



BSR/ASHRAE Standard 188P

Fourth Full Publication Public Review Draft

Legionellosis: Risk Management for Building Water Systems

Fourth Public Review (Complete Draft for Full Review)

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(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

The purpose of this document is to establish minimum legionellosis risk management requirements for building water systems.

Legionellosis refers to two distinct clinical illnesses. When the bacterium Legionella causes pneumonia, the disease is referred to as Legionnaires' disease, or LD. The Centers for Disease Control and Prevention (CDC) estimates that each year there are between 8,000 and 18,000 cases of Legionnaires' disease in the United States and that more than 10 percent of these cases are fatal. Legionella can also cause a less severe influenza-like illness known as Pontiac Fever. Most cases of legionellosis are the result of exposure to Legionella associated with building water systems.

The presence of Legionella bacteria in building water systems is not in itself sufficient to cause LD. Other necessary factors include environmental conditions that promote the growth of Legionella (e.g., warm water temperatures, biofilms, etc.), a means of transmitting the bacteria to people in the building (e.g., aerosol generation) and exposure of susceptible persons to colonized water that is inhaled or aspirated into the lungs. Legionella bacteria are not transmitted person-to-person or from normal (non-aspirated) ingestion of contaminated water. Susceptible persons at high risk for legionellosis include, but are not limited to, the elderly, dialysis patients, persons who smoke, and persons with underlying medical conditions that weaken the immune system.

The standard is intended for use by owners and managers of human-occupied buildings, and those involved in the design, construction, installation, commissioning, operation, maintenance and service of centralized building water systems and components.

This standard consists of numbered normative sections followed by normative and informative appendices. The normative sections and normative appendices specify what is required to comply with the standard. The informative appendices and informative references are provided for guidance about how to do things that may be necessary for a given building water system. Building water systems vary substantially in their design and their capability for transmission of Legionella. Scientific evidence is either lacking or inconclusive in certain aspects of Legionella control. Therefore, the informative appendices and informative references to this document provide suggestions, recommendations and references to guidance.

There have been major changes to the 4th public review draft standard that include:

- Alignment of the document with the revised title, purpose and scope.*
- Removal of HACCP (Hazard Analysis and Critical Control Points) terminology; some of the principles of the HACCP process are consistent with the process utilized in the document.*
- Provide a normative appendix for health care facilities meeting specific requirements that provides an alternate compliance path that is more stringent than for other facilities.*
- Requirements for design, construction, installation, commissioning, operation, maintenance and service are given more emphasis.*

Standard Project Committee – 188 has devoted a considerable amount of time and thought in resolving the concerns of affected and interested parties. We are looking forward to comments during the public review as an opportunity to make it more effective in managing the risk of a life threatening issue.

Following approval, it is anticipated that Standard 188 will be placed on continuous maintenance, permitting the standard to be updated through the publication of approved addenda to the standard. The planned schedule for republication is anticipated to be every third year with approved addenda and errata.

[Note to reviewers: This is a full public review and the complete draft is open for review and comment. Notes and examples are informational (non-mandatory) and integrated in the text of this document to give additional information intended to assist in the understanding or use of this document. Notes and examples are merely informative and do not contain requirements necessary for conformance to the standard. Notes and examples may not have been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.]

1. PURPOSE

The purpose of this standard is to establish minimum Legionellosis risk management requirements for building water systems.

2. SCOPE

2.1 This standard provides minimum Legionellosis risk management requirements for the design, construction, commissioning, operation, maintenance, repair, replacement and expansion of new and existing buildings and their associated water systems and components.

2.2 This standard applies to human-occupied commercial, institutional, multi-unit-residential and industrial buildings, excluding single-family residential buildings. Only where specifically noted in this standard, shall certain building water systems or parts of building water systems be exempt.

2.3 This standard is intended for use by owners and managers of human-occupied buildings, excluding single-family residential buildings. This standard is also intended for those involved in design, construction, installation, commissioning, operation, maintenance and service of centralized building water systems and components.

3. DEFINITIONS OF TERMS

analysis of building water systems: the systematic evaluation of potentially hazardous conditions associated with each step in the process flow diagrams.

at-risk individual: any person who is more susceptible than the general population to developing legionellosis because of age, health, medication, occupation, or smoking.

building water systems: all water systems, potable and non-potable, in the building or site.

building survey: a review of building water systems, water devices and certain factors used to determine the compliance requirements of this standard.

centralized building water system: any system that distributes water to multiple uses or multiple locations within the building or site.

control: to manage the conditions of an operation in order to maintain compliance with established criteria.

control location: a point where a physical, mechanical, operational or chemical control measure is required.

control limit: a maximum value, a minimum value or a range to which a chemical or physical parameter associated with a control measure must be monitored and maintained in order to reduce the occurrence of a hazardous condition to an acceptable level.

control measure: a disinfectant, heating, cooling, filtering, flushing or other means, methods, or procedures used to maintain the physical or chemical conditions of water to within control limits

corrective action: action to be taken to return control values to within established limits, when monitoring or measurement indicates the control values are outside the established control limits.

designee: The individual designated by the building owner to meet the requirements placed on the owner by the standard.

disinfectant: chemicals or physical agents used to kill or inactivate pathogens.

disinfection: the process of killing or inactivating pathogens.

disinfectant residual: the net amount of a chemical disinfectant remaining in treated water after chemical demand exerted by the water is satisfied.

hazard: *Legionella* bacteria in a building water system that, in the absence of control, can cause harm to humans.

hazardous condition: a condition that contributes to the potential for harmful human exposure to *Legionella*.

immunocompromised: a condition describing an individual who has increased susceptibility to infections due to existing human disease, medication regimens or other types of medical treatment. (See: *at-risk individual*)

Legionella: the name of the genus of bacteria that was subsequently identified as the causative pathogen associated with the 1976 outbreak of disease at the American Legion convention in Philadelphia. *Legionella* are common aquatic bacteria found in natural and building water systems, as well as in some soils.

legionellosis: the term used to describe Legionnaires' disease, Pontiac fever and any illness caused by exposure to *Legionella* bacteria.

monitoring: conducting a planned sequence of observations or measurements of the physical and chemical characteristics of control measures.

multiple housing units: a classification of housing where multiple separate housing units for residential and commercial inhabitants are contained within one building or several buildings within one complex.

non-potable: water that is not intended for direct and indirect human contact or consumption and that has the potential to cause harmful human exposure to *Legionella*.

process flow diagram: a step-by-step drawing of a building water system that includes the location of all water processing steps, including, but not limited to, conditioning, storing, heating, cooling, recirculation and distribution that are part of the building water systems.

potable water system: a building water distribution system that provides hot or cold water intended for direct and indirect human contact or consumption.

Program: the "Water Management Program".

Program Team: the group or individual designated by the building owner or designee to be responsible for developing, implementing and maintaining the *Program*.

risk: the potential for harm to humans resulting from exposure to *Legionella*.

risk management: systematic practices to reduce risk.

testing: conducting a planned sequence of observations or measurements of physical, chemical or microbial characteristics of water to assess whether conditions throughout building water systems meet the goals set by the Program Team.

validation: initial and ongoing confirmation that the Program, when implemented as designed, effectively controls the hazardous conditions throughout the building water systems.

verification: initial and ongoing confirmation that the Program is being implemented as designed.

Water Management Program (Program): the risk management plan for the prevention and control of legionellosis associated with building water systems, including documentation of its implementation and operation.

water service disruption: planned or unplanned events that reduce water delivery pressure below 20 psi (140 kPa) caused by new construction tie-ins, replacement of valves, hydrants, meters, pumping failures, pipeline breaks and other system repairs or emergency conditions.

water use end points: the points at which water exits from all potable and non-potable building water systems, fixtures and equipment

4. COMPLIANCE

The results of each Section 4 compliance determination and the associated building survey in Section 5 shall be documented and shall be available for review by the Authority Having Jurisdiction.

4.1 Building Designer Requirements

- 4.1.1 Survey each new building design and its water systems to determine if the design contains any of the devices or factors that relate to legionellosis described in Section 5. If the building and associated property has:
- any of the devices in Section 5.1, then all those devices shall comply with all applicable requirements of Section 8 of this standard
 - any of the factors listed in Section 5.2, then the new building design shall comply with the requirements of Section 8 of this standard.

4.2 Building Owner Requirements

- 4.2.1 The building owner or designee shall survey each existing building, new building and any renovation, addition or modification to an existing building and its water systems to determine if it contains any of the devices or factors that relate to legionellosis described in Section 5. The survey and conformance with the compliance requirements of Section 4 must occur prior to occupancy of a new building and before construction begins on renovations, additions or modifications to existing buildings. If the building and associated property has:
- any of the devices listed in Section 5.1, then all those devices shall comply with the requirements of Section 6 and all applicable requirements of Section 7 of this standard.
 - any of the factors listed in Section 5.2, then all building water systems shall comply with the requirements of Sections 6 and all applicable requirements of Section 7 of this standard.

4.2.2 The building owner or designee shall require the designer of any new building and renovation, addition or modification to an existing building to follow the requirements of Section 4.1 for the provided design.

4.2.3 The building owner or designee shall conduct and document the compliance determination in Section 4 of this standard at least once per year and anytime renovations, additions or modifications are made to the building.

4.3. Health Care Facility Requirements

4.3.1 Health care facilities that do not meet all of the qualifications of 4.3.2 shall comply with the requirements in Section 4.2, Section 6, and Section 7.

- 4.3.2 Health care facilities that meet all of the following qualifications shall comply with either the requirements in Sections 4.2, 6 and 7 or the requirements in normative Appendix A "Health Care Facilities":
- The health care facility is accredited by a regional, national or international accrediting agency or by the Authority Having Jurisdiction (AHJ) over the health care facility Infection Prevention and Control (IC) activities; and
 - The health care facility Infection Control program has an Infection Preventionist that is Certified in Infection Control (CIC) by the Certification Board of Infection Control and Epidemiology (CBIC) or other regional, national or international certifying body or the health care facility has an Epidemiologist with a minimum of a Master's degree or equivalent.

5. BUILDING SURVEY

5.1 The building shall be surveyed to determine whether it has one or more:

- open and closed circuit cooling towers or evaporative condensers that provide cooling and/or refrigeration for the HVAC&R system or other systems or devices in the building,
- whirlpools or spas either in the building or on the site, or
- ornamental fountains, misters, atomizers, air washes, humidifiers or other devices that release water aerosols in the building or on the site

5.2 The building shall be surveyed to determine whether it is characterized by one or more of the following factors that relate to legionellosis:

- a. it includes multiple housing units with one or more centralized potable water heater systems,
- b. it is more than 10 stories high (including any levels that are below grade),
- c. it is a healthcare facility where patient stays exceed 24 hours,
- d. it is a building containing one or more areas for the purpose of housing or treating occupants receiving treatment for burns, chemotherapy for cancer, or solid organ transplantation or bone marrow transplantation,
- e. it is a building containing one or more areas for the purpose of housing or treating occupants that are immunocompromised, at-risk, are taking drugs that weaken the immune system, have renal disease, have diabetes or have chronic lung disease, or
- f. it is a building identified by the owner or designee as being for the purpose of housing occupants over the age of 65 years.

6. GENERAL REQUIREMENTS

Required compliance with this section shall be determined by Section 4.

6.1 Principles of a “Water Management Program” (hereafter referred to as *Program*). A *Program* utilizing the following risk management principles shall be used to reduce the risk of legionellosis associated with building water systems:

- 6.1.1. Analysis of Building Water Systems:** Conduct a systematic analysis of hazardous conditions in the building water systems.
- 6.1.2. Control Locations:** Determine the locations in the system where control measures are required.
- 6.1.3. Control Limits:** For each control measure at each control location established in Section 6.1.2, determine the limits, including but not limited to a maximum value, minimum value or range within which a chemical or physical parameter must be monitored and maintained in order to reduce hazardous conditions to an acceptable level.
- 6.1.4. Monitoring:** Establish a system for monitoring the parameters associated with the control limits established in 6.1.3 above.
- 6.1.5. Corrective Actions:** Establish the corrective action(s) to be taken when monitoring indicates that the control parameters are outside the established control limits.
- 6.1.6. Confirm Program Implementation:** Establish procedures to confirm that all the program elements are being implemented as designed.
- 6.1.7. Documentation and Recordkeeping:** Establish documentation concerning all procedures and maintain records appropriate to these principles and their application.

6.2 Program Development. When the building survey required by Sections 4 and 5 indicates the presence of devices listed in Section 5.1 or the presence of factors listed in Section 5.2, a Program shall be implemented to manage the risk of legionellosis. A summary of the program development steps are represented in Figure 1, Elements of a Water Management Program. The Program shall be detailed in a plan that embodies all of the principles described in Section 6.1 and shall include the following elements:

6.2.1 Program Team. Identification of the person(s) on the *Program Team* responsible for developing and implementing the *Program* and the tasks for which they are responsible. The *Program Team* shall include one or more individuals selected from the following: the building owner or designee, employees, suppliers, consultants, or other individual or individuals to whom the building owner or designee has delegated authority and responsibility for the actions required by the *Program*. The *Program Team* can delegate *Program* tasks to subgroups. The *Program Team* shall have knowledge of Legionnaires’ disease as can be obtained through informative documents, such as ASHRAE Guideline 12.

6.2.2 Describe the Building Water Systems. The *Program Team* shall identify and describe the potable and non-potable water systems within the building and on the building site, including at a minimum:

- the locations of end point uses of potable and non-potable water systems,
- the location of water processing equipment and device(s) and
- how water is received and processed (conditioned, stored, heated, cooled, recirculated and delivered to end point uses).

6.2.3 Process Flow Diagrams. The information from Section 6.2.2 must be graphically described in step by step process flow diagrams. The process flow diagrams shall have sufficient detail to enable the identification, analysis and management of the risk of legionellosis throughout the building water systems. The *Program Team* shall confirm the process flow diagrams are representative of the systems as built.

6.2.4 Analysis of Building Water Systems. The *Program Team* shall use the process flow diagrams in Section 6.2.3 to evaluate where hazardous conditions may occur in the building water systems and determine where control measures can be applied to control potentially hazardous system conditions. The analysis shall also take into consideration the vulnerability of occupants and shall include the equipment and devices identified in Section 5.1. The analysis shall include provisions to respond to water service disruptions.

6.2.5 Control Measures. Based on the results of the analysis of building water systems in Section 6.2.4 the *Program Team* shall determine the control measures to be maintained. Control measures shall include preplanning of physical design and equipment siting. Control measures shall include treatment methods, technical and physical processes and procedures and activities or actions that monitor or maintain the physical or chemical conditions of water to within established control limits.

- Control Locations. The *Program Team* shall determine the locations in the building water system where control measures are required.
- Control Limits. The *Program Team* shall determine a maximum value, minimum value or range of values to which a chemical or physical parameter must be maintained.

6.2.6 Monitoring. The *Program Team* shall establish a system for monitoring that the measured physical and chemical characteristics of control measures are within the control limits. The system shall include the means, methods and frequency for monitoring activities.

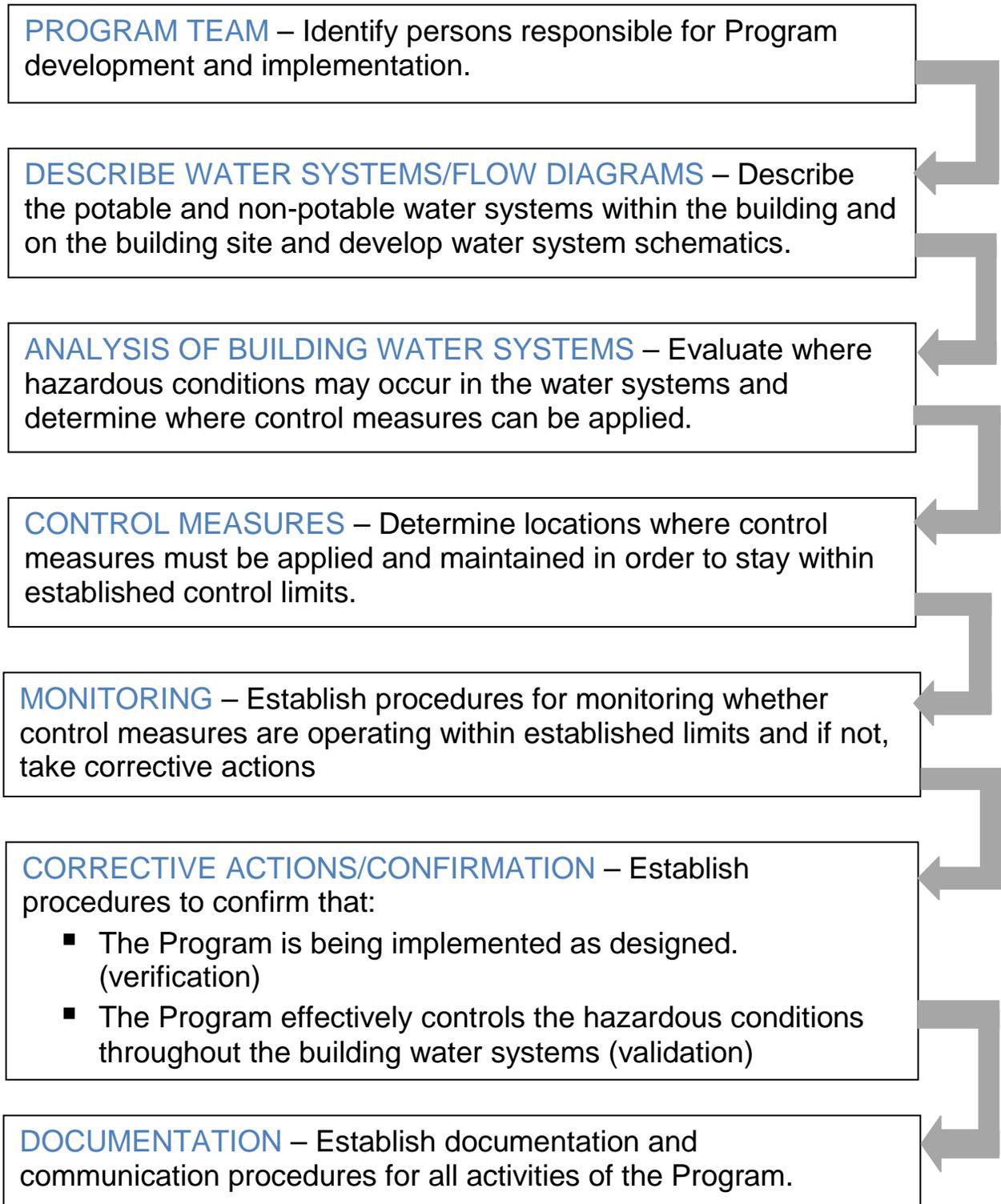
6.2.7 Corrective Actions. For each control location, the *Program Team* shall establish procedures for corrective actions to be taken when monitoring shows control measures are outside established control limits, shall identify the person responsible for taking the corrective action, shall identify the required response time for taking the corrective action, and shall identify all persons to be notified.

6.2.8 Program Confirmation. The *Program Team* shall establish procedures to confirm, both initially and on an ongoing basis that the Program is being implemented as designed (verification). The *Program Team* shall establish procedures to confirm, both initially and on an ongoing basis, that the Program, when implemented as designed, effectively controls the hazardous conditions throughout the building water systems (validation). The *Program Team* shall determine if testing for Legionella shall be performed and if so, how test results will be used to validate the Program. If the *Program Team* determines that testing is to be performed, the testing approach, including sampling frequency, number of samples, locations, sampling methods, and the test methods, shall be specified and documented. The *Program Team* shall include the following, as part of the determination whether to test for *Legionella*:

- Program control limits are not maintained in building water systems, including water systems with supplemental disinfection,
- a healthcare facility provides inpatient services to at-risk or immunocompromised populations, and
- there is a prior history of legionellosis associated with the building water system.

6.2.9 Documentation and Communication. The *Program Team* shall establish documentation and communication procedures for all activities of the Program. The *Program Team* is responsible for all water systems and for communication and coordination among sub-groups covering different portions of the building water system and associated equipment and devices. A master document providing the location of all Program documents shall be maintained.

FIGURE 1: Elements of a Water Management Program



7. REQUIREMENTS FOR BUILDING WATER SYSTEMS

Required compliance with the following Sections shall be determined by Section 4.

Informative Note: Recommendations and guidance on the design, maintenance, and operation of building water systems are provided in ASHRAE Guideline 12 *Minimizing the Risk of Legionellosis Associated with Building Water Systems*.

All water treatments required by this standard shall be applied in conformance with and comply with all applicable national, regional and local regulations.

Section 7.1 - Potable Water Systems

Section 7.2 - Cooling Towers and Evaporative Condensers

Section 7.3 - Whirlpool Spas

Section 7.4 - Decorative Fountains and Other Water Features

Section 7.5 - Aerosol Generating Air Coolers, Humidifiers and Air Washers

7.1 Potable Water Systems. This section describes the preventive measures required for potable water systems. The program documents shall include identification of the responsible persons for every step of each *Program* requirement.

Informative Note: Recommendations and guidance on the design, maintenance, and operation of building water systems are provided in ASHRAE Guideline 12 *Minimizing the Risk of Legionellosis Associated with Building Water Systems*.

7.1.2 Systems Startup and Shutdown. The *Program* documents shall include procedures for:

- a. cleaning and disinfection before commissioning any new system,
- b. shutdown, including any draining, purging, cleaning treatment and control settings,
- c. any unplanned loss of operating energy, loss of water treatment chemicals or system component repair or replacement,
- d. restarting safely from a drained shutdown condition and from an un-drained (stagnant) shutdown condition,
- e. monitoring and treatment following water supply interruptions or breaks in water supply piping, and
- f. re-establishing required temperatures throughout the hot water distribution system.

7.1.3 System Maintenance. The *Program* documents shall include procedures for:

- a. inspection and the inspection schedule for water containing vessels and system components,
- b. flushing or mixing of stagnant or low flow areas,
- c. maintenance and monitoring procedures, based on equipment manufacturers' recommendations for cleaning, disinfection, replacement of system components and other treatments the *Program Team* decides are necessary for:
 - i. hot and cold storage tanks
 - ii. ice machines
 - iii. water hammer arrestors
 - iv. expansion tanks
 - v. water filters
 - vi. shower heads and hoses
 - vii. electronic faucets
 - viii. aerators
 - ix. faucet flow restrictors
 - x. non-steam, aerosol generating humidifiers
 - xi. water heaters

- xii. infrequently used equipment, including eyewash stations and showers
- xiii. other equipment identified by the *Program Team*
- d. maintaining and storing instructions and forms for inspection notes and a corrective action log, and
- e. maintaining and storing component and equipment operating manuals.

7.1.4 Water Treatment. The *Program* documents shall include the following:

- a. monitoring method and schedule for temperature measurement in the hot and cold water systems,
- b. monitoring method and schedule for measuring the chemical disinfectant residual or physical parameters in the hot and cold water system,
- c. procedures to address water supply interruptions or breaks in water supply piping,
- d. procedures and schedule for maintaining water treatment systems disinfectants, and
- e. water treatment products, the procedures for their application and confirmation that the products comply with applicable regulations.

7.1.5 Contingency Response Plan The *Program* documents shall include for both hot and cold water system, the following:

- a. procedures to be followed if there are known or suspected cases of legionellosis associated with the use of potable water from the building water systems,
- b. directions issued by national, regional and local health department authorities,
- c. if the *Program Team* determines testing for Legionella shall be performed, the procedures shall include criteria for when and where the tests shall be performed,
- d. procedures for emergency disinfection, and
- e. procedures for other actions identified by the *Program Team* to prevent exposure to contaminated water.

7.2 Cooling Towers and Evaporative Condensers. This section describes the preventive measures required for cooling towers and evaporative condensers that provide cooling and/or refrigeration for the HVAC&R system or for other devices or systems in the building. The program documents shall include identification of the responsible persons for every step of each *Program* requirement.

Informative Note: Recommendations and guidance on the design, maintenance, and operation of building water systems are provided in ASHRAE Guideline 12 *Minimizing the Risk of Legionellosis Associated with Building Water Systems*.

7.2.1 Equipment Siting. At the time of new or replacement cooling tower installation, drawings shall be reviewed and hazardous conditions related to the following siting issues shall be identified and addressed prior to beginning construction:

- a. equipment siting issues that allow contamination from building systems or facility processes to be drawn into the equipment.
- b. equipment siting issues that allow cooling tower or evaporative condenser exhaust to infiltrate buildings and outside air intakes, and
- c. equipment siting and access issues that inhibit required maintenance and inspection.

7.2.2 New System Startup. The *Program* document shall include procedures for cleaning steps that are part of commissioning of the cooling system and management and control means of *ensuring* that ongoing water treatment is initiated immediately once the system is charged with water.

7.2.3 System Maintenance. The *Program* documents shall include the following:

- a. a schedule for inspections for general system cleanliness, drift eliminator condition, condition of fill material, and water distribution system operation,
- b. requirements and the schedule for basin or remote sump cleaning and purging of stagnant or low flow zones, and
- c. documentation requirements.

7.2.4 Water Treatment. The *Program* documents shall include the water treatment requirements to control microbiological activity, scale and corrosion and shall also:

- a. specify all equipment and chemicals used for the purpose of treating the open recirculating loop,
- b. include the minimum required schedule for inspection, maintenance and monitoring and a corrective actions plan, and
- c. identify the minimum requirements for documenting system water treatment.

7.2.5 Shutdown and Startup. The *Program* documents shall include startup and shutdown requirements to manage hazardous conditions associated with operation of fans during untreated water conditions and procedures for the following:

- a. shutdown that includes all chemical pretreatment steps, pump cycling protocols and procedures for system drainage for shutdown periods longer than the duration specified by the *Program Team*,
- b. startup from a drained system, and
- c. startup from an un-drained (stagnant) system that exceeds the number of idle days specified by the *Program Team*.

7.2.6 Disinfection of Cooling Towers and Evaporative Condensers. The *Program* documents shall include procedures and identify the responsible person for initiating the process for the following:

- a. remedial disinfection while in operation, including the conditions that require its application, and
- b. emergency disinfection, including the conditions that require its application.

7.2.7 Location of Cooling Tower Make-up Valve. The *Program* documents shall include requirements for the location of cooling tower make-up valve(s) and maintaining compliance with all applicable local, regional and national codes and regulations for air gaps and backflow preventers and the height of the discharge outlets and make-up valve over the rim of the overflow in the cooling tower or evaporative condenser basins. If no such codes and regulations exist for the location, then the *Program* shall include requirements for maintaining compliance with ASME/ANSI A112.1.2 for air gaps and for maintaining compliance with codes and regulations applicable to other locations, selected by the owner or designee, for backflow preventers and the height of the discharge outlets and make-up valve over the rim of the outflow in the cooling tower or evaporative condenser basins.

7.2.8 Contingency Response Plan. The *Program* documents shall include the following:

- a. procedures to be followed if there are known or suspected cases of legionellosis associated with the use of cooling towers and evaporative condensers,
- b. directions issued by national, regional and local health department authorities,
- c. if the *Program Team* determines testing for Legionella shall be performed, procedures shall include criteria for when and where the tests shall be performed,
- d. procedures for emergency disinfection, and
- e. procedures for other actions identified by the *Program Team* to prevent exposure to contaminated water.

7.3. Whirlpool Spas. This section describes the preventative measures required for public whirlpool spas. The *Program* documents shall include identification of the responsible persons for every step of each *Program* requirement.

Informative Note: Recommendations and guidance on the design, maintenance, and operation of building water systems are provided in ASHRAE Guideline 12 *Minimizing the Risk of Legionellosis Associated with Building Water Systems*.

7.3.1 General. Public whirlpool spas and their operation shall comply with national, regional and local codes.

7.3.2 Bather-Related Requirements. The *Program* documents shall include the following:

- a. the allowable bather load for each whirlpool spa,
- b. the procedures for posting and enforcing the allowable bather load for each whirlpool spa, and

- c. the procedures for posting a notice to bathers of the increased health risk related to use of whirlpool spas by individuals who are at-risk, are immunocompromised or who have chronic lung disease.

7.3.3 Filter Operation and Maintenance. The *Program* documents shall include procedures for filtration of whirlpool spa water.

7.3.3.1 Cartridge (canister) Filters. The *Program* documents shall include procedures and schedules for inspection and replacement of cartridge type filters, pressure gauges, valves and related equipment.

7.3.3.2 Granular Filters. The *Program* documents shall include procedures and schedules for backwashing, inspection, and replacement of granular type filters, pressure gauges, valves and related equipment.

7.3.4 Water Quality, Disinfection and Monitoring. The *Program* documents shall include procedures for the following:

- a. the scheduled changing of whirlpool spa water,
- b. maintaining the pH of the water within the range specified by local, regional and national codes and regulations,
- c. maintaining disinfectant levels, the products to be applied and requirements to follow disinfectant label directions,
- d. shock disinfection of the whirlpool spa at the end of each day by achieving the disinfectant residual and minimum circulation time recommended by the disinfectant manufacturer,
- e. maintenance of the disinfection system in accordance with the manufacturer's instructions,
- f. a measurement schedule and logbook of all residual disinfectant measurements,
- g. recording corrective actions in logbooks, and
- h. recording operations in logbooks maintained for the periods specified in local, regional and national codes and regulations and for at least 12 months and retained for at least an additional 12 months.

7.3.5 Microbiology. The *Program* documents shall include procedures for the microbiological standards required by local, regional and national health departments and to be achieved by public whirlpool spas.

7.3.5.1 Microbiological Testing. The *Program* documents shall include procedures for the following:

- a. the monthly, or more frequent, testing of spa water for indicator organisms and pathogens identified by the *Program* microbiological standards,
- b. maintaining the total Heterotrophic Aerobic Bacteria colony count at or below the maximum level specified by local, regional and national codes and regulations or ≤ 200 CFU/ml, if there are no applicable codes or regulations,
- c. maintaining the levels of indicator organisms at or below the standard threshold,
- d. if the *Program Team* determines testing for Legionella or other pathogens shall be performed, procedures shall include criteria for when and where the tests shall be performed, proper sampling procedures and the interpretation of test results, and
- e. responding to unsatisfactory test results, including disinfection record review and repetition of microbiological tests.

7.3.5.2 When Contamination Is Discovered. The *Program* documents shall include procedures to be followed if there is evidence of feces, vomiting or other gross contamination and shall including procedures for immediately taking the spa out of use, for spa cleaning, for disinfection of the entire spa system and for restoring the spa to service.

7.3.5.3 Contingency Response Plan. The *Program* documents shall include the following:

- a. procedures to be followed if there are known or suspected cases of legionellosis associated with the use of whirlpool spas,
- b. directions issued by national, regional and local health department authorities,
- c. if the *Program Team* determines testing for Legionella shall be performed, procedures shall include criteria for when and where the tests shall be performed,
- d. procedures for emergency disinfection, and

- e. procedures for other actions identified by the *Program Team* to prevent exposure to contaminated water.

7.3.6 Operating Manuals. The *Program* documents shall include procedures for regularly updating all operating manuals for filters, pumps and disinfection equipment and for maintaining them at a secure location accessible to maintenance personnel.

7.4 Decorative Fountains and Other Water Features. This section describes the preventative measures required for decorative fountains and other water features that are associated with buildings. The *Program* documents shall include identification of the responsible persons for every step of each *Program* requirement.

Informative Note: Recommendations and guidance on the design, maintenance, and operation of building water systems are provided in ASHRAE Guideline 12 *Minimizing the Risk of Legionellosis Associated with Building Water Systems*.

7.4.1 Equipment Siting. At the time of new or replacement decorative fountain or other water feature installation, drawings shall be reviewed and hazardous conditions related to the following siting issues shall be identified and addressed prior to beginning construction:

- a. organic contamination from adjacent sources,
- b. inadequate drains and stagnant areas,
- c. Inadequate access to pump(s), filter(s), tanks and treatment equipment, and
- d. external heat sources and inadequate air flow that could increase the risk of exposure to *Legionella*.

7.4.2 Operation. The *Program* documents shall include a description of the procedures for:

- a. draining, cleaning all components, disinfecting and refilling, if the water feature is not in operation for periods that exceed the number of idle days specified by the *Program Team*,
- b. confirming submerged lights will not operate unless the circulating pump is running, and
- c. confirming circulating pump(s) are running.

7.4.3 Maintenance. The *Program* documents shall include procedures for regular cleaning and cleaning when the buildup of dirt, organic matter or other visible debris and maintaining pumps and filters, as recommended by the manufacturer.

7.4.4. Water Treatment. The *Program* documents shall include procedures for t

- a. the weekly cleaning, disinfection of equipment and components, and replacement of water in systems with total water volume less than 5 gallons (20 liters) or the periodic use of a disinfectant, the products to be applied and a requirement to follow disinfectant manufacturer's directions, and
- b. the periodic use of a disinfectant, the products to be applied and a requirement to follow disinfectant manufacturer's directions, for systems equal to or greater than 5 gallons (20 liters).

7.4.5 Contingency Response Plan. The *Program* documents shall include:

- a. procedures to be followed if there are known or suspected legionellosis health problems associated with the use of decorative fountains and other water features in building systems,
- b. directions issued by national, regional and local health department authorities,
- c. procedures that include criteria for when and where tests shall be performed if the *Program Team* determines testing for *Legionella* shall be performed,
- d. procedures for emergency disinfection, and
- e. procedures for other actions identified by the *Program Team* to prevent exposure to contaminated water.

7.5 Aerosol Generating Misters, Atomizers, Air Washers and Humidifiers. This section describes the preventative measures required for misters, atomizers, air washers and humidifiers that cool or humidify by generating small water droplets discharged into the air. The program documents shall include identification of the responsible persons for every step of each *Program* requirement.

Informative Note: Recommendations and guidance on the design, maintenance, and operation of building water systems are provided in ASHRAE Guideline 12 *Minimizing the Risk of Legionellosis Associated with Building Water Systems*.

7.5.1 Equipment Siting. At the time of new or replacement aerosol generating misters, atomizers, air washers or humidifier installation, drawings shall be reviewed and hazardous conditions related to the following siting issues shall be identified and addressed prior to beginning construction:

- a. contamination from sources that can be drawn into the system ,
- b. Inadequate access to pump(s), filter(s), treatment equipment for maintenance and inspection, and
- c. external heat sources and inadequate air flow.

7.5.2 New System Startup. The *Program* documents shall have procedures for cleaning required when commissioning misters, atomizers, air washers and humidifiers

7.5.3 System Maintenance. The *Program* documents shall include procedures for:

- a. a maintenance schedule and instructions for maintaining air washer mist eliminators, evaporative, cooler/humidifier media, spray nozzles, water distribution system operation and other equipment and components identified by the *Program Team*,
- b. a maintenance schedule and instructions for cleaning basins and remote sumps and for cleaning and purging stagnant and low flow zones, and
- c. maintenance procedures documentation, inspection notes and corrective actions.

7.5.4 Water Treatment. When water treatment is used, the *Program* documents shall have procedures for:

- a. all equipment and chemicals used for the purpose of treating the open recirculating loop,
- b. an inspection and maintenance schedule for the water treatment equipment, and
- c. the schedule for all monitoring required by the water treatment program.

7.5.5 System Shutdown and Start-Up. The *Program* documents shall have procedures for:

- a. system shutdown, including any required chemical pretreatment, pump cycling and procedures for shutdown periods that exceed the number of idle days specified by the *Program Team*,
- b. system startup from a drained condition, and
- c. system startup from an undrained (stagnant) condition that exceeds the number of idle days specified by the *Program Team*.

7.5.6 Disinfection. The *Program* documents shall have procedures for remedial on-line disinfection and the conditions requiring its application and for emergency disinfection and the conditions requiring its application.

7.5.7 Contingency Response Plan. The *Program* documents shall include:

- a. procedures to be followed if there are known or suspected cases of legionellosis associated with the use of aerosol generating misters, atomizers, air washers and humidifiers,
- b. directions issued by national, regional and local health department authorities,
- c. procedures that include criteria for when and where the tests shall be performed if the *Program Team* determines testing for *Legionella* shall be performed,
- d. procedures for emergency disinfection, and
- e. procedures for other actions identified by the *Program Team* to prevent exposure to contaminated water.

8. REQUIREMENTS FOR DESIGNING BUILDING WATER SYSTEMS

8.1 General. When designing for new construction, renovation, refurbishment, replacement or repurposing a facility the following shall be documented:

- a. A system overview and intended mode of system operation.

- b. Documentation and design compliance to address hazardous conditions for each of the following shall be provided:
 - i. schematic diagrams of water systems,
 - ii. monitoring and control diagrams of water systems,
 - iii. local, regional and national code compliance,
 - iv. locations of access, fill, makeup, flush points, sampling points, temperature monitoring, and drain points,
 - v. locations of outside air intakes,
 - vi. building water equipment,
 - vii. commissioning,
 - viii. operating instructions and procedures,
 - ix. maintenance schedules, frequencies, and procedures,
 - x. dead legs and low flow portions of the piping and building water systems,
 - xi. impact of heat loss from hot water or heat gain by cold water in piping and water system components,
 - xii. possible cross connections between potable and non-potable water, and
 - xiii. inadequate access to water expansion tanks, water hammer arrestors, water storage tanks and water heaters and other equipment and components containing water.

8.2 Final Installation Documents

8.2.1. Drawings and documents of the actual installation shall be provided to the building owner or designee and shall include the following:

- a. The location on each piece of equipment associated with the building water systems.
- b. A drawing of the water distribution piping system, including system materials, pipe sizes, design flow rates, design temperatures, temperature monitoring points necessary to confirm design temperatures throughout the system, fill provisions, blow down provisions, makeup provisions, sampling points and drain provisions.
- c. The location of all outside air intakes.
- d. Size and options for each piece of water system equipment.
- e. Applicable control system wiring diagrams, schematics, device locations, calibration information, and operational sequences.
- f. Material specifications for all building water system components.
- g. Material specifications for all water systems insulation.
- h. Safety Data Sheets (SDS) for applicable materials used for building water system treatment, cleaning, flushing, disinfecting, and sealing.
- i. Installation requirements of all equipment.
- j. Start-up requirements of all equipment.
- k. Operational requirements of all equipment and systems.
- l. Maintenance procedures for all equipment and water systems, including required actions, frequencies, and durations.

8.3 Balancing. All water systems shall be balanced and a balance report for all water systems shall be provided to the building owner or designee.

8.4 Commissioning. Detailed instructions for commissioning of all building water systems shall be provided by the designer in the plans and specifications and shall include:

- a. procedures for flushing, disinfection and instructions that disinfection shall be completed within two weeks prior to occupancy, and
- b. confirmation that building water system performance meets design performance parameters documented in Section 8.2.1 and 8.3.

9. REFERENCES

1. ASME. 2012. ASME/ANSI A112.1.2-2012, *Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water-Connected Receptors)*. New York, New York: The American Society of Mechanical Engineers.

(This appendix is part of this standard. It contains requirements necessary for conformance to the standard. It has been processed according to the ANSI requirements for a standard and has been subject to public review and a consensus process.)

NORMATIVE APPENDIX A

HEALTH CARE FACILITIES

These requirements are only applicable to health care facilities meeting the qualifications of Section 4.3.2

A1. Supplemental Definitions for Terms used in Appendix A

legionellosis risk management plan: the documents that contains all information pertaining to the development and implementation of legionellosis risk management activities of a health care facility

Designated Team: the interdisciplinary group with the authority and responsibility for developing and implementing a legionellosis risk management plan

water system flow diagram: a step-by-step drawing of a building water system that includes all water processing steps and identifies areas of the health care facility designated for specialized care

A2. DESIGNATED TEAM

A2.1 Senior organizational leadership shall select the individual responsible for leading the *Designated Team* from the group responsible for compliance with physical environment accreditation standards. The membership of the *Designated Team* shall include but is not limited to:

- a. a person with senior organizational leadership authority to make command decisions about water restrictions or other response measures;
- b. a member of the facilities management staff familiar with the building water systems; and
- c. a member of the health care facility Infection Prevention and Control (IC) program who is an Infection Preventionist certified in infection control (CIC) by the Certification Board of Infection Control and Epidemiology (CBIC) or by an equivalent regional, national or international body or who is an Epidemiologist with a minimum of a Master's degree or equivalent.

A2.2 The *Designated Team* is responsible for developing, implementing and documenting all applicable requirements of Appendix A and any other activities assigned by Senior Organizational Leadership or their designee.

A3. WATER SYSTEM FLOW DIAGRAM

A3.1 The building water systems shall be graphically represented in water system flow diagrams that include:

- a. All water supply sources
- b. All water supply service entrances
- c. All water treatment systems and control measures, including disinfection and filtration
- d. All water processing steps, including, but not limited to, receiving, conditioning, storing, heating, cooling, recirculating and distributing
- e. All areas where hazardous conditions may contribute to the potential for *Legionella* amplification, including but not limited to:
 - i. All clinical support areas, including dietary and central sterile
 - ii. All patient care areas, including dialysis, respiratory therapy, and hydrotherapy
- f. All water use end points, including:
 - i. Cooling towers
 - ii. Open water features
 - iii. Spas and whirlpools
 - iv. Pools

- v Ice machines
- vi Humidifiers
- g. Other points determined by *Designated Team*

A4. RISK MANAGEMENT PLAN

A4.1 The legionellosis risk management plan must be contained within one or more documents. These documents are allowed to contain information that is not part of the legionellosis risk management plan and a master document providing the location of all plan documents shall be maintained. The legionellosis risk management plan shall include, without being limited to:

- a. the name, title and contact information for the *Designated Team* leader and the role and contact information for other *Designated Team* members
- b. the water system flow diagrams
- c. the systematic evaluation of physical and chemical conditions associated with each step in the water system flow diagrams, to determine where hazardous conditions can occur in the building water systems and where control measures may be applied
- d. identification of areas with higher probability of infection throughout the facility based on the intended use of water-based processes and the relative vulnerability of patients to legionellosis in areas designated for specialized care
- e. an evaluation of the results of A4.1.c. and A4.1.d. to estimate the likelihood of legionellosis
- f. the procedures required for prevention and control of legionellosis associated with the health care facility's building water systems. The procedures shall include:
 - i. identification of the control locations
 - ii. determination of the control limits
 - iii. development of monitoring procedures
 - iv. determination of corrective actions
- g. assignment of responsibility for each action required by the legionellosis risk management plan
- h. documentation of all aspects of the legionellosis risk management plan, including development, implementation, verification and validation
- i. disease prevention responses to elevated risk through monitoring of disease-surveillance. The responses shall include, without being limited to:
 - i. notification of relevant Infection Prevention and Control (IC), Environment of Care (EC)/facilities management, and provider staff of any test results that indicate elevated potential for *Legionella* amplification, transmission or infection
 - ii. procedures to be implemented when monitoring of control measures indicates deviation from control limits
 - iii. a determination if, when, where and how environmental testing for *Legionella* is to be performed
- j. actions to be taken by if the IC department identifies probable or confirmed legionellosis cases. The actions shall:
 - i. follow established Infection Control and Prevention Processes, including compliance with most recent requirements of the US Centers for Disease Control and Prevention (CDC) or other regional or national authority
 - ii. include implementation of remediation actions as necessary
 - iii. include evaluation of the legionellosis risk management plan and any necessary changes
- k. The *Designated Team* shall establish procedures to confirm, initially and on an ongoing basis that the legionellosis risk management program is implemented as designed (Verification) and that, when implemented as designed, the legionellosis risk management program effectively controls the hazardous conditions throughout the building water systems (Validation)

A5 EXISTING BUILDINGS, NEW CONSTRUCTION AND RENOVATIONS

A5.1 Existing Buildings. The *Designated Team* shall conduct an evaluation and estimate of the likelihood of legionellosis as specified in A4.1.e. for each existing building at least once per year. Based on the results of this evaluation and estimate, the *Designated Team* shall modify the legionellosis risk management plan as necessary. This process shall be repeated for all affected areas:

- a. whenever a building or portion of a building is changed, such that one or more water systems are affected,

- b. whenever major maintenance to a building water system is performed; including replacing tanks, pumps, heat exchangers, and replacement of distribution piping, and
- c. whenever there is a water service disruption from the supplier to the building.

A5.2 For new construction and renovations the *Designated Team* shall review the scope of work and determine the risk associated with the project and the Senior Organizational Leadership or their designee shall require the building designer and builder:

- a. to work cooperatively with the *Designated Team* to conduct an evaluation and estimate of the likelihood of legionellosis as specified in A4.1.5 for the project. Based on the results of this evaluation and estimate, the *Designated Team* shall modify the legionellosis risk management plan as necessary for the project (a) during the early planning, (b) during each phase of design and construction, and (c) during commissioning,
- b. to work cooperatively with the *Designated Team* to comply with all applicable portions of Section 9 “Requirements for Designing Building Water Systems,
- c. to provide timely documented reports to the *Designated Team* confirming compliance with the legionellosis risk management plan, and
- d. commissioning.

A6 BUILDING WATER SYSTEM PROCEDURES

A 6.1 The Legionellosis Risk Management Plan shall include procedures for the following building water systems:

- a. Potable water systems :
 - i. Section 7.1.2 “Systems Startup and Shutdown”
 - ii. Section 7.1.3 “System Maintenance”
 - iii. Section 7.1.4 “Water Treatment”
- b. Cooling towers:
 - i. Section 7.2.3 “System Maintenance”;
 - ii. Section 7.2.4 “Water Treatment”,
 - iii. Section 7.2.5 “Shutdown and Startup”,
 - iv. Section 7.2.6 “Disinfection of Cooling Towers and Evaporative Condensers”
 - v. Section 7.2.7 “Location of Cooling Tower Make-up Valve”
- c. Pools and spas shall be operated and maintained in accordance with original equipment manufacturer (OEM) requirements.
- d. Decorative fountains and open water features:
 - i. Section 7.4.2 “Operation”
 - ii. Section 7.4.3 “Maintenance”
 - iii. Section 7.4.4 “Water Treatment”.

(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

INFORMATIVE APPENDIX B

BIBLIOGRAPHY

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ASHRAE Guideline 12, “*Minimizing the Risk of Legionellosis Associated with Building Water Systems*”. ASHRAE, Atlanta, GA

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ASHRAE Handbook “*Applications*”, Chapter 48, “Water Treatment”. ASHRAE, Atlanta, GA

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Refer to the NSPF web site for applicable state and local swimming pool codes. (http://www.nspf.org/Codes_Links.html). National Swimming Pool Foundation, Colorado Springs, CO.

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INFORMATIVE APPENDIX C

Guidance if Legionella Testing Is Utilized

When testing of environmental water samples is utilized, it should be by a laboratory with demonstrated proficiency in the subject method, such as may be evidenced by certification by a national, regional or local government agency or by an accredited non-governmental organization (NGO).

For example, laboratories selected for evaluating environmental water samples for Legionella by culture should have demonstrated proficiency in the detection of Legionella in accordance with U.S. Centers for Disease Control and Prevention (CDC) Environmental Legionella Isolation Techniques Evaluation (ELITE) program, the European external quality assessment/proficiency testing program for Legionella isolation through Public Health England, or an equivalent program. In general, Laboratories used for microbiological testing of environmental water samples should be accredited in *Legionella* culture testing by a regional, national, or international accrediting body, for example, accredited to ISO/IEC 17025:2005 with *Legionella* culture testing in the Scope of Accreditation.