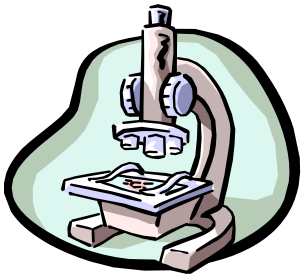
Revised 1/22/2003



QUALITY ASSURANCE AND QUALITY CONTROL PLAN

FOR THE GREATER LAWRENCE SANITARY DISTRICT LABORATORY

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Colleen M. Spero
Monitoring Manager

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STATEMENT OF COMMITMENT

The stated goal of the Greater Lawrence Sanitary District (GLSD) Laboratory is to generate the most precise, accurate and reproducible data possible in a timely and cost-efficient manner. The reliability and integrity of the sampling and analysis reflects directly on an excellent Quality Assurance/Quality Control (QA/QC) Program. To this end, GLSD has developed, written, and implemented this comprehensive program of QA/QC. GLSD recognizes the need to provide data that is representative of the conditions in question and is suitable for making decisions that involve compliance with environmental standards, public health, safety and legal obligations.

All analyses are conducted in strict accordance with approved, up-to-date methodologies and performed by highly trained, skilled technicians. GLSD recognizes that the establishment of a QA/QC program represents a considerable investment of both personnel and capital. GLSD feels this is a worthy investment as it officially documents the continual monitoring of the quality of generated data.

In addition, government regulatory agencies have specific requirements pertaining to laboratory QA/QC to insure the data they receive is an adequate and fair assessment of environmental conditions present. GLSD maintains its QA/QC program in accordance with guidelines set forth by E.P.A., NELAC and state certification authorities.

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Colleen M. Spero
Monitoring Manager

LABORATORY QUALIFICATIONS

The Greater Lawrence Sanitary District's (GLSD) Laboratory is certified as a Massachusetts Department of Environmental Protection State Laboratory under the auspices of the EPA Performance Evaluation Program, the Safe Drinking Water Act and 310 CMR 42.00: Regulations for Certification of Environmental Analysis laboratories. (Certification # MA066, Appendix A figure1).

STRUCTURE OF QA/QC PROGRAM

DEFINITION

To initiate discussion of structure and organization of QA/QC we should first define what is meant by "Quality Assurance/Quality Control".

A QA/QC program should assure three main goals: The quality of produced data, the quality of the program designed to monitor data and the assurance that data will not vary day to day or analyst to analyst. Quality Control insures that all data is precise, accurate and reproducible. The system that monitors the effectiveness of quality control is called quality assurance. To this end GLSD applies the following definition to QA/QC.

- QA/QC is the sum of the actions a laboratory takes to assure precise, accurate measurement of samples. QA/QC actions must involve all aspects of laboratory operations including sample collection and receipt, analysis, review and reporting procedures. An example of quality assurance would be duplicate, spike and check samples analyzed by the laboratory. An example of quality control would be using only analytical reagent grade chemicals, calibrating instrumentation, and temperature monitoring of various instruments.

METHODOLOGY

GLSD will use only EPA approved methodology (or their equivalent) in its analyses. (Appendix A figure 2). These methods allow the laboratory to provide dependable, efficient analyses and to generate data that can be traced to known standards in order to truly measure performance.

GLSD will use the appropriate analytical instruments as specified by the method and will operate the instrumentation in accordance with manufacturers guidelines.

Calibration curves will be prepared and verified daily as part of each methods standard operating procedure. Calibration curves will be compared

monthly to historical data to insure instrument reproducibility and integrity of standards. Instrumentation will be calibrated at least annually by an outside contractor. Exact details of methodology can be found in GLSD's standard operating procedures (S.O.P.'s).

CHEMICALS AND LAB PURE WATER

GLSD will use only analytical reagent grade chemicals for its analyses unless the method specifies otherwise. "Standard Methods for the Examination of Water and Wastewater", **18th edition** (or latest edition) or EPA's "Methods for Chemical Analysis of Water and Wastes" will be used as the standards for determining exact grades of chemicals used in subsequent analyses.

All glassware will be washed in a warm detergent solution and rinsed first with tap water then deionized water. Further, glassware preparation is outlined in the specific method for the parameter being analyzed.

Deionized water will be used for the preparation of all reagents, standards, blanks and sample dilutions. Deionized water will meet the following standards (per Std. Methods):

- Water will have a conductivity value of no greater than 2.0 umhos/cm at 25 degrees C, *on-line monitor will be checked daily*
- Water will be non-detect for residual chlorine
- Water will have a total metal content of <0.1 ppm (Pb, Cd, Cr. Cu, Ni, Zn), *each individual metal will be <0.05 mg/L*
- Water will have a heterotrophic plate count of <1000/cfu/1ml
- Water will be within a normal pH range of 5.5 – 7.5 pH units
- Water will have biosuitability in the range of 0.8-3.0

All deionized water will be checked internally by the laboratory monthly. Results of these checks will be kept in a log book. Organic free deionized water will be used in all organic analysis. Results will also be kept in a log book.

INTERNAL QUALITY CONTROL PROCEDURES

There are several systems in place within the laboratory to assure that quality control objectives for reporting data are achieved. These include, but are not limited to:

- Duplicate, Spike and Check Standards
- Control Charts
- Internal Self-Audit Reports
- Preventative Maintenance
- Proficiency Testing Samples (WS+WP Series)
- DMR QA Evaluation Samples

- Split Samples with Regulatory Agencies and Other Private, Certified Testing Laboratories

The daily, routing analysis of blanks, duplicates, matrix spikes and QC separate stock calibration check standards provide the means to assess the precision and accuracy are calculated and graphed on control charts for use by laboratory personnel for each parameter. A summary of both warning and control limits for accuracy, precision and QC separate stock calibration check standards is found in figure 3.

The laboratory develops limits based on actual performance. Control limits are recalculated for every 30 data points collected or once per year whichever is more frequent.

The frequency of analysis for these control measurements are procedure dependent and are summarized in the following tables.

TABLE 1

INORGANICS

CONTROL MEASURE	**FREQUENCY**
Method Blank	One Per Batch
Duplicate	One Per Group of 10 or Fewer Samples
Matrix Spike	One Per Group of 10 of Fewer Samples
QC Separate Stock – C.C. S.	One Per Batch or Every 10 Samples
Surrogate Standards	Added to all Standards, Samples and Blanks
QC Separate Stock – C.C.S.	One Every 20 Samples

TABLE 2

METALS

CONTROL MEASURE	FREQUENCY
Digested Blank	Every Batch
Method Blank	Every Batch and Checked Every 10 Samples
Duplicate	One Per Group of 20 or Fewer Samples
Matrix Spike	One Per Group of 20 or Fewer Samples
QC Separate Stock – C.C.S.	Once Every 10 Samples

TABLE 3

ORGANICS

CONTROL MEASURE	FREQUENCY
Trip Blank	Once Every 10 Samples
Method Blank	Daily/Between Samples as Necessary
Check Standard	Daily/Between Samples as Necessary
Matrix Spike/Duplicate	One Every 10 Samples or Once/Month

SAMPLING PROTOCOL

Sampling protocol is an important and essential part of any comprehensive QA/QC plan. Data validity, accuracy and precision that reflect environmental conditions relies directly upon sampling protocol and handling.

All sampling performed by GLSD is conducted by competent experienced field samplers in accordance with established sampling techniques, outlined in the cod of Federal Regulations 40 CFR Part 136. Sampling equipment is maintained according to manufacturers specifications. Samples taken by GLSD personnel will be collected, preserved and handled by the guidelines set forth by

EPA. Field records will be completed at the time the sample is taken and signed and dated by the person(s) taking the sample. Field records will contain on a chain of custody (C-O-C) form:

1. A unique sample I.D.
2. Date and Time of sample
3. Sample Location
4. Preservation needed (Appendix A figure 4)
5. Type of container
6. Analysis required
7. Name of sampler
8. Field data (i.e., pH, D.O., flow)

Samples will immediately be logged in a bound notebook upon receipt at the laboratory. A unique number will be assigned to the sample and marked on all sample containers.

The sample at this point has been transferred from the sample technician to the custody of the sample custodian of the laboratory. When transferring the custody of a sample the transferor must sign and record both the date and some of the transfer on the C-O-C form. (Appendix A figure 5).

Samples received at GLSD taken by personnel other than those employed by GLSD are assumed to have been acquired by accepted sampling protocols. GLSD reserves the right to reject all samples that it deems improper. GLSD assumes no liability for improper sampling or labeling when done by personnel outside the employment of the GLSD.

LABORATORY SAMPLE CONTROL PROCEDURES

The sample custodian, as designated by the Monitoring Manager, will be responsible for logging the sample in and marking all containers as outlined above. The custodian will inform laboratory personnel of samples needing priority analysis or preservation so that sample integrity is preserved. The sample custodian also makes sure the sample is stored under proper conditions, as well as destroyed or returned after analysis is complete or the sample hold times are exceeded.

The laboratory area is maintained as a controlled secure area. Only authorized personnel are permitted within the laboratory area.

INDUSTRIAL PRETREATMENT DEPARTMENT PROCEDURES

The following is the minimum requirements for sampling conducted by the Industrial Pretreatment Department. If there are any problems or concerns with any part of these requirements contact the Monitoring Manager.

PREPARATION

1. Reference the sampling schedule and verify how the sampling is to take place.
2. Determine the type of sample: Grab or Composite.
3. Review past history and verify the sampling location using the photo album.
4. Determine if special samples are to be taken.
5. Batch Sample (Grab) – Call location, determine if a sample can be obtained.
6. Composite – Unscheduled Compliance, Self-monitoring. Permit Analysis.

DEPARTURE

1. Before leaving for sampling: Calibrate pH meter, record reading and check equipment for conditions, note any problems.
2. Assemble sampler and check parts inventory (see manual).
3. Make sure that two charged batteries are ready. One will be used for a backup.
4. Prepare grab bottles, determined by checking previous documents for analysis conducted or discussed with Custodian.
5. Initiate Chain of Custody (COC) for any samples to be taken.
6. Load vehicle, check the following:

COMPOSITE SAMPLING	GRAB SAMPLING
a) Inventory manhole sampling equipment	Buckets
b) Sample carry unit	Holders
c) Ice packs	Gloves
d) Custody tape	pH paper
e) Locks & Chains	Preservatives
f) Plastic bags	Refrigerator

ON LOCATION

Make sure that you are prepared for entry.

1. Phone list/Identification Badge
2. Protective gear

SITE

1. Locate contact person
2. Verify sampling site
3. Verify that sampling site is in order

4. Check effluent
5. Check monitoring equipment
6. Check for hazards
7. Collect grab samples, if a hazardous condition is observed leave site and report to supervisor.

Evaluate pH of the effluent, measure using GLSD equipment. Record data in field notebook and on the Chain of Custody sheet. If pH is out of compliance recalibrate the pH meter and take another reading, record.

GRAB SAMPLE

1. Collect grab samples using bottles with preservative
2. Adjust pH as needed
3. Document the type of sample on the Chair of Custody form

COMPOSITE SAMPLE

1. Before drawing any sample verify if sampler is in working order
2. Set sampling setting using the operational manual as a guide
3. Adjust setting to the conditions of the site

    Security:

        1. Lock sampler using locks and chains
        2. Wrap unit in custody tape
        3. Place sampler in plastic bag, if needed
            1. Make sure sampler is not in a location that would allow for any interference of sampling.
        4. Obtain initial flow reading
        5. Transport grab samples to vehicle, refrigerate 4 degrees C
        6. Turn grab samples over to laboratory custodian upon arrival to GLSD facility

RETURN TO SITE

1. Follow steps above for entry & access to sampling location
2. Open the sampler and determine if a sample was taken
3. If sample is present cap the bottle
4. If multiple days are to be conducted, change bottles, batteries and reprogram unit if needed
5. Shut off sampler

DEPARTURE

1. Record – Working hours, flow data, any unusual conditions
2. Have contact sign Chain of Custody form
3. Secure sampler for transporting

4. Transfer sample to laboratory, turn over to custodian
5. Verify that COC form is in order

SAMPLE BREAKDOWN

1. Composite samples – Calculate volume needed referencing the analysis to be conducted
2. Daily/Weekly
    a) Wash bottles, unit, suction hose and strainer
    b) Determine condition of sampler, document as needed
    c) Store unit

FACILITIES AND INSTRUMENTATION

The second key issue in providing quality data is assuring that all laboratory instrumentation and facilities are within the correct environment for the generation of this data. Due to this key fact, GLSD maintains the proper conditions at its laboratory as set forth by EPA.

LABORATORY FACILITIES

The laboratory is kept clean and uncluttered at all times for safety as well as sample integrity purposes. The laboratory is climate controlled and all work surfaces have adequate lighting.

Several fume hoods are provided to assure the safety of laboratory personnel and to use in the analysis of trace elements, organics and procedures that give off toxins or an offensive odor. Fume hoods are tested and certified twice a year by a private contractor. To keep instrumentation operating under manufacturer's specifications service contracts are maintained and all apparatus receives adequate space and ventilation. Sample refrigerators are used to maintain samples at reduced temperatures as recommended by EPA sample protocol.

LABORATORY EQUIPMENT AND SUPPLIES

In addition to maintaining all instrumentation as specified by the manufacturer and various analytical methods as set forth by EPA, GLSD maintains additional instrumentation (Appendix A figure 6) as follows:

1. All gravimetric analyses are performed using an analytical balance which is calibrated daily by laboratory personnel and monthly using class S weights. This instrument is under contract and is serviced annually, or as needed. *The balance will be capable of detecting a weight of 100 mg at a 150 g load.*

2. Two refrigerators for maintaining samples, standards and reagents at required temperatures (i.e., 4 *+/- 2* degrees C). A freezer capable of 10 degrees C to –20 degrees C for maintaining samples and standards requiring low temperature storage. Temperatures are checked and recorded daily.

3. All glassware is of borosilicate glass. Volumetrics are all of Class A, denoting that they need not be calibrated before each use.

4. Analyses that are performed by gas chromatograph and atomic absorption spectrophotometer use the appropriate EPA defined method. Each instrument is calibrated before each group of samples is run or on a daily basis, whichever is more frequent. Blank samples are run concurrently to ensure that there are not interfering substances in the solvents or lab pure water or within the analytical system. There are at least two sources of calibration standards that are used against each other for purposes of analytical control. Spike, duplicate or QC samples are analyzed with every batch or every 10 samples to assure control of the calibration.

5. An NIST-Certified thermometer is in the laboratory at all times. All other thermometers are checked against it on an annual basis. Temperatures of incubators are checked twice daily *4 hours apart when in use*. *The temperature of the moist air incubator is maintained at 35 +/- 0.5 degrees C and the water incubator is maintained at 44.5 +/- 0.2 degrees C.* Refrigerators and ovens are checked daily and a record of each instruments temperature is kept in a laboratory log.

6. Spectrophotometers are calibrated by a State certified calibration specialist annually and records are kept of this calibration.

7. Standards used for the calibration of the instruments are prepared from primary reference standard materials obtained from commercial suppliers, the Federal EPA repository of analytical standards, or both. Records of Standard preparation, lot # and supplier are also kept in the bench logs.

8. Chemicals are dated upon receipt and logged into a chemical inventory log book. Date of receipt, shelf life and lot # are noted both in the book and on the bottle. If a chemical reaches expiration, it is immediately removed from use. It may be returned to use once it has been re-assayed and found satisfactory.

PREVENTATIVE MAINTENANCE

A good preventative maintenance program is a necessity in the analytical laboratory. Record keeping of basic routine maintenance and cleaning of instrumentation is vital. Separate log-books are utilized to document all

maintenance activities for the gas chromatograph, lsco sampler, atomic absorption spectrophotometer and lab pure water system.

Routine cleaning and calibration schedules for various equipment in the lab are detailed within the standard operating procedures. Service contracts are maintained for the atomic absorption spectrophotometer and the gas chromatograph. *Annually all balances microscopes, spectrophotometers, pH meters and the turbidimeter are checked by a certified calibration specialist*. Daily temperature monitoring of ovens, refrigerators, waterbaths and incubators assures that various equipment is in proper working order at the time of analysis.

The ultraviolet sterilization lamps in the UV sanitizer are cleaned monthly with ethanol and performance is checked quarterly by exposing agar spread plates to the light for two minutes. Records of these maintenance activities are documented in the micro QA/QC benchlog.

Good preventative maintenance planning and scheduling minimizes down time and helps pinpoint problem areas. It is an essential part of the quality assurance program.

IMPLEMENTATION AND REVISIONS

This QA/QC plan has been reviewed by the Monitoring Manager of GLSD and has been adopted as written. This program was implemented on November 1, 1990. Last revision was on *January 22, 2003*. This manual will be reviewed annually and upon completion of revisions and distribution of this manual all previous copies will be removed from use and stored for a period of five years. All lab standard operating procedures, and QC control charts document the time frame that the particular record was in force.

RESPONSIBILITY

The Monitoring Manager is responsible for overseeing all aspects of this QA/QC plan. He/She may designate various duties concerning QA/QC to key analytical personnel. The Monitoring Manager will review all data for release. The Monitoring Manager reserves the right to reject data generated by GLSD and to request data on QA/QC from any subcontracted laboratory. It is important to note that QA/QC is the responsibility of each individual on the laboratory staff. (Appendix A figure 7). Lab personnel must immediately report to the Monitoring Manager or the Executive Director with notice of any situation that could result in undue pressures from industry concerns or other GLSD staff that could adversely affect data quality and validity.

CORRECTIVE ACTION

It is the policy at the Greater Lawrence Sanitary District that any problems meeting control limits during performance are reported to the supervisor. The

supervisor in conjunction with the analyst review the system and determine the appropriate corrective action.

The basic decision-making outline for a corrective action is as follows:

- Define the problem(s)
- Assign responsibility for researching the problem
- Develop possible corrective action to solve the problem
- Implement corrective action
- Monitor corrective action to ensure that problem was solved
- Clearly document the problem, the corrective action taken and the dates involved. (Appendix A figure 8).

REMEDIATION

Data deemed unacceptable for QA/QC reasons will be immediately rejected and the sample reanalyzed (Appendix A figure 3). If more sample is needed, GLSD will obtain and analyze the sample immediately.

QA/QC is a tool for education and improvement of analysts as well as being a means to establish data validity. Individual infractions of QA/QC that can be attributed to a specific analyst will be corrected with no punitive measures. Continued infractions by an analyst will be viewed as a cause for disciplinary action.

All analysts at GLSD will review this QA/QC plan and records of this review will be kept in the individuals personnel file.

DATA PRODUCTION AND REPORTING

All documents involved in data generation and reporting are maintained at GLSD to assure traceability of data through each step of sample handling. Documents associated with this procedure include:

- Sample labels
- Chain of Custody form
- Master log-in book
- Job worksheets
- Individual notebooks for analytical data
- Related raw data and charts

All data is recorded in a bound laboratory notebook. A separate notebook is maintained for each individual parameter. All data pertinent to that parameter including duplicates, spike recoveries, standard curves and corrective actions etc. are also recorded within. Raw data is recorded on job work sheets by the performing analyst. The performing analyst calculates and reduces the data to the reportable units (mg/L, mg/kg dry etc.). The data is then transferred from the

worksheets to a final report form to be reviewed by the Monitoring Manager or his/her designate. All records are kept for a period of at least *ten* years.

The Monitoring Manager will conduct periodic, random internal self-audits of all systems, instrumentation, documentation and calculations to assess correctness and validity of data. Results of each internal self-audit are kept in the QA/QC files.

All reports are reviewed by the Monitoring Manager or his/her designate before release to utilities, industry, state and local officials. Drinking water suppliers will be notified immediately (<24 hours) of any result that exceeds the maximum contaminant level. Notification will normally be made by phone. The Monitoring Manager or his/her designate reserves the right to reject any or all data on a report if it does not satisfy QA/QC requirements.

All quality assurance data will be reported on a request basis. Laboratory duplicates and surrogate recoveries are always reported as GLSD's S.O.P.

LABORATORY SAFETY

This section acknowledges that the environment of the laboratory is different from the general plant. The lab generally encounters a wide variety of procedures that require use of numerous chemicals. Not only are there special safety precautions that need to be taken when using certain chemicals, but some samples and procedures have safety considerations that are unique in themselves.

The following information is intended to alert laboratory personnel of general safety hazards that could be encountered on a daily basis. It is not intended to detail all safety considerations. The analyst is primarily responsible for safety as it pertains to the methodology and should look up all unfamiliar chemicals in the Material Safety Data Sheets (MSDS). The MSDS's are located in the bookshelves adjacent to the fire hose.

If there is any doubt about the safety precautions necessitated by a certain chemical, sample or procedure, ask your supervisor for assistance.

SAFETY PRACTICES AND FACILITIES

The laboratory has several fire extinguishers, a safety shower, and eye wash station and a fire blanket. Make sure you are familiar with the location of these items and how to properly use them. The lab also has two fume hoods which should be used when working with any volatile, toxic, or flammable material. Eye protection is required at all times in the laboratory when working with and/or around chemicals. All spills should be cleaned up immediately and work areas should be clutter-free. All containers should be clearly labeled.

Labeled containers should never be used for any substance other than that on the label, and unmarked or unknown items should be disposed of properly. Use care when handling glassware. Check glassware for chips and cracks and dispose of broken glass properly. All glassware must be rinsed before setting aside for cleaning.

GENERAL HANDLING OF CHEMICALS

Always wear gloves when handling chemicals and samples. Transport acids and other hazardous chemicals in a bottle carrier. Pour corrosives slowly. Tilt the container you are pouring into and pour the corrosives down the side. Always add acid to water and not the reverse. For acid spills dilute with large quantities of water and neutralize with sodium bicarbonate until effervescence stops. For spill of a base dilute with large quantities of water and neutralize with a saturated boric acid solution. Spill control pillows are located under the general chemical storage area. Keep flammables as far away as possible from heat sources and, store them only in approved storage areas.

CHEMICALS REQUIRING SPECIAL HANDLING

The following list is comprised of chemicals typically used in the GLSD laboratory that require special handling. Make sure you are thoroughly familiar with each item on this list and its related hazards before usage.

* Sodium Acetate
* Chloroform
* Methylene Chloride
* Phenol
* Potassium Cyanide
* Organic Standards
* Metal Standards
* Sodium Hypochlorite
* Hydrogen Peroxide
* Pyridine
* Acids
* Bases
* Freon
* Kilit Ampules
* Brucine
* Brucine Sulfanilic Acid
* Kjeltabs
* Sodium Metasulfite

SAMPLES REQUIRING SPECIAL HANDLING

Some samples from industry have a known history of a certain pollutant or condition. Caution should be utilized when handling samples with the following:

* High or Low pH * History of Cyanide * History of Heavy Metals * Extreme Odor * Volatile Characteristics

SPECIAL PROCEDURAL PRECAUTIONS

Make sure you are thoroughly familiar with any procedure before performing it. Procedures worthy of special precautions are:

* Cyanide Distillations * Vacuum Filtration
* Metals by Atomic Absorption * TKN, COD Digestions
* Volatile Solids * All Microbiology * Digestions
* MBAS * Phenols * Fluoride Distillations

CHEMICAL STORAGE

There are several chemical storage areas located throughout the laboratory. General chemicals are stored in the glass door cabinets next to the Tecator Distillation Apparatus. Toxins and other hazardous chemicals are stored in the vented cabinet beneath the left fume hood. Flammables and solvents are located in the vented cabinet under the Titrimeter. Strong oxidizers are found in the vented cabinet beneath the Tubidimeter and acids are stored in the ACID cabinets near the drying ovens. All chemical storage areas are clearly marked. Should you have any question on where you should store a chemical after use ask your supervisor.

NOTE: The classes of chemicals mentioned above should always be stored separately.

WASTE DISPOSAL

Most chemicals used in the lab can be disposed of down the sink with plenty of cool water. There are, however, special disposal procedures for the following:

1. Chloroform Waste
2. Cyanide Waste
3. COD Waste
4. *Biological Waste*

For specific details on waste disposal as it pertains to a procedure, consult the STANDARD OPERATING PROCEDURES MANUAL in the reference bookcase.

EMERGENCY ACTION

When an emergency occurs in the laboratory, make sure you first notify others in the area of the nature of the emergency.

If necessary, report the emergency to the appropriate Fire, Rescue, or Medical Facilities. Emergency numbers are posted over both telephones in the laboratory. Emergency response is covered in more detail in your worker RIGHT-TO-KNOW TRAINING.

EMERGENCY TELEPHONE NUMBERS

FIRE: …….911

AMBULANCE: ……..911

HOSPITAL: ……..(978) 683-4000

POISON CONTROL: ..……MA 1-800-682-9211
NH 1-800-562-8236

POLICE: ……(978) 683-3168

PERSONNEL

The first issue in the generation of accurate precise data is the level of skill obtained by the laboratory staff. GLSD maintains a high level of excellence by hiring only highly skilled trained analysts. Regular training sessions and seminars are held for or attended by our personnel to keep abreast of ever changing regulations and methodology.

Personnel titles at GLSD reflect various degrees of training and experience. All personnel meet the following minimum standards set forth by EPA.

MONITORING MANAGER

1. **Academic Training**: The Monitoring Manager shall possess a Bachelor's Degree in biology, chemistry or a closely related field. The Monitoring Manager shall have at least twenty four (24) college credits in chemistry.

2. **Experience**: The Monitoring Manager shall have a minimum of three (3) years experience in an environmental analysis laboratory with an emphasis in management.

INSTRUMENT CHEMIST/LAB SUPERVISOR:

1. **Academic Training**: This individual shall have a Degree in biology, chemistry or a related discipline with a minimum of thirty (30) college chemistry credits.

2. **Experience**:

a) **Inorganic Chemistry** – A minimum of two (2) years of laboratory experience in chemical analysis is required. Individuals who utilize atomic absorption/inductively coupled plasma shall also have a minimum of two (2)

years experience in the analysis of water and wastewater. Six months training or experience is required for operation of an atomic absorption spectrophotometer (AA). One year training or experience in operation of inductively coupled plasma (ICP) methods.

b) **Organic Chemistry** – A minimum of two (2) years experience in chemical analysis is required. Six (6) months training or experience is required for operation of a gas chromatograph (GC). One year of training or experience is required for operation of a gas chromatograph/mass spectrometer (GC/MS).

MICROBOLOGIST:

1. **Academic Training**: The microbiologist shall have a minimum of a Bachelors Degree in biology, microbiology, or a related science with a minimum of four (4) college credits in microbiology.

2. **Experience**: This individual shall have a minimum of four (4) years experience as a laboratory technician with two (2) years experience in the biological examination of water, wastewater and sludge.

CHIEF LABORATORY TECHNICIAN:

1. **Academic Training:** This individual shall possess a minimum of a high school diploma or equivalent. College course work in chemistry is helpful.

2. **Experience**: A minimum of four (4) years experience as a Laboratory Technician with not less than two (2) years experience in the examination of water, wastewater and sludge. This individual shall demonstrate acceptable results in the analysis of quality control and performance evaluation samples.

The GLSD strongly encourages its personnel to participate in continuing education courses offered at area colleges and universities. Records of successfully completed courses become a permanent part of an employee's personnel file. GLSD also recommends that its personnel attend various conferences, seminars and training courses pertinent to laboratory analysis. Certificates of Achievement for these courses also become part of the employees personnel file.

CONCLUSION

This QA/QC manual is documented proof of GLSD's dedication and commitment to providing data that is representative of environmental conditions and is suitable for making sound decisions based on scientific facts. The continual monitoring and improvement of the QA/QC system will keep GLSD's

laboratory in step with ever changing legal and technological refinements in the analytical realm.

APPENDIX A

List of Figures

METHOD REFERENCE

Summary

PARAMETER	METHOD
Aluminum	S.M. 3111D
Antimony	S.M. 3111B
Arsenic	S.M. 3113
Beryllium	S.M. 3111D
Cadmium	S.M. 3111B
Furn.	S.M. 3113
Chromium	S.M. 3111B
Furn.	S.M. 3113
Copper	S.M. 3111B
Furn.	S.M. 3113
Iron	S.M. 3111B
Lead	S.M. 3111B
Furn.	S.M. 3113
Manganese	S.M. 3111B
Mercury	S.M. 31112
Molybdenum	S.M. 3111B
Nickel	S.M. 3111B
Furn.	S.M. 3113
Selenium	S.M. 3113
Silver	S.M. 3111B
Furn.	S.M. 3113
Zinc	S.M. 3111B
Chlorine Residual	S.M. 4500-CL-D
Specific Conductance	S.M. 2510B
Turbidity	S.M. 2130B
pH	S.M. 4500-H*B
Alkalinity	S.M. 2320-B
Biochemical Oxygen Demand	S.M. 5210B
Chemical Oxygen Demand	HACH Method
Total Solids	S.M. 2540B
Total Dissolved Solids	S.M. 2540C
Total Suspended Solids	S.M. 2540D
Total Volatile Solids	S.M. 2540E
Ammonia (asN)	S.M. 4500-NH_3B&E
Total Kjeldahl Nitrogen (asN)	S.M. 4500-NH_3E
Nitrate (asN) – WW	EPAA 352.1
Nitrate (asN) – DW	S.M. 4500D
Organic Nitrogen (asN)	Calculation
Nitrite (asN)	S.M. 4500-No_2B
Total Phosphorus (asP)	HACH 8190
Ortho-Phosphate (asP)	S.M. 4500-PE

METHOD REFERENCE (continued)

Summary

Hardness	S.M. 2340B+C
Sulfate	S.M. 4500-So_4^2-E
Sulfide	S.M. 4500S_2E
Chloride –ww	S.M. 4500 CL-B
Cyanide	S.M. 4500 CN-C+E
Fluoride-ww	S.M. 4500 F-B-+C
Fluoride-dw	4500 F+C
Oil & Grease	5520 B/1664
MBAS	5540 C
Phenol	EPA 420.1
Volatile Halocarbons	EPA 601
Volatile Aromatics	EPA 602
Total Coliform	S.M. 9222B
Fecal Coliform	S.M. 9222D/ 9221E

Special Note

Due to the extensive QA required for the analysis of total and fecal coliform the specific requirements from 310 CMR 42.00 are detailed in the Standard Operating Procedures for these methods.

APPENDIX A FIGURE 4

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF SAMPLES ACCORDING TO MEASUREMENT

MEASUREMENT	CONT.	PRESERVATIVE	HOLD TIME
Color	P,G	Cool, 4°C	48 hours
Sp. Conductance	P,G	Cool, 4°C	28 days
Hardness	P,G	Cool, 4°C	6 months
PH	P,G	None	Immediate
Residue			
Filterable	P,G	Cool, 4°C	7 days
Total	P,G	Cool, 4°C	7 days
Volatile	P,G	Cool, 4°C	7 days
Turbidity	P,G	Cool, 4°C	48 hours
Metals			
Total	P,G	Cool, 4°C & HNO_3, pH<2	6 months
Mercury	P,G	HNO_3, pH<2	28 days
Alkalinity	P,G	Cool, 4°C	14 days
Chloride	P,G	None	28 days
Residual Chlorine	P,G	None	Immediate
Cyanides	P,G	Cool, 4°C & NaOH, pH.2	14 days
Fluoride	P,G	None	28 days
Nitrogen			
Ammonia	P,G	Cool, 4°C & H_2So_4pH<2	28 days
Kjeldahl	P,G	Cool, 4°C & H_2So_4pH<2	28 days
Nitrate ww/dw	P,G	Cool, 4°C	48 hrs/28 days
Phosphorus			
Orthophosphate	P,G	Filter, Cool, 4°C	48 hours
Total Phosphate	P,G	Cool, 4°C, H_2So_4pH<2	28 days
BOD	P,G	Cool, 4°C	48 days
COD	P,G	Cool, 4°C, H_2So_4pH<2	28 days
OIL & GREASES	G only	Cool, 4°C, H_2So_4pH<2	28 days
Phenolics	G only	Cool, 4°C, H_2So_4pH<2	28 days
MBAS	P,G	Cool, 4°C	48 hours
Volaile Halocarbons & Aromatics	G. Vial W/Teflon lined Septum	1 HC1,pH<2	14 days
Bacteria			
Total & Fecal	P,G Sterile	Cool, 4°C Na_2SO_3	24 hours – dw 6 hours –ww
Microtox	P,G	Cool, 4°C	N/A

APPENDIX A FIGURE 6

EQUIPMENT

Gas Chromatograph Unit
UV Spectrophotometer Spectronic 21
UV Spectrophotometer Spectronic 301
Ion Analyzer
Orion pH Meter
Balance
Balance
Harvard Trip Balance
Refrigerator
Refrigerator
Drying Oven
Drying Oven
Muffle Furnace
BOD Incubator
Cyanide Midi-distillation Apparatus
Still
Water Purification System
Water Bath-Precision
Water Bath-Thelco
Water Bath-Boekel
COD Digestor
Tecator Digestor/Distillation Unit
Amperometer
Hot Air Incubator – Lab Line
Quebec Colony Counter
Autoclave
Specific Conductivity Meter
Specific Conductivity Meter
Digital D.O. Meter
Analog D.O. Meter
Analog D.O. Meter
Digital D.O. Meter
Dish Washer
Centrifuge
Microtox Toxicity Analyzer
Phase Contract Microscope
UV Sterilizer Box
Vacuum Pump
Computer
Small Refrigerator
Electric Typewriter
Copier

APPENDIX A FIGURE 6

EQUIPMENT (continued)

Fire Blanket
Misc. Safety Equipment
Hot Plate
Hot Plate
Hot Plate
Hot Plate
Hot Plate/Stirrer
Remote Control Hot Plate/Stirrer
Heating Mantle
Thermix Stirrer Plate
Stirrer Plate
Vent Hood
Lab Cart – Metal Blue
Lab Cart – Metal Blue
Atomic Absorption Spectrophotometer Lab Cart – Metal Brown
Lab Cart – Plastic Tan
Block Digester
S.P.E. Apparatus
I.C.P. (new 2002)

APPENDIX A FIGURE 7

GREATER LAWRENCE SANITARY DISTRICT

LABORATORY STAFF

(Flow Chart of QA/QC Responsibility)

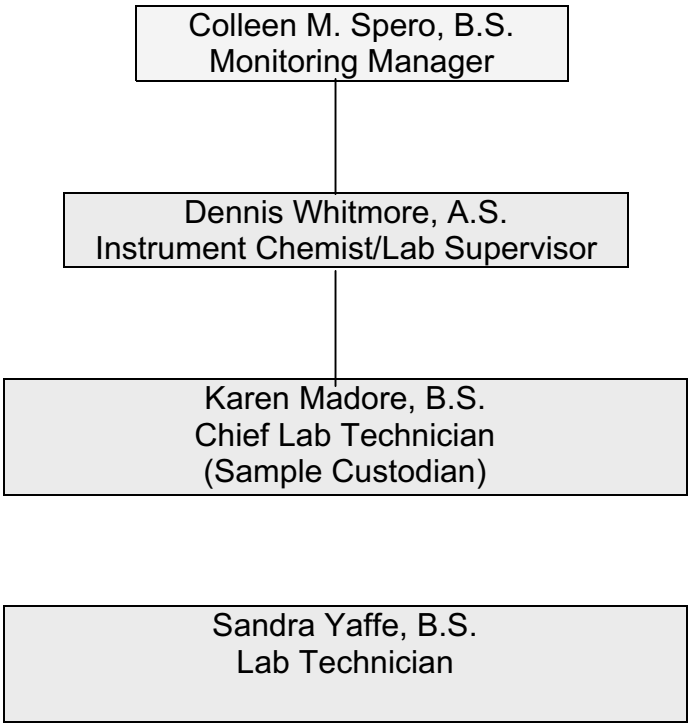

FIGURE 8

CORRECTIVE ACTION FORM

Originator: _____ **Date**:_____

Person Responsible for Reply: _____

Class:
a. Has a detrimental effect on the data
b. Might have an effect on the data
c. Has no effect on the data

Nature of Problem:

_____
_____
_____
_____
_____
_____
_____

Cause of Problem:

_____
_____
_____
_____
_____
_____
_____

Corrective Action Planned:

_____
_____
_____
_____
_____
_____
_____

Date Implemented: _____

Copies: To QA File
Attached to Final Report(s)
Attached to Raw Data

REFERENCES

Major sources of references utilized by this laboratory in developing this QA plan include:

Handbook for Analytical Quality Control in Water and Wastewater Laboratories
EPA 600/4-79-019, March 1979

Standard Methods for the Examination of Water and Wastewater 18th Edition

Test Methods for Evaluating Solid Waste:
Physical/Chemical Methods, SW-846 Third Edition – September 1986

Regulations for Laboratory Certification New Hampshire Department of Environmental Services ENV-C 300

Regulations for Laboratory Certification Massachusetts Department of Environmental Protection CMR 42.00