



STANDARD

ANSI/ASHRAE Standard 188-2015

Legionellosis: Risk Management for Building Water Systems

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NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE Web site at www.ashrae.org/technology.

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FOREWORD

The purpose of ASHRAE Standard 188 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” (LD). The Centers for Disease Control and Prevention (CDC) estimates that each year there are between 8000 and 18,000 cases of LD in the United States and that more than 10% 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*, 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 (nonaspirated) 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.*

This 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.

*Standard 188 consists of numbered normative sections followed by normative and informative annexes. The normative sections and normative annex specify the requirements to comply with this standard. The informative annexes and informative bibliography are provided for guidance that may be helpful 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 annexes and informative bibliography to this document provide suggestions, recommendations, and references to guidance.*

ASHRAE Standing Standard Project Committee (SSPC) 188 has devoted a considerable amount of time and thought to resolving the concerns of affected and interested parties. The committee thanks everyone who participated in the development of the standard, especially those who made public review comments.

Because changes to improve the standard are anticipated, Standard 188 is now on continuous maintenance, permitting it to be updated through the publication of approved addenda. The planned schedule for republication with approved addenda and errata is anticipated to be every third year.

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 (potable and *nonpotable*) water systems and components.

2.2 This standard applies to human-occupied commercial, institutional, multiunit residential, and industrial buildings. This standard does not include 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 the design, construction, installation, commissioning, operation, maintenance, and service of *centralized building water systems* and components.

3. DEFINITIONS

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

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

authority having jurisdiction (AHJ): an organization, office, or individual responsible for enforcing the requirements of this standard.

beneficial occupancy: stage of construction when all or part of a building is to be occupied for the purpose for which it was constructed, whether before or after completion.

building water systems: *potable* and *nonpotable* water systems in the building or on the site.

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 of values 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: chemical agent or physical treatments 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*.

HVAC&R: heating, ventilating, air conditioning, and refrigeration.

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*.)

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.

nonpotable: water that is not safe for drinking or for personal or culinary use 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 the plan's implementation and operation.

water service disruption: planned or unplanned events that reduce water delivery pressure below 20 psi (140 kPa) and that are caused by, but not limited to, new construction tie-ins; replacement of valves, hydrants, or 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 *nonpotable 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 (AHJ)*.

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 described in Section 5 that relate to *legionellosis*. If the building and associated property has

- any of the *building water systems* in Section 5.1, then all of those *building water systems* 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 shall survey each existing building, new building, and any renovation, addition, or modification to an existing building and its water systems as 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

- a. any of the *building water systems* listed in Section 5.1, then all of those *building water systems* shall comply with the requirements of Section 6 and all applicable requirements of Section 7 of this standard.
- b. any of the factors listed in Section 5.2, then all potable *building water systems* and all *building water systems* listed in Section 5.1 shall comply with the requirements of Sections 6 and all applicable requirements of Section 7 of this standard.

4.2.2 The building owner shall require the designer of any new building, and any 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 shall conduct and document the compliance determination in Section 4 of this standard at least once per year and any time 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 Section 4.3.2 shall comply with the requirements in Sections 4.2, 6, and 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 Annex A, "Health Care Facilities":

- a. 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.
- b. The health care facility IC program has an infection preventionist that is certified in infection prevention 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

- a. 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;
- b. whirlpools or spas, either in the building or on the site; or
- c. ornamental fountains, misters, atomizers, air washes, humidifiers, or other *nonpotable* water systems or 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 health care 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 *immuno-compromised*, *at-risk*, are taking drugs that weaken the immune system, have renal disease, have diabetes, or have chronic lung disease.
- 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. A *Program* utilizing the risk management principles in the following subsections 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, a minimum value, or a range of values 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 Section 6.1.3.

6.1.5 Corrective Actions. Establish the *corrective actions* to be taken when *monitoring* indicates that the *control* parameters are outside of the established *control limits*.

6.1.6 Confirm Program Implementation. Establish procedures to confirm that all of 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 one or more of the *building water systems* listed in Section 5.1 but none of the factors listed in Section 5.2, a program shall be

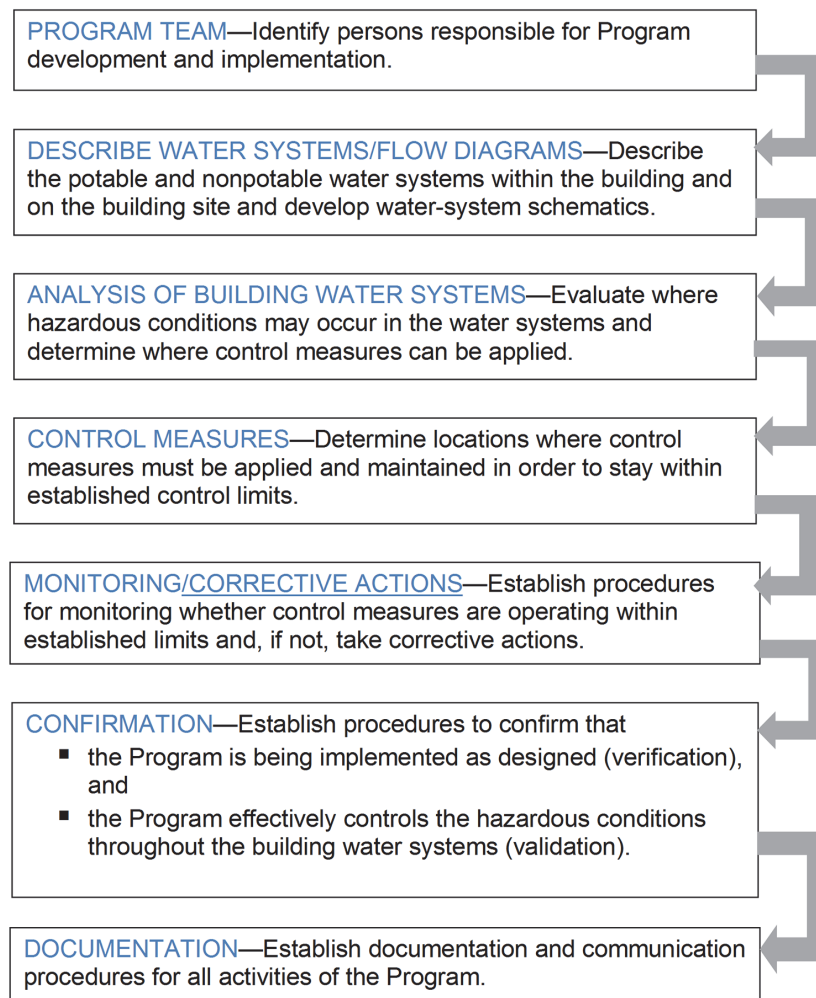


FIGURE 1 Elements of a water management program.

implemented to manage the risk of *legionellosis* for those *building water systems* listed in Section 5.1. When the building survey required by Sections 4 and 5 indicates the presence of one or more of the factors listed in Section 5.2, a *Program* shall be implemented to manage the risk of *legionellosis* for *potable building water systems* and for *building water systems* listed in Section 5.1. A summary of the program development steps are represented in Figure 1. The *Program* shall be detailed in a plan that embodies all of the principles described in Section 6.1 and shall include the elements described in the following subsections.

6.2.1 Program Team. Identify the persons 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 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 the *building water system* design and water management as it relates to *legionellosis* that can be obtained through informative documents,

such as ASHRAE Guideline 12, *Minimizing the Risk of Legionellosis Associated with Building Water Systems*.

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

- the locations of end-point uses of *potable* and *nonpotable water systems*,
- the location of water processing equipment and components, 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 that 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 *building water systems* 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*.

- a. **Control Locations.** The *Program Team* shall determine the locations in the *building water system* where *control measures* are required.
- b. **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* whether 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 that *control measures* are outside of 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 whether *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 test methods, shall be specified and documented. The *Program Team* shall include consideration of the following as part of the determination of whether to test for *Legionella*:

- a. *Program control limits* are not maintained in *building water systems*, including in water systems with supplemental *disinfection*.
- b. A health care facility provides in-patient services to *at-risk* or *immunocompromised* populations.
- c. A prior history of *legionellosis* is 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 subgroups covering different portions of the *building water system* and associated equipment. A master document providing the location of all *Program* documents shall be maintained.

7. REQUIREMENTS FOR BUILDING WATER SYSTEMS

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

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*.

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

- a. Section 7.1, “Potable Water Systems”
- b. Section 7.2, “Cooling Towers and Evaporative Condensers”
- c. Section 7.3, “Whirlpool Spas”
- d. Section 7.4, “Ornamental Fountains and Other Water Features”
- e. Section 7.5, “Aerosol-Generating Mistifiers, Atomizers, Air Washers, and Humidifiers”

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*.

7.1.1 System Start-Up and Shutdown. The *Program* documents shall include procedures for

- a. flushing 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 undrained shutdown condition;
- e. *monitoring* and treatment following water supply interruptions or breaks in water supply piping; and
- f. reestablishing required temperatures throughout the hot water distribution system.

7.1.2 System Maintenance. The *Program* documents shall include procedures for

- a. inspection of, and 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, *dis-*

infection, replacement of system components, and other treatments that the *Program Team* decides are necessary for the following:

1. Hot water and cold water storage tanks
 2. Ice machines
 3. Water-hammer arrestors
 4. Expansion tanks
 5. Water filters
 6. Shower heads and hoses
 7. Electronic faucets
 8. Aerators
 9. Faucet flow restrictors
 10. Nonsteam aerosol-generating humidifiers
 11. Water heaters
 12. Infrequently used equipment, including eyewash stations and showers
 13. 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.

7.1.3 Water Treatment. The *Program* documents shall include

- a. *monitoring* method and schedule for temperature measurement in the hot water and cold water system;
- b. *monitoring* method and schedule for measuring the chemical *disinfectant residual* or physical parameters in the hot water 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 system *disinfectants*; and
- e. water treatment products, the procedures for their application, and confirmation that the products comply with applicable regulations.

7.1.4 Contingency Response Plan. For both hot water and cold water systems, the *Program* documents shall include

- 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. directives 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 as necessary 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. Prior to the beginning of construction of new or replacement open-circuit cooling towers, closed-circuit cooling towers, or evaporative condensers, drawings shall be reviewed and the following items shall be addressed:

- a. Potential contamination from building systems or facility processes to be drawn into the equipment
- b. Potential for equipment to discharge into occupied spaces, trafficable areas, pedestrian thoroughfares, outdoor air intakes, and building openings
- c. Potential for equipment siting that inhibits access to the equipment for the required maintenance and inspection consistent with the manufacturer's instructions and guidelines

7.2.2 New-System Start-Up. The *Program* document shall include procedures for cleaning steps that are part of commissioning of the cooling system. The *Program* document shall also include procedures for 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

- a. a schedule for inspection of general system cleanliness, of drift eliminator condition and fill material condition, and of water distribution system operation;
- b. requirements and 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 Start-Up. The *Program* documents shall include start-up and shutdown requirements to manage *hazardous conditions* associated with operation of fans during untreated water conditions and procedures for

- 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. start-up from a drained system; and
- c. start-up from an undrained (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 proce-

dures and identify the responsible person for initiating the process for

- 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 Makeup Valve. The *Program* documents shall include requirements for the location of cooling tower makeup valves and for maintaining compliance with all applicable local, regional, and national codes and regulations for air gaps and backflow preventers and for the height of the discharge outlets and makeup valve over the rim of the overflow in the cooling tower or evaporative condenser cold water basins. If no such codes and regulations exist for the location, then the *Program* shall include requirements for maintaining compliance with ASME/ANSI A112.1.2¹ 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 for the height of the discharge outlets and makeup valve over the rim of the outflow in the cooling tower or evaporative condenser cold water basins.

7.2.8 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 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* 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;
- d. procedures for emergency *disinfection*;
- 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

- a. 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* or *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 gages, 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 gages, valves, and related equipment.

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

- 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 that are to be achieved by public whirlpool spas.

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

- a. 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 no codes or regulations apply;
- c. maintaining the levels of indicator organisms at or below the standard threshold;
- d. when and where tests shall be performed, proper sampling procedures, and the interpretation of test results should the *Program Team* determine that *testing* for *Legionella* or other pathogens is required;
- 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 include 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

- 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, proper sampling procedures, and the interpretation of test results;
- 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 Ornamental Fountains and Other Water Features. This section describes the preventative measures required for ornamental fountains and other water features that release water aerosols in the building or on the site. 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. Prior to beginning construction of an ornamental fountain or other water feature, drawings shall be reviewed and the following items shall be addressed:

- a. Potential organic contamination from adjacent sources
- b. Inadequate drains and stagnant areas
- c. Inadequate access to pumps, filters, tanks, and treatment equipment
- d. External heat sources and inadequate airflow that increase the temperature and thereby 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 pumps are running.

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

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

- a. the weekly cleaning, *disinfection* of equipment and components, and replacement of water in systems with total water volume <5 gal (20 L) or for the periodic use of a *disinfectant*, the products to be applied, and a requirement to follow *disinfectant* manufacturer's directions;
- b. the periodic use of a *disinfectant*, the products to be applied, and a requirement to follow *disinfectant* manufacturer's directions for systems ≥5 gal (20 L); and
- c. maintaining water temperature within the *control limits* in the *Program*.

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 that *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 Mistifiers, Atomizers, Air Washers, and Humidifiers. This section describes the preventative measures required for mistifiers, 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. Prior to beginning construction for installation of new or replacement aerosol-generating mistifiers, atomizers, air washers, or humidifiers, drawings shall be reviewed and the following items addressed:

- a. Potential contamination from sources that can be drawn into the system
- b. Inadequate access to pumps, filters, and treatment equipment for maintenance and inspection
- c. External heat sources and inadequate airflow that increase the temperature and thereby the *risk* of exposure to *Legionella*

7.5.2 New-System Start-Up. The *Program* documents shall have procedures for cleaning that is required when commissioning mistifiers, 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 procedure 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 or pump cycling, and procedures for shutdown periods that exceed the number of idle days specified by the *Program Team*;
- b. system start-up from a drained condition; and
- c. system start-up 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 that *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, renovations, refurbishment, replacement, or repurposing of 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:
 1. Schematic diagrams of water systems
 2. *Monitoring* and control diagrams of water systems
 3. Local, regional, and national code compliance

4. Locations of the following points: makeup, flush, sampling, temperature monitoring, and drain
5. Locations of outdoor air intakes
6. Building water equipment
7. Commissioning
8. Operating instructions and procedures
9. Maintenance schedules, frequencies, and procedures
10. No-flow and low-flow portions of the piping and *building water systems*
11. Impact of heat loss from hot water or heat gain by cold water in piping and water system components
12. Possible cross connections between potable and *non-potable* water
13. Inadequate access to water expansion tanks, water-hammer arrestors, water storage tanks, 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

- a. the location of 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, treatment points, and drain provisions;
- c. the location of all outdoor air intakes;
- d. size and options for each piece of water system equipment;
- e. applicable control system wiring diagrams, schematics, equipment and component 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 for all equipment;
- j. start-up requirements for all equipment;
- k. operational requirements for all equipment and systems; and
- 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. Commissioning shall include the following:

- a. Procedures for flushing and *disinfection*
 1. Procedures shall meet the requirements of AWWA C651² or AWWA C652³ or comply with all applicable national, regional, and local regulations.

2. *Disinfection* and flushing shall be completed within three weeks prior to whole or partial *beneficial occupancy*.
 - i. If *beneficial occupancy* of any part of the building is delayed more than two weeks but less than four weeks after *disinfection*, flushing of all fixtures shall again be completed.
 - ii. If *beneficial occupancy* of any part of the building is delayed four weeks or more after *disinfection*, the need for *disinfection* and/or flushing for unoccupied areas shall be determined by a *risk* assessment conducted by the water *Program Team*.
- b. Confirmation that *building water system* performance meets design performance parameters documented in Sections 8.2.1 and 8.3

9. REFERENCES

1. ASME. 2012. ASME/ANSI A112.1.2, *Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water-Connected Receptors)*. New York: The American Society of Mechanical Engineers.
2. AWWA. 2014. AWWA/ANSI C651, *Disinfecting Water Mains*. Denver, CO: American Water Works Association.
3. AWWA. 2011. AWWA/ANSI C652, *Disinfection of Water Storage Facilities*. Denver, CO: American Water Works Association.
4. EPA. 1979. Pesticides: Science and Policy. Swimming Pool Water Disinfectants. DIS/TCC-12, U.S. Environmental Protection Agency, Washington, DC. www.epa.gov/oppad001/dis_tss_docs/dis-12.htm.

(This is a normative annex and is part of this standard.)

NORMATIVE ANNEX 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 ANNEX A

legionellosis risk management plan: the documents that contain all information pertaining to the development and implementation of the *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 person with senior organizational leadership authority to make command decisions about water restrictions or other response measures;
- a member of the facilities management staff familiar with the *building water systems*; and
- 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 Annex 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

- all water supply sources;
- all water supply service entrances;
- all water treatment systems and *control measures*, including *disinfection* and filtration;
- all water processing steps, including but not limited to receiving, conditioning, storing, heating, cooling, recirculating, and distributing;
- all areas where *hazardous conditions* may contribute to the potential for *Legionella* amplification, including but not limited to

- all clinical support areas, including dietary and central sterile, and
- all patient care areas, including dialysis, respiratory therapy, and hydrotherapy;
- all *water use end points*, including
 - cooling towers,
 - open water features,
 - spas and whirlpools,
 - pools,
 - ice machines, and
 - humidifiers; and
- other points determined by the *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,

- the name, title, and contact information for the *Designated Team* leader and the role and contact information for other *Designated Team* members;
- the *water system flow diagrams*;
- 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;
- 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;
- an evaluation of the results of Sections A4.1(c) and A4.1(d) to estimate the likelihood of *legionellosis*;
- the procedures required for prevention and *control* of *legionellosis* associated with the health care facility's *building water systems*, including
 - identification of the *control locations*,
 - determination of the *control limits*,
 - development of *monitoring* procedures, and
 - determination of *corrective actions*;
- assignment of responsibility for each action required by the *legionellosis risk management plan*;
- documentation of all aspects of the *legionellosis risk management plan*, including development, implementation, verification, and validation;
- disease prevention responses to elevated *risk* through *monitoring* of disease surveillance, including but not limited to
 - notification of relevant IC, Environment of Care (EC)/facilities management, and provider staff of any test results that indicate elevated potential for *Legionella* amplification, transmission or infection;

2. procedures to be implemented when *monitoring of control measures* indicates deviation from *control limits*; and
3. a determination if, when, where, and how environmental testing for *Legionella* is to be performed;
- j. actions to be taken if the IC department identifies probable or confirmed *legionellosis* cases; the actions shall
 1. follow established IC processes, including compliance with most recent requirements of the U.S. Centers for Disease Control and Prevention (CDC) or other regional or national authority;
 2. include implementation of remediation actions as necessary;
 3. include evaluation of the *legionellosis risk management plan* and any necessary changes; and
- k. procedures established by the *Designated Team* to confirm initially and on an ongoing basis that the *legionellosis risk management plan* is implemented as designed (*verification*) and that, when implemented as designed, the *legionellosis risk management plan* 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 Section A4.1(e) at least once per year for each existing building. 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 system is affected;
- b. whenever major maintenance to a *building water system* is performed, including replacing tanks, pumps, heat exchangers, and 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* for the project as specified in Section A4.1.5; based on the results of this evaluation and estimate, the *Designated Team* shall modify the *legionellosis risk management plan* as necessary for the project (1) during the early planning, (2) during each phase of design and construction, and (3) during commissioning;
- b. to work cooperatively with the *Designated Team* to comply with all applicable portions of Section 9;

- c. to provide timely documented reports to the *Designated Team* confirming compliance with the *legionellosis risk management plan*; and
- d. to provide a commissioning plan.

A6. BUILDING WATER SYSTEM PROCEDURES

A6.1 The *legionellosis risk management plan* shall include procedures for the following *building water systems* or shall include a determination and rationale by the *Designated Team* for any procedures that are not required:

a. Potable water systems

1. **Systems start-up and shutdown.** The *legionellosis risk management plan* documents shall include procedures for
 - i. flushing and *disinfection* before commissioning any new system;
 - ii. shutdown, including any draining, purging, cleaning treatment, and *control* settings;
 - iii. any unplanned loss of operating energy, loss of water treatment chemicals, or system component repair or replacement;
 - iv. restarting safely from a drained shutdown condition and from an undrained (stagnant) shutdown condition;
 - v. *monitoring* and treatment following water supply interruptions or breaks in water supply piping; and
 - vi. reestablishing required temperatures throughout the hot water distribution system.
2. **System maintenance.** The *legionellosis risk management plan* documents shall include procedures for
 - i. inspection and the inspection schedule for water-containing vessels and system components;
 - ii. flushing or mixing of stagnant or low-flow areas;
 - iii. maintenance and *monitoring* procedures based on equipment manufacturers' recommendations for cleaning, *disinfection*, replacement of system components, and other treatments the *Designated Team* decides are necessary for
 - (a) hot water and cold water storage tanks;
 - (b) ice machines;
 - (c) water-hammer arrestors;
 - (d) expansion tanks;
 - (e) water filters;
 - (f) shower heads and hoses;
 - (g) electronic faucets;
 - (h) aerators;
 - (i) faucet flow restrictors;
 - (j) nonsteam aerosol-generating humidifiers;
 - (k) water heaters;
 - (l) infrequently used equipment, including eye-wash stations and showers;
 - (m) other equipment identified by the *Designated Team*;
 - (n) maintaining and storing instructions and forms for inspection notes and a correction action log; and
 - (o) maintaining and sorting component and equipment operating manuals.

3. **Water treatment.** The *legionellosis risk management plan* documents shall include
 - i. *monitoring* method and schedule for temperature measurement in the hot water and cold water systems;
 - ii. *monitoring* method and schedule for measuring the chemical *disinfectant residual* or physical parameters in the hot water and cold water system;
 - iii. procedures to address water supply interruptions or breaks in water supply piping;
 - iv. procedures and schedule for maintaining water treatment system *disinfectants*; and
 - v. water treatment products, the procedures for their application, and confirmation that the products comply with applicable regulations.
- b. **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 systems or for other devices or systems in the building. The *legionellosis risk management plan* documents shall include identification of the responsible persons for every step of each *legionellosis risk management plan* requirement.
 1. **System maintenance.** The *legionellosis risk management plan* documents shall include
 - i. a schedule for inspections of general system cleanliness, drift eliminator condition, condition of fill material, and water distribution system operation;
 - ii. requirements and the schedule for basin or remote sump cleaning and purging of stagnant or low-flow zones; and
 - iii. documentation requirements.
 2. **Water treatment.** The *legionellosis risk management plan* documents shall include the water treatment requirements to *control* microbiological activity, scale, and corrosion and shall also
 - i. specify all equipment and chemicals used for the purpose of treating the open recirculating loop;
 - ii. include the minimum required schedule for inspection, maintenance, and *monitoring* and a *corrective actions* plan; and
 - iii. identify the minimum requirements for documenting system water treatment.
 3. **Shutdown and start-up.** The *legionellosis risk management plan* documents shall include start-up and shutdown requirements to manage *hazardous conditions* associated with operation of fans during untreated water conditions and procedures for
 - i. shutdown that include all chemical pretreatment steps, pump cycling protocols, and procedures for system drainage for shutdown periods longer than the duration specified by the *Designated Team*;
 - ii. start-up from a drained system; and
 - iii. start-up from an undrained (stagnant) system that exceeds the number of idle days specified by the *Designated Team*.
 4. **Disinfection of cooling towers and evaporative condensers.** The *legionellosis risk management plan* documents shall include procedures and identify the person responsible for initiating the process for
 - i. remedial *disinfection* while in operation, including the conditions that require its application; and
 - ii. emergency *disinfection*, including the conditions that require its application.
5. **Location of cooling tower makeup valve.** The *legionellosis risk management plan* documents shall include requirements for the location of cooling tower makeup valves and for maintaining compliance with all applicable local, regional, and national codes and regulations for air gaps and backflow preventers and for the height of the discharge outlets and makeup valve over the rim of the overflow in the cooling tower or evaporative condenser cold water basins. If no such codes and regulations exist for the location, then the *legionellosis risk management plan* shall include requirements for maintaining compliance with ASME/ANSI A112.1.2¹ 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 for the height of the discharge outlets and makeup valve over the rim of the outflow in the cooling tower or evaporative condenser cold water basins.
- c. **Pools and spas.** Pools and spas shall be operated and maintained in accordance with original equipment manufacturer (OEM) requirements.
- d. **Ornamental fountains and open water features**
 1. **Operation.** The *legionellosis risk management plan* documents shall include a description of the procedures for
 - i. 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 *Designated Team*;
 - ii. confirming that submerged lights will not operate unless the circulating pump is running; and
 - iii. confirming that circulating pumps are running.
 2. **Maintenance.** The *legionellosis risk management plan* documents shall include procedures for regular cleaning; for cleaning the visible buildup of dirt, organic matter, or other debris; and for maintaining pumps and filters as recommended by the manufacturer.
 3. **Water treatment.** The *legionellosis risk management plan* documents shall include procedures for
 - i. the weekly cleaning, *disinfection* of equipment and components, and replacement of water in systems with total water volume <5 gal (20 L) or for the periodic use of a *disinfectant*, the products to be applied, and a requirement to follow *disinfectant* manufacturer's directions;
 - ii. the periodic use of a *disinfectant*, the products to be applied, and a requirement to follow *disinfectant* manufacturer's directions for systems ≥5 gal (20 L); and
 - iii. maintaining water temperature within the *control limits* in the *legionellosis risk management plan*.

(This annex 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 ANNEX B BIBLIOGRAPHY

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INFORMATIVE ANNEX 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 nongovernmental organization (NGO).

Laboratories performing microbiological culture *testing* of environmental water samples should be accredited by a

regional, national, or international accrediting body according to a nationally or internationally recognized standard, for example ISO/IEC 17025:2005. *Legionella* culture *testing* must be included as well as the laboratory's scope of accreditation.

As part of the laboratory accreditation, laboratories should have demonstrated proficiency in the detection of *Legionella* culture in accordance with one of the following:

- a. U.S. Centers for Disease Control and Prevention (CDC) Environmental *Legionella* Isolation Techniques Evaluation (ELITE) Program
- b. European external quality assessment/proficiency *testing* program for *Legionella* isolation through Public Health England
- c. An equivalent, nationally accredited proficiency test provider

NOTICE

INSTRUCTIONS FOR SUBMITTING A PROPOSED CHANGE TO THIS STANDARD UNDER CONTINUOUS MAINTENANCE

This standard is maintained under continuous maintenance procedures by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. SSPC consideration will be given to proposed changes within 13 months of receipt by the Senior Manager of Standards (SMOS).

Proposed changes must be submitted to the SMOS in the latest published format available from the SMOS. However, the SMOS may accept proposed changes in an earlier published format if the SMOS concludes that the differences are immaterial to the proposed change submittal. If the SMOS concludes that a current form must be utilized, the proposer may be given up to 20 additional days to resubmit the proposed changes in the current format.

ELECTRONIC PREPARATION/SUBMISSION OF FORM FOR PROPOSING CHANGES

An electronic version of each change, which must comply with the instructions in the Notice and the Form, is the preferred form of submittal to ASHRAE Headquarters at the address shown below. The electronic format facilitates both paper-based and computer-based processing. Submittal in paper form is acceptable. The following instructions apply to change proposals submitted in electronic form.

Use the appropriate file format for your word processor and save the file in either a recent version of Microsoft Word (preferred) or another commonly used word-processing program. Please save each change proposal file with a different name (for example, "prop01.doc," "prop02.doc," etc.). If supplemental background documents to support changes submitted are included, it is preferred that they also be in electronic form as word-processed or scanned documents.

For files submitted attached to an e-mail, ASHRAE will accept an electronic signature (as a picture; *.tif, or *.wpg) on the change submittal form as equivalent to the signature required on the change submittal form to convey non-exclusive copyright.

Submit an e-mail containing the change proposal files to:
change.proposal@ashrae.org

Alternatively, mail paper versions to:
ASHRAE
Senior Manager of Standards
1791 Tullie Circle, NE
Atlanta, GA 30329-2305

Or fax them to:
Attn: Senior Manager of Standards
404-321-5478

The form and instructions for electronic submittal may be obtained from the Standards section of ASHRAE's Home Page, www.ashrae.org, or by contacting a Standards Secretary via phone (404-636-8400), fax (404-321-5478), e-mail (standards.section@ashrae.org), or mail (1791 Tullie Circle, NE, Atlanta, GA 30329-2305).



FORM FOR SUBMITTAL OF PROPOSED CHANGE TO AN ASHRAE STANDARD UNDER CONTINUOUS MAINTENANCE

NOTE: Use a separate form for each comment. Submittals (Microsoft Word preferred) may be attached to e-mail (preferred), or submitted in paper by mail or fax to ASHRAE, Senior Manager of Standards, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: change.proposal@ashrae.org. Fax: +1-404-321-5478.

1. Submitter:

Affiliation:

Address:

City:

State:

Zip:

Country:

Telephone:

Fax:

E-Mail:

I hereby grant ASHRAE the non-exclusive royalty rights, including non-exclusive rights in copyright, in my proposals. I understand that I acquire no rights in publication of the standard in which my proposals in this or other analogous form is used. I hereby attest that I have the authority and am empowered to grant this copyright release.

Submitter's signature: _____ Date: _____

All electronic submittals must have the following statement completed:

I (insert name), through this electronic signature, hereby grant ASHRAE the non-exclusive royalty rights, including non-exclusive rights in copyright, in my proposals. I understand that I acquire no rights in publication of the standard in which my proposals in this or other analogous form is used. I hereby attest that I have the authority and am empowered to grant this copyright release.

2. Number and year of standard:

3. Page number and clause (section), subclause, or paragraph number:

- 4. I propose to:** ☐ Change to read as follows ☐ Delete and substitute as follows
(check one) ☐ Add new text as follows ☐ Delete without substitution

Use underscores to show material to be added (added) and strike through material to be deleted (~~deleted~~). Use additional pages if needed.

5. Proposed change:

6. Reason and substantiation:

7. Will the proposed change increase the cost of engineering or construction? If yes, provide a brief explanation as to why the increase is justified.

☐ Check if additional pages are attached. Number of additional pages: _____

☐ Check if attachments or referenced materials cited in this proposal accompany this proposed change. Please verify that all attachments and references are relevant, current, and clearly labeled to avoid processing and review delays. *Please list your attachments here:*

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

About ASHRAE

ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration, and sustainability. Through research, Standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow's built environment today.

For more information or to become a member of ASHRAE, visit www.ashrae.org.

To stay current with this and other ASHRAE Standards and Guidelines, visit www.ashrae.org/standards.

Visit the ASHRAE Bookstore

ASHRAE offers its Standards and Guidelines in print, as immediately downloadable PDFs, on CD-ROM, and via ASHRAE Digital Collections, which provides online access with automatic updates as well as historical versions of publications. Selected Standards and Guidelines are also offered in redline versions that indicate the changes made between the active Standard or Guideline and its previous version. For more information, visit the Standards and Guidelines section of the ASHRAE Bookstore at www.ashrae.org/bookstore.

IMPORTANT NOTICES ABOUT THIS STANDARD

To ensure that you have all of the approved addenda, errata, and interpretations for this Standard, visit www.ashrae.org/standards to download them free of charge.

Addenda, errata, and interpretations for ASHRAE Standards and Guidelines are no longer distributed with copies of the Standards and Guidelines. ASHRAE provides these addenda, errata, and interpretations only in electronic form to promote more sustainable use of resources.