APPENDIX A9

MICROBAC LABORATORIES, INC.
CHICAGOLAND DIVISION

Quality Assurance Plan

Revision 8.1

Prepared by:

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This revision of the QA Plan is effective upon signed approval by the following:

Managing Director	4/28/06 Date
QA/QC Manager	4/28/2006 Date

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2.0 FOREWORD

This Quality Assurance Plan has been established to serve two purposes: (1) to define for our employees, the routine systems for sample containers, sample collection and receipt, chain of custody, documentation, analytical procedures, data validation, data reduction, reporting, and archiving, and (2) to define for our clients, the minimum contractual conditions under which we will handle their samples. The requirements contained within this Plan are applicable to all sections, operations, functions, and employees of the Merrillville Indiana facility of Microbac Laboratories, Inc and it's service center in Indianapolis Indiana. Our quality systems are based on the requirements of the various accreditation, certification and approval programs for which we provide analytical services as well as the requirements of the analytical methods we perform and regulations/statutes applicable to the testing programs. The more stringent requirement between method, regulation and accreditation program is applied. When it is not clear as to which is the more stringent requirement, the requirement from the method takes precedent followed by the requirement from the regulation then followed by the accreditation requirement. Microbac Laboratories provides Training and Ethics programs geared to communicate Company policies and expectations. The goal of this training is prevention of improper actions. As part of our quality systems internal audits are conducted to provide a mechanism for the detection of improper actions.

This Quality Assurance Plan is a controlled document. As a controlled document, each copy is numbered on the title page. Moreover, Microbac will document and retain a list of recipients of this document. Upon major revision, Microbac Laboratories will assess the list of recipients and forward controlled copies of the new revision where appropriate. All Merrillville employees are notified of changes made in new revisions.

Due to constant changes in the environmental laboratory industry and the Microbac commitment to continuous improvement, revisions to this Plan will be made as necessary. Major revisions, such as a change in quality control procedures or implemented quality systems, will be designated as 6.0, 7.0, etc. Minor revisions, such as an update to the employee list or equipment list, will be designated as 6.1, 6.2, etc. Details of this process are included in the SOP Revision, Reporting and Tracking of the Quality Assurance Plan.

Clients may be supplied with copies of this document in support of a specific project. This document shall not be copied for purposes other than their immediate needs regarding the

particular project. If a copy of this Plan is required for a new project or an update to a current project, one should be requested from the Microbac Merrillville QA department to ensure inclusion of the latest revision. This Plan shall not be included in a client Quality Assurance Project Plan (QAPjP) without authorization by Microbac Laboratories. Copies of this document shall not be forwarded to Government agencies or other groups without the authorization of Microbac Laboratories.

3.0 QUALITY POLICY STATEMENT

QUALITY POLICY

Microbac Laboratories Inc. is dedicated to supplying our customers with high quality, cost effective analytical and value added services. In support of this goal Microbac will:

Provide our clients with the highest standard of service and data quality in accordance with good professional and analytical practices, documented standard operating procedures and compliance with all requirements of applicable state, national and international certification programs.

Continually improve all aspects of our business including our commitment to safety, the environment, data quality, service to our clients and cost effectiveness.

Focus on client satisfaction through employee involvement, leadership and personal responsibility.

This Quality Policy is fully endorsed by the members of the management team. This Quality Policy is communicated to, understood by, and implemented by all personnel.

4.0 ACCREDITATIONS

Microbac Laboratories Inc. is dedicated to producing data of a known and high quality. This position is demonstrated through participation in numerous accreditation or certification programs. Microbac has earned the following accreditations, approvals and certifications:

- Illinois Environmental Protection Agency for the chemical analysis wastewater, solid waste and drinking water in accordance with the requirements of the National Environmental Laboratory Accreditation Program [NELAP] (accreditation #100435)
- Illinois Department of Public Health for the microbiological analysis of drinking water (registry #175458)
- Indiana Department of Environmental Management approved support laboratory for solid waste and wastewater analyses (BAA-0203)
- Indiana State Department of Health for the chemical analysis of drinking water (lab #C-45-02)
- Indiana State Department of Health for the microbiological analysis of drinking water (lab #M-45-08)
- Kentucky Environmental and Public Protection Cabinet for the analysis of samples applicable to the Kentucky Underground Storage Tank program (lab #0061)
- North Carolina Department of the Environment and Natural Resources for the environmental analysis for NPDES effluent, surface water, groundwater, and pretreatment regulations (certificate #597)
- Wisconsin Department of Natural Resources for the chemical analysis of wastewater and solid waste (lab #998036710)

Copies of the certificates for our current accreditations, approvals, and certifications are posted in and maintained by the QA department. Accurate statements regarding the scopes and statuses of our accreditations is required as part of our professional demeanor and interactions with our clients and the public. The above listed accreditations, approvals and certifications verify that our quality and analytical systems meet the requirements of the applicable program and do not imply endorsement by the applicable accrediting authority or certifying body.

5.0 FACILITIES

5.1 Physical Facility

The Merrillville facility is located at 250 West 84th Drive, Merrillville, Indiana, 46410. The 12,000 square foot facility was designed to optimize production flow, safety, and quality control while at the same time not invalidate or adversely affect the test results. Environmental conditions are controlled with a HVAC system and cleanliness to ensure the proper functioning of computers and instruments as to maintain the integrity needed to supply acceptable calibration and test data. Separate and adequate areas are provided for sample preparation, analysis, reagent storage, as well as general storage and office areas. A copy of the floor plan in included in Appendix A.

The air-handling system for the laboratory was specifically designed to protect sensitive instruments from harmful vapors and to ensure that samples are not contaminated. An assortment of fume hoods is utilized to minimize contamination and protect the staff. In addition, sample preparation and instrumental analyses are performed in separate rooms, with particular attention to isolation of organic vapors from the analytical area. Good housekeeping measures are taken to ensure that the laboratory facility is maintained in a clean and orderly condition. These include, but are not limited to, putting samples away when finished, wiping the counter tops clean after use, cleaning the surface of equipment as needed, and weekly janitorial service.

When performing analytical procedures in the field, care is taken to provide adequate conditions for analytical testing. These steps include using laboratory pure water generated at the main lab, approved test kits, and quality control elements similar to those employed while performing an analytical procedure at the main facility.

Individual refrigerators, including a walk-in style cooler, are available for the separated storage of samples from standards, standards from reagents, and to eliminate a problem of cross contamination between sample types. These storage areas allow for the storage of samples according to the conditions specified in the reference methods.

The Merrillville facility is a secured facility with restricted entry. The reception and sample receiving entrances are staffed during normal business hours. All other entrances remain locked. Visitors, clients, and maintenance personnel requiring access beyond the reception and

sample receiving entrances are required to sign-in and sign-out of a visitor logbook that is maintained in the reception area. All doors to the facility are locked after normal working hours.

Designated employees are issued keys to the facility in order to permit after-hour entry. The Managing Director keeps documentation of the employee key distribution on file. Keys are returned to the Managing Director upon termination of employment.

5.2 Laboratory Information Management System

The Laboratory Information Management System (LIMS) is one feature of the facility that enables Microbac to provide the high level of service expected by our clients. The LIMS used by the Merrillville facility is a commercial software package that manages samples and analytical data. The main functions of the LIMS include an information database, automated sample tracking, data management, customized reports, quality control evaluation and documentation, and financial accounting capabilities.

The database capabilities of the LIMS provide for the collection of client information (including multiple contact names and locations) and test code parameters (including reference method, holding time, analyte name, reporting limit, and quality control specifications). The sample tracking capabilities of the LIMS provide up to the minute analytical status tracking of each sample and its associated test results. The data management features allow for automated data entry and calculations. The reporting features of the LIMS allow Microbac to provide various formats of reports to our clients. These reports are detailed in section 23.3 of this document. Automated quality control evaluation provides the client with accurate assessment of the data. The financial accounting features of the LIMS allow accurate invoices to be delivered to our clients and provide a means of tracking internal costs. These features allow Microbac to better serve our clients in a cost-effective manner.

5.2.1 Computer Security and Control

Access to the Laboratory Information Management System is approved, limited, and controlled through the use of separate and unique usernames and passwords. The security system allows users to access and modify only that information approved by the QA department and the Managing Director. The SOP Creating and Managing LIMS Users details the steps in managing system users. In addition, access to the analytical instrument software programs is controlled through the use of unique usernames and passwords, where available.

Passwords are to be kept confidential. Laboratory staff is required to log off of the system when they have completed their task.

5.2.2 Equipment Protection

The file server system is protected by the use of an uninterruptable power supply (UPS), anti-static materials, and surge protectors. Virus protection software is employed on the file servers as well as those computers with access to company provided e-mail.

5.2.3 Software Validation

All computer software used for data handling will be validated prior to use. Validation provided by the manufacturer is sufficient. Software validation will verify correct and accurate operation, processing, manipulation, calculations, recording, and reporting. For software programs or spreadsheet applications created in-house the Information Management staff or QA department performs this validation before the software is made available for use to the general staff. Internal software validation is documented and records retained. Refer to the Software Validation SOP for the details of this software validation and the documentation generated.

5.2.4 Data Backup

The network, which includes the database and system files, is backed up each day. This data is stored on a retrievable storage media. A series of data tapes are used with one of the tapes rotated and stored off site. Appropriate computer systems/software is retained as necessary for the retrieval of electronically stored records. Hard copy or write protected copies of data are retained where data is generated by computers not connected to the network. System backup is documented and records retained in accordance with the Performing Computer System Backups SOP.

6.0 ORGANIZATION CHART AND JOB RESPONSIBILITIES

6.1 Company Structure

Acquired by Microbac Laboratories, Inc. in March 2004 the Merrillville facility is part of a nationwide chain of laboratories servicing the testing needs of a variety of industries. A Managing Director who is responsible for all aspects of the facility operations manages each laboratory division. Each departmental manager reports directly to Mr. Robert Crookston, Managing Director of the Merrillville facility. Sufficient personnel are made available to ensure that the ratio of supervisory personnel to non-supervisory personnel provides adequate supervision for adherence to the requirements of this Quality Assurance Plan and the Standard Operating Procedures.

6.2 Management Authority

The management staff is responsible for setting laboratory policies and procedures, obtaining the necessary financial resources, and resolving conflicts. These policies and procedures document the analytical and operational activities of the laboratory. The Quality Assurance Manager is responsible for monitoring the QA policies and procedures as well as documenting the quality of data reported by the laboratory. The Managing Director and QA Manager are responsible for ensuring that the corporate QA policies and procedures as well as those found in this document are implemented and enforced within the Division. The management team is comprised of the following staff. If, at any time, these Managers are absent from the facility they or the Managing Director will identify appropriate personnel to temporarily perform these duties.

- Robert Crookston, Managing Director
- Jeff Loewe, QA/QC Manager
- Ron Misiunas, Client Services Manager
- Nancy Tavitas, Organics Manager
- Troy Goehl, Inorganics Manager
- Mike Chenoweth, Field Services Manager
- Kevin Falvey, Business Development Director
- Karen Ziolkowski, Senior Project Manager

6.3 Organization Chart

The organizational structure of the Merrillville facility is provided in Appendix B. A list of personnel, education, functions, and experience is included in Appendix C.

6.4 Job Responsibilities

A general description of job responsibilities is provided below for the various administrative and analytical staff. In addition to the below listed responsibilities, all employees, regardless of task or department, are required to perform and are responsible for performing their tasks in accordance with the various quality systems described in this Quality Assurance Plan.

6.4.1 Managing Director (MD)

This person is a full time employee of Microbac Laboratories, has overall responsibility for laboratory activities. As such, the Managing Director exercises day-to-day supervision of laboratory operations and reporting of results. The MD ensures the implementation of corporate policies, procedures and standard operating procedures (SOPs) to sustain an effective level of quality assurance. Key responsibilities include, but are not limited to, planning, marketing, overall supervision of personnel, monitoring the performance of the QA/QC activities, and monitoring the validity of the analyses performed and the data generated. In addition, as the Lead Technical Director, the Managing Director is responsible for designating the Unit Supervisors who are responsible for the production within their section. The MD, in conjunction with the Unit Supervisors, is responsible for ensuring that employees have the appropriate education or training needed to perform their duties. The Managing Director must assist in determining the availability of the lab to accept new projects. This availability includes considerations of equipment, facilities, staff, experience, etc. Moreover, this person is responsible for designating the directors of the laboratory. If, at any time, the Managing Director is absent from the facility the QA/QC Manager will temporarily perform these duties.

6.4.2 QA/QC Manager

This person is the director of all QA/QC activities, reports directly to the Managing Director as well as the Corporate QA Director and has direct access to Mr. Trevor Boyce, President of Microbac Laboratories, Inc. The QA/QC Manager functions independently from laboratory operations and production. As a result, this person is able to evaluate data objectively and without influence from outside factors. This person must have documented training or experience in the QA/QC procedures used in the laboratory, knowledge of the analytical procedures for which data review is performed as well as knowledge of the accreditation programs applicable to the lab. The QA/QC Manager is responsible for coordinating QA/QC procedures and the data review procedures for the entire lab, the laboratory accreditation's and performance testing (PT) samples, arranging and conducting internal audits, maintaining a base of approved subcontract laboratories, and the maintenance of the Quality Assurance Plan. The decisions of the QA/QC Manager concerning data quality and data validity are final and receive the complete support of the Managing Director. Other duties include, but are not limited to, the

preparation of Standard Operating Procedures (SOPs), control chart management, maintenance of the training files, and the scheduling and review of method detection limit data. If, at any time, the QA/QC Manager is absent from the facility the Managing Director will temporarily perform these duties.

6.4.3 Laboratory Information Management Staff

Laboratory Information Management staff is responsible for computer hardware and related software utilized throughout the laboratory and report directly to the Managing Director. Key responsibilities include, but are not limited to, improving the form and function of the LIMS, maintenance and backup of the LIMS and associated databases, implementation and verification of new hardware and software programs, and maintaining the functionality of the LIMS. These staff are responsible for maintaining systems that provide proper levels of quality assurance as well as maintaining the required quality control documentation. Activities of the LIMS staff are subject to direct review and audit by the QA/QC Department.

6.4.4 Project Managers

Project Managers are responsible for coordinating projects with the clients and the Unit Supervisors. The individual Project Managers are under the direct supervision of the Client Services Manager, who reports directly to the Managing Director. Project Managers are responsible for overseeing the specified project requirements starting with the initial client contact through the generation of the final report. In addition, Project Managers are responsible for ensuring that all sample acceptance criteria are verified and that samples are logged into the LIMS. Project Managers also review project requests, approve data for final report to the client, and generate the final report for submission to the client. Project Managers are given the authority of report signatories. The Managing Director and QA/QC Manager may also sign reports. Project Managers are responsible for following the established quality systems as well as maintaining the required quality control documentation.

6.4.5 Login/Shipping/Receiving Staff

The staff responsible for login, shipping and receiving samples report directly to the Client Services Manager. The responsibilities of these staff are to send approved sample containers to the clients, receive samples, log the samples into the LIMS system, and the organization of current samples in the storage areas. These staff are responsible for following the established quality systems as well as maintaining the required quality control documentation.

6.4.6 Unit Supervisors (Inorganics Manager and Organics Manager)

Unit Supervisors are the Technical Directors for their respective departments and are responsible for the production of analytical data, supervision of analysts and for reviewing the data produced within their designated section. Unit Supervisors report directly to the Managing

Director and are responsible for the operations, personnel management, financial management and planning for their section. Moreover, they assist the Managing Director in ensuring that employees have the appropriate education or training needed to perform their duties. Unit Supervisors must be familiar with the calibration and procedures, objective of the calibrations and procedures, and assessment of results for the sections of which they are responsible. Supervisors are responsible for following the established quality systems as well as maintaining the required quality control documentation.

6.4.7 Chemists

Staff Chemists are responsible for the oversight of sub-units within the laboratory and report directly to the Unit Supervisors. Chemists may also be responsible for duties such as method development, troubleshooting, sample analysis, and staff training. Chemists are responsible for following the established quality systems as well as maintaining the required quality control documentation.

6.4.8 Senior Technicians

Senior Technicians are responsible for producing instrument data that meet the requirements of the Standard Operating Procedures and this Quality Assurance Plan. Senior Technicians have the authority to not approve data that does not meet the quality assurance or quality control requirements. These staff are responsible for following the established quality systems as well as maintaining the required quality control documentation. Chemists, Senior Technicians, and Laboratory Technicians are the primary element in the implementation of effective quality control.

6.4.9 Laboratory Technicians

Technicians are responsible for sample preparation and for producing data from analyses that meet the requirements of the Standard Operating Procedures and this Quality Assurance Plan. Technicians have the authority to not approve data that does not meet the quality assurance or quality control requirements. Technicians are responsible for following the established quality systems as well as maintaining the required quality control documentation.

6.4.10 Field Services Staff

Field services staff report directly to the Field Services Manager. These personnel are responsible for the pick up and delivery of samples from various client sites, and the delivery of approved sample containers to these clients, as well as the collection of samples where designated.

In cases of sample collection, the field services staff collect samples, obtain field data, and submit samples to the lab in accordance with the Standard Operating Procedure for sample

collection or other applicable client or site specific plan. The Field staff are responsible for following the established quality systems as well as maintaining the required quality control documentation.

6.4.11 Administrative Staff

The administrative staff is responsible for routine office activities. These activities include, but are not limited to, reception, specialized report generation, submitting reports to the client, copying, filing, document generation, and invoicing. These staff are responsible for following the established quality systems as well as maintaining the required quality control documentation.

7.0 QUALITY ASSURANCE / QUALITY CONTROL

7.1 General QA/QC Responsibilities

Quality Assurance (QA) refers to those activities whose purpose is to provide the producer or user of a product or service the assurance that it meets defined standards of quality with a stated level of confidence[1]. QA practices do not guarantee the quality of the data, per se, but create an environment where a certain level of quality of the data is anticipated.

Quality Control (QC) refers to those activities whose purpose is to control the quality of a product or service so that it meets the needs of users[1]. These activities include the quality control tests performed by the analysts.

Properly understood, quality assurance begins before the sample containers are sent to the client and continues after the data is archived. Most books and articles on the analysis of any sample type state that sample collection is the most important part of the analytical process. This aspect of the analytical process must be realized and appropriately executed through proper planning between the client and the lab. The goal of this quality assurance program is to create and maintain an unequivocal sample history to verify the sample receipt, validity of the analysis, and report of the analytical data.

The requirements in this Quality Assurance Plan apply to all samples received. In cases where samples are received for compliance to another contract specific Quality Assurance Project Plan (QAPjP), Microbac will handle, analyze, and report samples in accordance with those program requirements. The requirements herein apply to all personnel within the organization that directly and indirectly generate analytical results.

It is the responsibility of each individual laboratory employee to learn and perform the appropriate procedures in their daily activities. This emphasizes that quality is *everyone's responsibility*, from the support staff to the analysts, and the administrative staff to the Managing Director. While management can delegate specific duties and authority to employees, this does not relieve them from their accountability for the function or actions of their designees. Personnel at all levels are responsible for identifying quality issues or potential quality issues and initiating corrective action to solve the problem and prevent reoccurrence.

7.2 Analyst Commitment to Quality

Each employee must adhere to and follow these listed business standards and practices:

- To produce results that are technically sound and legally defensible
- To present services in a confidential, honest and forth-right manner
- To assert competency only for work for which adequate equipment and personnel are available
- To have a clear understanding with the client as to the extent and kind of services to be rendered
- To provide employees with guidelines and an understanding of the ethical and quality standards required to work in this industry
- To operate facilities in a manner that protects the environment and the health and safety of employees and the public
- To obey all pertinent federal, state, and local laws and regulations
- To continually improve product and services quality
- To deal openly, honestly, and fairly in all business matters with employees and clients
- To provide objective and impartial judgment or opinion regardless of external influence
- To acquire a full understanding and knowledge of the methodology used and the associated requirements
- To apply the necessary quality control measures to ensure accuracy and precision
- To use good laboratory practices in the analysis of samples and handling of data

7.3 Managerial Review of the Quality Systems

To assess the appropriateness of the overall quality system, the management team performs a review of these systems using a multifaceted approach of monthly, quarterly, and annual reviews as described below.

Annually and whenever deemed necessary, the Quality Assurance Plan will be reviewed by laboratory management in accordance with the requirements of the SOP Revision, Reproduction and Tracking of the Quality Assurance Plan. The purpose of this review is to ensure the compliance to applicable accreditation requirements and to make additions or deletions for necessary changes or improvements. The department managers perform the annual review. Any staff member can perform additional reviews as needed. Documentation of these reviews is maintained in the QA office. Recommendations from these reviews will be assessed and, if appropriate, implemented.

Quarterly meetings of the management team address business, marketing and safety items as well as the suitability of policies/procedures, pertinent reports from the Managers, internal and external audits, performance testing studies, corrective/preventive actions, changes in the volume and type of work, and client feedback and complaints.

On a monthly basis, the QA Manager submits a QA Report to Management. This report is submitted to the Managing Director and Corporate QA Manager and addresses various quality assurance and quality improvement topics identified by Corporate.

8.0 DOCUMENT CONTROL

This section is applicable to all records produced by the laboratory. Documentation practices have been established for the following aspects of the laboratory operations: Sample Receipt and Login, Reagent and Standard Preparation, Sample Preparation, Instrument Preventative Maintenance, Instrument Calibration and Analysis, Data Review, Reporting, and Access to Archived Records. General practices are listed below. Details of these practices can be found in the applicable sections of this Plan or the applicable standard operating procedure.

Analytical data includes, at a minimum, instrument identification, analyst initials, date and time of analysis, calibration data, and analyte concentrations and units. Computerized printouts must contain, at a minimum, laboratory name and method reference (when available from the instrument software), lab sample number reference, analyst identification, date and time of analysis, and analytical data. Traceability data for the standards and reagents used must also be documented with the analytical or preparation data. These printouts are maintained chronologically in binders or file storage boxes designated for each individual instrument.

For analytical procedures that do not generate instrument printouts, all data entries and calculations are manually entered into analysis logbooks. A separate logbook is maintained for each analytical procedure. The required information entered into these logbooks is the same as that required for the instrument printouts. These logbooks shall be dated and signed, at the time the activity was performed, by the person performing the activity. All logbook entries shall be in chronological order. All entries shall be recorded in indelible black ink (other colors or pencils are not appropriate). Review documentation may be recorded in an indelible color other than black. Unused portions of a logbook page shall be "Z'd" out (or similarly marked as unused) and initialed and dated. Entries continuing on the next page should be noted as such with "continued on next page", or a similar statement, on the bottom of the page. Entries continuing on from the previous page should be similarly noted at the top of their page.

Each logbook for manual data entry shall be bound. The cover of the book shall include the laboratory name, unique name/purpose of the logbook, logbook number, as well as the "start date" and the "end date". All pages of bound logbooks shall be sequentially numbered. Details on preparing logbooks are contained in the Logbook Generation SOP.

All lab records as well as a copy of the final report and supporting documentation are maintained on file in such a manner that facilitates retrieval. Records are retained at the laboratory as space permits. When necessary, records are moved to permanent archive storage provide a total minimum retention of seven years, or longer if a contract specific requirement. This long-term archive storage is provided at an off-site location. All lab records are safely stored, held secure and in confidence to the client. Record storage procedures protect against loss to fire, theft, environmental deterioration, vermin, and electronic erasure. Lab records include, but are not limited to, QAPjPs, project correspondence, sampling records (when received), chain-of-custody records, shipping documents, Standard Operating Procedures, calibration, analytical and quality control data, data exception reports, final data reports, and audit reports. All lab records are accessible to auditing agencies. Access to the archived records is documented through the use of an access log. The details of the document control procedures are in the Document Control SOP.

8.1 Error Correction

Corrections to data shall not obliterate the original record by measures such as erasures, overwritten files or markings. This is accomplished on hardcopy records by drawing a single line through the error, and on electronic records, where possible, by maintaining the original and the modified records. When available through the software being used, electronic records shall identify the person, date and reason applicable to the change. Handwritten corrections and additions shall be dated and initialed by the person performing the activity, and shall identify the number of the appropriate error code of explanation. Appropriate error codes are:

1. Wrong Entry
2. Math Error
3. Footnoted Explanation

The use of WhiteOut® (or similar product) is strictly prohibited on laboratory data.

When corrections to a final report must be made after the original submission to the client the changes must be performed in a fashion that preserves the original result as well as indicating the change, reason for the change, who made the change and when it was made. This is accomplished through data revision in the LIMS and re-issuance of the report to the client. Typically, the Unit Supervisor, QA Manager or responsible analyst will make the change in the LIMS. The re-issued report is identified as "Revised" (or similar) and a memo identifying the reason for the change, the initials of the employee that made the change and the date it was made, is placed in the project file. An approved signatory must sign and submit the revised

report. Clients are notified, through the submittal of the revised report, as soon as possible of any event that casts doubt on the validity of results submitted in a final report. The details for producing amended reports can be found in the Report Generation SOP.

9.0 STANDARDS AND REAGENT TRACEABILITY

All standards and reagents must be tracked from their initial preparation through their use in the preparation and analytical batches. Standards purchased from an outside vendor are, where available, traceable to the National Institute of Standards Technology (NIST). A Certificate of Analysis, or similar document of traceability, is kept in the appropriate standards preparation log. Purchased standards may be used at their prepared and labeled concentration without further verification. Where NIST traceability is not available, satisfactory performance is evidenced by successful analysis of a known quality control sample or successful analysis of a blind performance sample, as available.

Standards preparation and reagent preparation logbooks are maintained throughout the laboratory. Each logbook must be labeled with the laboratory name, unique name/purpose of the logbook, logbook number, the "start date" and the "end date".

Each stock standard, subsequent dilution, and prepared reagent is given a unique tracking number. When preparing dilutions of a standard the following information is included in the standards log:

- standard number
- standard name
- preparation and expiration date
- initials of the preparer
- diluent
- number, concentration and amount used of stock standard
- final volume prepared
- final concentration

The absolute expiration date of a prepared standard is that date on which the stock solution expires. In mixes where there is more than one expiration date for the stock solutions, the earliest date is chosen as the expiration date for the entire mix. Each container shall be labeled with standard or reagent name, concentration, tracking number, and the expiration date. Containers too small for a label with the required information are labeled with a minimum of the logbook reference number and expiration date. Expired standards should be discarded and cannot be used for the generation of analytical data. Standards shall be prepared using glassware and delivering devices of known and acceptable accuracy.

Similar information must be recorded for any prepared reagent. Reagents must be of analytical reagent (AR) grade or better. The reagent purity is verified upon receipt and documented. Unless specified in the method, reagents are used until they are found to not produce the expected response. The labeling requirements for standards and reagents can be found in the SOP Labeling of Standards, Reagents, Extracts and Digestates.

Appropriate storage areas are available for the segregation and storage of all major types of chemicals. These storage areas are properly labeled to assist the laboratory staff in determining the proper chemical storage location. It is the responsibility of the laboratory staff to be familiar with the storage requirements and classification of the various chemicals.

Volumetric glassware is Class A glassware. Volumetric glassware shall not be used for the preparation of solutions that result in an exothermic reaction, or for the storage of reagents and standards. Borosilicate glassware is used if required by the analytical method certification program. The accuracy of all nonstandard labware (plastic cups, centrifuge tubes, etc.) used to measure initial sample volume, prepare dilutions, or measure the final volume of extracts or digestates must be verified and documented.

10.0 TESTING PROCEDURES

10.1 Routine Testing

Microbac utilizes a wide variety of analytical methods approved for use by various regulatory agencies. Typically, a monitoring regulation or client contract requirement specifies the analytical method that must be used.

10.2 Analytical Procedures

Laboratory specific Standard Operating Procedures (SOP) have been developed for each routine analytical procedure in accordance with the requirements of the Preparation of Standard Operating Procedures SOP. The SOPs detail the steps performed at the Merrillville facility. The SOPs are uniquely named and tracked by revision number. Each analytical SOP is in the following format:

1.0 Table of Contents
2.0 Scope and Application
3.0 Summary
4.0 Definitions
5.0 Interferences
6.0 Safety
7.0 Equipment and Supplies
8.0 Reagents and Standards
9.0 Sample Collection, Preservation & Holding Times
10.0 Quality Control
11.0 Calibration and Standardization
12.0 Procedure
13.0 Calculations and Data Handling
14.0 Method Performance
15.0 Pollution Prevention
16.0 Waste Management
17.0 References
18.0 Tables, Forms, Checklists, and Other Attachments

10.3 Special Testing

Special testing includes analyses for which standard methods are not available, or are available for a matrix other than the samples being considered. This type of work is only performed if select/appropriate individuals of the management team are convinced, on the basis of

professional judgment, that resources and expertise are sufficient to assure a reasonable probability of success. Requests for non-standard testing will be evaluated for compliance with Microbac's policies and procedures. A validation study is required before the method is authorized for use under normal reporting routines. Permission to use alternate methods may be granted only by the Managing Director, Unit Supervisors, or the QA/QC Manager.

10.4 Administrative Procedures

Laboratory specific Standard Operating Procedures (SOP) have been developed for each routine administrative (non-analytical) procedure in accordance with the requirements of the Preparation of Standard Operating Procedures SOP. The SOPs are uniquely named and tracked by revision number. Each administrative SOP is in the following format, utilizing only those sections that are applicable:

1.0 Table of Contents
2.0 Scope and Application
3.0 Summary
4.0 Definitions
5.0 Procedure
6.0 Calculations and Data Handling
7.0 References
8.0 Tables, Forms, Checklists, and Other Attachments

The QA department retains a list of the current analytical and administrative SOPs. Copies of the current SOPs are available to all personnel, and to clients upon request. Deviation from these procedures requires notification of the QA/QC Manager. To ensure continued suitability administrative SOPs are reviewed at a minimum of every two years. This review is documented. SOPs are named in a manner that identifies the procedure or task as well as the internal revision number of the SOP. A list of the current SOPs is available in Appendix D.

11.0 PROJECT ASSESSMENT AND MANAGEMENT

The Project Managers are responsible for assisting clients in the management of their sampling and analysis programs.

11.1 Project Assessment

The Project Manager responsible for a given client can accept work that is of a routine nature for Microbac. Each Project Manager is aware of the laboratory capabilities and is permitted to use their discretion in accepting work. Projects having the potential to impact the routine workload or exceed the lab capacity are routed through the Client Services Manager and, if necessary, the Managing Director prior to acceptance or proposal. The Managing Director is ultimately responsible for assessing the availability of the lab to accept new projects.

11.2 Project Management

Proper setup and handling is essential for the success of a project. Once a client is assigned to a Project Manager, this person has the responsibility for the following:

- Informing the client of our Sample Acceptance Policy
- Obtaining project specific information regarding analytes, methods, reporting limits, quality control, and report requirements (QC forms, narratives, etc.)
- Arranging the delivery and receipt of sample containers as necessary
- Arranging for sample pick-up, if requested
- Informing appropriate Unit Supervisors of incoming workload
- Monitoring sample progress in the lab
- Report generation
- Project inquiries from the client
- Communicating any potential problems to the client

All correspondence between the client and the lab that establishes or modifies what is to be done on a project is documented and retained. The format of this documentation may vary from project to project and may include, but is not limited to, memos placed in the project files. See the Project Management SOP for details.

12.0 QUALITY CONTROL

This section presents the QC requirements applicable to the analysis of environmental samples, as well as the methods for assessing data quality. The purpose of this QC program is to produce data of known quality that is legally defensible, satisfies applicable data quality objectives (DQOs), and meets or exceed the requirements of the SOP.

Performance of all analytical methods is monitored to assess the accuracy and precision of the procedure. Specific quality control checks are designed to provide the necessary information for method assessment. These quality control elements are the measures taken to ensure acceptable test conditions. These elements assess environmental conditions (e.g. temperature, humidity, light) as well as instrumental conditions (e.g. flow rate, detector capability) and the actual chemistry being performed.

The following elements apply only to the chemical analyses performed in the laboratory.

12.1 Elements of Quality Control – Chemical

A preparation batch is a group of samples that are carried through an applicable preparation technique (e.g. digestion, distillation, or extraction) at the same time using the same reagents and conditions. An analytical run is group of samples that are analyzed, at the instrument level, together using the same method, reagents and apparatus within the same time period. Typically, these are samples in the same RunID in the LIMS. The identity of each batch and run are unambiguously recorded as a unique "BatchID" or "RunID" so that a reviewer can identify the QC samples associated with a group of samples.

The type of QC samples and their use are identified below. The specifics regarding frequency, acceptance criteria, and corrective action are included in the tables found in Appendix E. Specifics regarding the requirements of these QC samples are detailed in the individual standard operating procedures.

12.1.1 Calibration

Instruments and support equipment are calibrated in accordance with the referenced analytical methods. Details of the calibration criteria are contained in the QC Tables in Appendix E and the SOPs. Where available, the calibration standards and instruments are checked through the use of second source standards. Certified titrants do not require verification provided they are used within the manufacturer specified expiration date. Unless stated otherwise in the appropriate SOP, the lowest standard in the calibration curve must be at or below the PQL for that analyte.

Alternatively, a verification standard at the PQL level may be analyzed prior to the analysis of environmental samples.

If the calibration acceptance criteria are not met, the operating curve may be narrowed either by eliminating a specific point of the curve (providing all project criteria are still met). For multi-analyte calibrations, specific analytes may be eliminated from the low or high points. Otherwise, the entire calibration curve is repeated. Elimination of any of the inner levels of the calibration in order to meet QC acceptance criteria is allowed provided that all analytes are eliminated in that level and the required minimum number of calibrated levels remain. If the low-level standard is removed from the curve, the PQL must be adjusted accordingly.

12.1.2 Surrogates (SURR)

Surrogates are used to evaluate accuracy, method performance, and extraction efficiency in Organic procedures. Surrogates shall be added to environmental samples, quality control samples, and blanks.

For Volatile Organic Analyte (VOA) analysis, all surrogates must meet the acceptance criteria. For Semi-Volatile Organic Analyte (SVOA) analysis, one surrogate per fraction (base-neutral and acid) may be out of the acceptance criteria. Only one of the two surrogates added must meet the acceptance criteria for Pesticide and PCB analysis. One surrogate is added for analysis by HPLC and the surrogate recovery must meet the acceptance criteria. If the surrogate recovery acceptance criteria are not met, samples must be re-extracted and analyzed. If the acceptance criteria are not met in two separately prepared analyses, the failure is considered matrix specific for that sample and the results are reported with an appropriate qualifier. If the acceptance criteria are not met reanalysis steps are limited to a single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis).

12.1.3 Internal Standards (IS)

Internal standards are used to correct sample results affected by column injection losses, purging losses, or viscosity effects. These compounds or elements are added to environmental samples, quality control samples, and blanks.

Used as a diagnostic tool to monitor method and system performance, acceptance criteria are strictly applicable to only the Continuing Calibration Verification. If the acceptance criteria are not met for the CCV, appropriate instrument maintenance is performed or a new initial calibration is established.

12.1.4 Retention Time Windows

Retention time windows are used in GC, GC/MS, and HPLC analysis for qualitative identification of single peak analytes. RT windows are calculated from replicate analyses of a standard on multiple days for GC and HPLC analyses. RT windows for GC/MS analyses are ± 30 seconds.

12.1.5 Manual Integration

Manual integration may be performed to accurately calculate the concentration of a compound in GC, GC/MS, and HPLC methods when it is deemed that, in the analyst's professional opinion, the automated integration was not properly performed. Manual integration is used only when absolutely necessary for proper integration and must be performed in accordance with the Manual Integration of Chromatographic Peaks SOP. All results for manually integrated peaks are identified as such on the instrument printouts.

12.1.6 Initial Calibration Verification (ICV)

A second source standard containing all target analytes is analyzed immediately after each initial curve, to verify the validity of the calibration. This standard must be from a separate source or lot number from that used for calibration.

If the acceptance criteria are not met for the ICV reanalysis/corrective action steps are limited to the following. When deemed appropriate, the analyst may take lesser corrective action.

- Single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis)
- Perform corrective action (e.g. prepare new standard, rinse system, etc.) followed by the analysis of another calibration verification. If acceptance criteria are not met in this second consecutive (immediate) calibration verification, then perform one of the following. Either,
    - demonstrate performance after corrective action with two consecutive successful calibration verifications, or
    - a new initial instrument calibration must be performed.

The acceptance criteria must be met before samples can be analyzed. However, sample data associated with an unacceptable calibration verification may be reported if the verification indicates high bias and the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

12.1.7 Initial Calibration Blank (ICB)

Not applicable to GC, GC/MS, or HPLC analyses. A reagent blank is analyzed after the ICV and prior to the analysis of environmental samples. A blank may also be analyzed after high concentration samples to demonstrate that carryover contamination does not exist.

Samples associated with an ICB indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier reported. If the acceptance criteria are not met reanalysis steps are limited to a single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis).

12.1.8 Interference Check Sample (ICS)

The interference check samples (solutions A and AB) are used in inductively coupled plasma analyses to verify background and interelement correction factors.

Samples associated with an ICS indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier reported. If the acceptance criteria are not met reanalysis steps are limited to a single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis).

12.1.9 Method Blank (MBLK)

The method blank goes through all applicable preparation steps and is used to document non-contamination of the entire analytical process. In methods that require no sample preparation (i.e. neat analysis) the MBLK is the same as the ICB. In these cases, a separate ICB and MBLK are not analyzed as the single analysis satisfies the instrument and procedural requirements.

The MBLK is considered a batch control parameter. Samples associated with a MBLK indicating high bias must be reprepared and analyzed. The only exceptions are samples that indicate a non-detectable concentration despite the MBLK result, or where the project DQOs are met and an appropriate qualifier reported. If the acceptance criteria are not met reanalysis steps are limited to a single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis).

12.1.10 Laboratory Control Sample (LCS)

The LCS is prepared with analyte-free water or applicable solid matrix. Where available, a purchased solid matrix spiked with representative analytes may be used. The LCS shall be spiked at a level less than or equal to (i.e. near) the midpoint of the calibration curve for each

analyte. This QC sample shall be carried through the entire preparatory and analytical procedure to document the accuracy of the entire analytical process. In methods that require no sample preparation (i.e. neat analysis) the LCS is the same as the ICV or CCV depending on concentration. In these cases, a separate ICV/CCV and LCS are not analyzed as the single analysis satisfies the instrument and procedural requirements.

The LCS is considered a batch control parameter. Samples associated with a LCS that fails to meet the acceptance criteria for recovery must be reprepared and analyzed. The only exceptions are samples that indicate a non-detectable concentration when the LCS indicates high bias, or where the project DQOs are met and an appropriate qualifier is reported. If the acceptance criteria are not met reanalysis steps are limited to a single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis).

12.1.11 Matrix Spike / Matrix Spike Duplicate (MS/MSD)

A matrix spike and matrix spike duplicate are separate aliquots of sample spiked with known concentrations of analyte. The spiking occurs prior to preparation and analysis. Samples used for the MS/MSD are chosen at random. This allows for the evaluation of all sources of a given sample matrix over time so that various matrix problems can be noted. The MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve, with the exception of Semi-Volatile Organic Analyte (SVOA) analysis, in which are spiked at levels slightly above the midpoint.

The MS/MSD are matrix-specific quality control samples and are used to assess the bias for accuracy and precision of a method in a given sample matrix. Matrix spikes are analyzed as required by the test method or as part of a systematic planning process to meet defined data quality objectives. The MS/MSD accuracy recovery is not solely used to assess batch control. The decision or to prepare the entire batch is determined according to the MS/MSD Evaluation and Corrective Actions Flow Chart in Appendix E.

Samples having an indigenous concentration greater than or equal to 4 times the spiked amount are considered not applicable for spike analysis at that level. Where the sample chosen for MS/MSD analysis is one of a group of samples submitted from a site with homogeneous character and the MS/MSD require that the sample is reprepared and analyzed, all samples from that Sample Delivery Group should be reanalyzed under similar conditions. If the acceptance criteria are not met in two separately prepared analyses, the failure is considered

matrix specific for that sample and the results yielding better recovery are reported with an appropriate qualifier. If the acceptance criteria are not met reanalysis steps are limited to a single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis).

In batches where insufficient sample is available for the performance of a MSD, a MS may be performed on two different samples or a duplicate laboratory control sample (LCSD) should be analyzed. The MS results from the two samples or the LCSD results are used to evaluate the precision criteria.

12.1.12 Duplicates (DUP)

Applicable to analyses where MS/MSD are not, duplicate samples are analyzed using identical recovery techniques and treated in an identical manner. Duplicate sample results are used to assess the precision of the entire analytical process. Samples used for the DUP are chosen at random. This allows for the evaluation of all sources for a given sample matrix over time.

The DUP is a matrix-specific quality control sample and is used to assess the bias of a method due to a given sample matrix. The DUP is not used to solely assess batch control. If the acceptance criteria (% RPD) are not met, the sample and its duplicate must be reprepared and analyzed. Relative Percent Difference is calculated only where the two values are greater than or equal to 5 times the PQL. If the values are below 5 times the PQL, the acceptance criteria are ± 1 PQL of each other. If the acceptance criteria are not met reanalysis steps are limited to a single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis).

Where the sample chosen for duplicate analysis is one of a group of samples submitted from a site with homogeneous character and the DUP requires that the sample is reprepared and analyzed, all samples from that Sample Delivery Group should be reanalyzed under similar conditions. If the acceptance criteria are not met in two separately prepared analyses, the failure is considered matrix specific for that sample and the results yielding better recovery are reported with an appropriate qualifier.

In batches where insufficient sample is available for the performance of a DUP, a duplicate laboratory control sample (LCSD) should be analyzed, where applicable. The LCSD results are used to evaluate the precision criteria.

12.1.13 Post-digestion Spikes (PDS)

A PDS is applicable only to digested metals analyses and those general chemistry (wet chemistry) analyses that include a preparation step (e.g. cyanide, nitrogen – ammonia, and phenolics). A post-digestion spike may be analyzed to assist in the assessment of matrix interference when the MS and MSD fail to meet the accuracy acceptance criteria. In addition, a PDS can be used as a troubleshooting tool. The spiking solution is added to a sample aliquot just prior to analysis thereby evaluating the matrix effect on the analysis process only and not the preparation portion. Samples having an indigenous concentration greater than or equal to 4 times the spiked amount are considered not applicable for spike analysis at that level.

If the MS/MSD fail to meet the accuracy acceptance criteria and the PDS is within the acceptance criteria, matrix interference should be suspected. If the MS/MSD and PDS fail to meet the accuracy acceptance criteria, matrix interference is probable and the sample, MS/MSD, and PDS should be reprepared and analyzed. A smaller sample size should be considered as means to negate the apparent matrix interference.

12.1.14 Serial Dilution (SD)

As a troubleshooting tool, it may be necessary to analyze a serial dilution of a sample. The results of a 1:5 serial dilution should agree with each other within 10% (unless stated otherwise in the reference method). These criteria are for evaluating the matrix effect in a new or unusual matrix and not for comparing results for a sample diluted because it was above the calibration range of the instrument.

12.1.15 Method of Standard Additions (MSA)

MSA is a method for the correction of interference as evidenced by the failure of the MS, MSD and PDS. This technique may be used to report a value in cases of matrix interference. Only applicable to trace metals analyses this procedure adds increments of the analyte to a sample to establish a response function (i.e. calibration curve), and by extrapolation determines the amount of analyte originally present in the sample.

12.1.16 Continuing Calibration Verification (CCV)

For Inorganics, a second source standard containing all target analytes is analyzed to verify that the calibration curve remains valid. This standard must be from a separate source or lot number from that used for calibration. For Organics, a calibration standard is analyzed to verify that the calibration curve remains valid.

If the acceptance criteria are not met for the CCV reanalysis/corrective action steps are limited to the following. When deemed appropriate, the analyst may take lesser corrective action.

- Single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis)
- Perform corrective action (e.g. prepare new standard, rinse system, etc.) followed by the analysis of another calibration verification. If acceptance criteria are not met in this second consecutive (immediate) calibration verification, then perform one of the following. Either,
  - demonstrate performance after corrective action with two consecutive successful calibration verifications, or
  - a new initial instrument calibration must be performed.

Sample data associated with unacceptable calibration verification may be reported if the verification indicates high bias and the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier reported.

12.1.17 Continuing Calibration Blank (CCB)

Not applicable to GC, GC/MS, or HPLC analyses. A reagent blank is analyzed after the CCV. A blank may also be analyzed after high concentration samples to demonstrate that carryover contamination does not exist.

Samples associated with an CCB indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier reported. If the acceptance criteria are not met reanalysis steps are limited to a single reanalysis (must be immediate, that is without any corrective action, and performed from same volume used for initial analysis).

12.1.18 Control Charts/Tabulations

Control chart data are retained in the LIMS for all quality control sample types. Charts can be generated at any time to evaluate performance. Where allowed by the reference method, laboratory generated acceptance limits are statistically prepared for ICV and CCV recovery, Surrogate recovery, LCS recovery, MS recovery for accuracy, and MSD/DUP recovery for precision. Statistical outliers are removed and a minimum of the 20 most recent data points used to update the limits. When used, lab generated acceptance limits are evaluated or updated on a minimum annual basis. Control limits are established at the average plus-and-minus three standard deviations ($\overline{X} \pm 3\sigma_{n-1}$) unless otherwise required in the reference method. The details of generating these limits are included in the Generation and Updating Statistical Recovery Limits SOP.

12.1.19 Subsampling

When removing a portion of an environmental sample, the appropriate care and technique must be used in order to obtain a representative subsample. For water samples this includes thoroughly shaking the sample container in order to mix any solids. It is appropriate to shake filtered groundwater samples as any particulate in the filtrate is from the original sample. For solid and semi-solid samples this includes stirring the sample in order to homogenize any stratified layers within the sample container. The above techniques do not apply to removing an aliquot for the analysis of volatile organic compounds (VOCs) or total organic halides (TOX).

12.2 Elements of Quality Control – Microbiology

The following elements apply only to the analyses performed in the microbiology laboratory. These elements are in addition to or take precedence over similar requirements found in other sections of this Quality Assurance Plan.

12.2.1 Lot Comparison

Prior to their use on environmental samples, new lots of membrane filters, new lots of media received from the vendor and new lots of media prepared in the lab are compared against the previous lot. Using a positive control the comparison determines if the new lot is different from the old lot as defined by the Student t-test. Unacceptable lots cannot be used for the analysis of environmental samples.

12.2.2 Media Controls

New lots of media received from the vendor as well as new batches of media prepared in the lab must be evaluated prior to use on environmental samples. Positive and negative controls are analyzed. The positive control uses a culture that is intended to be the detected analyte of the procedure. The negative control uses a culture that is not intended to be the detected analyte of the procedure. Unacceptable lots/batches cannot be used for the analysis of environmental samples.

12.2.3 Method Blanks (MBLK)

The method blank goes through all applicable analytical steps and is used to document non-contamination of the analytical process. This control uses sterile buffered dilution water to verify the sterility of the media, equipment and techniques used to process environmental samples.

The MBLK is considered a batch control parameter. Samples associated with a MBLK indicating high bias must be reprepared and analyzed. The only exceptions are samples that indicate a non-detectable concentration despite the MBLK result, or where the project DQOs are met and an appropriate qualifier reported.

12.2.4 Glassware and Sample Containers

One piece of cleaned glassware per washed and prepared lot is checked with bromothymol green indicator to verify the absence of alkaline or acidic residues. Unsatisfactory results require that all glassware from that lot must be re-washed and re-tested prior to being used in the lab.

Prior to being sent to clients one container from each lot of sterilized sample containers is verified for sterility using a non-selective broth. This verification is documented and retained. Unsatisfactory results require that all containers from that sterilized lot must be re-sterilized and/or re-washed, sterilized, and re-tested prior to being made available to clients.

Prior to being sent to clients one container from each lot of sterilized sample containers is verified to provide sufficient dechlorination. Unsatisfactory results require that all containers from that sterilized lot must be re-prepared and re-tested prior to being made available to clients.

12.2.5 Analyst Quality Control

The primary analyst and each back up analyst perform a count of a count comparison plate, monthly, for total Coliform and fecal Coliform, and quarterly for Heterotrophic Plate Count analysis. This data is documented and retained.

12.2.6 Quality Control Samples

Blind QC samples for various procedures and analytes are analyzed at a minimum annual basis. These samples are used to assess the entire analytical process including the environmental conditions of the laboratory.

12.2.7 Subsampling

When removing a portion of an environmental sample for analysis, appropriate care and technique must be used in order to obtain a representative subsample. For water samples this includes thoroughly shaking the sample container. For solid and semi-solid samples this includes stirring the sample with a sterile spatula in order to homogenize any stratified layers within the sample container.

12.3 Support Equipment

The laboratory water system includes filtration, water softening, organic removal, ion removal, and reverse osmosis to surpass the standards for Type I water as defined in Standard Methods for the Examination of Water and Wastewater. Treated water is fed to taps located throughout laboratory. Maintenance of the system is documented when performed. Daily measurements of resistivity are made and documented and corrective action taken and documented as needed. Acceptance criteria are greater than 10 Megohm-cm. Resistivity below 15 indicates the upcoming need for system maintenance. Continued monitoring of the lab pure water system is

performed through the analysis of method blanks for all analytes in general and the specific achievement of the requirement of <0.05-mg SiO_2/l.

Class S-1 masses are used to check balances for accuracy and precision. The masses cover the range from 100 grams to 2 milligrams. These masses are recertified every year. The QA office maintains the certificates of traceability.

Annually and as needed, NIST traceable reference thermometers are used to check the thermometers used throughout the lab. The traceable thermometers are recertified every year. The QA office maintains the certificates of traceability. Thermometers are verified at the point of use and correction factors are applied in their daily use. If a thermometer is used at more than one point it is verified at those points which it is used. The procedure for the verification of thermometers is included in the SOP Thermometer Calibration. Thermometers are graduated to enable measurement at the appropriate sensitivity. Thermometers used for microbiological analyses at 35°C are graduated in no greater than 0.5° graduations or 0.2° graduations for use at 44.5°C.

Balances are calibrated or verified (if unable to calibrate) at a minimum of two masses each day of use. Calibration/verification data are recorded in logbooks each day of use and corrective action taken and documented as needed. Acceptance criteria for verification are ±1 times the readout sensitivity (e.g. a balance reading to 0.01g has criteria of ±0.01g). Quarterly, all balances are verified at three masses. Semi-annually, all balances are serviced, cleaned and calibrated/verified by a third party contractor. The QA office maintains the certificates of traceability. The daily and quarterly checks as well as the semi-annual calibrations verify the accuracy of the balance over the entire range of use. The procedures used for daily balance calibration are included in the SOP Daily Balance Calibrations.

pH meters have a minimum of 0.1 unit sensitivity. An Automatic Temperature Compensating (ATC) probe is used to negate the effects of temperature differences between the standards and samples. The meters are calibrated each day of use with a minimum of 2 buffers. Initial and continuing verifications are required. Acceptance criteria are ±0.1 unit.

Specific Conductivity meters are calibrated each day of use. Initial and continuing verifications are required. Acceptance criteria are ±10% or ±1 umhos/cm, whichever is greater.

All ovens, coolers, refrigerators, freezers and incubators are monitored on a daily basis at the point of use. The temperature of the microbiology incubators is monitored two times per day at least 4 hours apart. Temperatures are recorded in logbooks each day of use and corrective action taken and documented as needed. Daily temperature logs document the lab name, thermometer ID, oven/cooler/etc. ID, date, corrected temperature, acceptance range, corrective action, and initials of the person measuring the temperature. The appropriate correction factor (from comparison to the NIST traceable thermometer) is applied to all thermometer readings. Thermometers with a correction factor greater than 3°C will not be used in the lab.

The delivery volume of Eppendorf® and Oxford® style pipettes is verified and documented on a minimum weekly basis. Verification data are recorded in logbooks and corrective action taken and documented as needed. The analysts performing this check should be varied. Acceptance criteria are ±3% difference. Equipment not meeting the acceptance criteria is not used in the laboratory. Details of this requirement are included in the Calibration of Manual Repipetters SOP. Glass microliter syringes are considered Class A glassware provided they come with a certificate attesting to the accuracy of the syringe. Syringes without vendor certification are verified annually and labeled with a correction factor for continued use.

Nephlometers used to measure turbidity are calibrated each day of use. Initial and continuing calibration verifications are performed and documented. Acceptance criteria are ±10.0% recovery.

The rotation rate of the tumbler units used for the Toxicity Characteristic Leaching Procedure (TCLP) and other such procedures is verified prior to use on a daily basis. Acceptance criteria are 30 ± 2 rpm. These checks are documented and any units not meeting the acceptance criteria are removed from service.

12.4 Sample Containers

Many containers are purchased certified clean from a commercial vendor. These containers are ready for use and require no additional monitoring prior to use. Containers that are cleaned in-house must be verified clean prior to shipment to clients in accordance with the Bottle Preparation and Shipping SOP. Lots that do not meet the acceptance criteria cannot be used for the collection of environmental samples.

12.5 Demonstrations of Capability & Detection Limits

Prior to the unsupervised analysis of environmental samples, analysts performing a new procedure (i.e. new to the lab or to them) must successfully perform an Initial Demonstration of Capability (IDC) study. Detection limit and Capability studies are applicable only to those tests where a spike solution is available.

The Linear Dynamic range must be established for each element at each wavelength measured by Inductively Coupled Plasma. A LDR study is the analysis of a minimum of three standards at concentrations that exceed the normal calibration range. The LDR is the concentration where recovery deviates by more than 10% of the true value.

For each new procedure, annually thereafter, and whenever a substantial change occurs in the instrumentation or procedure, an Instrument Detection Limit (IDL) study must be performed for each trace metals procedure. An IDL study is the consecutive analysis of a minimum of seven blanks. The IDL is the minimum level at which the instrument, with 99% confidence, can detect the difference between noise and signal.

For each new procedure, annually thereafter, and whenever a substantial change (i.e. a change that affects how the test is performed or that affects the sensitivity of the instrument) occurs in the instrument or procedure, a Method Detection Limit (MDL) study must be performed. A MDL study is the consecutive analysis of a minimum of seven standards spiked into lab pure water or an appropriate solid matrix. These standards are taken through all preparation and analytical steps of the procedure. The MDL is a statistical value defined as the minimum level at which the procedure, with 99% confidence, can detect analyte in the matrix in which it was performed. MDL studies are applicable only to those tests where a spike solution is available. The MDL data are evaluated to verify the relationship between the detection limit and the reporting limit as well as the appropriateness of the spike level used in the study. It must be understood that the detection limit may not be attainable in all real-world sample matrices.

Documentation of all IDC, LDR, IDL, and MDL studies are retained on file in the same fashion as all other lab records. Details on the procedures for performing these studies is included in the Capability and Detection Limit Studies SOP.

Reporting limits are based upon the data generated in the Method Detection Limit studies or the limits specified in the reference method. Results reported to the Wisconsin DNR are evaluated

and reported down to the MDL. Whenever possible, the reporting limit should be set at a Practical Quantitation Limit (PQL) of 5-10 times the MDL. The lowest level that any analyte should be reported at is a value of 2.2 times the Method Detection Limit, as seen in the table below. The number of significant figures reported is limited by the precision of the analysis. As such, the number of significant figures supported by the MDL study limits the sensitivity of the PQL. Reporting down to the MDL is always discouraged, as the probability for false biased data is considered too great. Reporting limits are based on an "as received" or "wet weight" basis. "Dry weight" reporting limits are increased directly proportional to the amount of solids in the sample. Reporting limits are adjusted when lesser sample size than the maximum is used. The number of significant figures reported is maintained regardless of the magnitude of the value due to concentration, dilution or unit conversion.

Guidance for Establishing Reporting Limits

If 2.2*MDL is	**Then the Reporting Limit is <u>at least</u> the**
> 0 and ≤ 1 unit	Nearest multiple of 0.1 greater than that value
> 1 and ≤ 5 units	Nearest multiple of 1 greater than that value
> 5 and ≤10 units	Nearest multiple of 5 greater than that value
>10 and ≤50 units	Nearest multiple of 10 greater than that value
> 50 units	Nearest multiple of 100 greater than that value

13.0 SHIPPING AND RECEIVING

Procedures to ensure the custody and integrity of the samples begin at the time of sample collection and continue through disposal. Records concerning sample custody and condition are maintained as required in the Sample Receipt and Login SOP.

13.1 Shipping

The shipping department packages the appropriate sample bottles and a chain-of-custody (COC) form into a shipping container (typically a Coleman® style cooler). Additional cooler items may include, but are not limited to, sampling instructions and cooler custody seals. Details are included in the Bottle Preparation and Shipping SOP.

13.2 Sample Receipt

The requirements for sample receipt are included in our Sample Acceptance Policy (SAP). A copy of this policy is included in Appendix F. The SAP includes information regarding sample containers, preservatives, receipt temperature, holding time, and the Chain of Custody (COC) form. The Sample Acceptance Policy must be made available to the appropriate sample collection personnel and client project managers.

Transfer of sample custody is documented on the COC. A completed COC must include the following information and accompany all samples collected in the field for laboratory analysis. A copy of our Chain of Custody form is included in Appendix F.

Required Sample Receipt Information

- Client name and address
- contact person
- name and signature of sample collector
- sample description
- date and time of sample collection
- number of containers
- matrix
- preservative
- requested analyses
- a relinquishing signature

The Sample Receipt department receives all samples into the laboratory. All sample containers are visually inspected for bottle breakage and other abnormalities (such as insufficient sample

volume). All abnormalities and discrepancies between the sample container identification and the chain of custody form are also noted in the LIMS. The results of the cooler and sample inspections as well as container lot numbers are documented on the LIMS Cooler Inspection form. The sample receipt temperature is measured on a representative sample from each cooler using a non-contact thermometer. The acceptance criteria for receipt temperature are 0.1 – 6°C (with the exception of samples for North Carolina DENR or Wisconsin DNR compliance, which must be received in the range of 0.1 – 4°C). Water samples for microbiological analysis must be received <10°C. Samples that are delivered within 2-hours of collection are considered acceptable if there is evidence that the chilling process has begun (e.g. ice or cooler packs are present). The sample control personnel sign the chain of custody form prior to sample information being logged into the LIMS.

The Project Manager will notify the client of any significant problem with a sample. The direction from the client is documented on the Cooler Inspection form, which is included in the project file. A copy of this form accompanies the analytical report.

13.3 Login

All samples received at the laboratory are logged into a computerized laboratory information management system (LIMS), which assigns a unique laboratory sample number to each sample. This sample number is used to identify all subsamples, and subsequent digestates or extracts prepared from the original sample. Moreover, each container for a given sample is issued a unique container identification number. This provides for an unequivocal link between the unique field ID and the sample container used for analysis.

Login personnel determine which analysis is required for a given sample from the information provided on the chain of custody. Using the information given on the COC and the project definition, the following details are logged into the LIMS.

- Client information
- Project name
- QC level
- General comments (that appear on the report)
- Turnaround time (which calculates and enters the due date)
- Date and time received
- Client sample ID

- Date and time collected
- Matrix
- Container type
- # of containers
- Storage area within the lab
- COC #
- Sample specific comments
- Test codes (which link to the reference method numbers)

The original COC, Cooler Inspection form, and any paperwork shipped with the sample is placed into a project file, which is then given to the applicable Project Manager. The Project Manager verifies the receipt of the sample, COC information, and analyses logged into the LIMS.

Labels are generated by the LIMS for each sample container. These labels are durable, water resistant, and printed with indelible ink. The labels include the following information:

- Sample number
- Client sample ID information
- Date received
- Date collected
- Storage area
- Sample specific comments
- Container ID
- Required tests from that container

Should any sample be sent to a subcontract laboratory (within our network or not), the login department will generate a new chain of custody for the sample(s) sent to the subcontract lab. This chain of custody will identify the Microbac sample number so that client confidentiality is not compromised. Subcontracted sample chain of custody forms will be returned to the client with the analytical results.

13.4 Sample Storage and Disposal

Samples are stored in separate and dedicated storage areas and sample refrigerators/freezers. Separate refrigerators/freezers are available for extractable organic analyses, volatile organic analyses, general chemistry analyses, and microbiological analyses. In addition, soil samples

are segregated from aqueous samples. A single large walk-in style cooler is available for long-term storage, storage of excess sample volume, retention of "Hold" samples, and other similar needs. Acid preserved samples for metals analyses are not retained in cold storage. Separate areas are available for the storage of extracts and digestates. Personal food items for consumption are not allowed in the sample, standard or reagent coolers. Where a sample or a portion of a sample is to be held secure for reasons such as litigation, safety, etc., a locked storage unit is maintained within the main walk-in cooler. The QA/QC Manager keeps the key to this storage unit. Access to the unit it documented. This storage unit provides isolation of samples so the prevent cross-contamination.

All cooler temperatures are monitored and documented each day of use. All sample coolers are required to store samples in the range of 0.1 – 6°C (with the exception of samples for North Carolina DENR or Wisconsin DNR compliance, which must be stored in the range of 0.1 – 4°C). Acceptance criteria for freezers are less than -10°C. If the temperature range is not maintained, corrective action is taken and documented as needed.

The analysts remove samples from the storage coolers for analysis. After their use, the analyst returns samples to their storage area.

Samples are removed from their designated storage area for disposal based upon the date of receipt. Depending on the matrix type and specific project needs, samples may be placed into long-term storage or immediately disposed. Depending upon the matrix type and characteristics of the sample, samples may be disposed of by pouring down the sink (with treatment for acidic or basic pH), as part of general refuse, as special waste, as hazardous waste, or returned to the client. The specific details of the disposal practices can be found in the Sample Disposal SOP.

14.0 EQUIPMENT, SUPPLIES AND SERVICES

14.1 Major Equipment

A list of the major analytical equipment is included in Appendix G. Individual pieces of major analytical instrumentation are given a unique identification number. For every Instrument ID, the following information is logged into the LIMS.

- Instrument type
- Description
- Manufacturer
- Model
- Serial Number
- Date purchased
- Condition upon receipt

14.2 Instrument Maintenance

Routine maintenance is performed according to the manufacturers recommended procedures. The frequency of this maintenance is based upon the manufacturer's guidance and the experience of the trained analytical staff. Only trained staff and certified third party contractors will perform equipment and instrument maintenance or repairs. Instrument specific logbooks are used to document the maintenance (both scheduled and non-scheduled) performed on each piece of equipment. Copies of manufacturer maintenance reports are also retained in these logbooks. At a minimum, maintenance logs will include the following information.

- Instrument ID
- Specific required maintenance items
- Operator's manual, if available
- Service records of calibration/verification/maintenance

Major instruments as well as support equipment that are generating output that does not meet the required acceptance criteria must be labeled as "Out of Service". If appropriate, the power supply to the equipment should be interrupted. When an instrument problem occurs, the effect on data previously generated is evaluated, where applicable.

14.3 Supply and Service Procurement

The procurement of equipment and supplies is controlled to ensure that the equipment and supplies used by the laboratory are of known quality and conform to the specified requirements. Control includes vendor selection, evaluation of the quality records provided by the supplier by methods such as solvent checks, and examination of items received upon delivery or completion. Purchased equipment is not used until the capability and detection limit requirements identified in this Plan are performed and documented. Vendor records are maintained in the LIMS. Procurement planning, supplier selection, and verification of procurement requirements are the responsibility of the Managing Director. Details of this procedure are in the Supply Procurement SOP.

14.4 Subcontracting

Analysis that cannot be performed at the Microbac Merrillville facility may be subcontracted to another laboratory. Whenever possible, subcontracted analyses will be performed at a laboratory within the Microbac network. Microbac will notify our client of our intent to subcontract any analyses. This notification will be in writing, typically via quote for services, facsimile, or e-mail. For verbal quotes and request for service notification will be verbal. Subcontract laboratories are acceptable if they have the ability to perform the appropriate analysis, a documented quality system (i.e. a copy of their Quality Manual submitted to Microbac), and are currently certified/accredited, as appropriate, for the analysis in question. Analyses requiring a particular accreditation/certification will be subcontracted only to a lab that currently holds the applicable approval. The QA department maintains a list of approved subcontract laboratories.

Microbac will submit to our client the subcontracted laboratory results as received from the subcontract lab. Subcontracted sample chain of custody forms will be returned to the client with the analytical results.

15.0 PROFICIENCY TESTING (PT)

Proficiency testing (PT) samples are used to evaluate the analytical performance and the resulting quality of the data produced. These audits are performed in addition the to routine quality control checks. Performance audits are intended to reflect, as closely as possible, the laboratory performance under normal operating conditions. The evaluation and any corrective actions are handled in accordance with the requirements of the Internal Audits SOP.

15.1 Scheduled PT Samples

The laboratory participates in a minimum of two separate PT studies each year for the drinking water, wastewater and RCRA solids parameters for which we hold accreditations/certifications for chemical analyses. These are single-blind studies that are scheduled approximately six months apart. One set of PT samples are analyzed annually for the microbiological testing parameters for which we are certified as well as various other microbiological parameters in food/solid matrices. Performance samples are also analyzed as required by the USEPA Discharge Monitoring Report – Quality Assurance (DMR-QA) program. In addition to these, our Corporate Quality office administers a performance testing program for which they provide samples on a quarterly basis of varying matrices for a variety of analytical parameters.

PT studies are performed for a variety of the microbiological procedures performed at the lab. Studies for the drinking water and food/solid matrices are scheduled at a minimum annual frequency.

Upon receipt of the PT report, the QA department evaluates the results and distributes copies of the report to the Managing Director and Unit Supervisors.

15.2 Non-scheduled Proficiency Samples

In addition to the routinely analyzed and scheduled PT samples, PT samples may be submitted into the lab for analysis. The necessity for these additional PT samples is at the discretion of the QA/QC Manager, upon request from the Managing Director or a Unit Supervisor, as a follow-up to corrective action requests from unacceptable PT results on external performance testing samples, and upon a valid request from a client. These can be submitted as single blind or double-blind samples.

15.3 PT Sample Performance Criteria

Unless specified by the certification program, performance samples are obtained from a vendor approved by the National Voluntary Laboratory Accreditation Program. This program approves vendors that meet the requirements of the National Environmental Laboratory Accreditation

Program (NELAP) Proficiency Testing Oversight Body (PTOB) / Proficiency Test Provider Accreditor (PTPA) requirements as defined in Chapter 2 of the current NELAC standards.

Of the PT samples analyzed, acceptable performance, as defined by the PT program, must be obtained for two of the last three samples analyzed for each field of testing. The analysis of the three rounds is limited to a maximum of eighteen months. The date analyzed for two PT samples applicable to the same field of testing must be at least 30 days apart.

The PT sample provider is authorized to release the results of all PT samples applicable to our accreditation / certification directly to our accrediting / certifying authorities.

All performance samples are logged in and handled as actual environmental samples. This allows for the application of the same staff, methods, preparation and analytical procedures, equipment, and facilities as real environmental samples.

Prior to the official release of study results from the provider, Microbac will not send a PT sample or a portion of the PT sample to another laboratory for analysis. This includes sending the sample or a portion of the sample to another facility within the Microbac network of labs. Moreover, the Merrillville facility will not knowingly receive and analyze a PT sample or a portion of a PT sample from another laboratory including one within the Microbac network of labs. Accordingly, prior to the official release of study results from the provider, Microbac Laboratories will not communicate our results to another lab nor try to obtain the results for a PT sample from the provider or another laboratory.

The laboratory data, submitted results, and final report for all PT samples are considered laboratory records are retained accordingly. Any LIMS generated report for a PT sample, the report submitted to the provider and the final report from the provider is retained in the QA office. Results identified as “Not Acceptable”, as defined by the PT program, must be investigated and appropriate corrective action taken and documented. The Corrective Action Form is used to document the failure and the corrective actions taken. The QA office maintains documentation of this investigation and the resulting corrective actions.

16.0 CORRECTIVE ACTION

Corrective action is necessary whenever deviations from requirements of the quality system occur. There are two categories of corrective actions – system and analytical. Regardless of the category, corrective actions are documented using a Corrective Action Report (CAR) form. Documentation of each corrective action is kept on file. The forms used are monitored by the QA department to ensure that out of control events and actions are documented, that the corrective actions are appropriate and effective, and that the corrective actions are implemented within the agreed upon time frame. A copy of the CAR form is attached in Appendix H.

16.1 System Corrective Action

System corrective action is the result from the identification of a deficient element of our quality system. Examples include, but are not limited to, audit deficiencies and "not acceptable" ratings on a Performance testing sample and continued failure of a particular quality control element. The QA department typically initiates the corrective action reports for system corrections, although all staff has the authority to identify deficiencies in the quality system. The appropriate designee is responsible for investigating the problem and determining the corrective action needed. Regardless of who initiates a Corrective Action Report, the QA Manager is responsible for monitoring the corrective action process. When the source of the problem has been identified and corrective action suggested, the CAR form is completed, evaluated and, if appropriate, approved by the Unit Supervisor and QA department. These 'Quality System CARs' are numbered by and retained in the QA office.

At the discretion of the QA office, a Stop Work Order may be issued in conjunction with an analytical or quality system CAR. The QA office issues Stop Work Orders. When issued, all appropriate staff is notified of the perceived problem. During the time of a Stop Work Order, no environmental samples may be analyzed by that particular procedure. Upon acceptable completion of the CAR, the Stop Work Order can be lifted by the QA office and analyses resumed.

Regardless of the source or projected impact on the system failure, the following systematic approach is used in developing a suitable corrective action. The emphasis of the corrective action process is to identify the problem and prevent it from reoccurring.

- Define the problem
- Establish the root cause of the problem
- Determine the needed action to resolve the problem and eliminate the root cause
- Implement corrective action
- Verify the corrective action has been implemented and has eliminated the problem

16.2 Analytical Corrective Action

Analytical corrective action is required when a particular quality control element fails to meet the established acceptance criteria. The technician or their Unit Supervisor typically initiates the corrective action reports for analytical corrections. These forms identify the problem, any affected samples and any actions taken to meet the requirements of this Plan. The CAR form is completed, evaluated and, if appropriate, approved by the Unit Supervisor and QA department. These "Analytical CARs' are retained in the applicable project files.

17.0 DEVIATION FROM POLICY OR PROCEDURE

These quality systems and this quality program is designed to meet or exceed the requirements of various certification programs, environmental compliance programs, and analytical testing requirements. To the extent possible, sample results are reported only if all quality control elements are acceptable. On occasion, however, situations occur where the "standard" requirements cannot be obtained, maintained, or simply are not applicable. In cases such as these, deviation from written policy or procedure may be acceptable. Each case is independently evaluated by the production, QA and project management departments to assess the affect the nonconformity will have on the data quality objectives for the project. Evaluations are documented with a Corrective Action Report form. Where the data is deemed useable and reported despite the failure of a quality control element these data are qualified in the analytical report.

17.1 Data Qualifiers

The following data qualifiers are used on the analytical and quality control reports to identify when a quality control element did not meet the applicable acceptance criteria.

Data Qualifiers

B – Analyte detected at or above the reporting limit in the Method Blank

E – Estimated value; Value measured above the highest point of calibration

H – Sample prepared or analyzed beyond the maximum allowable holding time

I – Matrix interference

R – Precision criteria (RPD) outside of the acceptance limits

S – Spike recovery outside of the acceptance limits

SD – Analyte diluted below the quantitation limit

18.0 COMPLAINTS

Complaints may come in two forms – external and internal. To help provide the best quality service to our clients, all employees are empowered to initially address external complaints. Typically, the Customer Services Manager, a Project Manager or the Managing Director will resolve external complaints. Supervisors and the Managing Director typically field and resolve any internal complaints. Regardless of who fields a complaint, every effort will be given so that we can satisfy the needs of the client while meeting any applicable regulatory requirement. All complaints from clients regarding the timeliness or quality of the services provided by Microbac and the resulting resolution are documented using the External Complaint Resolution Form. The Managing Director reviews each form to ensure sufficient resolution. A copy of this form is included in Appendix I. The details of this procedure are included in the Complaint Handling SOP. Complaints that raise doubt concerning compliance with our policies/procedures or related to data quality are forwarded to the QA office so that the issue can be promptly audited.

Where a complaint or inquiry involves analytical data, sample reanalysis is performed in duplicate when holding time and sample volume permit. Duplicate reanalysis allows for the statistical resolution of conflicting or questionable results. The client or a Project Manager can initiate this reanalysis request. If the re-analysis results agree as a duplicate to each other as well as to the original result, the original result is considered verified and reported. If the re-analysis results do not agree as a duplicate to the original result, matrix, procedural or other effects are indicated. In this instance, all results for the sample are reviewed and the most appropriate result is reported and the Report appropriately labeled. Under no circumstance shall a value obtained from an analytical batch that is in control be omitted from the report unless the decision is fully documented and maintained in the project file. Post-digestion spikes (PDS) are a valuable tool in the evaluation of matrix interference's and may be used, where applicable, to evaluate the accuracy of a questioned result.

19.0 CONFIDENTIALITY

Analytical results and all associated client or project information are treated as confidential. To help ensure that analytical data and correspondence are directed only to the individuals for whom the data/information was prepared, a Client File Set-up Form is completed for each new client prior to the release of data. This form allows for the proper entry and verification of the clients' critical information such as address, phone number, fax number, and e-mail address. Requests from other firms for copies of analytical reports or project information are honored only with the consent of the original client.

Electronic transfer of data from the Merrillville facility via telefacsimile (fax) or electronic mail systems (e-mail) will be accompanied by the following statement: "This communication is for the exclusive and confidential use of the designated recipient, and any other distribution or use is unauthorized and strictly prohibited. If you are not the designated recipient, please notify the sender immediately then delete the message from your computer or destroy the facsimile."

20.0 INTERNAL AUDITS

The purpose of auditing is to identify whether the lab is generating scientifically sound and defensible data, and that daily operating systems meet the requirements of this quality assurance plan. Microbac performs three types of audits: performance audits, analytical procedure audits and system audits. Details of the audit procedures and the schedule applied are included in the Internal Audits SOP.

Copies of periodic audit reports are given to the respective Unit Supervisor. Summaries of those audits are given to the Managing Director and Corporate QA Director.

20.1 Performance Audits

Performance audits are conducted periodically throughout the year. Performance audits include scheduled Proficiency Testing samples as well as unscheduled blind and double blind quality control samples. Findings from these audits are used to evaluate the defensibility and data quality produced by the analytical system. Deficiencies from these audits are discussed with the analyst.

20.2 Analytical Procedure Audits

Audits of our analytical procedures are performed periodically throughout the year. These audits are used to evaluate the procedural steps used in the performance of the various analytical procedures performed in the lab. Randomly selected samples from various test methods are evaluated in this process. Deficiencies from these audits are discussed with the analyst.

20.3 System Audits

A systems audit is performed on a, minimum, annual basis. The systems audit is a comprehensive review of the overall quality and measurement system. The purpose of these audits is to confirm compliance with the requirements of this Quality Assurance Plan, and to assess the applicability of the quality system to other certification and regulatory programs. Systems audits identify the presence of the necessary organization, facility, and quality systems needed to provide evidence of the laboratory's capability and competence.

21.0 TRAINING

Proper employee training is applicable to all laboratory operations including administrative tasks, production, sample handling, sample analysis, and data review. The training provided is detailed in the Employee Training SOP.

Upon hire, employees receive an employee orientation, safety training, and environmental management training by the Managing Director, Quality Assurance training (which includes the QAP, confidentiality, quality control, and ethics) by the QA department, notification of employee benefits and payroll information by the Human Resources department, and initial production training by their Unit Supervisor. A log containing the name, signature, initials and hire date of each employee is maintained in the QA office. This list, which provides for the identification of persons responsible for signing lab records, is signed during the Quality Assurance training.

Non-analytical job function training is also provided. This training may include, but is not limited to, sample receipt, chain of custody procedures, LIMS, section specific QA/QC policies and procedures, data review and data reporting, waste control and disposal, and administrative/clerical job functions.

Training files are maintained for each analyst. These files document their education and previous experience as well as internal training received while employed by Microbac. Training certificates are filed to document participation in any external training courses or workshops on specific equipment, analytical techniques or laboratory procedures. Copies of initial demonstration studies, and performance testing results are also kept in the QA Training Files.

To ensure that the objectives and policies of this Quality Assurance Plan are communicated to, understood by, and implemented by all laboratory personnel, all new laboratory employees are required to read the latest revision of this Plan. Employees are required to abide by all sections of this document. A copy of the Employee Certification section at the end of this document must be signed and returned to the QA department by each employee. This certification is retained in the employee's training file.

Prior to performing any analytical procedure, an employee must be thoroughly trained in all aspects of that procedure. The Unit Supervisor or their designee performs this training. Documentation of this training is retained in the employee's training file. When being trained in a

new procedure, analysts will serve as an apprentice with an experienced analyst or receive instruction by an instrument manufacturer or other third party training course. All analytical data generated by an employee in training (trainee) shall be reviewed and documented by the trainer, Unit Supervisor, or the QA department prior to it's approval for reporting.

Prior to the unsupervised analysis of environmental samples, analysts performing a new procedure (i.e. new to the lab or to them) must successfully perform an Initial Demonstration of Capability (IDC) study. The Initial Demonstration for sample preparation is satisfied through the analysis of four Laboratory Control Samples and for analytical procedures through the analysis of four verification standards. Initial Demonstration's are documented with a spreadsheet report and certification statement attesting to the validity of the study. A copy of the IDC certification statement is included in Appendix J.

On-going analyst proficiency is demonstrated through one of the following options per year:

- acceptable performance of a blind sample (single blind to the analyst), or
- another IDC, or
- successful analysis of a blind performance sample on a similar test method using the same technology (e.g., GC/MS volatiles by purge and trap for Methods 624 or 8260) would require documentation for only one of the test methods, or
- acceptable accuracy and precision from a minimum of four consecutive laboratory control samples or verification standards.

22.0 ETHICS

All employees of Microbac Laboratories Inc. are expected to conduct themselves and the business of Microbac Laboratories Inc. in a professional and ethical manner. The success of this Quality Assurance Plan is based on the ethical behavior of all employees. Microbac Laboratories believes that any short-term gain as a result of unethical behavior is not worth the long-term consequence. All actions and decisions must have the highest regard for the intention as well as the letter of the requirement. Microbac is always willing to accept the rigors of doing what is right, thereby creating an atmosphere free from factors influencing the quality of our product. Various efforts are put forth to help ensure that employees are free from any commercial, financial and other undue pressures that might adversely affect the quality of their work. The various efforts towards this goal include continued Ethics training, restricting contact between our clients and the analysts analyzing their samples, fair and appropriate financial restitution and treatment of our employees, and open door policies to the top level of corporate management.

Microbac Laboratories, Inc. supports the following list of ethical and data integrity standards. These standards are included in our Ethics Policy, which stresses that the integrity of our data must never be compromised. The standards help to ensure the integrity of our data to meet the quality needs of our clients. In order to ensure that employees are aware of the high standards of integrity that are expected of them as Microbac personnel, each employee is required to read and sign the Ethics Policy at the time of hire. This signed copy is retained in their training file. A copy of the Microbac Laboratories Ethics and Data Integrity Agreement is provided in Section 27.0. In addition, all employees are supplied with an annual Ethics training course.

Ethical & Data Integrity Standards

- To produce technically sound and legally defensible results
- To present services in a confidential, honest, and forth-right manner
- To assert competency only for work for which adequate equipment and personnel are available
- To have a clear understanding with the client as to the extent and kind of services to be rendered
- To provide employees with guidelines and an understanding of the ethical and quality standards required to work in this industry

- To operate facilities in a manner that protects the environment and the health and safety of employees and the public
- To obey all pertinent Federal, State, and local laws and regulations
- To continually improve product and service quality
- To deal openly, honestly, and fairly in all business matters with employees and clients
- To provide objective and impartial judgement or opinion regardless of external influence

Compliance with the Ethics and Data Integrity Agreement is required and will be strictly enforced. The following are examples of unethical behavior, which is not supported by Microbac Laboratories, Inc. This list is not all-inclusive.

Unethical Actions

- Making up of analytical data or any other sampling and analysis data. Examples of this are reporting a result without performing the procedure, or assigning a date/time of sample collection without knowledge of the actual collection information.
- Intentional falsification of analytical or sampling data. Examples of this are the intentional inaccurate evaluation of control limits, or changing the date/time of sample collection in order not to exceed the maximum allowable hold time.
- Improper calibration or verification. Examples of this are not performing the required calibration, not performing the calibration properly, improper tuning of the GC/MS, or not performing the required continuing verification quality control.
- Intentional deviation from the approved SOP.
- Misrepresentation of analytical data. Examples of this are using a sample size or final volume in the calculation when a different sample size or final volume was actually used in the analysis, or over-dilution or under-dilution of samples or standards. This also includes falsification of standards or reagent preparation data.
- Improper peak integration (i.e. peak shaving or peak enhancing).
- Misrepresentation of the nature of a sample. This is using a sample (QC or real world) as if it were digested/extracted when it actually was not.
- Improper use of the analytical conditions. Examples of this are improperly changing settings (oven temperature, flow rate, injection volume, etc.) to assist in recovery.
- Improper clock setting.
- Intentional deletion or disposal of non-compliant or questionable data.
- Intentional omission of a required data flag(s).

- File substitution. This is the renaming of a file for use in another data set or as another sample in the same data set.
- Unnecessary changes to computer software.
- Intentional misrepresentation of reported data. This includes the date/time of analysis, method performed, analyst, certification, etc.
- Misrepresentation of credentials, including education, training, employment history, etc.

23.0 DATA REDUCTION, VALIDATION AND REPORTING

23.1 Data Reduction

Data reduction involves the handling of raw sample data including, but not limited to, detector response, electrode potential readings, titrant volumes, and gravimetric measurements to achieve final sample concentrations. Automated systems are used for calculation and reduction wherever feasible.

23.2 Data Review

A minimum two-tier technical review of all data is performed and documented. This provides for the documentation of data review, verification and cross-checking procedures. The details of this procedure are included in the Peer Review and Electronic QA Validation of Analytical Results SOP.

23.2.1 1st Level Technical Review

The Laboratory Technician performing an analysis reviews all of their own data and is responsible for ensuring that the calculations were properly performed and the quality control requirements were met. All final calculations and the evaluation of quality control samples are performed by the LIMS. A Data Review Checklist is initiated by the Technician to document this review. Results from all measurements (including environmental samples and QC samples) of an in-control batch are now available for entry into the LIMS. The Data Review Checklist is then given to a peer knowledgeable with the current requirements of that analytical procedure, a Senior Technician, Unit Supervisor, the QA/QC Manager, or the Managing Director.

23.2.2 2nd Level Technical Review

A peer, Senior Technician, Unit Supervisor, the QA/QC Manager, or the Managing Director reviews the data by repeating the verification performed by the Laboratory Technician. This step is documented through use of the Data Review Checklist. Data entered into the LIMS via electronic data transfer may be reviewed electronically. Data entered into the LIMS via manual data entry must be reviewed using the raw data, where a representative number of the calculations are verified and the quality control parameters are evaluated. A Project Manager may review Field data entered into the LIMS.

Acceptable data are now available for approval in the LIMS. This is performed through the "QA Validation" function of the LIMS. This step approves the data for release to the client. The ability to perform this approval step is limited through the select issue of rights, and is controlled by use of usernames and passwords. Data not meeting the requirements of the standard operating procedure is appropriately qualified using the narrative function in the LIMS.

23.2.3 Project Manager Review

Before the data is released to the client, a Project Manager will review all final reports for consistency and completeness to ensure that the data meet the overall data quality objectives of the client and the project. This review is intended to verify that those analyses requested on the chain of custody have been performed, the sample information is accurate, and the appropriate data qualifiers have been added.

23.2.4 Quality Assurance Review

In addition to the tiered review process, the quality assurance department will periodically perform data audits. These audits, required as part of our quality systems audit program, can be performed for the generation of reports that include quality control data, and as a troubleshooting measure.

23.3 Reporting

Microbac offers a variety of report packages. The details of these reports are listed below and the procedure for generating these reports found in the Report Generation SOP.

23.3.1 Level I Report – Results Only

Our basic report format is results only. This standard analytical report, accompanied by a cover letter and Work Order Summary, contains the following elements. The cover letter and summary report provide a link to the result page(s). The Project Manager responsible for the generation of the report and its contents signs the cover letter.

- Laboratory name, address, and phone number
- Title of "Analytical Results"
- Date reported
- Client name (with address on the cover letter)
- Client project ID
- Work Order and Sample number (providing a unique report number)
- Client sample identification and description
- Client defined matrix
- Collection date and time
- Date received
- Analyte
- Result (at client requested reporting limits and units)
- Reporting limit
- Units

- Applicable data qualifiers for blank contamination, spike recovery failure, duplicate recovery failure, and identification of values that exceed the linear range of the instrument, as applicable
- Dilution factor
- Date and time of sample preparation
- Preparation and Analytical method references
- Date and time of analysis
- Analyst initials
- Page numbering

The chain of custody form and the LIMS Cooler Inspection Form are returned with each report. Any deviations from the requirements of our Sample Acceptance Policy will be noted in the final report on the Cooler Inspection Form. Quality Control deficiencies, if present, are identified in a Case Narrative report generated by the LIMS.

23.3.2 Level "II Std" Report

Our Level "II Std" report format includes all elements of the Level I report plus additional quality control information. The quality control data is delivered in the form of QC Summary Reports generated by our LIMS. The QC Summary Reports for a Level II report include the results for the batch controls and the matrix controls.

23.3.3 Level "II LUST" Report

Our Level "II Std" report plus a CLP Form 8 for Internal Standard recovery. This report is specifically designed to meet the requirements of the IDEM LUST program.

23.3.4 Level "III Std" Report

This report format includes all elements of the Level "II Std" report as well as copies of the raw data for Organic analyses and the calibration data for Inorganic analyses. The QC Summary Reports for a "Level III Std" report include the results for the instrument, batch and matrix controls. A Case Narrative report is included for each analytical group and addresses sample receipt conditions, a hold time evaluation, calibration, instrument quality control, batch quality control, and matrix quality control.

23.3.5 Level "IV Std" Report

This report format includes all elements of the Level "II Std" report and copies of the raw data for all analyses. The QC Summary Reports for a Level "IV Std" report include the results for the instrument, batch and matrix controls. A Case Narrative report is included for each analytical

group and addresses sample receipt conditions, a hold time evaluation, calibration, instrument quality control, batch quality control, and matrix quality control.

23.3.6 Level "III+" Report

This report format includes all elements of the Level "II Std' report as well as copies of the raw data for Organic analyses and the calibration data for Inorganic analyses. The QC Summary Reports for a Level "III+" report include the results for the instrument, batch and matrix controls, and the Organic raw data is supplied via a detailed Quantitation Report, which include the ion ratios used for identification. The performance of our 'routine' quality control parameters is the default for Level "III+" packages, however, client-specified or program-specific controls are performed as applicable. A Case Narrative report is included for each analytical group and addresses sample receipt conditions, a hold time evaluation, calibration, instrument quality control, batch quality control, and matrix quality control.

23.3.7 Level "IV+" Report

This report format includes all elements of the Level "II Std" report as well as copies of the raw data for all analyses. The QC Summary Reports for a Level "IV+" report include the results for the instrument, batch and matrix controls, and the Organic raw data is supplied via a detailed Quantitation Report, which include the ion ratios used for identification. The performance of our 'routine' quality control parameters is the default for Level "IV+" packages, however, client-specified or program-specific controls are performed as applicable. A Case Narrative report is included for each analytical group and addresses sample receipt conditions, a hold time evaluation, calibration, instrument quality control, batch quality control, and matrix quality control. Our Level "IV+" report format is compliant with the requirements of the Indiana Department of Environmental Management (IDEM) Office of Land Quality and Office of Water Quality.

23.3.8 CLP-Like Reports

Our Level III and Level IV report formats can be furnished using CLP-equivalent forms. These forms are included as a replacement to the QC Summary Reports typically supplied in our data packages.

23.3.9 Electronic Data Deliverables (EDD)

Electronic data deliverables are available in various formats depending on project requirements.

24.0 DEFINITIONS

Accuracy – The degree of agreement of a measured value with the true or expected value of the quantity of concern (% recovery of a known spiked analyte).

Aliquot – A measured portion of a sample, or solution, taken for sample preparation or analysis.

Analyte – The specific component measured in an analysis.

Analytical Batch – A group of samples which are analyzed, at the instrument level, together using the same method, reagents and apparatus within the same general time period. Typically, these are samples in the same run ID in the LIMS.

Blank – An artificial sample designed to assess specific sources of laboratory contamination. There are several types of blanks, which monitor a variety of processes:

- Calibration Blank – An aliquot of the standard diluent (water or organic solvent) that is not carried through the sample preparation scheme. It is analyzed to verify that the analytical system is free from contamination. Also referred to as an instrument blank or solvent blank.
- Equipment Blank – An aliquot of lab pure water collected in the field and analyzed to determine the level of contamination introduced into the sample due to sampling technique.
- Field Blank – An aliquot of lab pure water transferred in the field and analyzed to determine the level of contamination due to environmental factors at the site.
- Method Blank – An aliquot of lab pure water or solid matrix taken through sample preparation (when required) and analysis. It is a test for contamination in sample preparation and analyses. Also referred to as a Preparation Blank.
- Trip Blank – An aliquot of lab pure water in a sample container similar to that used for the associated samples. A trip blank remains unopened throughout the sampling, handling and transportation of the containers and samples. It is used to measure for possible cross-contamination during transport, handling, and storage. Trip Blanks are most useful in documenting contamination in the analysis of volatile organic analytes.

Bias – The deviation of a measured value from a known or accepted value due to matrix effects or method performance. Bias may be determined quantitatively to correct measured values. Bias may be positive or negative.

Breakdown – A measure of the decomposition of certain analytes (DDT and Endrin) into by-products.

Calibration – The establishment of an analytical curve based on the absorbance, response, emission intensity, or other measured characteristic of known standards. The calibration standards must be prepared using the same type and concentration of acids, solvents, or other solutions used in the sample preparation.

Calibration Factor – A measure of the gas chromatographic response of a target analyte to the mass injected. The calibration factor is analogous to the Relative Response Factor (RRF) used in GC/MS analysis.

Chain-of-custody – Procedures and associated documents designed to trace the custody of a sample(s) from the point of origin to final disposition, with the intent of legally demonstrating that custody remained intact and that tampering or substitutions were precluded.

Completeness – The percentage of measurements made which are judged to be valid measurements. The completeness goal is to generate sufficient amount of valid data based on project needs.

Confirmation – In gas chromatography, an unknown compound in a sample is identified based upon its retention time on a specific chromatographic column. Because several compounds may exhibit the exact same retention time on a given column, a secondary analysis on a different column or detector is often required for additional confidence in the compound identification.

Continuing Calibration Verification Standard (CCV) – A standard used to verify the continued acceptability of the initial calibration curve. A continuing calibration verification standard must be analyzed at a set frequency depending on the method requirements. When using an external calibration technique, the concentration of the continuing calibration verification standard shall be varied within the established calibration range. If an internal standard is used, only one CCV must be analyzed per analytical batch.

Control Limit – The limits shown on a control chart beyond which it is highly improbable that a point could lie while the system remains in a state of statistical control.

Control Chart – A graphical plot of test results with respect to time or sequence of measurements together with limits within which they are expected to lie when the system is in a state of statistical control.

Data Quality Objectives (DQOs) – During the planning phase of a project requiring laboratory support, the data user must establish the quality of data required from the investigation. Such statements of data quality are known as DQOs. DQOs are qualitative and quantitative statements of the data required to support specific decisions or regulatory actions. DQOs must take into account sampling considerations as well as analytical protocols.

Detection Limit – The smallest concentration/amount of some component of interest that can be measured by a single measurement with a stated level of confidence.

- CRDL – Contract required detection limit.
- IDL – Instrument detection limit. A statistically determined detection limit used to estimate the instrument's sensitivity. The IDL is obtained by analyzing seven consecutive blanks to assess the variability of the instrument.

- MDL – Method detection limit. The minimum concentration of a substance that can be measured and reported with a 99% degree of confidence. MDLs are determined by analyzing a minimum of seven consecutive standards that have been processed through all preparatory steps.
- PQL – The Practical Quantitation Limit is the lowest concentration that can reliably be achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Typically, the PQL is a value in the range of 5 - 10 times the MDL. This is the reporting limit and is also referred to as the Estimated Quantitation Limit (EQL).

Dixon's Outlier Test – A statistical test used to measure the validity of a data point in comparison to an applicable data population. Particularly useful with relatively small (3 to 25) data populations. Reference Use of Statistics to Develop and Evaluate Analytical Methods, Grant Wernimont, AOAC, page 156, 1985.

Double blind Sample – A sample, of known concentration by the submitter, that is submitted in such a way that the analyst does not know its composition as a QC sample nor the concentration.

Ethical Behavior - Action performed that exhibit right or good conduct.

Initial Calibration Verification (ICV) – A standard used to verify the accuracy of calibration standards. Analyzed immediately following calibration and being prepared from a second source than that of the calibration standards, its known value is measured against the calibration curve. This determines the integrity of calibration curve. Also referred to as an external verification standard or check standard.

Interference Check Standard (ICS) – Applicable to analysis performed using ICP and consisting of two standard solutions (A and AB), the ICS is analyzed to verify that correct background and interelement corrections are being applied.

Headspace – Any area in a container not completely filled by the sample, thus allowing gases to collect in that space.

Holding Time – The maximum storage time allowed between sample collection and sample analysis when the designated preservation and storage techniques are employed.

Internal Standard (IS) – Applicable to ICP and GC/MS analyses only. An analyte not of interest as a target yet having a similar chemistry to the targets, which is added to all samples, QC samples, and calibration standards just prior to instrument analysis. Internal standards are used as the basis for quantitation of target compounds for GC/MS analysis.

Laboratory Control Sample (LCS) – An aliquot of laboratory pure reagent spiked with target analytes or compounds representative of target analytes. The sample is carried through the entire analytical process and analyte recovery is used to monitor method performance. Also referred to as a laboratory fortified blank (LFB).

Laboratory Control Sample Duplicate (LCSD) – An aliquot of laboratory pure reagent spiked with the identical amount(s) of target analyte(s) as the LCS. Results of the two spikes are used to assess both the bias and precision of a method with a given sample matrix.

Matrix – The component or substrate which may contain the analyte of interest. Matrices are generalized into the following: aqueous (includes extracts from the TCLP or other extraction procedure, groundwater, surface water, and wastewater), drinking water (potable water and laboratory pure water), non-aqueous liquid (organic liquid having <15% settleable solids), and solid (includes sediment, sludge, and soil).

Matrix Interference – The influence of the sample matrix or sample components upon the ability to qualitatively identify or quantitatively measure compounds in environmental samples.

Matrix Spike (MS) – An aliquot of a sample that is spiked with a known amount of target analyte(s). Recovery of the matrix spike, expressed as percent recovery, is used to assess the bias of a method in a given sample matrix.

Matrix Spike Duplicate (MSD) – An aliquot of the same sample used for the MS, spiked with the identical amount(s) of target analyte(s) as the MS. Results of the two spikes are used to assess both the bias and precision of a method with a given sample matrix.

Method of Standard Addition (MSA) – A method in which small increments of a substance under measurement are added to a sample to establish a response function, and by extrapolation, to determine the amount of the substance originally present in the sample.

Narrative – Portion of the report that includes details and information about the sample and the analytical data. The LIMS and report structure generate different types of narratives including,

- Batch Narrative – report generated by the LIMS in which details are given for any quality control nonconformance and its effect on the data, where the nonconformance effects all samples in the batch.
- Case Narrative – report which details the number of samples received, date received, requested analyses, evaluation of holding times, and a summary of the quality control test results.
- Sample Narrative – report generated by the LIMS in which details are given for any quality control nonconformance and its effect on the data, where the nonconformance is sample specific within the batch.

Percent Difference (%D) – Used to compare two values, the percent difference indicates both the direction and the magnitude of the comparison. The percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

$$\%D = \frac{(X - Y)}{X} * 100$$

where: X = value 1
Y = value 2

Percent Recovery – A measure of accuracy that is calculated as the measured value relative to the true value, expressed as a percent.

$$\%R = \frac{MV}{TV} * 100$$

where: MV = measured value
TV = true value

Precision – The degree of mutual agreement characteristic of independent measurements as the result of repeated application of the process under specified conditions. It is concerned with the comparability of results from duplicate or replicate analyses. (%RPD between the recoveries of two known analyte spikes, and %RSD between the recoveries of three or more measurements).

Preparation Batch – A group of samples of similar composition which are prepared together using the same method, reagents and apparatus within a 24 hour calendar day or every 20 samples, whichever is more stringent. Typically, these are samples in the same batch ID in the LIMS.

Preservative – A reagent added to a sample, or an action used, to prevent or slow decomposition or degradation of a target analyte or a physical process. Thermal and chemical preservation may be used in tandem to prevent sample deterioration.

Relative Percent Difference (% RPD) – Used to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

$$\% \text{ RPD} = \frac{|X - Y|}{(X + Y) / 2} * 100$$

where: X = value 1
Y = value 2

Relative Response Factor – A measure of the relative response of an analyte compared to that of its internal standard. Relative response factors (RRF) are determined by analysis of calibration standards and are used in the quantitation of target analytes in samples. RRF is calculated as follows:

$$RRF = \frac{Ax \times Cis}{Ais \times Cx}$$

where:
Ax = area of the compound of interest measured
Cis = concentration of the internal standard
Ais = area of the internal standard
Cx = concentration of the analyte of interest

Relative Retention Time (RRT) – The ratio of the retention time of a compound to that of a standard (such as an internal standard).

$$RRT = \frac{RT_c}{RT_{is}}$$

where:
RT_c = Retention time for the semi-volatile target or surrogate in continuing calibration.
RT_{is} = Retention time for the internal standard in calibration standard or in a sample.

Relative Standard Deviation – Statistical parameter used to measure the variability of a data set with respect to the mean of that data set.

$$\%RSD = (SD / mean) * 100$$

Retention Time – The time elapsed from sample injection until the specific compound elutes or exits the chromatographic column at the detector. Each analyte has a characteristic retention time on a specific column allowing this information is used to qualitatively identify the analytes in the sample.

Sample – A portion of material to be analyzed. Sample type can be identified by its intended use. As follows:

- Environmental Sample – Material supplied by the client for analysis.
- Laboratory QC Sample – Used in assessing the performance of the analytical system. Examples include, but are not limited to, method blanks, laboratory control samples, and calibration verification samples.
- Matrix-specific QC Samples – Used to asses the accuracy or precision of the measurement in a given sample matrix. Examples include, but are not limited to matrix spikes, duplicates, and surrogates.

Sample Delivery Group (SDG) – A unit within a single project that is used to identify a group of samples for delivery. Unless defined otherwise by the client, a SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in a SDG are due concurrently.

Sample Duplicate – Two aliquots of the same sample processed independently. This monitors precision of the analysis. Precision results are reported as relative percent difference (RPD).

Single blind Sample – A sample, of known concentration by the submitter, that is submitted in such a way that the analyst does not know the concentration.

Standard Deviation - A statistical parameter that indicates the variability of a data set as centered on the mean.

$$SD = \sqrt{\sum(x_I - x_{mean})^2 / n-1}$$

Where, x_I is an individual value
X_{mean} is the average of all values
n is the total number of values in the data set

Standard Operating Procedure (SOP) – A procedure adopted for repetitive use when performing a specific measurement or task. It may be a standard method or one developed by the client or lab.

Surrogate Compound – Applicable to GC, GC/MS, and HPLC analyses only. Compound that behaves similarly, with respect to the analytical method, as the analytes of interest but is not normally found in environmental samples. Often, surrogates are isotopic homologues of target analytes. Surrogate(s) are added to all blanks, samples and QC samples prior to preparation and analysis. Recovery of surrogates is used to assess method performance.

25.0 REFERENCES

1. Taylor, J. K., "Quality Assurance of Chemical Measurements", Lewis Publishers, Inc., 1987.
2. National Environmental Laboratory Accreditation Conference (NELAC) Constitution, Bylaws, and Standards, Approved June 5, 2003.
3. Title 35, Subtitle A, Chapter II, Part 186 of the State of Illinois Rules and Regulations.
4. Manual for the Certification of Laboratories Analyzing Drinking Water, USEPA, EPA/570/9-90/008, April 1990.
5. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Update III, USEPA, December 1996.
6. Methods for Chemical Analysis of Water and Wastes, USEPA, EPA-600/4-79-020.
7. Methods for the Determination of Metals in Environmental Samples, Supplement I, USEPA, EPA/600/R-94/111, May 1994.
8. Methods for the Determination of Inorganic Substances in Environmental Samples, USEPA, EPA/600/R-93/100, August 1993.
9. Methods and Guidance for Analysis of Water, USEPA, EPA 821-C-99-004, June 1999.
10. Standard Methods for the Examination of Water and Wastewater, APHA/AWWA/WEF, 18th ED, 1992, and 19th ED, 1995.
11. Code of Federal Regulations.
12. Air Force Center for Environmental Excellence Quality Assurance Project Plan, version 3.0, USACE, March 1988.
13. Shell for Analytical Chemistry Requirements, USACE.
14. ISO/IEC 17025, General Requirements for the Competence of Calibration and testing Laboratories, ISO, Geneva, Switzerland, 1999.
15. Microbac Laboratories, Inc. Corporate Policies and Procedures Manual.

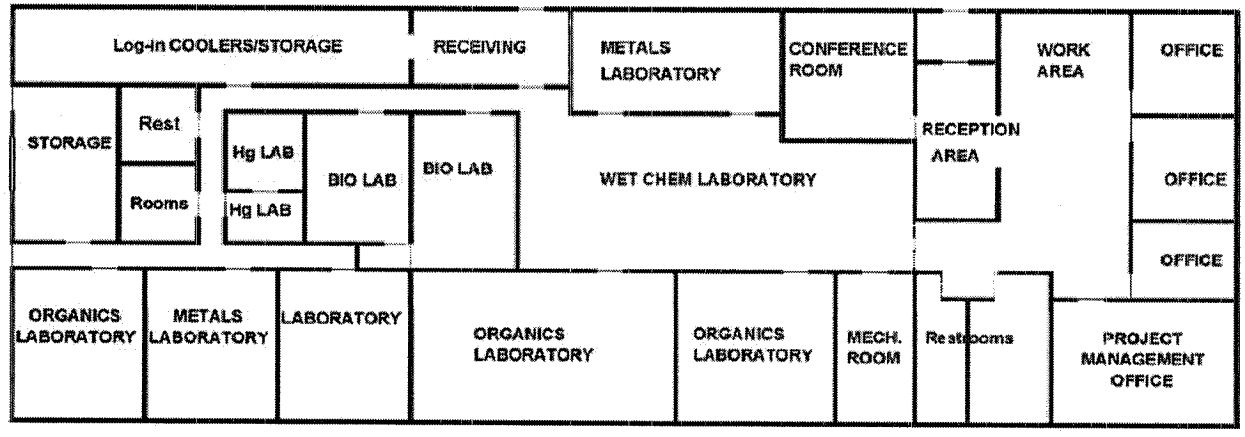
26.0 APPENDICES

The contents of the following appendices is fluid and due to their nature may be changed without necessitating a revision to this Plan. When critical to the quality of analytical results, employees are notified of the changes and documentation of this notification retained.

26.1 Appendix A – Facility Floor Plan

Microbac

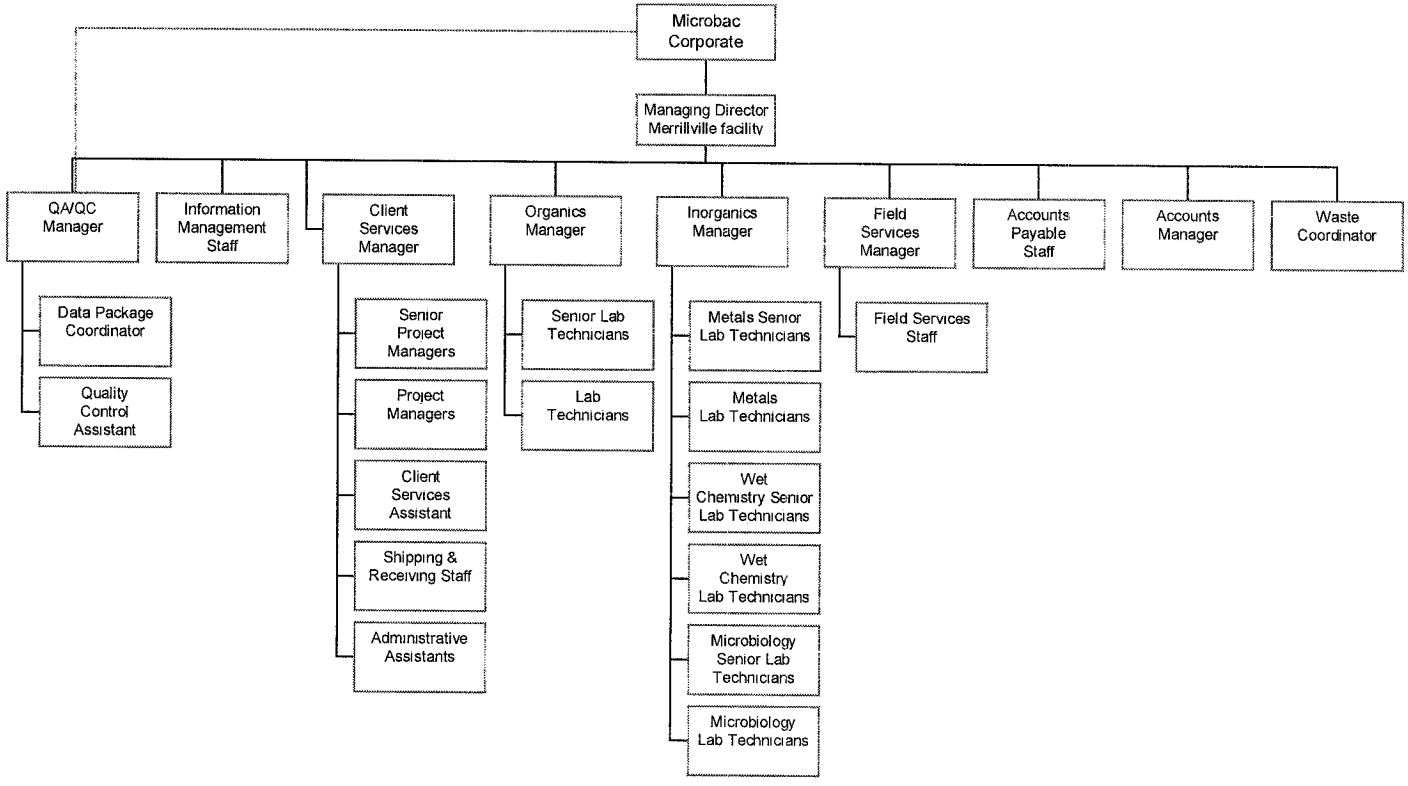
Chicagoland Division
250 West 84th Drive
Merrillville, Indiana 46410



26.2 Appendix B – Organization Chart

Microbac Laboratories, Inc.

Merrillville, IN facility



26.3 Appendix C – Personnel, Education, Function, and Experience

NAME	EDUCATION	FUNCTION	DEPARTMENT	YEARS EXPERIENCE
Robert Crookston	B. S. Biology; CHMM	Managing Director	Administration	18
Jeffrey Loewe	B. S. Chemistry	QA/QC Manager	Quality Assurance	18
Ron Misiunas	B. S. Molecular Biology	Client Services Manager	Client Services	14
Kevin Falvey	B. A. Social Sciences; CHMM	Accounts Manager / Waste Coordinator	Administration	16
Troy Goehl	B. S. Chemistry	Inorganics Manager	Inorganics	9
Nancy Tavitas	B. S. Chemistry	Organics Manager	Organics	19
Michael Chenoweth	B. S. Geology	Field Services Manager	Field Services	14
Carl Volkman	B. S. Computer Information Systems Technology	IT / LIMS Administrator	Administration	3
Deborah Griffiths	A.S. Chemistry; Bachelor's Program	Senior Project Manager	Client Services	19
Karen Ziolkowski	B. S. Medical Technology	Senior Project Manager	Client Services	22
Carey Gervase	High School Diploma	Project Manager	Client Services	3
Kathy Luther	M. S. Environmental Science	Project Manager	Client Services	13
Allyl McCarron	B. S. Elementary Education	Data Package Coordinator	QA/QC	14
Darla Natzke	A. S. Chemical Technology	QC Assistant	QA/QC	6
Shon Arhendt	B. S. Biological Sciences	Senior Technician	Metals	11
Amanda Couch	B. S. Biology	Technician	Metals	2
Darrin Dickerson	A. S. Chemical Technology	Technician	Metals	11
Brian Mills	A. S. Chemical Technology	Senior Technician	Organics	6
Jennifer Noel	B. S. Biology	Senior Technician	Organics	8
Christine Robinson	B. S. Biology	Senior Technician	Organics	15
James Burden	B. S. Chemistry	Technician	Organics	13
James Manley	B. A. Chemistry	Technician	Organics	7
Mike Sedor	B. S. Environmental Science	Technician	Organics	12
Amy Sheehy	B. S. Biology	Technician	Organics	6
Allison Grieff	B. S. Biology	Technician	Wet Chemistry	2
Randon Lingenfelter	B. S. Chemistry	Technician	Wet Chemistry	1
Nicole Rainwater	Bachelor's Program	Technician	Wet Chemistry	4
Brian Reimink	Bachelor's Program	Technician	Wet Chemistry	4
Nathaniel Stout	Bachelor's Program	Technician	Wet Chemistry	<1
Jennifer White	Bachelor's Program	Technician	Organics	1
Renee Clayton	B. S. Biology	Technician	Microbiology / Wet Chemistry	4

NAME	EDUCATION	FUNCTION	DEPARTMENT	YEARS EXPERIENCE
Jim Deter	High School Diploma	Field Services	Field Services	5
Pat Goodpaster	High School Diploma	Field Services	Field Services	7
Pete Petrusha	Technical School	Field Services	Field Services	9
Scot McCord	High School Diploma	Sample Receipt	Sample Receipt	<1
Dan Paluch	B. A. English	Sample Receipt	Sample Receipt	3
Ken Smith	2 yr. Bachelor's Program	Sample Receipt	Sample Receipt	11
Linda Craig	Business School Program	Receptionist	Administration	21

26.4 Appendix D – List of Standard Operating Procedures

Following is a list of the Standard Operating Procedures. This list is revised as needed. An up-to-date list of the SOPs is available through the QA office.

TITLE	REV #	FILENAME
Corporate & Local Policies		
Manual Integration Policy	0	
Business Conduct Policy	2	
Ethics and Data Integrity	2	
Capital Expenditure Procedure		3-1
Capital Expenditure Procedure		3-2
Vehicle Fleet Policy		4-1
Motor Vehicle Record Policy		4-2
Outside Testing Subcontracting Policy	0	
Cell Phone Policy	1	
Administrative		
After Hours Sample Receipt	0	AfterHoursReceipt(0)
Analytical Data Entry – Metals Section	0	DataEntry-AnalytMetals(0)
Analytical Data Entry – Organics Section	0	DataEntry-AnalytOrg(0)
Analytical Data Entry – Wet Chemistry	0	DataEntry-AnalytWetChem(0)
Bottle Preparation and Shipping	0	BottlePrep&Shipping(0)
Calibration of Manual Repipetters	0	RepipetterCalib(0)
Capability and Detection Limit Studies	2	IDC-MDL(2)
Complaint Handling	0	complaint(0)
Creating and Managing LIMS Users	0	LIMS-Users(0)
Daily Balance Calibrations	1	BalCal(1)
Daily Temperature and Water System Checks	0	DailyTempWaterChecks(0)
Deviation / Corrective Action Reports	0	Deviation-CAR(0)
Document Control	0	DocControl(0)
Employee Training	0	Training(0)

Estimation of Measurement Uncertainty	0	MeasUncert(0)
Field Sampling Activities	0	Field Sampling Activities(0)
Generation and Updating of Statistical Recovery Limits	1	StatLimits(1)
Generating the Daily NPDES Report for U.S. Steel - Midwest	1	USS-DailyNPDES(1)
Glassware Washing and Preparation	0	GlassWash(0)
Good Laboratory Practices (training document)		GLP-013102
Groundwater Sampling	0	Field_Groundwater(0)
Handling Confidential Business Information	0	CBI(0)
Internal Audits	2	InternalAudits(2)
Internal Chain of Custody	0	ICOC(0)
Labeling of Standards, Reagents, Extracts and Digestates	1	Labeling(1)
Logbook Generation	0	LogbookGen(0)
Manual Integration of Chromatographic Peaks	0	ManualIntegration(0)
Peer Review and Electronic "QA Validation" of Analytical Results	0	DataEntry-QAValid(0)
Performing Computer System Backups	2	ServerBackup(2)
Preparation Batch Data Entry	1	DataEntry-Prep(1)
Preparation of Standard Operating Procedures	2	SOPSOP(2)
Project Management	0	ProjectManagement(0)
Record Transfer	0	RecordTrans(0)
Report Generation	1	Report(1)
Revision, Reproduction and Tracking of the Quality Assurance Plan	0	QAP-RevTrack(0)
Sample Compositing	0	SampleComposite(0)
Sample Disposal	1	SampleDisposal(1)
Sample Receipt and Login	6	SampleReceipt(6)
Software Validation	0	SoftwareValidation(0)
Supply Procurement	0	Supply Procurement(0)
Test Code Maintenance	0	TestCodeMaint(0)
Thermometer Calibration and Use	1	ThermCal(1)

Organic		
Chlorinated Herbicides by SW-846 Method 8151A	0	8151A(0)
Interference Clean Up for PCB Analysis	0	OrgCleanup(0)
Organochlorine Pesticides by EPA Method 608 and SW-846 Method 8081A	3	608-8081(3)
Polychlorinated Biphenyls (PCBs) by EPA Method 608 and SW-846 Method 8082	4	608-8082(4)
Polynuclear Aromatic Hydrocarbons by EPA Method 610 and SW-846 Method 8310	5	610-8310(5)
Preparation of Aqueous Samples for Herbicide Analysis using SW-846 Method 8151A	0	AqOrgPrp8151A(0)
Preparation of Aqueous Samples using Continuos Liquid-Liquid Extraction by SW-846 Method 3520C	0	AqOrgPrp3520C(0)
Preparation of Aqueous Samples using Liquid-Liquid Extraction by SW-846 Method 3510C	2	AqOrgPrp3510C(2)
Preparation of Non-aqueous Samples for Herbicide Analysis using SW-846 Method 8151A	0	NAqOrgPrp8151A(0)
Preparation of Non-Aqueous Samples using Sonication	4	NAqOrgPrp3550B(4)
Preparation of Oil Samples by SW-846 Method 3580A For the Analysis Of Polychlorinated Biphenyls (PCBs)	0	PCB-OilPrep3580A(0)
Preparation of Wipe Samples by SW-846 Method 3580A For the Analysis Of Polychlorinated Biphenyls (PCBs)	0	PCB-WipePrep3580A(0)
Sample Preparation Using the Extraction Procedure for Oil Wastes SW-846 Method 1330A	0	OilyWaste1330A(0)
Semi-Volatile Organic Compounds (SVOA) by EPA Method 625 and SW-846 Method 8270C	7	625-8270(7)
Total Petroleum Hydrocarbons using SW-846 Method 8015B	0	8015B(0)
Toxicity Characteristic Leaching Procedure for Volatile Organic Compounds using SW-846 Method 1311	4	TCLP1311VOA(4)

Volatile Organic Compounds by EPA Method 624 and SW-846 Method 8260B using the SOLAtek 72 Autosampler	2	624-8260Solatek(2)
Metals		
Mercury using the CETAC M6000A by EPA Method 245.1 and SW-846 Methods 7470A/7471A	3	245-7471CETAC(3)
Metals by Graphite Furnace Atomic Absorption (GFAA) Spectroscopy using EPA 200-series and SW-846 7000-series Methods	0	GFAAmetals(0)
Metals by Inductively Coupled Plasma Emission Spectroscopy using EPA Method 200.7 and SW-846 Method 6010B and the TJA Iris ICP-AES	3	2007-6010B(3)
Preparation of Aqueous Samples and Extracts for Total or Dissolved Metals Analysis by Graphite Furnace Atomic Absorption Spectroscopy	2	MetAqPrp-GFAA(2)
Preparation of Aqueous Samples and Extracts for Total or Dissolved Metals Analysis by Inductively Coupled Plasma or Flame Atomic Absorption Spectroscopy	5	MetAqPrp-ICPFLAA(5)
Preparation of Non-Aqueous Samples and Extracts for Total Metals Analysis	5	MetNAqPrp(5)
Toxicity Characteristic Leaching Procedure for Metals and Semi-Volatile Organic Compounds using SW-846 Method 1311	5	TCLP1311MetalSVOA(5)
Water Extraction using ASTM Standard D3987	0	WaterExtraction(0)
Wet Chemistry		
Acidity Using SM Method 2310B and EPA Method 305.1	0	Acidity(0)
Alkaline Digestion For Hexavalent Chromium by SW-846 Method 3060A	2	Cr+6Digest(2)
Alkalinity by EPA Method 310.1	3	Alk310-1(3)

Ammonia – Nitrogen By Automated Phenate Colorimetry using EPA Method 350.1 and SM Method 4500-NH3 G	6	NH3AutoPhen(6)
Ammonia – Nitrogen By Manual Colorimetry using EPA Method 350.2 and SM Method 4500-NH3 B,C	3	NH3ManualNess(3)
Biochemical Oxygen Demand and Carbonaceous Biochemical Oxygen Demand	5	BOD(5)
BTU by Calorimetry using STM Standard D240	0	BTU(0)
Carbon Dioxide by Standard Methods Method 4500-CO2 C	0	CarbonDioxide(0)
Chemical Oxygen Demand by EPA Method 410.4	5	COD410-4(5)
Chloride by Silver Nitrate Titration by SM Method 4500-Cl- B	1	Cl-AgNO3(1)
Chlorine, Residual by EPA Method 330.5	3	Cl2-330-5(3)
Color Using Visual Inspection by EPA Method 110.2	0	Color-Visual(0)
Cyanide, Total, Amenable and Weak Acid Dissociable by Midi Distillation and Automated Colorimetry	7	CN-TotalAmenWAD(7)
Dissolved Oxygen using EPA Method 360.1 and Standard Methods Method 4500-O G	0	DO(0)
Fluoride by EPA Method 340.2	0	Fluoride340-2(0)
Fluoride by EPA Method 340.2 using Manual Ion Selective Electrode Potentiometry	0	Fluoride340-2manual(0)
Hexane Extractable Materials by EPA Method 1664A using Liquid-Liquid Extraction	1	HEM-1664A-LLE(1)
Hexane Extractable Materials by EPA Method 1664A using Liquid-Liquid Extraction for Samples from the National Steel Corporation	0	HEM-1664A-LLE-NatSteel(0)
Hexane Extractable Materials by EPA Method 1664A using Solid Phase Extraction	1	HEM-1664A-SPE(1)
Hexane Extractable Materials in Soils and Solids by Modified EPA Method 1664A and SW-846 Method 9071A	3	HEM-Soxhlet(3)
Hexavalent Chromium by SM Method 3500-Cr D and SW-846 Method 7196A	3	Cr+6(3)

Ignitability (Flash point) using SW-846 Method 1010 and ASTM Standard D92	3	Flash(3)
Nitrate/Nitrite, Total as Well as Individual Nitrite and Nitrate by EPA Methods 353.2, 354.1, and SM Method 4500-NO3 F	1	NO3NO2-CdRed(1)
Orthophosphate Using EPA Method 365.1	0	OPO4-3651(0)
Paint Filter Liquids Test by SW-846 Method 9095A	4	PaintFilter(4)
Percent Free Acid by ASTM Standard D2790	0	FreeAcid(0)
pH by EPA Method 150.1, SW-846 Method 9040A and SW-846 Method 9045C	3	pH(3)
Phenolics, Total Recoverable by EPA Method 420.2 and SW-846 Method 9066	7	Phenolics(7)
Reactive Cyanide or Reactive Sulfide Preparation	2	ReactivityPrep(2)
Settleable Solids by Standard Methods Method 2540 F	0	SetSolids(0)
Specific Conductivity by EPA Method 120.1	3	SpecCond(3)
Specific Gravity Using SM Method 2710F and Density Using a Modified SM Method 2710F	0	SpGravity(0)
Specific Oxygen Uptake Rate (SOUR) Using Standard Methods Method 2710 B	0	SOUR(0)
Sulfate by EPA Method 375.4 and SW-846 Method 9038	1	SO4Turb(1)
Thiocyanate by Standard Methods method 4500-CN-M	0	Thiocyanate(0)
Total Chlorine Using Standard Methods Method 4500-Cl D	0	Cl2-AmpTitration(0)
Total Dissolved Solids for Aqueous Samples	4	TDS(4)
Total and Reactive Sulfide	0	Sulfide(0)
Total Kjeldahl Nitrogen by EPA Method 351.2	7	TKN351(7)
Total Phosphorus by EPA Method 365.3	0	PO4-3653(0)
Total Solids, Total Volatile Solids, Ash, and Total Organic Content	3	TotalSolids(3)
Total Suspended Solids for Aqueous Samples	4	TSS(4)

Vanadium Pentoxide by Colorimetry	0	V5(0)
Microbiology		
Fecal Coliform By Membrane Filtration by SM Method 9222 D	0	FecalMF(0)

26.5 Appendix E – Analytical Quality Control Tables

The following tables contain the method specific quality control requirements, acceptance criteria, and corrective actions for the analytical procedures performed. Additional details are contained in the method specific Standard Operating Procedure (SOP) and should be adhered to where a discrepancy exists between these written criteria and the SOP.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – ORGANIC ANALYSES		
	Pesticides by EPA Method 608 and SW-846 Method 8081A	
QC Parameter	**Requirement**	**Corrective Action**
DDT / Endrin Breakdown	Evaluate 4,4'-DDT and Endrin breakdown prior to calibration. Acceptance criteria are ≤ 15% breakdown.	If acceptance criteria are not met, perform instrument maintenance and re-evaluate breakdown.
Calibration	Minimum of 5 levels for single component analytes. A single point calibration is performed for multi-component analytes. Acceptable linear calibration if CF %RSD ≤ 10 for Method 608 or ≤ 20 for Method 8081A .	If calibration not linear, construct a non-linear calibration curve. Correlation coefficient (r) must be ≥ 0.99 and not forced through zero.
Surrogates (SURR)	Added to all QC samples and environmental samples. Acceptance criteria are the statistically generated limits listed in LIMS. Two surrogates (DCB and TCMX) are added. Only one must meet the acceptance criteria.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, re-extract and analyze. If analyses of re-extract fail to meet acceptance criteria, report results with appropriate data qualifier.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are 80.0 – 120% recovery for Method 608 and the statistically generated limits listed in LIMS for Method 8081A.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Method Blank (MBLK)	One per extraction batch of maximum 10 samples for Method 608 and 20 samples for Method 8081A with minimum of 1 per day. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the MBLK result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per extraction batch of maximum 10 samples for Method 608 and 20 samples for Method 8081A with minimum of 1 per day. Acceptance criteria are the statistically generated limits listed in LIMS. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all quality control and environmental samples associated with the LCS must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 10 samples for Method 608 and 20 samples for Method 8081A with minimum of 1 per day. Acceptance criteria are the statistically generated limits listed in LIMS. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a duplicate LCS (LCSD) should be extracted and analyzed. Acceptance criteria are the statistically generated limits listed in LIMS.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Continuing Calibration Verification (CCV)	Calibration source standard analyzed at the beginning of each analytical sequence, after the more frequent of every 12 hours or every 20 samples, and after the last sample. Acceptance criteria are ≤ 15% difference from the initial calibration.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Confirmation	All sample detects must be confirmed by analysis on a second, dissimilar column. Acceptance criteria are ≤ 40% difference. Confirmation may not be necessary if the sample matrix is well established through prior analysis.	If acceptance criteria are not met, evaluate the baseline for co-elution. If co-elution or no other chromatographic problems are evident, report the higher of the results. The confirmation disparity must be communicated to the data user.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – ORGANIC ANALYSES		
	PCBs by EPA Method 608 and SW-846 Method 8082	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum of 5 levels for Aroclors 1016 and 1260. (A minimum of 3 levels in required for Method 608.) A single point calibration is performed for the remaining Aroclors. Acceptable linear calibration if CF %RSD ≤ 10 for Method 608 or ≤ 20 for Method 8082.	If calibration not linear, construct a non-linear calibration curve. Correlation coefficient (r) must be ≥ 0.99 and not forced through zero.
Surrogates (SURR)	Added to all QC samples and environmental samples. Acceptance criteria are the statistically generated limits listed in LIMS. Two surrogates (DCB and TCMX) are added. Only one must meet the acceptance criteria.	If acceptance criteria not met, re-extract and analyze. If analysis of re-extract fails to meet acceptance criteria, report both sets of results with appropriate data qualifier.
Initial Calibration Verification (ICV)	Second source standard including Aroclors 1016/1260 analyzed after calibration. Acceptance criteria are the statistically generated limits listed in LIMS.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Continuing Calibration Verification (CCV)	Calibration source standard analyzed at the beginning of each analytical sequence, after the more frequent of every 12 hours or every 20 samples, and after the last sample. The concentration is varied throughout the run. Acceptance criteria are ≤ 15% difference from the initial calibration.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Method Blank (MBLK)	One per extraction batch of maximum 10 samples for Method 608 and 20 samples for Method 8082 with minimum of 1 per day. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the MBLK result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per extraction batch of maximum 10 samples for Method 608 and 20 samples for Method 8082 with minimum of 1 per day. Includes Aroclors 1016/1260. Acceptance criteria are the recovery limits in Table 3 of Method 608 and the statistically generated limits listed in LIMS for Method 8082. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 10 samples for Method 608 and 20 samples for Method 8081A with minimum of 1 per day. Includes Aroclors 1016/1260. Acceptance criteria are the recovery limits in Table 3 of Method 608 and the statistically generated limits listed in LIMS for Method 8082. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	If the acceptance criteria are not met, evaluate the MSD against the accuracy criteria.
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a duplicate LCS (LCSD) should be extracted and analyzed. Acceptance criteria are the statistically generated limits listed in LIMS.	If the accuracy criteria are not met for the MS or MSD, and the LCS is in control, report the sample results with the appropriate qualifier. If the precision criteria are not met between the MS and MSD, report the sample results with the appropriate qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – ORGANIC ANALYSES		
	PAHs by EPA Method 610 and SW-846 Method 8310	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum of 5 levels. Linear calibration if RF <10% RSD for Method 610 or <20% for Method 8310.	If calibration not linear, construct a non-linear calibration curve. Correlation coefficient (r) must be ≥ 0.99 and not forced through zero.
Surrogates (SURR)	Added to all QC samples and environmental samples. Acceptance criteria are the statistically generated limits listed in LIMS.	If acceptance criteria not met, re-extract and analyze. If analysis of re-extract fails to meet acceptance criteria, report both sets of results with appropriate data qualifier.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are the statistically generated limits listed in LIMS.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Continuing Calibration Verification (CCV)	Calibration source standard analyzed at the beginning of each analytical sequence, after the more frequent of every 12 hours or every 20 samples, and after the last sample. Acceptance criteria are ≤ 15% difference from the initial calibration.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Method Blank (MBLK)	One per extraction batch of maximum 10 samples for Method 610 and 20 samples for Method 8310 with minimum of 1 per day. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the MBLK result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per extraction batch of maximum 10 samples for Method 610 and 20 samples for Method 8310 with minimum of 1 per day. Acceptance criteria are the recovery limits in Table 3 of Method 610 and the statistically generated limits listed in LIMS for Method 8310. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 10 samples for Method 610, or 20 samples for Method 8310, with minimum of 1 per day extracted. Acceptance criteria are the recovery limits in Table 3 of Method 610 and the statistically generated limits listed in LIMS for Method 8310. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a duplicate LCS (LCSD) should be extracted and analyzed. Acceptance criteria are the statistically generated limits listed in LIMS.	If the accuracy criteria are not met for the MS or MSD, and the LCS is in control, report the sample results with the appropriate qualifier. If the precision criteria are not met between the MS and MSD, report the sample results with the appropriate qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – ORGANIC ANALYSES		
	Volatile Organic Compounds by EPA Method 624 and SW-846 Method 8260B	
QC Parameter	**Requirement**	**Corrective Action**
Tuning	50-ng BFB for every 12 hour sequence; acceptance criteria in table below	Repeat if criteria not met.
Calibration	Minimum of 5 levels. Linear calibration if RF for CCCs <30 %RSD, average %RSD for all target compounds < 15, and SPCC criteria met. SPCC criteria: ≥ 0.300 for chlorobenzene and 1,1,2,2-tetrachloroethane; ≥ 0.100 for chloromethane and 1,1-dichloroethane and bromoform.	If calibration not linear, repeat initial calibration or the following option may be used. Averaging. If the %RSD of all (target and non-target) compounds is < 15, the calibration can be considered acceptable and the average RF used.
Surrogates (SURR)	Added to all QC samples and environmental samples. Acceptance criteria are the statistically generated limits listed in LIMS.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, re-extract and analyze. If analyses of re-extract fail to meet acceptance criteria, report results with appropriate data qualifier.
Internal Standards (IS)	Added to all standards, QC samples and environmental samples. Acceptance criteria for CCV are RT ± 30 seconds from last initial calibration and area within range of -50 to +100%.	Used as a diagnostic tool to monitor method and system performance. If acceptance criteria are not met for the CCV, perform instrument maintenance or perform a new initial calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed immediately after calibration. Acceptance criteria are the statistically generated limits listed in LIMS.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, terminate analysis, correct the problem, and recalibrate.
Continuing Calibration Verification (CCV)	Calibration source standard analyzed at the beginning of each analytical sequence. Acceptance criteria are the SPCC criteria for calibration and RF for CCCs < 20% difference from initial calibration for Method 8260, and the acceptance limits listed in Table 5 of Method 624 for that method..	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Method Blank (MBLK)	One per batch of maximum 20 samples with minimum of 1 per day. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the MBLK result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, terminate analysis, correct the problem, and recalibrate. Sample results may be reported with appropriate data qualifier.
Laboratory Control Sample (LCS) **[QC Check Sample for Method 624]**	One per batch of maximum 20 samples with a minimum of 1 per day. Acceptance criteria are the recovery limits in Table 5 for Method 624 and the statistically generated limits listed in LIMS for Method 8260B. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, terminate analysis, correct the problem, and recalibrate. Sample results may be reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the recovery limits in Table 5 for Method 624 and the statistically generated limits listed in LIMS for Method 8260B. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – ORGANIC ANALYSES		
	Volatile Organic Compounds by EPA Method 624 and SW-846 Method 8260B	
QC Parameter	**Requirement**	**Corrective Action**
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a MS on 2 different samples or a duplicate LCS (LCSD) should be analyzed. Acceptance criteria are the statistically generated limits listed in LIMS.	If the acceptance criteria are not met, sample results may be reported with appropriate data qualifier.

Method 624 / 8260B Tune Criteria	
Mass	Ion Abundance Criteria
50	15 -- 40% of mass 95
75	30 -- 60 % of mass 95
95	Base peak, 100% relative abundance
96	5 – 9 % of mass 95
173	< 2 % of mass 174
174	> 50 % of mass 95
175	5 – 9 % of mass 174
176	> 95 but < 101 % of mass 174
177	5 – 9 % of mass 176

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – ORGANIC ANALYSES		
	Semi-Volatile Organic Compounds by EPA Method 625 and SW-846 Method 8270C	
QC Parameter	**Requirement**	**Corrective Action**
Tuning	50-ng DFTPP for every 12 hour sequence. Acceptance criteria listed in table below. Benzidine and Pentachlorophenol tailing factors evaluated every 12 hours. Acceptance criteria are <3 and <5, respectively.	Repeat if criteria not met.
Calibration	Minimum of 5 levels. Linear calibration if RF for SPCCs > 0.050, %RSD for CCCs < 30, and average %RSD of all compounds < 15.	If calibration not linear, repeat initial calibration is analyzing by Method 625. If analyzing by Method 8270C, the following options may be used. Averaging. If the %RSD of all (target and non-target) compounds is < 15, the calibration can be considered acceptable and the average RF used.
Surrogates (SURR)	Added to all QC samples and environmental samples. Acceptance criteria are the statistically generated limits listed in LIMS. One B/N and one Acid fraction surrogate may be out without corrective action necessary.	If acceptance criteria not met, re-extract and analyze. If analysis of re-extract fails to meet acceptance criteria, report both sets of results with appropriate data qualifier.
Internal Standards (IS)	Added to all standards, QC samples and environmental samples. Acceptance criteria for CCV are RT ± 30 seconds from last initial calibration and area within range of -50 to +100%.	If acceptance criteria are not met for the CCV, perform instrument maintenance or perform a new initial calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are the statistically generated limits listed in LIMS.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Continuing Calibration Verification (CCV)	Calibration source standard analyzed at the beginning of each analytical sequence. Acceptance criteria are RF for SPCCs ≥ 0.050 and RF for CCCs < 20% difference from initial calibration for Method 8270C, and ≤ 15% difference from the initial calibration for Method 625 .	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Method Blank (MBLK)	One per extraction batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are <PQL or <5% of sample concentration. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per extraction batch of maximum 20 samples with minimum of 1 per day. Acceptance criteria are the recovery limits in Table 6 of Method 625 and the statistically generated limits listed in LIMS for Method 8270. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 20 samples with minimum of 1 per day. Acceptance criteria are the recovery limits in Table 6 of Method 625 and the statistically generated limits listed in LIMS Method 8270. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	If the acceptance criteria are not met, evaluate the MSD against the accuracy criteria.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – ORGANIC ANALYSES		
	Semi-Volatile Organic Compounds by EPA Method 625 and SW-846 Method 8270C	
QC Parameter	**Requirement**	**Corrective Action**
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a duplicate LCS (LCSD) should be extracted and analyzed. Acceptance criteria are the statistically generated limits listed in LIMS.	If the accuracy criteria are not met for the MS or MSD, and the LCS is in control, report the sample results with the appropriate qualifier. If the precision criteria are not met between the MS and MSD, report the sample results with the appropriate qualifier.

Method 625 / 8270C Tune Criteria	
Mass	Ion Abundance Criteria
51	30 - 60% of mass 198
68	< 2% of mass 69
69	Present
70	< 2% of mass 69
127	40 - 60% of mass 198
197	< 1% of mass 198
198	Base peak, 100% relative abundance
199	5 - 9% of mass 198
275	10 - 30% of mass 198
365	> 1% of mass 198
441	Present but less than mass 443
442	> 40% of mass 198
443	17 - 23% of mass 442

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – ORGANIC ANALYSES		
	Nitroaromatics and Nitramines (Explosives) by SW-846 Method 8330	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum of 5 levels. Linear calibration if RF <20% RSD.	If calibration not linear, construct a non-linear calibration curve. Correlation coefficient (r) must be ≥ 0.99 and not forced through zero.
Surrogates (SURR)	Added to all QC samples and environmental samples. Acceptance criteria are the nominal limits of 65 – 135% recovery.	If acceptance criteria not met, re-extract and analyze. If analysis of re-extract fails to meet acceptance criteria, report both sets of results with appropriate data qualifier.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are the statistically generated limits listed in LIMS.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Continuing Calibration Verification (CCV)	Calibration source standard analyzed at the beginning of each analytical sequence, after the more frequent of every 12 hours or every 10 samples, and after the last sample. Acceptance criteria are ≤ 15% difference from the initial calibration.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Method Blank (MBLK)	One per extraction batch of maximum 20 samples with minimum of 1 per day. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the MBLK result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per extraction batch of maximum 20 samples with minimum of 1 per day. Acceptance criteria are the nominal recovery limits of 20 – 150%. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 20 samples with minimum of 1 per day extracted. Acceptance criteria are the nominal recovery limits of 20 – 150%. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, all quality control and environmental samples associated with the blank must be re-extracted and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a duplicate LCS (LCSD) should be extracted and analyzed. Acceptance criteria are nominal recovery limits of 20 – 150% for accuracy and ≤50% RPD for precision.	If the accuracy criteria are not met for the MS or MSD, and the LCS is in control, report the sample results with the appropriate qualifier. If the precision criteria are not met between the MS and MSD, report the sample results with the appropriate qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – METALS ANALYSES		
	EPA Method 200.7 and SW-846 Method 6010B	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum of blank and one standard. Correlation coefficient criteria is $r \geq 0.995$ using two integrations per analysis.	Correct problem and repeat calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are the RSD of two integrations < 5%, as well as the method-defined limits of 95.0 to 105% recovery for Method 200.7 and 90.0 – 110% recovery for Method 6010B. Samples with a non-detect concentration may be reported if the ICV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Interference Check Standard (ICS)	Analyze solutions A and AB at the beginning and end of each analytical batch. Acceptance criteria for Solution A are 80.0 – 120% recovery for the spiked elements and <PQL for the others. Acceptance criteria for Solution AB are 80.0 – 120% recovery for the spiked elements. Samples with a non-detect concentration may be reported if the ICS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK)	One per digestion batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per digestion batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the method-defined limits of 85.0 – 115% recovery for Method 200.7 and 80.0 – 120% recovery for Method 6010B aqueous controls. Acceptance criteria are the vendor supplied limits for solid matrix controls. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the method-defined limits of 70.0 – 130% recovery for Method 200.7 and 75.0 – 125% recovery for Method 6010B. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a duplicate LCS (LCSD) should be extracted and analyzed. Acceptance criteria are the accuracy criteria for the MS and $\leq$ 20.0% RPD for precision. Samples with a non-detect concentration may be reported if the MSD fails to meet the accuracy acceptance criteria with a positive bias.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – METALS ANALYSES		
	EPA Method 200.7 and SW-846 Method 6010B	
QC Parameter	**Requirement**	**Corrective Action**
Continuing Calibration Verification (CCV)	Second source standard analyzed after every 10 samples and after the last sample. Concentration is different that that of the ICV. Acceptance criteria are the method-defined limits of 90.0 – 110% recovery with the RSD of two integrations < 5%. Samples with a non-detect concentration may be reported if the CCV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Continuing Calibration Blank (CCB)	Analyzed after every ten samples and the last sample. Acceptance criteria are the same as required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Post Digestion Spike (PDS)	As needed for matrix interference evaluation. Acceptance criteria are the method-defined limits of 85.0 – 115% recovery for Method 200.7 and 75.0 – 125% recovery for Method 6010B. Samples with a non-detect concentration may be reported if the PDS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, a matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.
Serial Dilution (SD)	As needed for matrix interference evaluation. Acceptance criteria for a 1:5 dilution are ≤ 10% difference between the original and diluted sample concentration.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, a matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – METALS ANALYSES		
	EPA 200 Series Methods (excluding 200.9) and SW-846 7000 Series Methods for FLAA and GFAA	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum of blank and four standards. Correlation coefficient criteria is r ≥ 0.995.	Correct problem and repeat calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are the method-defined limits of 90.0 – 110% recovery. Samples with a non-detect concentration may be reported if the ICV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate or report sample results with appropriate data qualifier.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK)	One per digestion batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the MBLK result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per digestion batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the nominal limits of 80.0 – 120% recovery for waters. Acceptance criteria are the vendor supplied limits for solid matrix controls. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the nominal limits of 75.0 – 125% recovery. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a duplicate LCS (LCSD) should be extracted and analyzed. Acceptance criteria are the nominal limits of 75.0 – 125% recovery for accuracy and ≤ 20.0% RPD for precision. Samples with a non-detect concentration may be reported if the MSD fails to meet the accuracy acceptance criteria with a positive bias.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Continuing Calibration Verification (CCV)	Second source standard analyzed after every 10 samples and the last sample. Concentration is different that that of the ICV. Acceptance criteria are the method-defined limits of 90.0 – 110% recovery for the 200 series methods and 80.0 – 120% recovery for the 7000 series methods. Samples with a non-detect concentration may be reported if the CCV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate or report sample results with appropriate data qualifier.
Continuing Calibration Blank (CCB)	Analyzed after every ten samples and the last sample. Acceptance criteria are the same as required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – METALS ANALYSES		
	EPA 200 Series Methods (excluding 200.9) and SW-846 7000 Series Methods for FLAA and GFAA	
QC Parameter	**Requirement**	**Corrective Action**
Post Digestion Spike (PDS)	As needed for matrix interference evaluation. Acceptance criteria are the method-defined limits of 85.0 – 115% recovery. Samples with a non-detect concentration may be reported if the PDS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, a matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.
Serial Dilution (SD)	As needed for matrix interference evaluation. Acceptance criteria for a 1:5 dilution are ≤ 10% difference between the original and diluted sample concentration.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, a matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – METALS ANALYSES		
	EPA 200.9	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum of blank and three standards. Correlation coefficient criteria is r ≥ 0.995.	Correct problem and repeat calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are the method-defined limits of 95.0 – 105% recovery. Samples with a non-detect concentration may be reported if the ICV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate or report sample results with appropriate data qualifier.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK) Applicable only if samples are digested, otherwise the ICB = MB.	One per digestion batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS) Applicable only if samples are digested, otherwise the ICV = LCS.	One per digestion batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the method-defined limits of 85.0 – 115% recovery. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 10 samples with minimum of 1 per day analyzed. Acceptance criteria are the method-defined limits of 70.0 – 130% recovery. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. Acceptance criteria are the method-defined limits of 70.0 – 130% recovery and ≤ 20.0% RPD for precision. Samples with a non-detect concentration may be reported if the MSD fails to meet the accuracy acceptance criteria with a positive bias.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Continuing Calibration Verification (CCV)	Second source standard analyzed after every 10 samples and the last sample. Concentration is different that that of the ICV. Acceptance criteria are the method-defined limits of 90.0 – 110% recovery. Samples with a non-detect concentration may be reported if the CCV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate or report sample results with appropriate data qualifier.
Continuing Calibration Blank (CCB)	Analyzed after every ten samples and the last sample. Acceptance criteria are the same as required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Post Digestion Spike (PDS) Applicable only if samples are digested.	As needed for matrix interference evaluation. Acceptance criteria are the method-defined limits of 85.0 – 115% recovery. Samples with a non-detect concentration may be reported if the PDS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, a matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – METALS ANALYSES		
	Mercury by EPA 245.1 and SW-846 7470A and 7471A	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum of blank and five standards. Correlation coefficient criteria is r ≥ 0.995.	Correct problem and repeat calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are the method-defined limits of 90.0 – 110% recovery (95 – 105% for DW). Samples with a non-detect concentration may be reported if the ICV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate or report sample results with appropriate data qualifier.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK)	One per digestion batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per digestion batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are 85.0 – 115% recovery for waters (85 – 115% for DW). Acceptance criteria are the vendor supplied limits for solid matrix controls. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 20 samples with minimum of 1 per day analyzed. Acceptance criteria are 75.0 – 125% recovery (70 – 130% for DW). Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. If insufficient sample is available for a MSD, a duplicate LCS (LCSD) should be extracted and analyzed. Acceptance criteria are 75.0 – 125% recovery for accuracy (70 – 130% for DW) and ≤ 20.0% RPD for precision. Samples with a non-detect concentration may be reported if the MSD fails to meet the accuracy acceptance criteria with a positive bias.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Continuing Calibration Verification (CCV)	Second source standard analyzed after every 10 samples and the last sample. Concentration is different that that of the ICV. Acceptance criteria are the method-defined limits of 80.0 – 120% recovery (90 – 110% for DW). Samples with a non-detect concentration may be reported if the CCV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate or report sample results with appropriate data qualifier.
Continuing Calibration Blank (CCB)	Analyzed after every ten samples and the last sample. Acceptance criteria are the same as required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – METALS ANALYSES		
	Mercury by EPA 245.1 and SW-846 7470A and 7471A	
QC Parameter	**Requirement**	**Corrective Action**
Post Digestion Spike (PDS)	As needed for matrix interference evaluation. Acceptance criteria are 85.0 – 115% recovery. Samples with a non-detect concentration may be reported if the PDS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, a matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.
Serial Dilution (SD)	As needed for matrix interference evaluation. Acceptance criteria for a 1:5 dilution are ≤ 10% difference between the original and diluted sample concentration.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, a matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – METALS ANALYSES		
	Mercury by EPA 1631E	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Three system blanks and five standards. Calibration Factor <15% RSD with the PQL level standard within 75 – 125% recovery.	Correct problem and repeat calibration.
System Blanks	Three system blanks. Acceptance criteria are <PQL each and as an average with a standard deviation <0.1.	If acceptance criteria are not met, recalibrate.
Ongoing Precision & Recovery (OPR)	Calibration standard analyzed after calibration as well as at the end of the analytical run (or every 12-hour sequence, whichever is more frequent). Acceptance criteria are the method-defined limits of 77 – 123% recovery. Samples with a non-detect concentration may be reported if the OPR fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate or report sample results with appropriate data qualifier.
Quality Control Sample (QCS)	Second source standard analyzed after calibration. Acceptance criteria are the nominal limits of 77 – 123% recovery. Samples with a non-detect concentration may be reported if the QCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate or report sample results with appropriate data qualifier.
Method Blank (MBLK)	Three per batch. Acceptance criteria are <PQL or less than 1/10 of the sample concentration. Samples with a non-detectable concentration may be reported regardless of the MBLK result.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, environmental samples associated with the MBLK must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	Minimum of one per 10 samples per site (lab to run a minimum of 1 per 10 per day analyzed). Acceptance criteria are 71 – 125% recovery. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. Acceptance criteria are 71 – 125% recovery for accuracy and ≤ 24.0% RPD for precision. Samples with a non-detect concentration may be reported if the MSD fails to meet the accuracy acceptance criteria with a positive bias.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.

GENERAL QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY				
	General Gravimetric Techniques		General Titrimetric Techniques	
QC Parameter	**Requirement**	**Corrective Action**	**Requirement**	**Corrective Action**
Calibration	Daily balance 2-point calibration or verification with Class S masses.	Repeat calibration.	Not applicable. Use purchased "standard" titrants before their expiration date.	
Initial Calibration Verification (ICV)	Not applicable.		Not applicable.	
Initial Calibration Blank (ICB)	Not applicable.		Not applicable.	
Method Blank (MBLK)	One per batch of maximum 20 samples with minimum of 1 per day analyzed. the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be reanalyzed, or sample results reported with appropriate data qualifier.	One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be reanalyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	Where available, one per batch of maximum 20 samples with minimum of 1 per day analyzed. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be reanalyzed, or sample results reported with appropriate data qualifier.	One per batch of maximum 20 samples with minimum of 1 per day analyzed. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be reanalyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample Duplicate (LCSD)	Replaces the DUP when sufficient sample volume is not available. Acceptance criteria and corrective action for accuracy are the same as for the LCS. Acceptance criteria and corrective action for precision are the same as for the DUP.		Replaces the DUP when sufficient sample volume is not available. Acceptance criteria and corrective action for accuracy are the same as for the LCS. Acceptance criteria and corrective action for precision are the same as for the DUP.	

GENERAL QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY				
	General Gravimetric Techniques		General Titrimetric Techniques	
QC Parameter	**Requirement**	**Corrective Action**	**Requirement**	**Corrective Action**
Matrix Spike (MS)	Not applicable.		Where applicable, one per batch of maximum 20 samples with minimum of 1 per day analyzed. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Not applicable.		Required with each MS. Unless method-specified, acceptance criteria are lab generated RPD limits for precision.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Duplicate (DUP)	Minimum of one per 20 samples with a minimum of one per day analyzed. Unless method-specified, acceptance criteria are lab generated RPD limits for concentrations $\geq$ 5X the PQL. For samples < 5X the PQL, acceptance criteria are $\pm$ 1 PQL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, the sample and the DUP must be re-analyzed, or sample results reported with appropriate data qualifier.	When MS/MSD are not applicable, minimum of one per 20 samples with a minimum of one per day analyzed. Unless method-specified, acceptance criteria are lab generated RPD limits for concentrations $\geq$ 5X the PQL. For samples < 5X the PQL, acceptance criteria are $\pm$ 1 PQL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, the sample and the DUP must be re-analyzed, or sample results reported with appropriate data qualifier.
Continuing Calibration Verification (CCV)	Not applicable.		Not applicable.	
Continuing Calibration Blank (CCB)	Not applicable.		Not applicable.	

GENERAL QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY				
	General Colorimetric Techniques		General Potentiometric Techniques	
QC Parameter	**Requirement**	**Corrective Action**	**Requirement**	**Corrective Action**
Calibration	Minimum of blank and four standards. Correlation coefficient criteria is r ≥ 0.995.	Correct problem and repeat calibration.	Minimum of blank and four standards. Correlation coefficient criteria is r ≥ 0.995.	Correct problem and repeat calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the ICV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate.	Second source standard analyzed after calibration. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the ICV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK) Not applicable to analyses without a preparation step. In these cases, the MBLK = ICB/CCB.	One per preparation batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be re-prepared and analyzed, or sample results reported with appropriate data qualifier.	One per preparation batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be re-prepared and analyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS) Not applicable to analyses without a preparation step. In these cases, the LCS = ICV/CCV.	One per preparation batch of maximum 20 samples with minimum of 1 per day analyzed. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be re-digested and analyzed, or sample results reported with appropriate data qualifier.	One per preparation batch of maximum 20 samples with minimum of 1 per day analyzed. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be re-digested and analyzed, or sample results reported with appropriate data qualifier.

GENERAL QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY				
	General Colorimetric Techniques		General Potentiometric Techniques	
QC Parameter	Requirement	Corrective Action	Requirement	Corrective Action
Laboratory Control Sample Duplicate (LCSD)	Replaces the MSD when sufficient sample size is not available. Acceptance criteria and corrective action for accuracy are the same as for the LCS. Acceptance criteria and corrective action for precision are the same as for the MSD.		Replaces the MSD when sufficient sample size is not available. Acceptance criteria and corrective action for accuracy are the same as for the LCS. Acceptance criteria and corrective action for precision are the same as for the MSD.	
Matrix Spike (MS)	One per batch per general matrix type of maximum 20 samples with minimum of 1 per day analyzed. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.	One per batch per general matrix type of maximum 20 samples with minimum of 1 per day analyzed. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. Unless method-specified, acceptance criteria are lab generated RPD limits for precision.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.	Required with each MS. Unless method-specified, acceptance criteria are lab generated RPD limits for precision.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Post Digestion Spike (PDS)	As needed for matrix interference evaluation. Acceptance criteria are same as used for MS recovery. Samples with a non-detect concentration may be reported if the PDS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.	As needed for matrix interference evaluation. Acceptance criteria are same as used for MS recovery. Samples with a non-detect concentration may be reported if the PDS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.

GENERAL QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY				
	General Colorimetric Techniques		General Potentiometric Techniques	
QC Parameter	Requirement	Corrective Action	Requirement	Corrective Action
Continuing Calibration Verification (CCV)	Second source standard analyzed at the beginning of each analytical batch, after every 10 samples and after the last sample. Concentration is varied throughout the run. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the CCV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate. For chemistries with daily calibration, an alternative is to reprocess the analytical batch.	Second source standard analyzed at the beginning of each analytical batch, after every 10 samples and after the last sample. Concentration is varied throughout the run. Unless method-specified, acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the CCV fails to meet the acceptance criteria with a positive bias.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate. For chemistries with daily calibration, an alternative is to reprocess the analytical batch.
Continuing Calibration Blank (CCB)	Analyzed with the CCV. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.	Analyzed with the CCV. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.

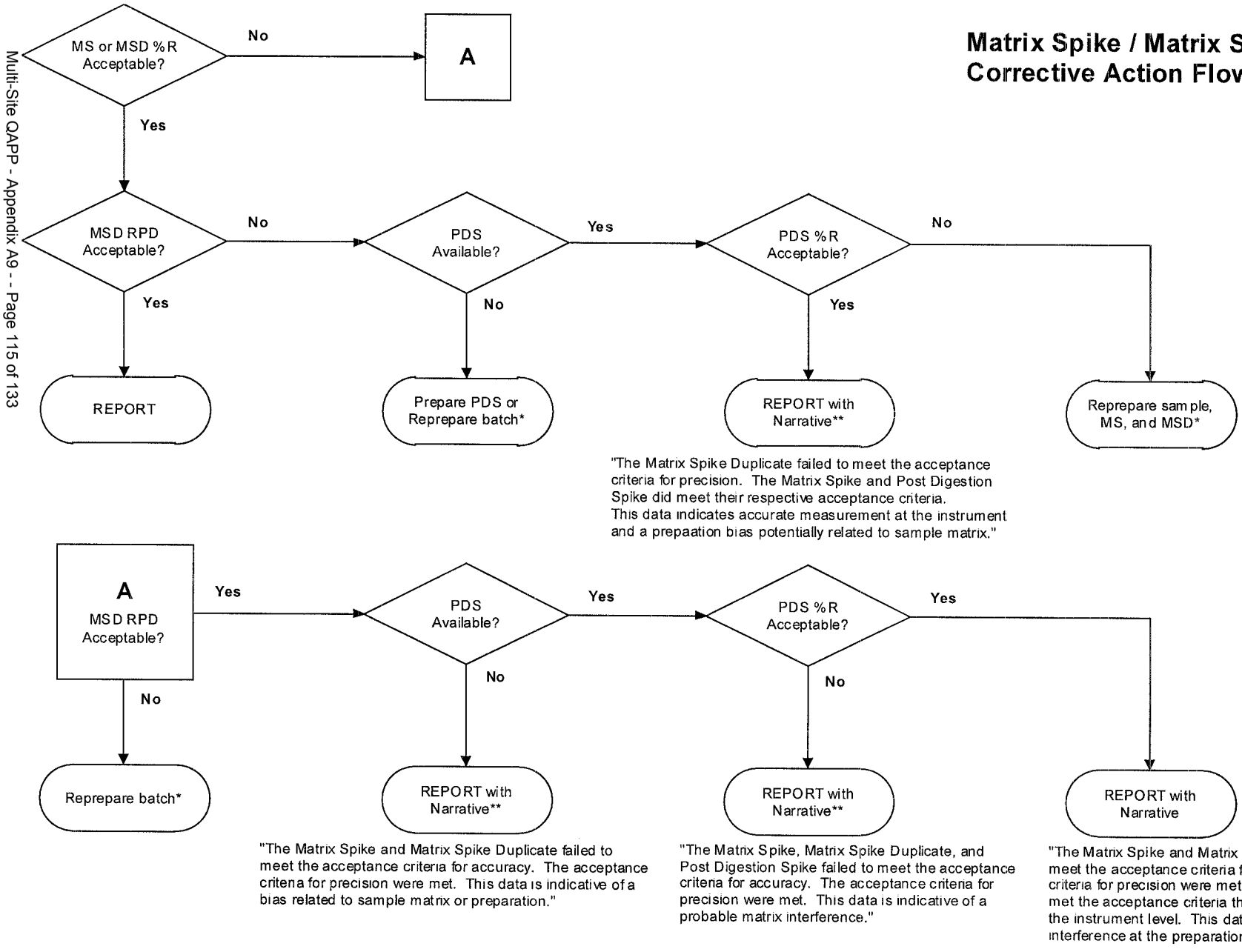
METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY		
	Cyanide by EPA Method 335.2, SW-846 Method 9012A, and Standard Methods (18) Method 4500-CN C,E	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum blank and 4 standards. Correlation coefficient criteria is r ≥ 0.995. New curve prepared every 6 months for manual colorimetry and daily for automated colorimetry.	Repeat calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are 85.0 to 115% recovery.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK)	One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be reanalyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are 90.0 – 110% recovery. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be reanalyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample Duplicate (LCSD)	Replaces the MSD when sufficient sample size is not available. Acceptance criteria and corrective action for accuracy are the same as for the LCS. Acceptance criteria and corrective action for precision are the same as for the MSD.	
Matrix Spike (MS)	One per batch per general matrix type of maximum 10 samples with minimum of 1 per day analyzed. Acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. Acceptance criteria are ≤ 20.0% RPD for precision.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Post Digestion Spike (PDS)	As needed for matrix interference evaluation. Acceptance criteria are same as used for MS recovery. Samples with a non-detect concentration may be reported if the PDS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.
Continuing Calibration Verification (CCV)	Second source standard analyzed at the beginning of each analytical batch, after every 10 samples and after the last sample. Concentration is varied from that of the ICV. Acceptance criteria are 85.0 – 115% recovery.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate. For daily calibration, an alternative is to reprocess the analytical batch.
Continuing Calibration Blank (CCB)	Analyzed with the CCV. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY		
	Phenolics by EPA Method 420.2 and SW-846 Method 9066	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum blank and 4 standards. Correlation coefficient criteria is r ≥ 0.995. New curve prepared daily.	Repeat calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are lab generated recovery limits.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK)	One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be reanalyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be reanalyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample Duplicate (LCSD)	Replaces the MSD when sufficient sample size is not available. Acceptance criteria and corrective action for accuracy are the same as for the LCS. Acceptance criteria and corrective action for precision are the same as for the MSD.	
Matrix Spike (MS)	One per batch per general matrix type of maximum 10 samples with minimum of 1 per day analyzed. Acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. Acceptance criteria are lab generated precision limits.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Post Digestion Spike (PDS)	As needed for matrix interference evaluation. Acceptance criteria are same as used for MS recovery. Samples with a non-detect concentration may be reported if the PDS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, matrix interference should be expected. If acceptable to the project data quality objectives, samples results may be reported with appropriate data qualifier.
Continuing Calibration Verification (CCV)	Second source standard analyzed at the beginning of each analytical batch, after every 10 samples and after the last sample. Concentration is varied from that of the ICV. Acceptance criteria are lab generated recovery limits.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate. For daily calibration, an alternative is to reprocess the analytical batch.
Continuing Calibration Blank (CCB)	Analyzed with the CCV. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY		
	Hexavalent Chromium by SM (18) 3500-Cr D, SW-846 Method 3060A and 7196A	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	Minimum blank and 3 standards. Correlation coefficient criteria is r ≥ 0.995. New curve prepared every 6 months for manual colorimetry and daily for automated colorimetry.	Repeat calibration.
Initial Calibration Verification (ICV)	Second source standard analyzed after calibration. Acceptance criteria are 90.0 to 110% recovery.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK)	Applicable to the analysis of solids samples only. One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be reanalyzed, or sample results reported with appropriate data qualifier.
Laboratory Control Sample (LCS)	Applicable to the analysis of solid samples only. One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are 80.0 – 120% recovery. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be reanalyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	One per batch per general matrix type of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are 85.0 – 115% recovery for waters and 75.0 – 125% recovery for, both, soluble and insoluble spike types on solid samples. Samples with a non-detect concentration may be reported if the MS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. Acceptance criteria are ≤ 20.0% RPD for precision.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Post Digestion Spike (PDS)	Applicable to the analysis of solid samples only. Analyze if the MS/MSD fail to meet the acceptance criteria for accuracy with a low bias. Acceptance criteria for the PDS are 85.0 – 115% recovery.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, the sample and the MS/MSD must be re-digested and analyzed, or sample results reported with appropriate data qualifier.
Continuing Calibration Verification (CCV)	Second source standard analyzed at the beginning of each analytical batch, after every 10 samples and after the last sample. Concentration is varied from that of the ICV. Acceptance criteria are 90.0 – 110% recovery.	If acceptance criteria are not met, reanalyze. If reanalysis fails to meet the acceptance criteria, recalibrate. For daily calibration, an alternative is to reprocess the analytical batch.
Continuing Calibration Blank (CCB)	Analyzed with the CCV. Acceptance criteria are the same as that required for the ICB.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.

METHOD SPECIFIC QUALITY CONTROL REQUIREMENTS – WET CHEMISTRY		
	Hexane Extractable Materials by EPA Method 1664A	
QC Parameter	**Requirement**	**Corrective Action**
Calibration	2-point calibration or verification at 2 mg and 1000 mg with Class S masses before initial and final weightings. Acceptance criteria are 2 mg ± 10% (1.8 – 2.2 mg) and 1000 mg ± 0.5% (995 – 1005 mg).	Repeat calibration.
Laboratory Control Sample (LCS) / Ongoing Precision Recovery (OPR)	One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are lab generated recovery limits obtained from data meeting the method specified limits of 79.0 – 114% recovery for HEM and 64.0 – 132% recovery for SGT-HEM. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the LCS must be reanalyzed, or sample results reported with appropriate data qualifier.
Initial Calibration Blank (ICB)	Analyzed after the ICV. Acceptance criteria are <PQL or <10% of sample concentration. Samples with a non-detectable concentration may be reported regardless of the ICB result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, recalibrate, or sample results reported with appropriate data qualifier.
Method Blank (MBLK)	One per batch of maximum 20 samples with minimum of 1 per day analyzed. Acceptance criteria are <PQL. Samples with a non-detectable concentration may be reported regardless of the MBLK result. Analyses applicable to our WI certification must be evaluated down to the current MDL.	If acceptance criteria not met, reanalyze. If reanalysis fails to meet acceptance criteria, all environmental samples associated with the MBLK must be reanalyzed, or sample results reported with appropriate data qualifier.
Matrix Spike (MS)	One per 20 samples from a given collection point. Acceptance criteria are lab generated recovery limits obtained from data meeting the method specified limits of 79.0 – 114% recovery for HEM and 64.0 – 132% recovery for SGT-HEM. Samples with a non-detect concentration may be reported if the LCS fails to meet the acceptance criteria with a positive bias.	Evaluate the accuracy recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.
Matrix Spike Duplicate (MSD)	Required with each MS. Acceptance criteria are lab generated recovery limits. Samples with a non-detect concentration may be reported if the MSD fails to meet the accuracy acceptance criteria with a positive bias.	Evaluate the precision recoveries of the MS/MSD according to the flow chart at the end of this Appendix. Factors affecting the decision to reprepare a sample or to report data with a qualifier include, but are not limited to, available sample, holding time, and project DQOs.

Matrix Spike / Matrix Spike Duplicate Corrective Action Flowchart



* Use lesser sample amount for MS/MSD sample. If the sample is part of a client specific Sample Delivery Group, all samples in the SDG must be reprepared and analyzed in a similar manner.
** Professional judgement should be used in determining when to report data with a narrative or to reanalyze the sample/batch.

26.6 Appendix F – Chain of Custody and Sample Acceptance Policy

Copies of the Chain of Custody form and our Sample Acceptance Policy are on the following pages.

Microbac

Samples Submitted to:
[ ] 250 West 84th Drive, Merrillville, IN 46410, Tel: 219-769-8378, Fax: 219-769-1664
[ ] 5713 West 85th Street, Indianapolis, IN 46278, Tel: 317-872-1375, Fax: 317-872-1379

Chain of Custody Record

Number

Instructions on back

Client Name	Project	Turnaround Time	Report Type
Address	Location	[ ] Routine (7 working days)	[ ] Results Only [ ] Level II
City, State, Zip	PO #	[ ] RUSH* (notify lab)	[ ] Level III [ ] Level III CLP-like
Contact	Compliance Monitoring? [ ] Yes(1) [ ] No	_____ (needed by)	[ ] Level IV [ ] Level IV CLP-like
Telephone #	(1)Agency/Program		[ ] EDD

Sampled by (PRINT) _____ Sampler Signature _____ Sampler Phone # _____

Send Report via [ ] Mail [ ] Telephone [ ] Fax (fax #) _____ [ ] e-mail (address) _____

* **Matrix Types:** Soil/Solid (S), Sludge Oil Wipe Drinking Water (DW) Groundwater (GW), Surface Water (SW), Waste Water (WW) Other (specify)

** **Preservative Types:** (1) HNO3, (2) H2SO4, (3) HCl, (4) NaOH, (5) Zinc Acetate, (6) Methanol, (7) Sodium Bisulfate, (8) Sodium Thiosulfate, (9) Hexane, (U) Unpreserved

Client Sample ID	Matrix*	Grab	Composite	Filtered	Date Collected	Time Collected	No. of Containers	Requested Analyses → Preservative Types ** ↓									For Lab Use Only

Possible Hazard Identification [ ] Hazardous [ ] Non-Hazardous [ ] Radioactive Sample Disposition [ ] Dispose as appropriate [ ] Return [ ] Archive

Comments	Relinquished By (signature)	Date/Time	Received By (signature)	Date/Time
	Relinquished By (signature)	Date/Time	Received By (signature)	Date/Time
Sample temperature upon receipt in degrees C =	Relinquished By (signature)	Date/Time	Received for Lab By (signature)	Date/Time

rev 11/04/04 Page____ of ____

DATE: September 21, 2004

TO: Clients of Microbac Laboratories, Inc.

RE: **Sample Acceptance Policy**

In an effort to further Microbac Laboratories' Commitment to Quality we have prepared the following Sample Acceptance Policy. The intention of this policy is to enable us to better serve you with superior tracking of your samples.

Microbac Laboratories operates a quality program that meets the requirements of the National Environmental Laboratory Accreditation Program (NELAP). As part of our Quality Program specific procedures are followed when samples are received to the laboratory. As a routine, Microbac evaluates samples for proper sample containers, preservation, transport temperature, holding time and Chain of Custody information. These procedures are used as the basis of determining sample viability by regulatory agencies. In addition to performing these routine procedures NELAP also requires that we communicate with you, our client, when certain parameters fail to meet standard sample receipt protocols. The following is a statement of our sample receipt policies.

Chain of Custody:

A chain of custody MUST accompany all samples received at the laboratory. The purpose of the Chain of Custody (COC) is to identify all pertinent information concerning a sample or sample delivery group. The following information on the Chain of Custody will be reviewed: client name and address, sample collector's name, sample description/identification, matrix, date and time of collection, number of containers, preservative and requested analysis. In the event that any of this information is missing from the Chain of Custody and is deemed necessary to ensure the integrity of the samples and analysis, your Microbac Project Manager will contact you to review any discrepancies or missing information. Any missing receipt information will be documented in the final report.

Sample Containers:

Upon receipt at the laboratory sample containers will be evaluated to ensure that all of the containers are intact, that the container type meets the requirement of the specific analytical method, and that the bottles are properly filled. If it is determined that a container has been compromised, improperly filled, or is not appropriate, your Microbac Project Manager will be notified. In the event that the container condition is deemed significant to adversely effect the integrity of the samples and analysis, your Microbac Project Manager will contact you for direction. Provided sample integrity is maintained, analysis will proceed as normal. Documentation of this decision will be provided to you as part of the Cooler Inspection form in the final report.

Preservatives:

Chemical preservatives are required by many analytical methods in order to render a specific analyte stable until analysis can be performed. Chemical preservatives are to be added AT THE TIME OF SAMPLING (either added directly or via pre-preserved bottles). Upon receipt at the laboratory, samples will be evaluated to ensure that individual sample bottles are properly preserved. If it is determined that a sample is improperly preserved, the appropriate preservative will be added and your Microbac Project Manager will be notified. Unless directed otherwise through the Exceptions section of the attached Policy Receipt Form or the COC accompanying the samples, analysis will proceed as normal. If preservation is performed at the lab, documentation of this action will be provided to you as part of the Cooler Inspection form in the final report.

Transport/Receipt Temperature:

Many of the analytical methods utilized require that samples be kept cool during sample transport. Microbac will assess and document the receipt temperature of each cooler received at the laboratory. Where thermal preservation is required, the receipt temperature must be in a range of 0.1 – 6°C unless receipt is made within two (2) hours of sampling and an attempt has been made to cool the samples. If samples are received outside of the required temperature range, your Microbac Project Manager will be notified. Unless directed otherwise through the Exceptions section of the attached Policy Receipt Form or the COC accompanying the samples, analysis will proceed as normal.

Documentation of the receipt temperature will be provided to you as part of the Cooler Inspection form in the final report.

Holding Time:

Samples should be provided to the laboratory as soon as possible after collection to ensure that analysis can be performed within the method specified Holding Time. Upon receipt at the laboratory, the sample date and time as well as the required chemistries will be evaluated to identify if any of the samples may be past the maximum holding time. Samples found to be past or near their holding time will be referred to your Microbac Project Manager who will contact you if necessary. Analysis will NOT be initiated on samples that have exceeded their maximum holding time unless client authorization is given. Documentation of this decision will be provided to you as part of the Cooler Inspection form in the final report.

Client specific requirements, such as sampling plans and QAPjP's, may require alternate actions when samples fail to meet all sample receipt requirements. Alternate procedures must be made available to Microbac in writing prior to sample receipt. Samples will be evaluated against these alternate requirements and appropriate documentation made in the final report. Please make certain that this policy information is made available to the applicable sample collectors.

Thank you for your understanding and attention to these details. Working together, we can meet your immediate analytical needs as well as future evaluations of data integrity.

Sample Acceptance Policy Receipt Form

I, _____, declare that I am a representative of
(Printed Name)

_____ in _____
(Company Name) (City, State)

And am able to make the following authorization for applicable projects. I understand that I reserve the right to repeal this request, in writing to Microbac Laboratories, at any time. (This authorization will be used for any project in which I am listed as the client contact, unless Microbac Laboratories is otherwise notified.)

By signing below, I attest that I have read and understand the Microbac Sample Acceptance Policy and agree to these conditions with the following exceptions.

Exceptions (Place an "X" in the appropriate box below)

- ❑ No exceptions

- ❑ Exceptions: _____

_____
_____
_____
_____
_____

Client Representative Signature: _____ Date: _____

26.7 Appendix G – Equipment List

DEPARTMENT	DESCRIPTION	SERIAL #	LAB ID
Organics	HP5890 Series II GC	3115A34915	VOA-1
	HP5971 Mass Selective Detector	3114A02148	VOA-1
	Tekmar 3000 Concentrator	96242020	VOA-1
	Solatek 72 Autosampler	US01155002	VOA-1
	HP5890 Series II GC	2919A22532	VOA-2
	HP5972 Mass Selective Detector	3609A03555	VOA-2
	Tekmar 3000 Concentrator	93347001	VOA-2
	Solatek 72 Autosampler	US01151001	VOA-2
	HP5890 Series II GC	2728A13688	VOA-3
	HP5970 Mass Selective Detector	3034A12873	VOA-3
	Tekmar 2000 Concentrator	88300018	VOA-3
	Tekmar 2016 ALS	94221007	VOA-3
	HP5890 Series II GC	2938A24766	VOA-4
	HP5970 Mass Selective Detector	2905A11924	VOA-4
	Tekmar 2000 Concentrator	91190009	VOA-4
	Tekmar 2016 ALS	93200003	VOA-4
	Tekmar 2016 ALS	94200013	VOA-4
	HP5890 Series II GC	3235A46380	VOA-5
	HP5972 Mass Selective Detector	3307A00246	VOA-5
	Tekmar 3100 Concentrator	US02010007	VOA-5
	Solatek 72 Autosampler	US02056033	VOA-5
	HP5890 Series II GC	3223A43647	SVOA-1
	HP5971 Mass Selective Detector	3222A03781	SVOA-1
	HP7673 ALS	2704A07363	SVOA-1
	HP5890 Series II GC	3235A45051	SVOA-2
	HP5972 Mass Selective Detector	3524A02920	SVOA-2
	HP7673 ALS	3401A37489	SVOA-2
	HP5890 Series II GC	3336A53454	SVOA-3
	HP5971 Mass Selective Detector	2919A00311	SVOA-3
	HP7673 ALS	3114A25786	SVOA-3
	HP5890 Series II GC	3336A52601	SVOA-4

HP5972A Mass Selective Detector	3549A03138	SVOA-4
HP7673 ALS	3348A37145	SVOA-4
HP5890 Series II GC	3310A49394	ECD-1
Electron Capture Detector	K3855	ECD-1
Electron Capture Detector	F6627	ECD-1
HP5890 Series II GC	3108A34009	ECD-2
Electron Capture Detector	L5647	ECD-2
Electron Capture Detector	L2973	ECD-2
HP5890 Series II GC	3115A35056	FID-1
Flame Ionization Detector		FID-1
HP5890 Series II GC	272BA12416	FID-2
Flame Ionization Detector		FID-2
HP HPLC Series 1050	2931J00900	HPLC-1
UV / Fluorescence Detector	3337G04321	HPLC-1
Zymark TurboVap II Concentrator	TV9445N5817	TurboVap #1
Zymark TurboVap II Concentrator	3987	TurboVap #2
Fisher 550 Probe Sonicator	F1356	Sonicator #1
Fisher 550 Probe Sonicator	F2652	Sonicator #2
International Centra-HN Centrifuge	24850640	Centrifuge #1
Continuous LLE Glassware	-----	-----
Denver XL-500 Top Loading Balance	B-040564	Bal-3
Ohaus Navigator N12120 Top Loading Balance	1122260997	Bal-4
Frigidaire Freezer	-----	Freezer #1
White Westinghouse Refrigerator/Freezer	RTF11865	Cooler/Freezer #2
Philco Refrigerator	-----	Cooler #3
Whirlpool Estate Refrigerator/Freezer	EC4128572	Cooler/Freezer #4
Whirlpool Estate Refrigerator/Freezer	VSG3371680	Cooler/Freezer #5
General Electric Freezer	RV170685	Freezer #6
Hotpoint CTA12CLF Refrigerator /Freezer	AM435555	Cooler #18
Whirlpool Refrigerator/Freezer	E32656107	Cooler #19

	Fisher Isotemp 506G Drying Oven	70700184	Oven #4
Metals	TJA IRIS Advantage ICP-AES	10586	ICP-2
	Thermo TRACE ICP-AES	11388	ICP-4
	CETAC M-6000A Mercury Analyzer	010101MAS	CVAA
	CETAC M-7500 Mercury Analyzer	40303	CVAF
	Perkin Elmer 4100ZL GFAAS	6145	GFAA-3
	Varian 220Z GFAAS	EL01023785	GFAA-4
	Environmental Express EE54 Block Digestion Unit	424CEC0557	Hot Block #1
	Environmental Express EE54 Block Digestion Unit	615CEC0834	Hot Block #2
	8-place TCLP/ZHE Tumbler Unit	-----	Tumbler #1
	8-place TCLP/ZHE Tumbler Unit	-----	Tumbler #2
	8-place TCLP/ZHE Tumbler Unit	-----	Tumbler #3
	12-place TCLP/ZHE Tumbler Unit	-----	Tumbler #4
	Box-style TCLP Tumbler Unit	-----	Tumbler #5
	AND HR-120 Analytical Balance	12200102	Bal-5
	Mettler BB-300 Top Loader Balance	58817	Bal-6
Wet Chemistry	Lachat QuikChem 8000 Flow Injection Analyzer	A83000-466	Lachat-1
	Lachat QuikChem 8000 Flow Injection Analyzer	A83000-1842	Lachat-2
	Milton Roy Spectronic 20D+ Spectrophotometer	3DUA200051	SPEC-2
	YSI Model 5100	03C0683 AB	BOD-Probe
	Orion Model 122 Conductivity Meter	24020015	SCMeter
	Fisher Scientific Accumet 25 pH Meter	-----	Accumet pH #2
	Orion 230 pH Meter	14318	Orion pH #2
	Orion 720A Ion Meter	10232	ISE-1
	Mettler AE-100 Analytical Balance	G80020	Bal-2
	Denver XL-1800 Top Loading Balance	66806	Bal-7
	Mettler AE-100 Analytical Balance	SV03515	Bal-10
	2 6-place SPE Units (for HEM by 1664)	-----	-----
	Pensky-Martens Closed Cup Flashpoint Tester	1082	Flashpoint #1
	Pensky-Martens Closed Cup Flashpoint Tester	5332	Flashpoint #2
	2 Barnant Thermocouple Thermometers #600-	-----	-----

	1040		
	Thermolyne 1300 Muffle Furnace	S47920362924	Furnace #1
	Thermolyne 1400 Muffle Furnace	1049001069797	Furnace #2
	Thermolyne 6000 Muffle Furnace	1060981259939	Furnace #3
	Fisher 655-F Drying Oven	30400156	Oven #1
	Precision 45EG Drying Oven	699071588	Oven #2
	Fisher Isotemp 750F Drying Oven	40700148	Oven #3
	Fisher Scientific Model 307C BOD Incubator	61200348	Incubator-1
	Bioscience COD Reactor	COD-B418	COD Digestor #1
	Hach Model 45600 COD Reactor	900301873	COD Digestor #2
	Lachat BD-46 Block Digestor	1800-373	TKN Digestor #1
	Midi Distillation Unit	-----	Distillation Unit A
	Lachat 1700-000 Midi Distillation Unit	2000-432	Distillation Unit B
	Kontes Midi Distillation Unit	-----	Distillation Unit C
	Barnstead/Thermolyne 2200 Hot Plate	848940899099	Hotplate #1
	Barnstead/Thermolyne Mirak Hot Plate	847000427269	Hotplate #2
	Barnstead/Thermolyne Mirak Hot Plate	847000427270	Hotplate #3
	General Electric Refrigerator / Freezer	-----	Cooler #1
	Cannon Constant Temperature Bath	0752-A4900	ViscBath-1
	Parr Oxygen Bomb Calorimeter 1341EB	6889	Bomb #1
	Miscellaneous distillation glassware, stir plates and other labware	-----	-----
Microbiology	Equatherm Incubator	994-002	Incubator-3
	Hach 16E Incubator	0701597	Incubator-4
	Fisher IsoTemp 655D Incubator	31000254	Incubator-5
	Napco Water Jacketed Incubator		Incubator-6
	Blue M 200A Incubator	ZA-3571	Incubator-7
	Scientific Products 13100 Water Bath	0969	Bath-1
	Precision 253 Water Bath	9401-401	Bath-2
	Precision 253 Water Bath	9602-006	Bath-3
	Frigidaire FPCI-152T-7 Refrigerator/Freezer	72AC2938	Cooler #13

	Kelvinator MRT18BRBW1 Refrigerator/Freezer	LA42401740	Cooler #14
	White-Westinghouse MRT18BRBW2 Refrigerator/Freezer	LA44003267	Cooler #15
	General Electric SMR04DAMAWW Refrigerator	HD319326	Cooler #20
	Market Forge Sterilmatic Autoclave	164025	Autoclave Unit A
	Market Forge Sterilmatic Autoclave	150337	Autoclave Unit B
	Denver XL-500 Top Loading Balance	B040060	Bal-8
	Mettler P1000 Top Loading Balance	307509	Bal-9
	2 Millipore 3-place Filtration Units	-----	-----
	Blak-Ray UVL-56 UV Lamp	-----	-----
	New Brunswick C-110 Dark Field Colony Counter	18961	-----
	Fisher Micromaster Microscope	FW00-14B-1508	Microscope #1
	Fisher Stereomaster II SPT-ITH Microscope	-----	Microscope #2
	Leitz Laborflux D Microscope	041581	Microscope #3
	XSP 10 Series Microscope	-----	Microscope #4
Miscellaneous	NIST Traceable Mass Set	59131	-----
	NIST Traceable Mass Set	22894	-----
	ERTCO NIST Traceable Thermometer -20 to 110oC in 1oC increments	F93-331	-----
	ERTCO NIST Traceable Thermometer 0 to 205oC in 0.2oC increments	1581	-----
	ERTCO NIST Traceable Thermometer 25 to 55oC in 0.1oC increments	2856	-----
	Raytek Raynger ST Noncontact Thermometer	2953870101-0052	-----
	TAFCO 9X12' Walk-in Cooler	-----	Walk-in Cooler
	TRUE Model GDM-72 Reach-in Cooler	1-2908805	Cooler #8
	TRUE Model GDM-72 Reach-in Cooler	1-2643796	Cooler #7
	TRUE Model GDM-72 Reach-in Cooler	1-2908788	Cooler #10
	TRUE Model GDM-72 Reach-in Cooler	1-2725611	Cooler #9
	TRUE Model GDM-72 Reach-in Cooler	1-3064704	Cooler #6
	TRUE Model GDM-72 Reach-in Cooler	1-2908804	Cooler #11

	TRUE Model GDM-72 Reach-in Cooler	1-2908799	Cooler #12
	Hot Point CTA14CTB Refrigerator / Freezer	R2529758	Cooler #16
	General Electric TB12MCC Refrigerator / Freezer	TC612479	Cooler #17
	TRUE Model T-49 Reach-in Cooler	1-3473595 / AKA4460YXA	Cooler #21
	CRC Commander Refrigerator	-----	Cooler #22
	Culligan Water Treatment System (includes Soft-Minder Twin Water Conditioner (salt softening), Organic removal (carbon treatment), 5 micron particulate removal, Series E Reverse Osmosis, mixed-bed ion removal, and 0.05 micron particulate removal)	-----	DI System #1
	Culligan Water Treatment System (includes Soft-Minder Twin Water Conditioner (salt softening), Organic removal (carbon treatment), 5 micron particulate removal, Series E Reverse Osmosis, mixed-bed ion removal, and 0.05 micron particulate removal)	-----	DI System #2
Field Services	ISCO 6700 Wastewater Sampler	19E03100	-----
	ISCO 3700 Wastewater Sampler	08117-019	-----
	ISCO 2900 Wastewater Sampler	09330-020	-----
	Orion 210 pH Meter	13047	-----
	Orion 230 pH Meter		-----
	Orion 290A Ion Meter	12037	-----
	Hach Model 2100P Turbidimeter	10200027974	-----
	Hach Chlorine Test Kits (58700-00)	-----	-----
	Miscellaneous Stainless Steel and Teflon sample collection and mixing equipment	-----	-----
	2 Soil augers (1 open and 1 closed)	-----	-----
	Ekman Bottom Grab (dredge) Sampler	-----	-----

26.8 Appendix H – Corrective Action Request Form

Microbac Laboratories, Inc. — *FOR QA OFFICE USE* —
QS CAR #:

DEVIATION / CORRECTIVE ACTION REPORT (CAR) FORM

DATE INITIATED: _____ **ANALYTE:** _____

INITIATED BY: _____ **BATCH/RUN ID:** _____

AFFECTED SAMPLE ID's: _____

PROBLEM/DEFICIENCY: _____

ROOT CAUSE & DETAILS: Root Cause: [ ] Undetermined [ ] Other (explain)

CORRECTIVE ACTION TAKEN: [ ] None [ ] Other (explain) _____

PREVENTIVE ACTION: [ ] None [ ] Other (explain) _____

Dept. Manager Approval: _____ **Date:** _____
QA Dept. Approval: _____ **Date:** _____

Case Narrative: [ ] Written By/Date: _____ [ ] None Required

VERIFICATION: [ ] None Required [ ] Other (explain) _____

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26.9 Appendix I – External Complaint Resolution Form

Microbac Laboratories, Inc.

External Complaint Resolution Form

Client Information	Microbac Information
Company Name: _____	Received By: _____
Location: _____	Received Date: _____
Representative: _____	Responsible for Response: _____

Issue(s) Discussed: _____

Suggestions or actions taken (circle one) to resolve this instance: _____

Suggestions or actions taken (circle one) to prevent reoccurrence: _____

Completed By: _____ Date: _____

Managing Director Review

Additional actions to be taken: _____

Client Verification (if available): _____

Approved by: _____

Date: _____

Original to External Complaint file

Copy to appropriate client or project file

26.10 Appendix J – Initial Demonstration of Capability (IDC) Report

An example copy of the IDC Certification Statement is included on the following page.

Microbac Laboratories, Inc.

Initial Demonstration of Capability (IDC) Certification Statement

Date:
Analyst:

Matrix:
Method Number:

We, the undersigned, CERTIFY that:

1 The analyst(s) identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

2 The test method(s) was performed by the analyst identified on this certification.

3 A copy of the test method(s) and laboratory-specific SOPs are available for all personnel on-site.

4 The data associated with the demonstration of capability are true, accurate, complete and Self-explanatory (1).

5 All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

Section Manager's Name and Title	Signature	Date
QA Manager's Name and Title	Signature	Date

(1) True: Consistent with supporting data
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

27.0 ETHICS AND DATA INTEGRITY AGREEMENT

(These pages include an example of the agreement included in the Corporate Policies and Procedures binder. A copy of this Agreement is signed and returned upon employment.)

Microbac Laboratories, Inc.

ETHICS AND DATA INTEGRITY AGREEMENT

I. I, _____, hereby state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at Microbac Laboratories, Inc.

II. I hereby acknowledge that I have been formally instructed to consider Quality as the most important aspect of all my job responsibilities and requirements. I have reviewed and understand this Ethics and Data Integrity Policy and the Business Conduct Policy. I acknowledge that I have been formally instructed to be honest in the production and reporting of data and to insist on excellence in quality control.

III. I hereby agree, that in the performance of my duties at Microbac Laboratories, Inc., that:

- I will use Microbac approved analytical methods and Standard Operating Procedures for all work assigned to me;
- I will only report results or data that match the actual results observed or measured. Furthermore, I will not modify data values unless the modification can be technically justified through a method acceptable to Microbac. All such modifications will be clearly and thoroughly documented in the appropriate laboratory record and raw data and include my initials or signature and date.
- I will not intentionally nor improperly report dates and times of analyses that are not the actual dates and time the analyses were conducted;
- I will not intentionally represent another's work as my own, not represent my work as that of someone else;
- I will not intentionally make false statements to, or seek to otherwise deceive, Microbac employees, leaders or clients.

- Through acts of commission, omission, erasure, or destruction, I will not intentionally misrepresent through improper reporting: sampling events, inspections, measurements, standard results, data, test results or conclusions.

IV. I hereby agree to inform Microbac Laboratories, Inc. of any accidental reporting of non-authentic data in a timely manner.

V. I hereby agree to inform Microbac Laboratories, Inc. of any operational events inconsistent with policy or standard operating procedures that result in of non-authentic data in a timely manner.

VI. I hereby understand that the willful disregard or failure to comply with the terms, as set forth within this document, will result in a detailed investigation that could lead to severe disciplinary action, including but not limited to, termination of employment and criminal and/or civil prosecution.

28.0 EMPLOYEE CERTIFICATION

By signing below, I certify that I have read, understand, and will abide by the current revision of this Plan. Not with the intention of placing more importance on any given section of the Plan, I understand the significance of the following sections.

- Analyst Commitment to Quality (Section 7.2). I understand the dedication Microbac Laboratories puts forth in providing data of a known and high quality. I will abide by this commitment and notify management if I identify areas for improvement.

- Confidentiality (Section 19.0). I understand the position Microbac has taken towards the confidentiality of its clientele, their data, and the operations of the laboratory. I will make every effort to not knowingly divulge any confidential information to the public.

- Ethics (Section 22.0). I have signed and returned a copy of the Ethics and Data Integrity Agreement. I understand the position Microbac has taken towards ethics and data integrity and will not intentionally deviate from the written requirements and intent of the Agreement.

- The Quality Assurance Plan in its entirety. I understand that this manual defines the quality systems of the Microbac Merrillville facility as well as its service center(s).

_____ _____
Employee Signature Date