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CHAPTER 4

QUALITY ASSURANCE (Note - Many of the sections of this chapter were adapted from Microbiological Methods for Monitoring the Environment I. Water and Wastes, EPA-600/8-78-071, 1978.)

1. INTRODUCTION

1.1 Role in Research

1.1.1 In research for any purpose, the quality of data must be protected. Quality assurance plays a key role in the production and protection of scientifically valid data through a variety of planned and systematic activities and procedures. A laboratory quality control program is the orderly application of practices necessary to remove or reduce errors in any laboratory operation that are attributable to personnel, equipment, supplies, sampling procedures, and analytical methods.

1.1.2 A quality control program must be practical, integrated, and require only a reasonable amount of time or it is likely to be bypassed. When properly administered, a balanced, conscientiously applied quality control program assures the production of uniformly high quality data without interfering with the primary analytical functions of the laboratory. When possible, this laboratory program should be supplemented by participation of the laboratory in an interlaboratory quality control program.

1.2 Scope of Program. This chapter on Quality Assurance deals

with sample collection, facilities, maintenance, personnel, equipment and instruments, supplies, and procedures. See Microbiological Methods for Monitoring the Environment I. Water and Wastes, EPA-600/8-78-071, U. S. Environmental Protection Agency, Cincinnati, Ohio, 1978, for discussions of statistics applicable to microbiology (p. 225), and for the development of a quality control program (p. 244). For the latter, also see Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, U. S. Environmental Protection Agency, Washington, D. C., 1980. For discussions of safety, see Biosafety in Microbiological and Biomedical Laboratories (Draft), Centers for Disease Control, Atlanta, Georgia, and National Institutes of Health, Bethesda, Maryland, 1983.

2. SAMPLE COLLECTION

2.1 Water and Sewage Samples

2.1.1 Water and sewage samples collected must be representative of the particular environment sampled.

2.1.2 Sample sites and sampling frequency must provide representative characteristics and variabilities.

2.1.3 The number of samples collected must rest within the processing capability of the laboratory.

2.2 Chain of Custody. A strict chain of custody procedure is required for all samples in legal enforcement actions. (For chain of custody procedures, see Handbook for Sampling and Sample Preservation of Water and Wastewater, NTIS, PB83-124503, 1982, pp. 345-355.)

2.3 Sample Handling Procedures

2.3.1 Aseptic technique must be maintained during sampling.

2.3.2 Sterile containers and equipment must be used in all sampling procedures.

2.3.3 When a sample is received in the laboratory, the integrity of the sample container and the condition of the sample must be checked and recorded.

2.3.4 It must be ascertained that the sample has been properly labelled.

2.3.5 In enforcement cases, a check must be made to assure that

the chain of custody procedure has been followed.

2.4 Transport of Samples. Proper conditions must be met to maintain viability of viruses during transport.

2.4.1 Samples must be refrigerated or iced immediately upon collection.

2.4.2 All samples that cannot be processed within 24 hours must be frozen and stored at -70 degrees C immediately. Freezing and thawing of virus samples must be kept to a minimum.

3. LABORATORY FACILITIES

3.1 Air Handling Systems

3.1.1 All laboratories should be maintained under negative air pressure.

3.1.2 Biological safety cabinets should be available for work requiring sterile conditions and protection for personnel and samples.

3.2 Disinfection of Laboratory. Laboratories should be equipped with ultraviolet lights (see Table 1) for general decontamination of rooms during periods when personnel are absent. Take precautions to prevent entry of personnel into laboratories when UV lights are on.

3.3 Space Allocation

3.3.1 Laboratories should provide separate rooms for processing in each of the following categories: potable, surface, and ground waters; sewage and wastewater effluents; sludges, silts, and other solids; cell cultures; and virus identification.

3.3.2 Freezers, incubators, and instruments should be housed in rooms where they can be accessed without disturbing ongoing laboratory effort.

3.3.3 The areas provided for preparation and sterilization of media, glassware, and equipment should be separate from other laboratory work areas but close enough for convenience.

3.4 Traffic

3.4.1 Visitors and through-traffic must be minimized in work areas.

3.4.2 Signs must be posted on doors to limit access to work

areas.

3.5 Bench Space Allocation

3.5.1 Sufficient clean bench space must be available for work to be performed efficiently. For routine studies the minimum area recommended for each worker is six linear feet. Research or other analyses that demand specialized equipment may require significantly more space per worker. These estimates of bench space are exclusive of areas used for preparatory and supportive activities.

3.5.2 Bench tops should be set at heights of 36-38 inches. This height is usually comfortable for work in a standing or sitting position.

3.5.3 Depth of bench tops should be 28-30 inches.

3.5.4 Desk tops of sit-down benches should be set at a height of 30-31 inches. This height is required to accommodate microscopy, plaque counting, calculating, and writing.

3.5.5 Bench tops should be stainless steel, epoxy plastic, or other smooth impervious material which is inert and corrosion-resistant.

3.5.6 Bench tops should be seamless or have seams sealed with impervious material.

3.6 Lighting. Laboratory lighting must be even, screened to reduce glare, and provide about 100 footcandles of light intensity on working surfaces.

3.7 Walls and Floors

3.7.1 Walls should be covered with waterproof paint, enamel, or other surface material that provides a smooth finish which is easily cleaned and disinfected.

3.7.2 Floors should be covered with good quality tiles or other heavy duty material which can be maintained with skid-proof wax.

3.8 Monitoring for Cleanliness in Work Areas

3.8.1 High standards of microbiological cleanliness must be maintained in work areas.

3.8.2 Laboratory surfaces and laboratory air should be monitored for microorganisms by one or more procedures.

Tests should be run on a weekly or on some other time basis based on experience to monitor counts in the same work areas over time and to allow comparisons between different work areas. Microbial densities in the air should not exceed 15 colony-forming units per 930 square centimeters (approximately 1 square foot) of agar medium exposed per 15 minutes of exposure. For a detailed description of these monitoring procedures, see Microbiological Methods for Monitoring the Environment I. Water and Wastes, EPA-600/8-78-017, 1978, pp. 195-197.

4. LABORATORY MAINTENANCE

4.1 Cleaning

4.1.1 Laboratory benches must be cleaned after each use and at the end of each working day; shelves, floors, and windows must be cleaned on a scheduled basis.

4.1.2 Work benches must be wiped down with disinfectant before and after each use. Dry-dusting is not permissible in a virology laboratory.

4.1.3 Floors must be wet-mopped and treated with a disinfectant solution to reduce contamination of air in the laboratory. Sweeping or dry-mopping is not permissible in a virology laboratory.

4.1.4 Spills and leaks must be cleaned up immediately and disinfected when necessary.

4.2 Storage

4.2.1 Laboratory areas must be kept free of clutter. Clutter can be controlled by cleaning up work areas immediately after each use and by conducting a weekly clean-up of the laboratory.

4.2.2 Equipment and supplies should be stored when not in use.

5. LABORATORY PERSONNEL

Virologists, other microbiologists, technicians, and support personnel in the environmental virology laboratory must have training and experience appropriate for the laboratory's program. The variety and complexity of the tasks and tests performed determine the professional bench and on-the-job-training required.

5.1 Professional Level

5.1.1 Professional staff perform scientific work in connection with identification, culture, study, and control of viruses and other organisms. Most of the work is performed in a laboratory environment and is generally concerned with research and development, monitoring, regulations, and public health.

5.1.2 Professional responsibilities require the ability to apply and adapt scientific theories and principles of microbiology at a level that allows making limited independent decisions.

5.1.3 The basic educational requirement is a BS/BA degree in virology or microbiology or a BS/BA degree in biology with a minor in virology or microbiology.

5.2 Supervisory and Senior Grade Level

5.2.1 The Supervisory and Senior Grade level staff retain the key positions of responsibility for planning and directing the systematic research on a virus problem area and for organizing, evaluating, and documenting the results pertinent to these activities.

5.2.2 Professional responsibilities include direct leadership in assigned subject matter areas, exercising full and independent responsibility for the development of criteria, methods, and virus data of general applicability for use by others, interpreting the scope and scientific quality of the data, and serving as a specialist in virology.

5.3 Technician Level

5.3.1 The technician level staff typically assist professionals by doing routine tests, performing tasks involving a series of steps, and maintaining records of experiments.

5.3.2 Technician responsibilities include performing repetitive tasks, some understanding of the work done in the laboratory and the relationships of various tasks, recognizing readily observable events or reactions, and making precise measurements.

5.4 Supervision of Personnel in Laboratory

5.4.1 The laboratory should be directed by a Professional Virologist. In a small laboratory where the staff consists of a single non-professional technician, an approved consultant virologist must be available for guidance and counselling.

5.4.2 Work assignments in the laboratory must have readily

definable objectives.

5.4.3 The supervisor or consultant must review staff performance at least annually and laboratory procedures used at least quarterly. Sample collecting and handling, media and glassware preparation, sterilization, routine testing procedures, counting, data handling, quality control techniques, and laboratory safety are areas requiring examination.

6.LABORATORY EQUIPMENT AND INSTRUMENTS

Quality control of laboratory apparatus includes servicing and monitoring the operation of incubators, water baths, hot-air sterilizing ovens, autoclaves, water stills, refrigerators, freezers, and other laboratory equipment. Each item of equipment must be tested to verify that it meets the manufacturer's specifications and the user's needs for accuracy and precision. (See Table 1 for check list.)

6.1 Balances. Balances must be kept clean and protected from corrosion, checked monthly with weights meeting class S standards, and serviced annually.

6.2 pH Meters. Before each use, pH meters must be standardized with two standard buffers (pH 4.0, 7.0, 10.0) bracketing pH of sample. Buffer solutions must not be reused.

6.3 Distilled Water

6.3.1 Conductivity of distilled water must be monitored at least daily, and preferably continuously, with a conductivity meter. For continuous monitoring, an in-line meter should be used.

6.3.2 The water still must be drained and cleaned at least monthly.

6.3.3 The water reservoir must be cleaned at least quarterly.

6.4 Deionized Distilled Water (see Table 2)

6.4.1 Conductivity of deionized distilled water must be monitored at least daily and preferably continuously with a conductivity meter. For continuous monitoring, an in-line meter should be used.

6.4.2 Deionized distilled water must be monitored for bacteria monthly.

6.4.3 Chemical analysis of deionized distilled water may be done when necessary by chemists trained in such procedures.

6.4.4 Cartridges of deionizing resins must be replaced as indicated by manufacturer or on the basis of analytical tests.

6.5 Ultraviolet Lights. Ultraviolet lights must be checked quarterly. When less than 80 percent of the rated initial output is emitted, the lights must be replaced. Also perform spread plate irradiation test quarterly. For appropriate procedures, see Microbiological Methods for Monitoring the Environment I. Water and Wastes, EPA-600/8-78-017, 1978, pp. 198-199.

6.6 Centrifuges

6.6.1 Centrifuges must contain a safety interlock.

6.6.2 Centrifuges must be disinfected and cleaned frequently.

6.6.3 On centrifuges not equipped with a built-in tachometer, rheostat controls must be checked against a tachometer at various loadings every six months to insure proper gravitational forces. Rheostats should never be used as final indicators of centrifuge speed when centrifuges are equipped with built-in tachometers.

6.7 Downward Flow Laminar Hoods

6.7.1 Downward flow laminar hoods must be free of clutter, and all surfaces must be cleaned and swabbed with a disinfectant before and after each use.

6.7.2 Hoods must be tested at least once annually to ensure proper operation. CAUTION: The integrity of the air curtain may be compromised by air currents produced in hoods with clutter.

6.8 Thermometers. Thermometers must be calibrated at least once annually against National Bureau of Standards (NBS) certified thermometers or equivalents.

6.9 Refrigerators. Refrigerator temperatures must be monitored and recorded daily.

6.10 Dispensing Apparatus. Dispensing apparatus must be checked for accuracy of delivery volume at each volume change and periodically throughout extended runs. Apparatus must be recalibrated when necessary.

6.11 Steam Autoclaves. Steam autoclaves must be equipped with steam filters. Steam autoclaves must be monitored at each use with temperature recording charts and indicator tapes. Autoclave operation must also be checked weekly with maximum-minimum thermometers and spore strips or suspensions. Autoclaves should be checked weekly with a thermocouple inserted into simulated worst case material.

6.12 Gas Sterilizers. Gas sterilizers must be monitored at each use with recording charts and indicator tapes. Such sterilizers must also be checked weekly with spore strips or suspensions. CAUTION: Ethylene oxide is toxic. Proper precautions must be taken to protect personnel against exposure to ethylene oxide.

6.13 Hot-Air Ovens. Hot-air ovens must be monitored at each use with temperature indicator tapes and thermometers or recording charts calibrated in the 160-180 degrees C range. Hot air ovens must also be checked weekly with spore strips.

6.14 Roller Drum Apparatus. Each roller drum apparatus for cell cultures must have an alarm that signals power failure.

6.15 Freezers

6.15.1 All -70 degrees C freezers must be equipped with temperature-recording charts and alarms to signal excessive temperature changes.

6.15.2 All -20 degrees C freezers must be equipped with temperature-recording charts or with thermometers.

6.15.3 Freezers should be cleaned and defrosted at least every six months.

6.16 Incubators

6.16.1 Walk-in incubators must be equipped with temperature-recording charts and alarms.

6.16.2 Reach-in incubators must contain automatic high temperature cut-offs and must be checked daily with thermometers immersed in water.

6.17 Security. All incubators, freezers, and refrigerators should be secured with locks.

7. LABORATORY SUPPLIES

7.1 Laboratory Ware

7.1.1 Laboratory ware must be thoroughly cleansed (see Chapter 2) and rinsed in deionized distilled water (see Table 3).

7.1.2 Unless otherwise indicated, glassware must be sterilized in a dry heat oven at 170 degrees C for one hour; autoclavable plasticware must be sterilized in an autoclave at 121 degrees C for one hour. Use indicator tape to assure that sterilization temperature has at least been reached; record date of sterilization on tape.

7.1.3 Whenever feasible, cell culture vessels should be discarded after one use.

7.1.4 Laboratory ware should be tested for acid and alkaline residuals and detergents by the procedures described in Microbiological Methods for Monitoring the Environment I. Water and Wastes, EPA-600/8-78-017, 1978, pp. 199-200. Laboratory ware that has not come clean and laboratory ware with acid, alkaline, or detergent residuals must be recleansed.

7.2 Media and Chemicals

7.2.1 All chemicals and media must be dated upon receipt. Unless otherwise indicated, only the purest grade of commercially available chemicals, usually reagent-grade, may be used. Caked media and media in opened containers for more than six months must be discarded.

7.2.2 When appropriate, media must be pretested for sterility and nutritional quality and lots ordered from approved batches.

7.3 Membrane Filters. Membrane filters must be checked by a bubble test for air leaks and must meet federal government specifications (for bubble test procedure, see Microbiological Methods for Monitoring the Environment I. Water and Wastes, EPA-600/8-78-017, 1978, p. 205).

7.4 Sintered-Glass Filters. Sintered-glass filters must be checked periodically for retention of bacteria (for testing retention characteristics see 1983 Annual Book of ASTM Standards, Vol. 11.02, p. 856).

8. LABORATORY PROCEDURES

8.1 Cell Cultures

8.1.1 Test for Sterility. Test all cell culture media for sterility before use. To test cell culture media for sterility, incubate all media at 37 degrees C for one week prior to use. If gross contamination is not visible after

incubation, media must be tested in thioglycollate broth.

8.1.2 Preparation of Cell Lines

(a) To reduce risk of contaminating one cell line with another, prepare only one cell line in a given room at any one time, and cleanse and disinfect work area thoroughly before introducing another cell line.

(b) To reduce risk of massive microbiological contamination, prepare separately media and reagents for each cell line.

(c) Use only heat-inactivated serum (56 degrees C for 30 minutes) in preparation of media.

(d) Personnel must wear protective clothing, changing after each use.

8.1.3 Preparation of Cell Cultures

(a) Trypsinize and dispense cells into fresh stock media in a downward flow laminar hood.

(b) Check cell density by packed cell volume, or if feasible, by direct cell count before and after distributing cells.

(c) Test all distributed media for sterility in thioglycollate broth to determine whether contamination of media occurred during preparation of cell cultures.

(d) Test cell cultures at least once a month for Mycoplasma contamination (Mycotrim Mycoplasma Detection System, Hana Media, Inc., or equivalent, may be used to test for Mycoplasma).

8.1.4 Record Keeping. A continuous record must be kept of cell line passages.

8.2 Virus Plaque Assays

8.2.1 Preparation for Assay

(a) Cell cultures must be washed by replacement of culture medium in cell culture vessels with serum-free medium four hours or less before cultures are used to assay for viruses.

(b) Cell cultures must be checked microscopically and macroscopically periodically after seeding for growth of cultured cells and for contamination.

(c) The same cell culture batch, and thereby cell cultures of the same age, must be used for any given assay.

(d) Uninoculated overlay controls must be included in each assay to detect endogenous viruses.

(e) Cell line sensitivity must be tested routinely against reference viruses.

8.2.2 Volume Assayed. A minimum of 10 percent of each processed sample eluate must be assayed; however, the total volume of each processed drinking water sample eluate must be assayed.

8.2.3 Time of Assay. Processed samples must be refrigerated immediately at 4 degrees C and should be assayed as quickly as possible. If a sample cannot be assayed within 8 hours after processing, it must be frozen quickly and stored at -70 degrees C until assayed.

8.2.4 Controls. Diluents and/or elutants used in processing samples should be assayed as controls.

8.2.5 Counting Plaques. Viral plaques must be counted from first day of appearance; viral plaques must be marked as they are counted.

8.2.6 Disposition of Data. All data must be reviewed for consistency and adequacy and properly documented and stored.

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TABLES

Table 1. Monitoring Laboratory Equipment.

Item		Monitoring Procedure
1 Balance	a	Use an analytical balance with a sensitivity of 1 mg or less at a 10 g load for weighing 2 g or less. For weighing larger quantities, use a balance with a sensitivity of 50 mg at a 150 g load.
	b	Check balance monthly with a set of certified class S weights.
	c	Wipe balance and weights clean after each use.
	d	Protect weights from laboratory humidity and corrosion.
	e	Contract, on an annual basis, with a qualified expert for balance maintenance.
2 pH Meter	a	Compensate pH meter for temperature with each use.
	b	Date standard buffer solution when first opened, and check monthly with another pH meter. Discard buffer solution if the pH is more than plus or minus 0.1 pH unit from the manufacturer's stated value or if it is contaminated with microorganisms.
	c	Standardize pH meter with two standard buffers (pH 4.0, 7.0, 10.0) bracketing pH of sample, before each use.
	d	Do not re-use buffer solutions.
	e	Contract, on an annual basis, with a qualified expert for pH meter maintenance.

3	Water Still	a	Drain and clean still at least monthly, according to instructions from the manufacturer.
		b	Drain and clean distilled water reservoir at least quarterly.
		c	Monitor distilled water daily for conductance. Conductivity should not exceed 2 micromho/cm at 25 degrees C.
4	Water Deionizer	a	Monitor deionized distilled water for conductance at least daily and continuously when possible. Conductivity may not exceed 0.1 micromho/cm at 25 degrees C. Monitor for trace metals and other toxic compounds when necessary (see Table 2).
		b	Replace cartridges of deionizing resins as indicated by manufacturer or as indicated by analytical results.
		c	Monitor bacterial counts at exit point of deionizer unit. Replace cartridges when standard plate count exceeds 1,000 CFU/mL.
5	Ultra-violet Lamps	a	Clean ultraviolet lamps monthly by wiping them violet with a soft cloth moistened with ethanol.
		b	Test ultraviolet lamps with a light meter quarterly; if lamps emit less than 80 percent of their rated initial output, replace them.
		c	Perform spread plate irradiation test quarterly. For procedure, see Microbiological Methods for Monitoring the Environment I. Water and Wastes, EPA-600/8-78-017, pp. 198-199.
6	Centri-fuges	a	Disinfect and clean centrifuges frequently.
		b	Check brushes and bearings for wear every six months.
		c	For centrifuges not equipped with built-in tachometers, check rheostat control against a

		tachometer at various loadings every six months to ensure proper gravitational fields.
7	Micro-scope	a Allow only trained technicians to use microscopes.
		b Appoint one laboratory worker to be responsible for the care of the microscopes.
		c Clean optics and stage of microscope after every use. Use only lens paper for cleaning.
		d Keep microscopes covered when not in use.
		e Establish annual maintenance on contract.
8	Downward Flow Laminar Hood	a With an appropriate instrument, check filters in hood monthly for plugging or obvious dirt accumulation. Clean or replace filters as needed.
		b Check hood for leaks and for appropriate rate of air flow every three months.
		c Expose blood agar plates to air flow in hood for one hour once per month to measure contamination.
		d Every two weeks, remove plug from outlet of hood, and clean ultra-violet lamps with a soft cloth moistened with ethanol.
		e Test ultraviolet lamps quarterly with a light meter. If lamp emits less than 80 percent of its rated output, replace lamp.
		f Perform maintenance as directed by the manufacturer.
		g Once a week, measure efficiency of air flow at hood face with a pressure monitor control device.
9	Thermo-meters and Recording	a Check the accuracy of thermometers and temperature recording instruments, in the monitoring range, at least annually against an NBS certified thermometer or equivalent.

Devices		Thermometer graduations should not exceed the deviation permitted in the analytical method. Check mercury columns for breaks.
	b	Record calibration checks in a quality control record. Mark NBS calibration correction on each thermometer or on the outside of the incubator, refrigerator, or freezer containing the thermometer.
	c	Record daily temperature checks on charts, and retain records for at least six months.
10 Refrigerator	a	Check and record refrigerator temperature daily.
	b	Clean refrigerator monthly.
	c	Identify and date all material in refrigerator.
	d	Defrost unit, and discard outdated materials in refrigerator and freezer compartments every six months.
11 Dispensing Apparatus	a	Check accuracy of delivery from dispensing apparatus with an NBS class A, graduated cylinder at the start of each volume change and periodically throughout extended runs.
	b	Lubricate moving parts of apparatus according to manufacturer's instructions and at least once per month.
	c	Correct immediately any leaks, loose connections, or malfunctions in apparatus.
	d	After dispensing agar or medium, pass a large volume of hot deionized distilled water through dispenser to remove traces of agar or medium.
	e	At the end of the work day, disassemble parts that have come in contact with disposed fluid, wash well, rinse with deionized distilled water, and dry.

12	Steam Auto-clave	a Equip autoclave with steam filter.
		b Record temperature in autoclave continuously with recording thermometer.
		c Verify that autoclave maintains uniform operating temperature.
		d Test performance of autoclave at each use with indicator tape and weekly with maximum-minimum thermometer and with spore strips or suspensions. If evidence of contamination occurs, identify and eliminate cause.
		e Test performance of autoclave weekly with a thermocouple inserted into simulated worst case material.
		f Procure semi-annual preventive maintenance inspections.
13	Hot Air Oven	a Equip oven with a thermometer accurate in 160-180 degrees C range.
		b Each time a hot air oven is used, monitor performance of oven with temperature indicator tape and thermometer or temperature recording chart.
		c Monitor sterilization weekly with spore strips.
14	Freezers	a Check temperatures in freezers continuously with a recording thermometer.
		b Equip each freezer with a temperature/power alarm system.
		c Identify and date all materials in freezers.
		d Clean and defrost freezers every six months. Discard outdated materials.
15	Incuba-tors (Air/Water	a If partially-submersible glass thermometer is used to monitor incubator temperature, bulb and stem must be immersed in water to the mark

Jacket) on stem.

b Monitor temperatures in incubators continuously with recording thermometers. Measure temperatures daily on top and bottom shelves of incubators. Periodically measure temperatures on all shelves in use. (For walk-in incubators, expand test points proportionately.)

c Equip each incubator with a temperature/power alarm system.

d Whenever possible, locate incubators where room temperature is in the 16-27 degrees C range.

Table 2. Standards for Deionized Distilled Water

Parameter	Ideal Monitoring Frequency	Limit
1. Chemical Tests:		
Conductivity	With each use	0.1 micromho/cm at 25 degrees C
pH	Optional	5.5-7.5
Total Organic Carbon	Optional	1.0 mg/liter
Trace Metal, Single	Optional	0.05 mg/liter
Trace Metals, Total Cd, Cr, Cu, Ni, Pb, Zn	Optional	1.0 mg/liter
Ammonia/Amines	Optional	0.1 mg/liter
Free chlorine	Optional	None detectable by amperometric titration

2. Bacteriological Test:

Standard Plate Count for Freshly Dispensed Water	Monthly	1,000 CFU/mL

Table 3. Laboratory Ware Maintenance

1.	Utensils and Vessels	Use utensils and vessels of non-corrodible and non-contaminating materials such as Pyrex glass,stainless steel, and appropriate plastics.
2.	Laboratory Ware (Reusable)	a With each use, examine laboratory ware especially screw-capped dilution vessels and flasks, for chipped or broken edges and etched surfaces. Discard chipped or badly-etched laboratory ware. b Inspect laboratory ware after cleansing. Water should sheet without beading significantly. If water beads excessively on the cleansed surfaces, recleanse the laboratory ware. c Test laboratory ware for acid or alkaline residues by adding bromthymol blue indicator to representative laboratory ware items (see Section 7.1.4). d Test laboratory ware for residual detergent (see Section 7.1.4).

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