Standard Operating Procedure

Seasonal Water Quality Monitoring

Prepared by Ying Yao.

Meadowlands Environmental Research Institute (MERI)
Rutgers University-Newark

NJDEP Laboratory Certification Number: 02437

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1.0 INTRODUCTION, SCOPE AND APPLICABILITY

1.1 INTRODUCTION:

The Meadowlands Environmental Research Institute (MERI), the scientific field station of Rutgers University-Newark, was created to preserve, protect and research the valuable marshes that spread through 14 towns in New Jersey. The laboratory performs both scientific research and regulatory testing. Information and data generated by MERI for its clients under permit is scientifically credible as analysis adheres to strict guidelines set forth by the NJDEP. MERI's management is committed to generating data of the highest quality to fulfill all aspects of the laboratory's operation.

1.2 SCOPE:

MERI provides chemical and biological data to support the following:

A) Permit testing
B) District Operations
C) Continuous sonde monitoring for the New Jersey Ambient Water Quality Data Exchange
D) University Research
E) In-house Monitoring

1.3 APPLICABILITY:

All objectives and procedures in this QM pertain to customers and clients with regulatory needs. Any research performed solely by the MERI lab or jointly with another university does not necessarily adhere to N.J.A.C. 7:18 regulations.

2.0 TERMS AND DEFINITIONS

All terms, definitions and procedures are taken from the state ruling N.J.A.C. 7:18, last amended November 22nd, 2006, which is enforced by the New Jersey Department of Environmental Protection, Office of Quality Assurance.

3.0 MANAGEMENT REQUIREMENTS

3.1 *ORGANIZATION:*

3.1.1 MERI is a part of the Rutgers University-Newark and is located at 2 DeKorte Park Plaza, Lyndhurst NJ, 07071. The State Laboratory Certification Number is 02437. To inquire about research projects or permitting needs, Ying 'Cheryl' YAO can be contacted at 201- 460- 4604.

3.1.2 The Quality Manual (QM) in conjunction with the Standard Operating Procedures (SOPs) provide guidance for the laboratory operations and serve as the document that defines criteria necessary to meet the standards of N.J.A.C. 7:18. The QM details the activities and evaluation criteria necessary to ensure the analytical data meet the requirements of N.J.A.C. 7:18. The QM

also documents procedures intended to ensure that all data are of high known quality in order to meet the scientific objectives of MERI.

3.2 *PERSONNEL:*

3.2.1 The following is a list of all personnel that work in or oversee the laboratory portion of MERI. Their titles and job responsibilities are also included.

MERI

Francisco Artigas, Ph.D: Director of MERI
The Director of MERI oversees and develops all research projects. Serves as the liaison of MERI activities to all Directors in other departments encompassed in the NJSEA and Rutgers. Certifies analytic reports for release to clients. Supervises all activities in the laboratory. Responsible for project management and project development. Oversees all data and checks for compliance with state guidelines. In charge of all finding and applying for all research grants

Sandy Speers: Administrative Coordinator
Fills out all appropriate forms for the monthly reporting of Sports Complex samples and sends the monthly packet to the client. Orders all supplies and instruments for the lab. Assists with grant writing. In charge of processing payments for all services rendered due to permit requests.

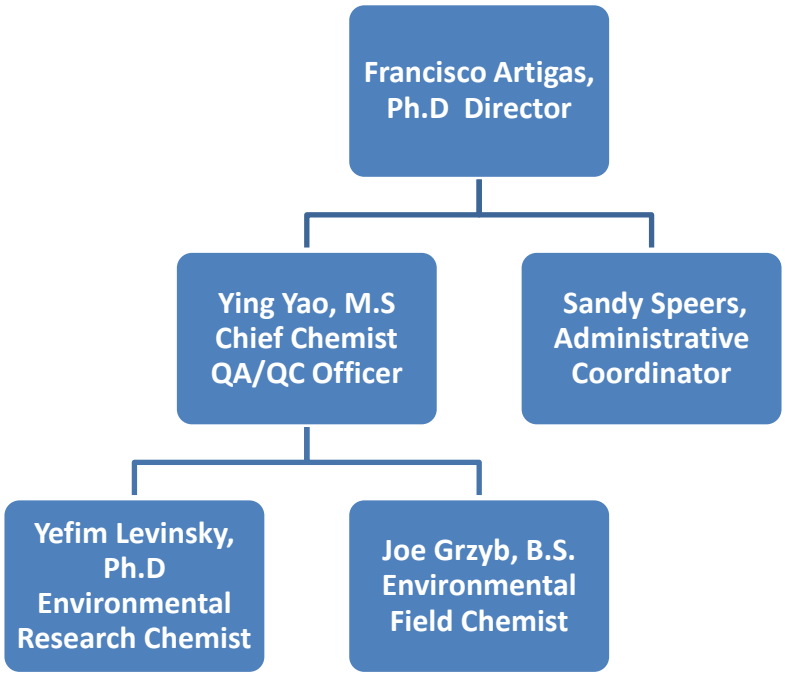
Ying Yao, M.S: Chief Chemist & QA/QC Officer
Supervises and is responsible for all activities and data generated in the laboratory. Responsible for project management and project development. Ensures compliance with quality control and laboratory quality assurance objectives. Ensures that projects and testing are completed accurately and on time. Manages the use of the Mercury Analyzer, GC-ECD/ FID, IC, ICP-MS and GC-MS. Responsible for the low level Mercury, Chloride, Nitrate, Phosphate, Nitrite, Sulfate, and Fluoride in PT test. Ensures that all subordinates follow proper laboratory and waste management procedures (OSHA). Performs all sample analysis on the Ion Chromatograph and ensures that instrument follows NJDEP guidelines. Also keeps control charts, maintenance log, LCR and MDL for IC. Keeps records and updates supplies as well as MSDSs. Performs the annual Right To Know Study.

Yefim Levinsky, Ph.D: Environmental Research Chemist
Responsible for the maintenance and certification of both the AA (Cold vapor and trap) and the ICP-MS. This includes LCR, LDR and MDL studies as well as maintaining an instrument log and instrument control charts. Digests all air, tissue, water, and sediment before analysis and runs them in accordance to N.J.A.C 7:18. Responsible for the PT tests for all heavy metal parameters, COD, BOD, TDS and TSS.

Joe Grzyb, B.S: Environmental Field Chemist
Responsible for all field sampling including soil coring, air and water sampling. Maintains and calibrates continuous monitoring devices. Ensures that data is posted on the website in an accurate and timely manner. Responsible for all sample number generation, COC and filing of COAs. Responsible for all PCB and Pesticide extraction. Responsible for conductivity, turbidity, pH, PCBs and Pesticide PT tests. Contact person for the Sports Complex testing.

Generates Sports Complex reports. Develops a work plan for sample analysis to ensure holding times are met.

3.2.2 Figure 1: MERI Organization Chart:



3.3. *ACCEPTANCE OF SAMPLES:*

3.3.1 A sampling event is scheduled by the Environmental Chemist and is performed by the Field Chemist. The decision to formally accept samples is based on the client's expectations, turnaround times, and what methods need to be performed. Samples are accepted by signing the COC.

The customer is notified of any non-conformances that may affect the integrity of the data. The samples are analyzed unless the customer requests otherwise or the nature of the non-conformance makes analysis impractical. Data from compromised samples are flagged and recorded in the report.

The report will reflect if policies are deviated from, including if samples are prepared or analyzed beyond the accepted holding times, samples are incorrectly preserved or if the integrity of the sample was compromised with as in the case of a broken sample bottle.

3.3.2 Technical and Supporting Procedures:

The laboratory maintains SOPs for both certified and non-certified procedures performed in the laboratory. Every technician in MERI has a copy of those SOPs on their computer and the printed version can be found in the SOP binder, located in office of room EE2.

3.3.3 It is required to annually review and update (if necessary) all SOPs for certified parameters following the most updated versions of both EPA and Standard Methods.

3.3.3.1 The QA/QC officer must approve and sign the latest version of the SOP and put it in the binder.

3.3.3.2 The QA/ QC officer is responsible for keeping the Laboratory QM up to date. The QM is reviewed and revised at least annually and will be posted on MERI's website at: http://meri.njmeadowlands.gov. The posted version is the latest version of the QM.

3.4. REVIEW OF REQUESTS AND PERMIT CONTRACTS

3.4.1 The MERI laboratory has one contract request known as the Sports Complex. Any other requests for analysis must be approved by Ying Yao. Such requests can either be a long term project or a single sampling event. The form can be found at http://meri.njmeadowlands.gov/lab/forms-and-cost/. Ms. Yao will determine if the lab is capable of performing the test within the state requirements. He then informs the technicians so that they can develop their work plan to accommodate the new contract.

3.4.2 Ultimately, the Senior Environmental Scientist is responsible for making sure the lab is adhering to permit requirements and is the liaison with the Rutgers legal department to make sure all appropriate documents are kept on file.

3.4.3 Communications are maintained with the client from the request/quote through the commencement of work. This includes informing the client of any deviation from the contract or agreement.

3.5. SUBCONTRACTING OF ENVIRONMENTAL TESTS

Samples that need to be sent out either due to work overload or because the MERI lab is not currently certified for a specific parameter are sent to QC Labs. All samples are labeled with a MERI sample number and a QC Lab Sample number. Both laboratories fill out their specific COC and each sign the others form when the sample transfers locations. QC Labs reports back to field chemist with all results and the MERI lab includes their sample results in the final report for the client. The administrative assistant is in charge of paying this vendor.

4.0. CORRECTIVE ACTION

4.1 Corrective action must be taken when QA requirements are not met or MERI receives a list of violations after their bi-annual state audit. This includes, but is not limited to, changing SOPs, implementing new procedures, purchasing new supplies or maintaining better calibration records.

4.2 Each technician is responsible for implementing the corrective action that falls under their lab work. All corrective actions must be taken within 90 days of notification.

4.3 All corrective actions are documented and monitored to endure compliance with N.J.A.C. 7:18. The laboratory QA officer maintains a list of corrected actions undertaken by lab personnel.

5.0. PREVENTATIVE ACTION

5.1 Preventative Action is a proactive process used to identify, process and improve upon issues in instrumentation or procedures.

5.2 All maintenance or repairs performed on equipment is documented either on an EExcel sheet or a laboratory note book. This includes the changing of tubing and columns as well as disassembling an instrument for cleaning (including water quality sondes).

6.0. CONTROL OF RECORDS

6.1 *GENERAL:*

6.1.1 Records with QA activities including external and internal audits, certification records and PT studies are filed in a dedicated area by the QA/QC officer.

6.1.2 All written records shall be legible, easily accessible and stored in a manner that will minimize loss, damage and deterioration. MERI will keep all records for five years and then send them for storage on site in a location called “The Castle.”

6.1.3 All electronic records should be saved on the technician’s computer and on the MERI shared drive. Data is archived to a CD if needed.

6.1.4 Sample History

The Chain of Custody includes:

A) Sample Number
B) Sampling/ Storage Date
C) Time Sampled
D) Parameter
E) Method Number
F) Matrix
G) Time Stored
H) Preservative
I) Date Analyzed
J) Technician's initials

There is also a spot at the bottom for any additional comments and an area where the person dropping off the samples should sign and the person receiving them should sign. The COC is signed for both an inter-laboratory sampling event or when working with an outside laboratory.

6.2 *TECHNICAL:*

6.2.1 Most of the data generated for the wet chemistry and sonde parameters are written in a notebook. This data is transferred to an Excel file. The Excel file is printed out and taped into the notebook, next to the handwritten data. The file is also saved on the shared drive.

6.2.2 All instrument files, including chromatography data, are saved on the respected computer. These files are stored under the Project Name and date. All software and hardware data will remain on the computer for at least 5 years. All records will include calibration points, batch lists, control charts, maintenance logs and records of standard lot numbers and their expiration dates.

6.2.3 All documentation records should be captured and stored at the time of generation.

6.2.4 Entry errors on paper records are not erased. Corrections are made by crossing out the error and correcting it next to that marking. It should then be initialed if the correction is not performed by the chemist who generated the data. Electric files will be corrected by the person who created them and the latest version will be saved to the shared drive.

7.0 ENVIRONMENTAL TEST METHODS AND METHOD VALIDATION

7.1 *CERTIFICATION:*

7.1.1 An official list of all certified parameters can be located here: http://meri.njmeadowlands.gov/downloads/lab/CertifiedParameters.pdf

7.1.2 QA Targets:

A. **Ammonia:** The ERA Quality Control must fall within ± 15 percent of certified values

B. **BOD:** Glucose-Glutamic Acid is performed in duplicate for every batch. It must give results of 198 ± 30.5 mg/L as stated on the certificate.

C. **COD:** The ERA Quality Control must fall within ± 15 percent of certified values

D. **Fecal Coliform:** Both a positive and negative control culture is used to confirm that the growth on the plate is Fecal Coliform. A monthly verification step is also performed and the reported results are adjusted depending on the results from this test. See MERI SOP 000113 for details.

E. **TDS:** In every batch performed, the QC sample must meet the acceptance criteria on the certificate. The matrix spike (MS) and the matrix spike duplicate (MSD) must have an RPD value within 5% of each other.

F. **TSS:** Every batch, the QC must meet acceptance criteria on the certificate. Sports Complex samples are very low in TSS, so an RPD value of 5% between duplicates is recommended but not always possible.

G. **Turbidity:** The QC must be within the acceptance of the stated values and the check standards must be within 5% of their actually values. Duplicate values are taken for each measurement on the bench top meter and should be within 5% of each other.

H. **Conductivity:** Duplicate samples are taken during a field sampling event and must have an RPD under 5%.

I. **pH:** The accuracy of the pH standards must be within ± 0.05 of the standard value. The calibration check (QC pH from ERA) must be within ± 0.1 SU of true value.

J. **Metals (AA, ICP-MS):** The calibration R value for each analyte must be greater than 0.995. Duplicates should have an RPD value of 5%. The LFM (Matrix Spike) should be within 20% of the calculated value. The reporting limit (RL) is the lowest standard on the curve. Reported values cannot go under the determined RL or over the highest standard on the curve. Samples must be diluted that are above the yearly determined LCR, which is the high value where the curve is no longer linear. Duplicate samples must have an RPD within a

20% limit. The Check Standard must fall within 10% of its known value. If any of the above QA guidelines are not met, the machine is recalibrated.

K. **Mercury (AA):** The calibration R value for each analyte must be greater than 0.995. Duplicates should have an RPD value of 5%. The LFM (Matrix Spike) should be within 20% of the calculated value. The reporting limit (RL) is the lowest standard on the curve. Reported values cannot go under the determined RL or over the highest standard on the curve. Samples must be diluted that are above the yearly determined LCR, which is the high value where the curve is no longer linear. Duplicate samples must have an RPD within a 20% limit. The Check Standard must fall within 10% of its known value. If any of the above QA guidelines are not met, the machine is recalibrated.

L. **Low Level Mercury:** Initial Precision and Recovery sample must be between 79-121%. The Ongoing Recovery must be 79-121 %. The Percent Recovery of the Matrix Spike must be between 77-125 %. Matrix Spike Duplicate must have an RPD within 24% of each other. The Quality control sample must be within the acceptable range on the Certificate of Analysis. Information in detail can be found in MERI SOP 000131.

M. **Anions (Ion Chromatograph):** The calibration R value for each analyte must be greater than 0.995. Duplicates should have an RPD value of 5%. An LFB (highest standard, diluted 100x) must be with 10% of the known value. The LFM (Matrix Spike) should be within 20% of the calculated value. Reported values cannot go under the determined RL or over the highest standard on the curve. Samples must be diluted that are above the yearly determined LCR, which is the high value where the curve is no longer linear. The Check Standard (QC IC from ERA) must fall within 10% of its known value. If blanks exceed 0.015 mg/L for any analyte, the machine is dirty and must be cleaned. If any of the above QA guidelines are not met, the machine is recalibrated.

N. **PCBs/ Pesticides:** The working calibration curve, calibration factor, or RF must be verified on each working day by the measurement of one or more calibration standards. If the response for any parameter varies from the predicted response by more than +/- 15%, the test must be repeated using a fresh calibration standard. Alternatively, a new calibration curve must be prepared for that compound.

7.1.3 *MDL:* MDL for PCBs, Pesticides, IC, COD and Ammonia are generated yearly. The MDL is defined as the minimum concentration of an analyte that can be measured by the method 99% confidence of its presence in the sample matrix. The applicable Student's T Value is multiplied by the measured standard deviation of the population of samples. Typically, 7 of the same known, low concentrations are analyzed in an MDL study. The SOPs should be updated with the new MDL, annually.

7.1.4 *Reporting Limits:* The RL must be greater than or equal to the results of the MDL study. The lowest calibration standard should be at or near the RL. The proposed RL is different for all certificates and is sometimes 2-5 times the MDL or the lowest standard on the curve.

7.1.4.1 Any value detected that is lower than Reporting Limit should be reported to client using the term "< RL."

7.2: *CALIBRATION:*

7.2.1 Calibration Standards are obtained from an accredited manufacturer that provides a certificate of analysis. Standards must be prepared fresh, each day the instrument is in use. This procedure should be logged and should include the expiration date and LOT number.

7.2.2 Records are kept when each field instrument, bench top instrument or chromatography is calibrated, which is every day they are in use.

7.2.3 All instruments are calibrated using a minimum on three standards, which the exception of the DO and conductivity meter which use a one shot calibration.

7.3 *MEASUREMENT TRACEABILITY:*

7.3.1 Most Quality Control Standards are obtained from ERA which is an ISO/NIST certified company. Quality Control recoveries must be +/- 10%, unless the limits are stricter of the COA.

7.3.2 Any other QC samples obtained will be traceable to NIST or EPA guidelines.

7.3.3 Continuing calibration checks are implemented for all machines, every ten samples. If proper recovery is not met, the machine should be recalibrated and the batch re ran.

7.4 *ADDITIONAL REQUIREMENTS:*

7.4.1 All purchased reagents and solvents are dated upon receipt. When a commonly used item is out of stock, the environmental chemist must be informed at it will be reordered.

7.4.2 The preparation of all standards, stock solutions, QC samples and titrants should be documented in a laboratory notebook.

7.4.3 All technicians must participate in the annual NJDEP State proficiency test. If the first attempt fails, the technician must repeat the study after 6 months. If the second attempt fails and the parameter is suspended, the analyst must take measure to identify the issues in the methods that are causing poor results.

7.4.4 The NJDEP will conduct an on-site audit approximately every 3 years. All technicians must be present for a full evaluation of their work to check if it meets the requirements of N.J.A.C 7:18. If any deficiencies are obtained, they must be corrected and sent to the OQA in the appropriate time frame.

7.5 *SAMPLING METHODS:*

7.5.1 MERI adheres to a strict set of sampling methods for both permit needs and research. The laboratory properly labels and spikes containers before putting the bottles in coolers. Coolers are taken to the field and samples are taken from the bank with a pole grab sampler.

7.5.2 MERI adheres to the Clean Hands/ Dirty Hands technique for low level mercury sampling and all digestion work is performed in a Class 100 Cleanroom.

7.5.3 Other sample matrix that require testing for research will be sampled according to that project's QAPP.

7.5.4 Any deviation from proper sampling protocol will be documented on the COC when the technician returns from the lab.

8.0 HANDLING SAMPLES AND TEST ITEMS

8.1.1 All field sampling procedures and types of containers used, sample transport requirements and holding time adhere strictly to N.J.A.C 7:18.

8.1.2 A new sample location is documented on a map with GPS data by MERI's GIS department.

8.1.3 Samples are stored in a number of different areas including two refrigerators and three freezers.

8.1.4 The temperature of these storage areas are recorded in the green MERI Record Binder on a daily basis. The serial number on these thermometers is also recorded. Glass thermometers are calibrated next to a NIST thermometer quarterly and digital ones are calibrated yearly. The correction factor is properly displayed next to the thermometers.

8.1.5 Sample numbers are generated in Excel by the Environmental Chemist

9.0 QUALITY ASSURANCE FOR ENVIRONMENTAL TESTING

9.1 The laboratory has an established quality control program for monitoring the performance of test methods conducted under this manual. A batch of samples consists of 20 or fewer samples are prepared and analyzed in a single run

9.2 Calibration standards are checked against a certified reference material or other independently prepared standards.

9.3 Replicate analyses are used to evaluate precision. Precision is expressed by the relative percent difference to compare duplicate samples and spikes. Most parameters indicate that the RPD values should be less than 5 %.

9.4 The accuracy of the test is assessed using spiked samples. The recovery should be between +/- 15%.

9.5 A Precision and Accuracy log is kept for all chromatographs and the AA which include plotting recovery data and verifying that it lies within +/- two standard deviations from the mean. If there is an outlier, this is an indication that someone is wrong with the instrument.

9.6 Upper and lower control limits are expressed as the first standard deviation from the mean.

9.7 An LCR study is performed for each instrument to determine where the calibration curve is no longer linear. The LCR number should be checked every six month with a single high standard.

10 REPORTING

10.1 Tests results are reported accurately, clearly, unambiguously and contain all method required information, reporting requirements of N.J.A.C 7:18. The report contains the Sample numbers, MDL, Matrix, Method Number and the technician's name.

10.2 The Report for Sports Complex, which includes the required permit sheet, is signed by the Director of MERI or the Senior Environmental Scientist in his absence.

10.3 A signed and properly filled in COC is attached to all reporting.

10.4 A paper copy of the report is sent by the Administrative Assistant to the Sports and Exposition Authority at the end of each month.

11 SIGNED AGREEMENTS:

_____	_____
Francisco Artigas, Ph.D., Director of MERI	(Date)
_____	_____
Sandy Speers.: Administrative Assistant	(Date)
_____	_____
Ying Yao, Chief Chemist & QA/QC Officer	(Date)
_____	_____
Yefim Levinsky, Ph.D.: Inorganic Chemist	(Date)
_____	_____
Joe Grzyb, B.S.: Environmental Field Chemist	(Date)