure to protect and back up all of our electronic records. In order for an employee to access or use LIMS they must have a user password or code; each code and password are unique. This is done in effort of minimizing unauthorized use of the system and any manipulation of data/records. Raw data from ChemStation is backed to a CD. Duplicate copies are made of the CD's, one set is stored in the lab for chemist convenience; the other



set is stored in high capacity hard drive and placed in a safe box to prevent from disaster. All records, including but not limited to instrumental raw data, run logs, analytical reports, instrument maintenance logs, standard logs and QA documents will be retained in the lab for a period of seven years. Records older than seven years will be destroyed.

Our goal is generate scientifically valid & reproducible data using published technical protocols. When discrepant data arises, that is data that is serially inconsistent or is inconsistent with different but related test methodologies, we will investigate the cause, including reanalysis & re-extraction of the sample, until arriving at a conclusion as to the cause of the discrepancy & the probability of which data are correct. If there is a probability of lab error we will revise our published data. If there is a probability of sampling error we will inform the sample submitter. If there is a probability of sample inhomogeneity we will average the data & we will publish either the entire data or averaged value & flag the data as such. Clients will occasionally contest the results of a specific sample and the subsequent re-analysis of this sample provides further feedback on the quality of analytical work. If re-analysis shows that the lab's original results are in error, then the analysis is free of charge and corrective action will be taken. If and when ethical concerns issues arise; it is immediately brought to the attention of both QA and laboratory management for further investigation. Together they will work towards resolving the matter. We strive towards publishing only unbiased & scientifically valid data that is free from third party influence.

H. Internal Quality Control Checks

QC, standards, blanks, method performance check standards, surrogates and internal standards are examined daily within each analytical batch or sequence and evaluated against their acceptance criteria, and corrective action taken if needed. These parameters are plotted & their graphs examined on a regular basis to determine trends & anticipate problems.

MAI has a dedicated internal QC officer who reviews all QC data, monitors QC compliance with established and method specified criteria. They report their findings to the lab manager & lab director.

When needed, and in consultation with the lab managers, the QA officer may implement new quality control procedures on a laboratory-wide or group basis.



External Quality Control Checks

QC samples are solicited from clients and are welcomed from governmental agencies in an ongoing effort to maintain and improve analytical quality. NVLAP & CA certified third party external performance evaluation samples are tested as an external QC check at a minimum of once per year for water and soil (when available) matrices. Our results for these blind QC samples are reported to the third party supplier who evaluates them against their true values, and reports this data and acceptance criteria ranges to MAI and the California DHS / ELAP. These reports are available for review upon request and will at a future time be published on our website for client access. External audits of our lab are performed by state agencies and other third party accreditors, as well as by our clients, and are welcomed. Complete supporting data (calibrations, CCVs, MB, QC, PCS & chromatograms / instrument records) are available to our clients when they want to audit particular data sets.

I. Chemical Standards & Reagents

Chemical standards and reagents are stored in a computerized log and identified with consistent nomenclature. Our goal and practice is to use one lot number or manufacturer, for CCV, QC or both. Our reagents/consumable materials are purchased through our known vendors. These reagents/consumables are tested to make sure that they meet our requirements and are compatible with our machines, this in effort to get the best results.

J. Confidentiality of Data

It is our policy not to release any data to third parties without the client's authorization. When asked for data by a third party we must first obtain our client's permission before releasing data. Data that is electronically transmitted by fax or email contains a confidentiality notice directing any unintended recipient to inform us of our error & destroy the received documents. Electronically stored data within the lab's computer network is protected by firewall security. We will comply with any written request by a client or government agency to maintain strict confidentiality regarding any data or techniques that are proprietary or matters of national security. The agreement must be in writing & will be signed by all pertinent parties within the lab.

K. Corrective Actions

Errors, deficiencies and data that do not pass acceptance criteria will be investigated. Some of these instances may require corrective actions. These corrective actions will be documented in appropriate locations including instrument-specific maintenance logs, run logs and the company error log. Clients will occasionally contest the results of a specific sample and the subsequent re-analysis of this sample provides further feedback on the quality of analytical work. If re-analysis shows that the lab's original results are in error, then the analysis is free of charge and corrective action will be taken. An overall lab error log is kept as record of our laboratory's performance and is available for client inspection.



L. Error Log

We keep an error log of mistakes that we have made, in terms of reported data, log in, hold time or service errors. This helps us track the relative error rate of the lab overall.

M. Staff Training

Staff that is well trained is essential to the error free operation of the laboratory & to the generation of high quality analytical data. A training document is signed by each chemist attesting that they have been adequately trained; and have read and understand the laboratory SOPs and published methods and they will conduct analysis according to the method criteria. All method criteria, whether for CCV, calibration, method blanks, performance check standards, & quality control are readily available to all in a convenient format. When method criteria do not exist we define in house acceptance criteria.

If method criteria cannot be met chemists are required to bring the matter to the attention of a supervisor for remedial action.

We have laboratory SOP's and published methods in proximity to each chemist. Each chemist is instilled with the philosophy that "We are not in the business of guessing, we are in the business of certainty." As such any questions that they have regarding data acceptability, suitability, or procedures must be brought to the attention of a higher authority that can resolve any questions.

The Supervisory Chemists are considered competent and proficient in a wide variety of analyses and instrument troubleshooting / repair and serve as technical advisors to the less experienced technicians and chemists. They are responsible for training new employees and ensuring that analytical methods and instruments are working properly. Other chemists and technicians may also be experienced and proficient enough to conduct training and instrument troubleshooting and maintenance but are generally knowledgeable in fewer analyses.

Veteran employees are in charge of training new employees. Training includes hands-on instrumental operation, becoming familiar with the appropriate SOPs and published methods and completing a satisfactory initial demonstration of proficiency. A training check list is signed by all chemists. In addition, the trainer will review the trainee's data until proficiency has been established. Proficiency is defined as being able to independently and satisfactorily perform an analysis error free for a period of two weeks to one month.

Our staff is trained to look for discrepant data & to examine as fully as is needed to characterize its source.

N. Client Feedback

Our staff welcome client feedback & carefully listen to spontaneous feedback that comes to us from clients so as to improve our quality & service. If a data result is questioned, we carefully and fully investigate it. Our first response is to ascertain whether the correct number & units were reported as well whether the sample was logged in correctly. Second, we reanalyze the original sample or its extract and simultaneously begin re extraction and re analysis of the



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sample. When discrepant data is found, that is data that is serially inconsistent or is inconsistent with different but related test methodologies, we investigate the cause of the discrepancy until arriving at a conclusion as to the probability of which data are correct. If there is a probability of lab error we will revise our published data. If there is a probability of sampling error we will inform the sample submitter. If there is a probability of sample inhomogeneity we will average the data & we will publish either the entire data or averaged value & flag the data as such.

O. Quality Assurance Reports

The QA program will be reviewed and reported on at least annually by the lab/QA manager. This report will include an assessment of the overall effectiveness of the program and identify any deficiencies. The report will also include suggestions on how to deal with deficiencies as well as on improvements if necessary.