ANSI/ASHRAE Standard 188-2015

Legionellosis: Risk Management for Building Water Systems

25th Annual Rocky Mountain Chapter ASHRAE Technical Conference

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C&IH
CHEMISTRY & INDUSTRIAL HYGIENE, INC.

About ASHRAE Standards

Standards Development

ASHRAE Standards are:

Voluntary, Consensus, Codified, Accredited
Measurement or Test
Standard of Design
Standard of Practice

Where to find the Standard:

ASHRAE Standards are available for purchase but may also be viewed at no charge on the ASHRAE website:

www.ashrae.org/standards
Click on ‘Preview ASHRAE Standards’

History: Legionellosis or Legionaires Disease

- 1976: First isolated as a unique strain in 1976 occurring at an American Legion convention held at the Bellevue Stratton Hotel in Philadelphia. Previously unknown strain of bacteria, subsequently named Legionella. 221 attendees contracted the acute pneumonia-like disease, 34 deaths
- 1985: Stafford, England - hospital cooling tower - 175 sickened, 28 deaths
- 1999: Netherlands – Flower Exposition - 318 illnesses, 32 deaths
- 2001: Murcia, Spain – 800 suspected cases, 449 confirmed, 6 deaths
- 2005: Canada – Nursing home cooling tower - 127 illnesses, 21 deaths
- 2014: Lisbon, Portugal – Fertilizer plant cooling tower 302 hospitalizations, 7 deaths

ASHRAE Issues Long Awaited Standard 188 Published June 2015

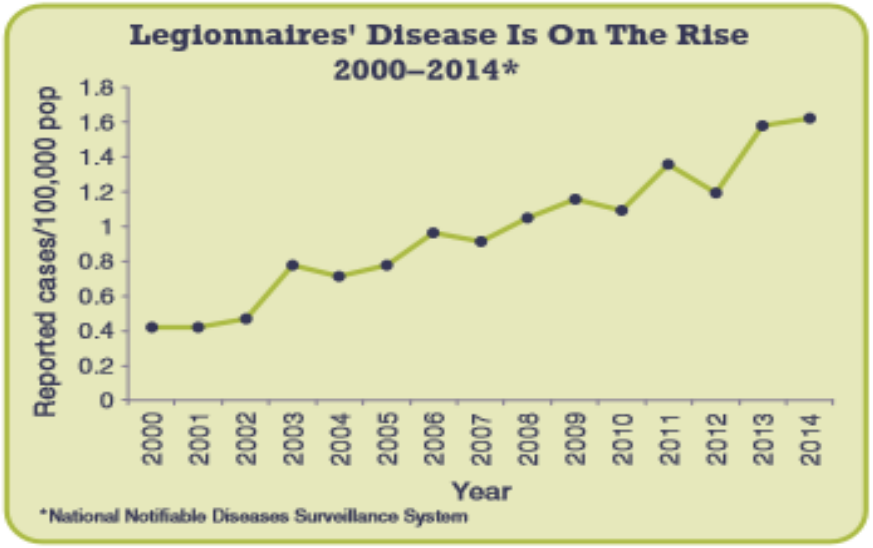
Less than a month later:

July into August 2015 – Bronx

Opera House Hotel cooling tower

120 people sickened – 12 deaths





In the United States, reported cases of Legionnaires' disease have increased by nearly four times since 2000. More illness occurs in the summer and early fall but can happen any time of year.

* Source: CDC, Dept. of Health and Human Services, June 2016

September 2015 – also in the Bronx

13 additional illnesses - 1 more death

This cooling tower had been cleaned during the earlier outbreak!

Newsweek

TECH & SCIENCE

NEW YORK CITY COUNCIL PASSES LAW TO CURB LEGIONNAIRES' OUTBREAK

BY JESSICA FIRGER ON 8/13/15 AT 6:58 PM

The New York City Council voted unanimously on Thursday to pass legislation that mandates strict regulations of cooling towers, a move that comes in response to the current outbreak of Legionnaires' disease in the South Bronx. The Council voted 42-0 in favor of new regulations



New Emergency Regulations Take Immediate Effect to Prevent Spread of Legionella and Protect New Yorkers

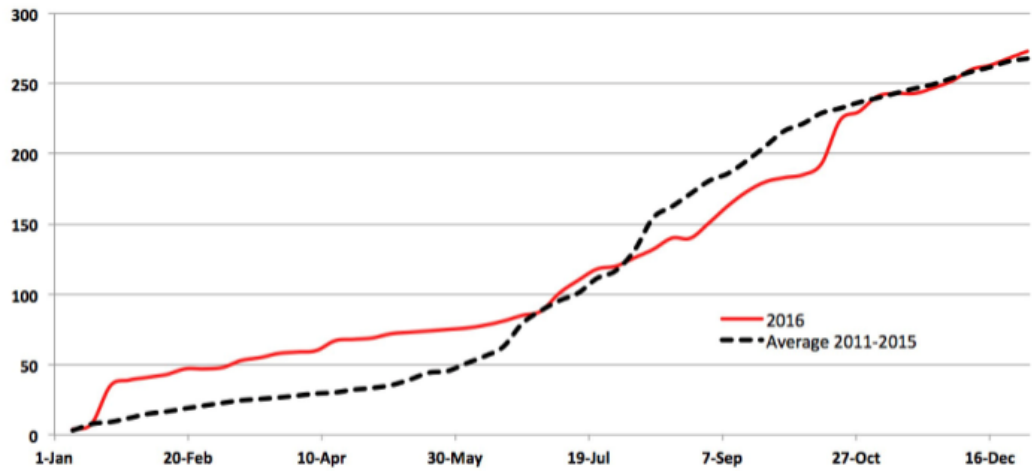
Alliance to Prevent Legionnaires' Disease

MISGUIDED HEALTH POLICY PUTS PUBLIC AT RISK FOR LEGIONNAIRES' DISEASE

ASSESSMENT OF NEW YORK REGULATIONS TO PREVENT LEGIONNAIRES' DISEASE ENACTED IN AUGUST 2015

NEW YORK REGULATIONS HAVE NOT REDUCED LEGIONNAIRES' DISEASE CASES

Figure 4. Reported Legionellosis 2016 compared to 5-year average New York City[20]



A large outbreak of Legionnaires' disease in the South Bronx during the summer of 2015 prompted New York City and New York State officials to enact emergency regulations. Unfortunately, these regulations ignored issues with the public water system and instead narrowly focused only on water-cooled air conditioning systems with cooling towers. This was because water-cooled air conditioning systems were quickly declared to be the source of the bacteria causing the outbreak without an investigation of the public water supply and without following the Centers for Disease Control and Prevention's (CDC) investigation protocols.

Legionellosis:
Legionnaires' Disease, Pontiac Fever, (et. al.)

Caused by exposure to Legionella bacteria in mists from cooling towers, whirlpool spas, faucets & showers, decorative fountains…





- Legionnaires' Disease
  - *A type of pneumonia w/ lung inflammation and usually infection with fatality rate of up to 10%*
  - *Treated with antibiotics*
  - *2-4 months for full recovery*
- Pontiac Fever
  - *Non-pneumonia, flu-like illness*
  - *Far milder than LD*
  - *Does not require treatment*
  - *Recovery in 2-5 days*





Legionella Propagation Factors within Building Water Systems*

1. Bioflilm – surfaces within water systems that are constantly moist generate slime, provide food and shelter for the organism
2. Scale and sediment – provide similar protected areas for bacteria to prosper
3. Water temperature – Optimal (ASHRAE & CDC:77ºF-108ºF, AIHA: 80-120ºF)
4. Water pressure fluctuations and/or vibrations – can cause biofilms to dislodge colonizing downstream devices
5. pH – fluctuations can diminish effects of disinfection
6. Inadequate disinfectant – heating, filtering, and storing water can diminish water quality
7. Water stagnation – encourages biofilm growth with subsequent temperature and disinfectant sheltering of bacteria

Similar conditions can occur in water distribution piping and systems outside the building

* Source: CDC, Dept. of Health and Human Services, June 2016



Legionella pneumophila

Legionella is found naturally in freshwater environments, like lakes and streams, but generally the low amounts in freshwater do not lead to disease. *Legionella* can become a health problem in building water systems. To pose a health risk, *Legionella* first has to **grow** (increase in numbers). Then it has to be **aerosolized** so people can breathe in small, contaminated water droplets.*

Who Gets Legionellosis? Where?

Susceptable populations:

- *Age > 50 years*
- *Current or former smoker*
- *Chronic lung diseases (emphysema, COPD)*
- *Weakened immune system (cancer, diabetes, HIV AIDS, Kidney failure)*
- *Taking medications that weaken immune systems*



Occupancies:

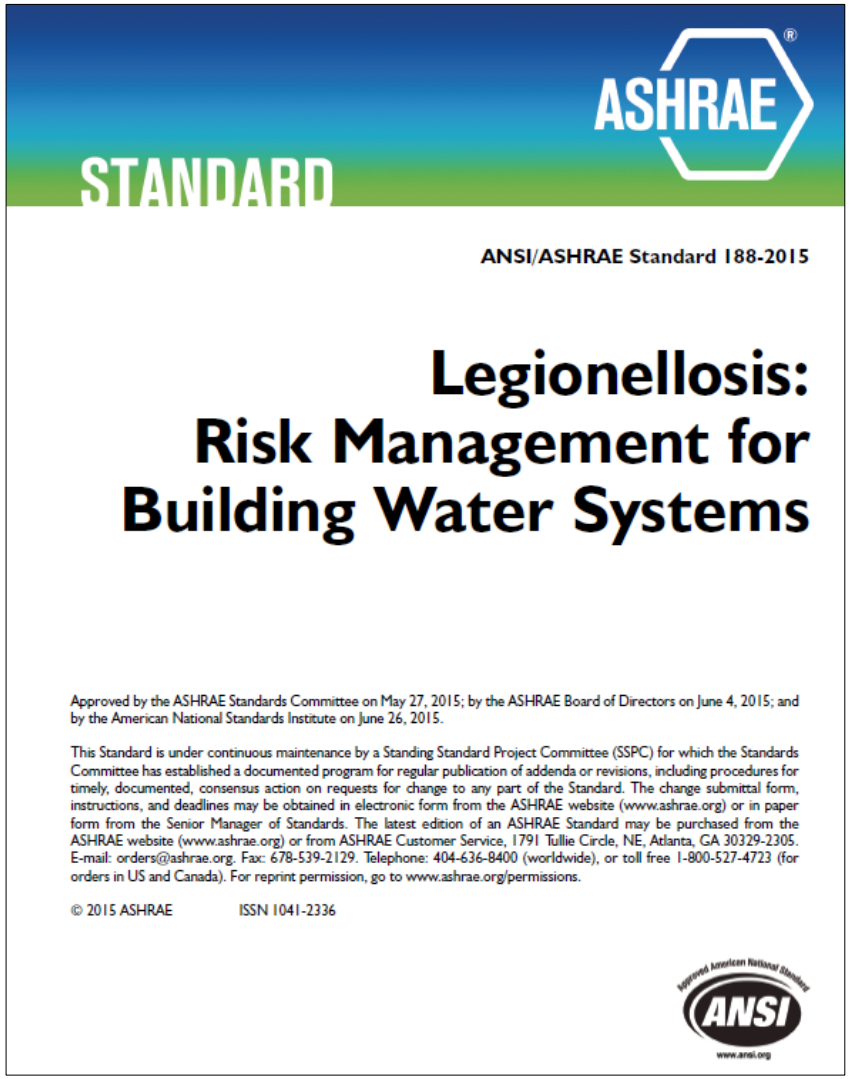
- *Hospitals*
- *Nursing homes, elder care facilities*
- *Recreational pools, water features, spas, decorative fountains*
- *Hotels, office buildings with proximities to cooling towers*



ANSI/ASHRAE Standard 188-2015
Legionellosis: Risk Management for Building Water Systems

Nine Sections

1. Purpose
2. Scope
3. Definitions
4. Compliance
5. Building Survey
6. General Requirements
7. Requirements for Building Water Systems
8. Requirements for Designing Building Water Systems
9. References
10. Annex A – Health Care Facilities



ANSI/ASHRAE Standard 188-2015
Legionellosis: Risk Management for Building Water Systems

Section 1 - Purpose:

To establish minimum *Legionellosis* risk management requirement for *building water systems (BWS)*

Section 2 - Scope:

1. Requirements for design, construction, commissioning, operation, maintenance, repair, replacement, and expansion for new and existing buildings (potable and non-potable) water systems
2. Applies to human-occupied commercial, institutional, multi-unit residential, and industrial buildings
3. Intended for use by owners, managers, and those involved in design construction, installation, commissioning, operation, maintenance, and service of centralized building water systems and components

Section 3 - Definitions:



Definition - Risk Management: Systematic Practices to Reduce Risk

Section 4 – Compliance (Documentation for AHJ)

- *Building Designer, Building Owner, & Health Care Facility Requirements:*
  - *Determine Qualifying BWS relating to legionellosis as described in Section 5.1*
    - If any qualify, then all qualify and must comply with Section 6 and Applicable section 7.
  - *Determine Qualifying Building Characteristics relating to legionellosis in Section 5.2*
    - If any qualify, then all qualify and must comply with Section 6 and Applicable section 7. Includes potable water systems. New building design characteristics comply with Section 8.
  - *Special Conditions for Health Care Facilities that:*
    - are accredited by a regional, national, or international accrediting agency or AHJ
    - have an infection control (IC) program that is operated by a certified preventionist or epidemiologist with a master's degree or equivalent.
    - Must comply with Sections 6 & 7 or Normative Annex A

Building Survey – Compliance Criteria

Section 5 – Building Survey

- *§5.1 Qualifying Water Systems: (Non-Potable Water)*
  - *Open and closed-circuit cooling towers or evaporative condensers*
  - *Whirlpools or spas within the building or on-site*
  - *Ornamental fountains, misers, atomizers, air washers, humidifiers, or other water aerosolizing devices*
- *§5.2 Qualifying Building Characterizations: (Potable and Non-Potable Water)*
  - *Multiple housing units with one or more centralized potable water-heater systems*
  - *Greater than 10 stories including below grade levels*
  - *Health care facilities with patient stays exceeding 24 hours*
  - *Treatment centers for burn patients, chemotherapy, solid organ or bone marrow transplantation*
  - *Buildings housing or treating occupants that are immunocompromised, at-risk, are taking drugs that weaken immune systems, that have renal disease, diabetes or chronic lung disease*
  - *Buildings that house occupants over the age of 65 years.*

Section 6 - General Requirements

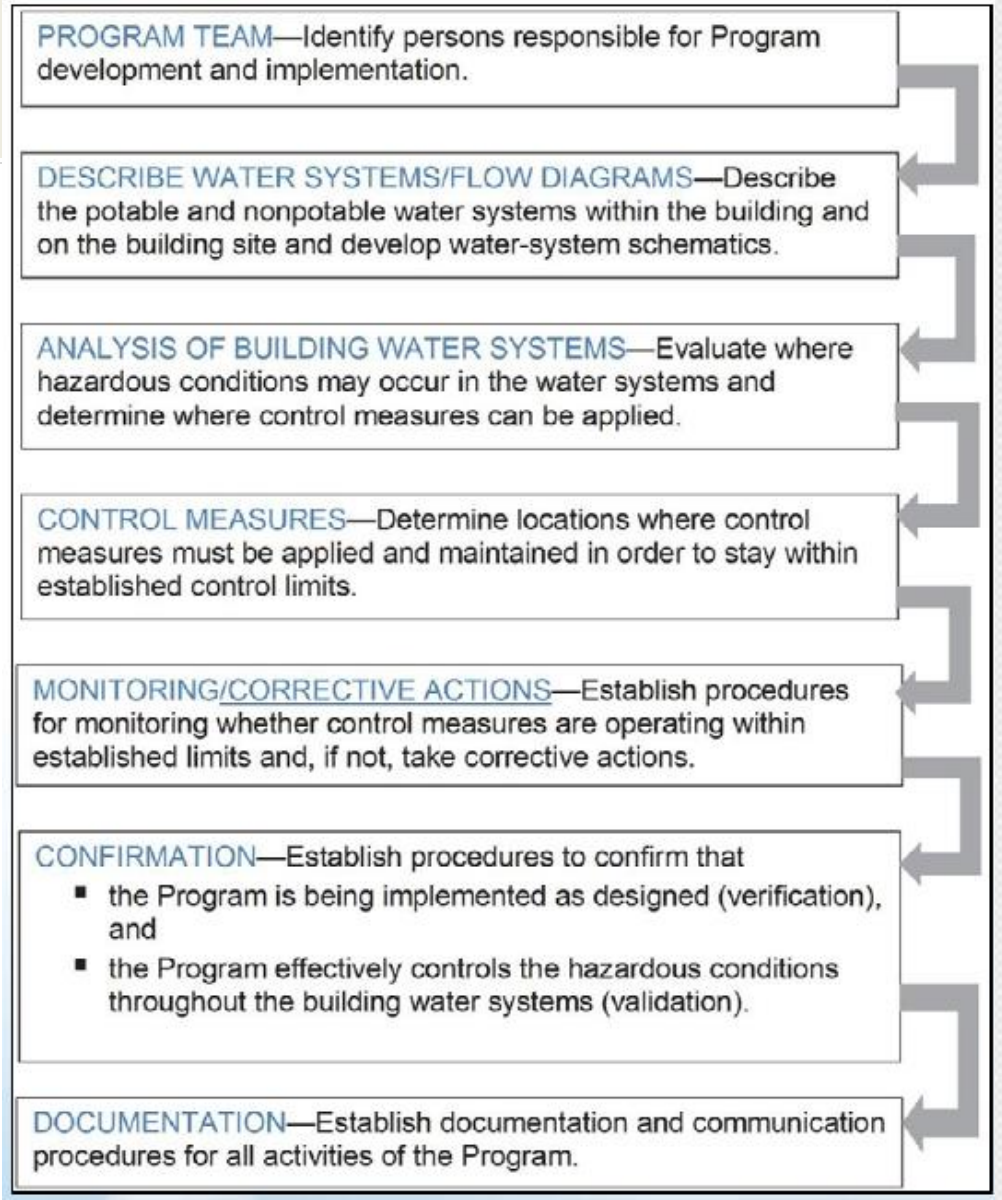
Section 6.1 – Principles of a Water Management Program (WPM)

- *§6.1.1 – 6.1.7 Outline of Risk Management Principles*
  - *Analysis of building water systems for hazardous conditions*
  - *Determination of water control locations*
  - *Establish control limits, (min/max levels) for physical or chemical parameters to be metered or monitored for acceptable limits*
  - *Establish a system for monitoring established limits*
  - *Establish corrective actions for exceedances*
  - *Establish procedures for confirmation of program implementation*
  - *Document all procedures and maintain records*

Water Management Program Development

Section 6.2 - Program Development

- *§6.2.1- 6.2.7 WMP Details*
  - *When non-potable water systems exist in 5.1 above, outside the building parameters of 5.2, those water systems shall be included in a management program.*
  - *When building parameters of 5.2 exist both potable and non-potable water systems shall be included in a management program.*



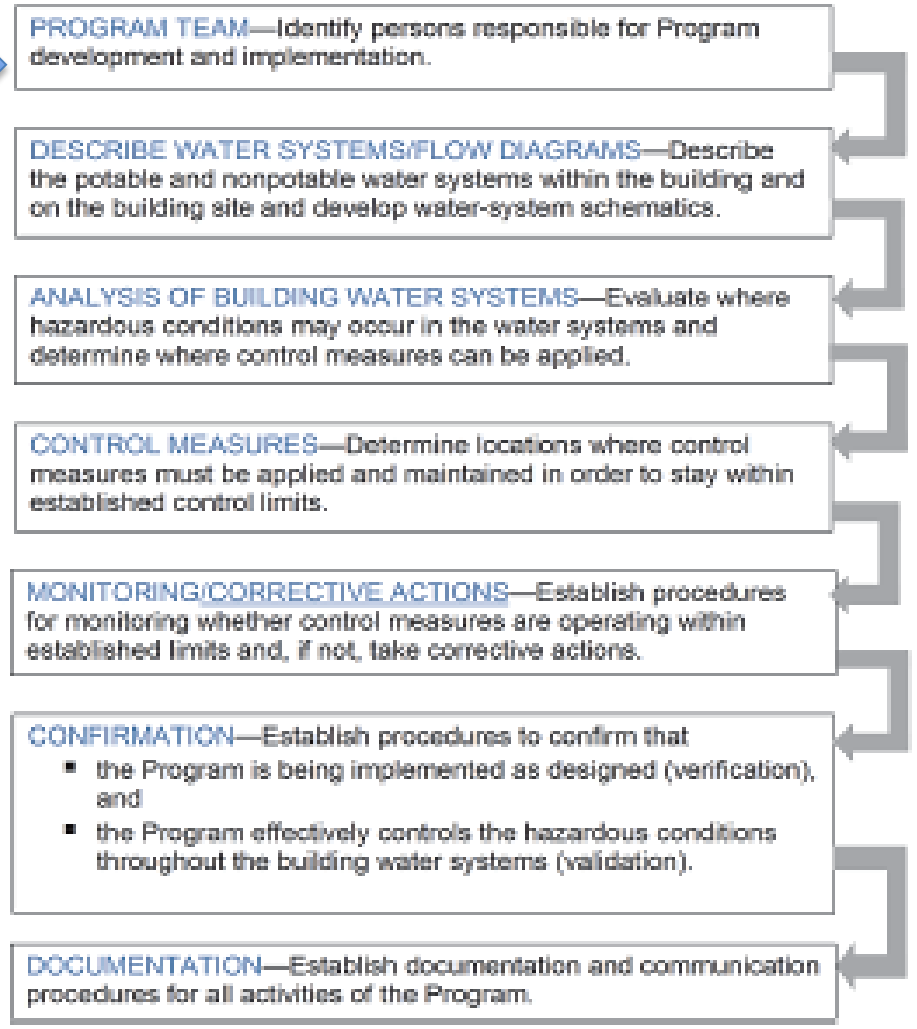
© 2015 ASHRAE

The WMP Details
Program Team

§6.2.1 Program Team persons responsible for developing and implementing the program and tasks

- *Shall include one or more persons selected from building owner or designee, employees, suppliers, consultants or other delegated individuals*
- *Shall have knowledge of the water system design and water management as relates to Legionellosis (See ASHRAE Guideline 12)*
- *Can delegate Program tasks to sub groups*

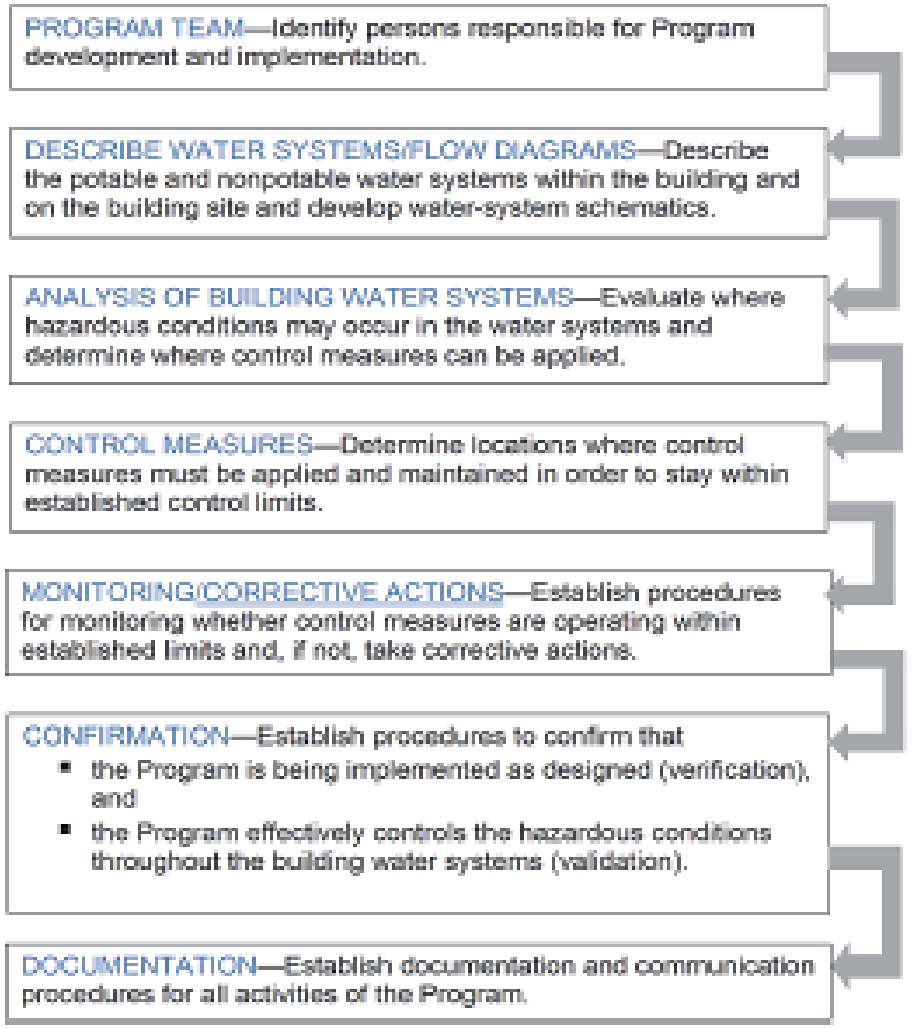
- **Commercial** (Office, Hotels, Institutional, Government, etc.)
  - *Facility director, Maintenance, Housekeeping Health & Safety*
- **Industrial** (Manufacturing, Pharma, Food Processing, etc.)
  - *Plant manager, Maintenance, Engineering, Health & Safety, Environmental*
- **Health Care** (Hospitals, Nursing, Retirement, etc.)
  - *Facility Director, Administrator, Health & Safety, Infection Control, Environmental Services, Medical Director, Chief Engineer*



WPM Details
Description

§6.2.2 Description of the building potable and non-potable water systems by the Program Team

- Locations of end-point uses
  - *2nd floor locker room showers, toilet rooms on floors 1-10 (room numbers)*
- Locations of water processing equipment
  - *Cooling tower sand filter, (penthouse), coffee machine cartridge filters (Break rooms, floors 2-10)*
- How water is received & Processed
  - *Water heater storage tank, (basement mech room), Hot water recirc. Pump (1st floor utility room)*



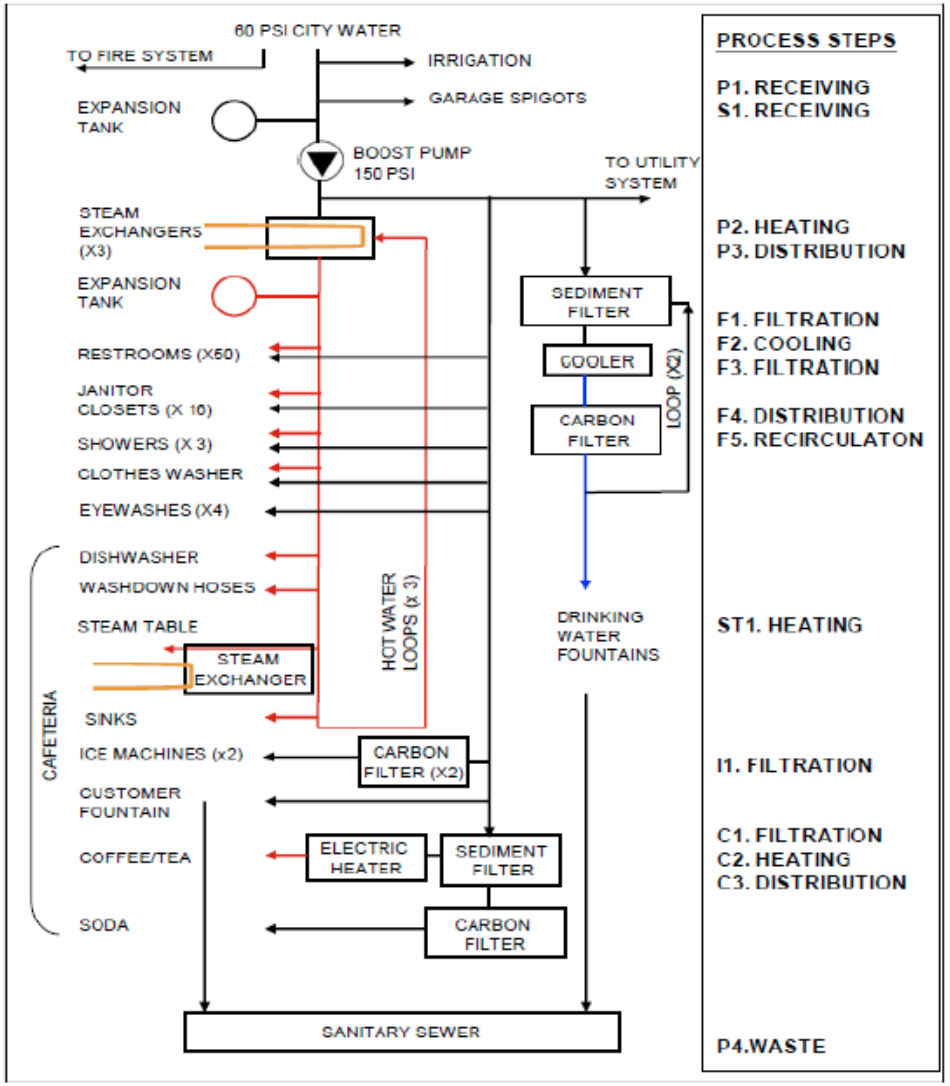
WPM Details
Description

§6.2.3 Process Flow Diagrams

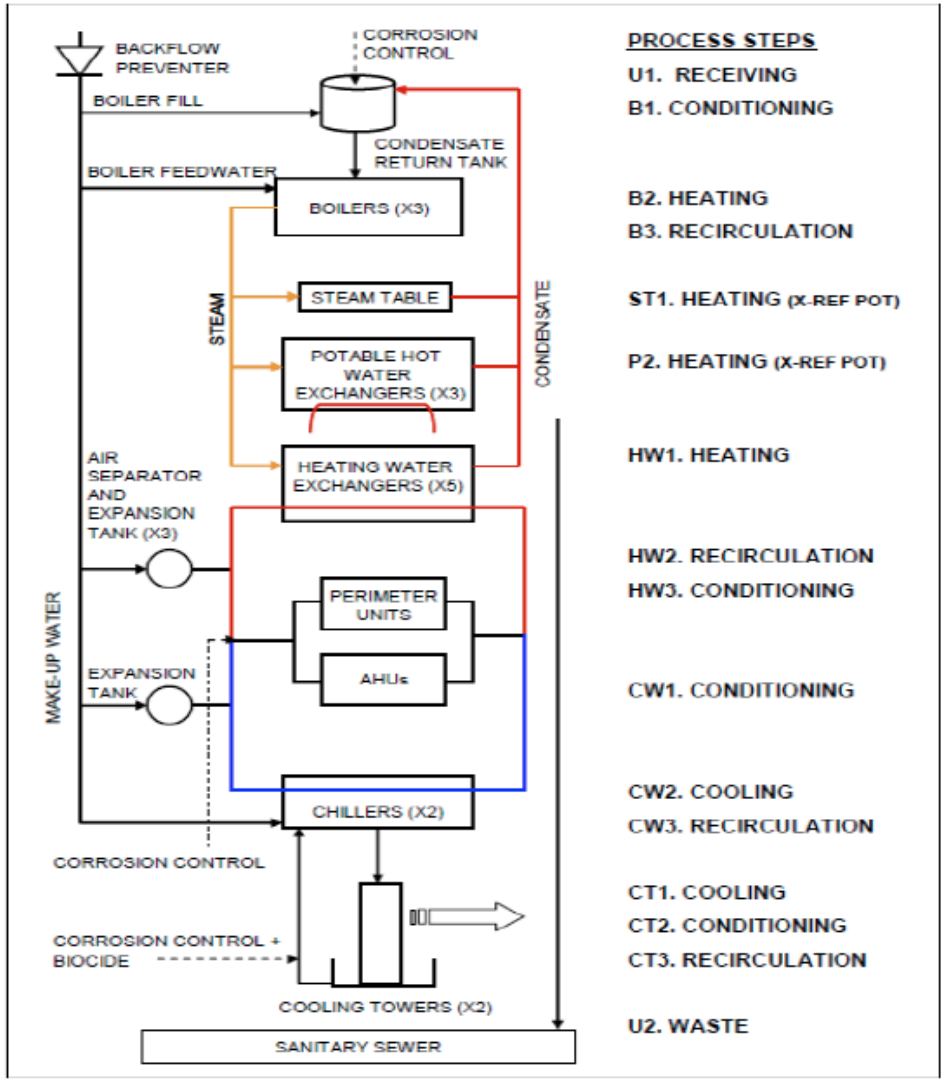
- *Information from 6.2.2 must be graphically described in step-by-step process flow diagrams*
- *Diagrams shall have sufficient detail to enable identification, analysis, & management of the risk of legionellosis throughout the bldg. water systems*
- *Program Team shall confirm that the diagrams are correct & accurate representations of the as-built systems*

Process Flow Diagrams

Potable



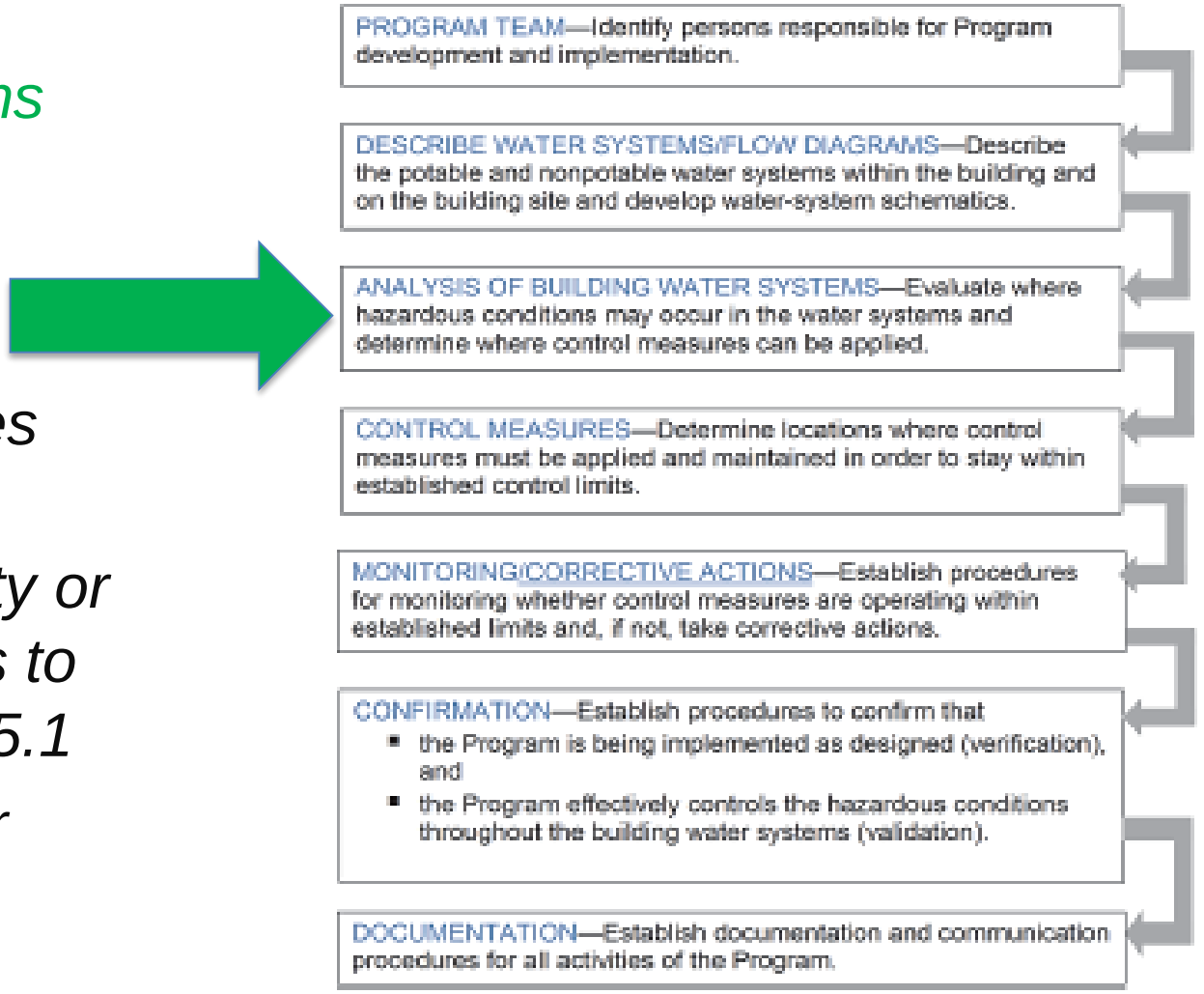
Non-potable



WPM Details
Analysis of Building Water Systems

§6.2.4 Analysis of Building Water Systems

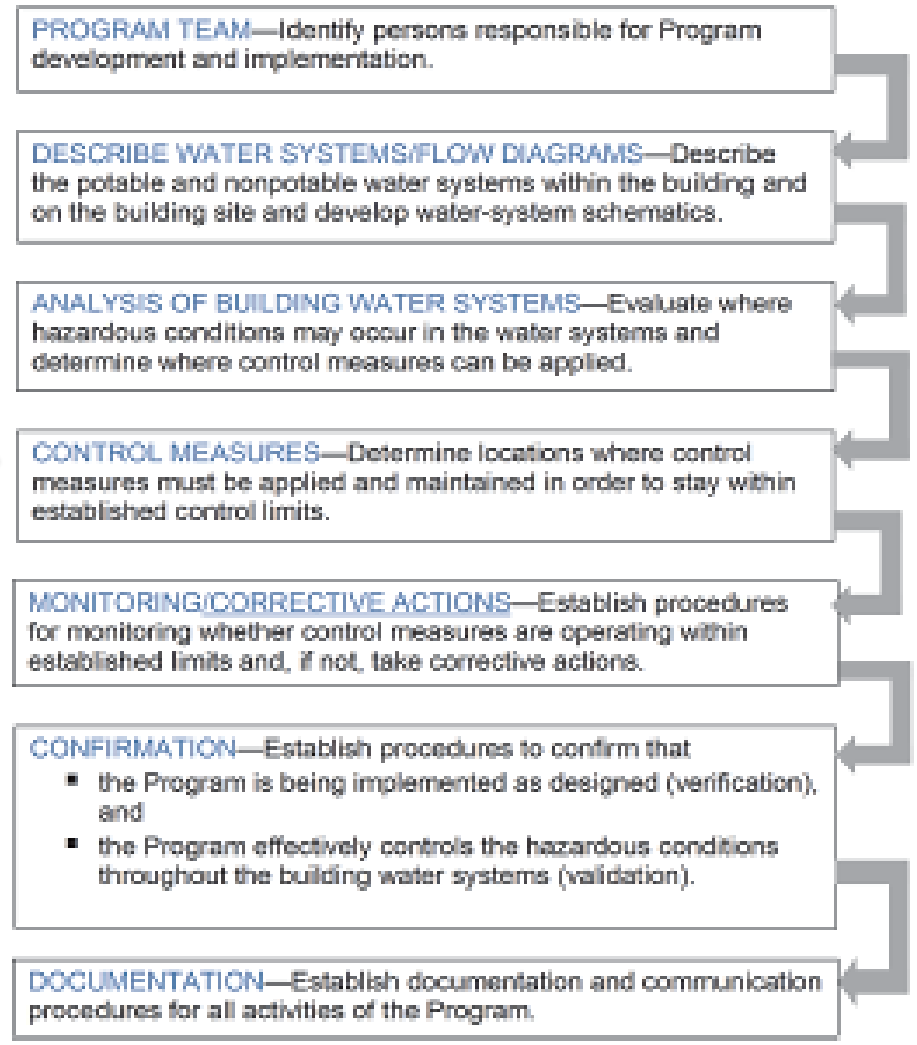
- *Use the Process Flow Diagrams from §6.2.3*
- *Evaluate where hazardous conditions may occur and where control measures may be applied*
- *Take into consideration the vulnerability or susceptibility of the building occupants to the bldg. water systems identified in §5.1*
- *Provide provisions to respond to water service disruptions*



WPM Details
Control Measures

§6.2.5 Develop Control Measures

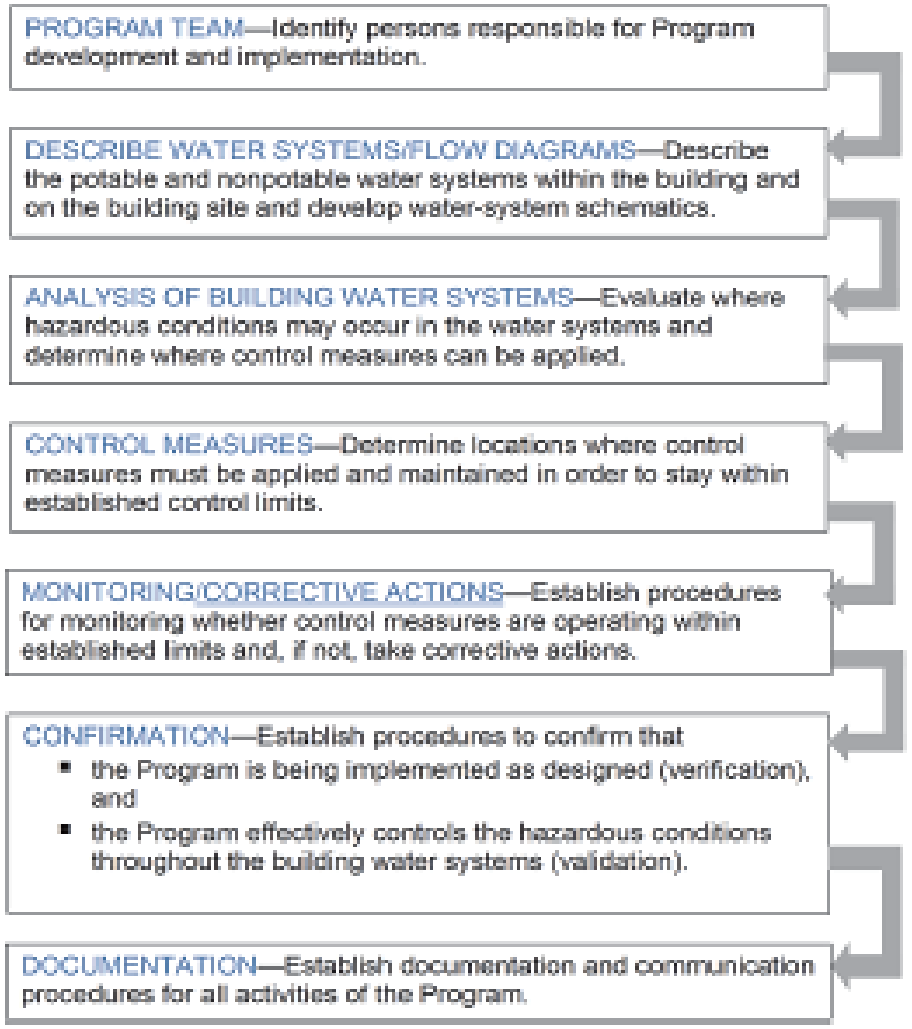
- *Based upon the results of the analysis from §6.2.4, determine control measures to be maintained*
- *Physical design and equipment siting for disease control*
  - *Treatment methods, technical and physical processes, procedures, activities or actions that monitor or maintain water conditions*
  - *§ 6.2.5.a Control Locations (where)*
    - Break room coffee filter, water heater, cooling tower sand filter
  - *§ 6.2.5.b Control limits (how)*
    - Change filter every 30 days, water heater 130°-140°, Sand filter backflush every week



WPM Details
Monitoring

§6.2.6 Monitoring

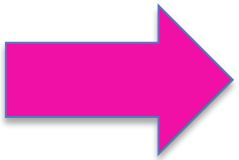
- *Establish a system for monitoring physical and/or chemical characteristics of control systems implementation*
- *Shall include the means, methods, and frequency for monitoring activities*
- *From § 6.2.5.b State the Control Location, type of instrument used, how it is used & calibrated, min & max values, frequency, (for potable & non-potable)*
  - *Maintenance logs - note change-out date on the filter housing tag)*
  - *Electronic readings and reports – log water heater temperature reading on clipboard at the temperature gauge*
  - *BMS outputs, records – Check against manual readout.*

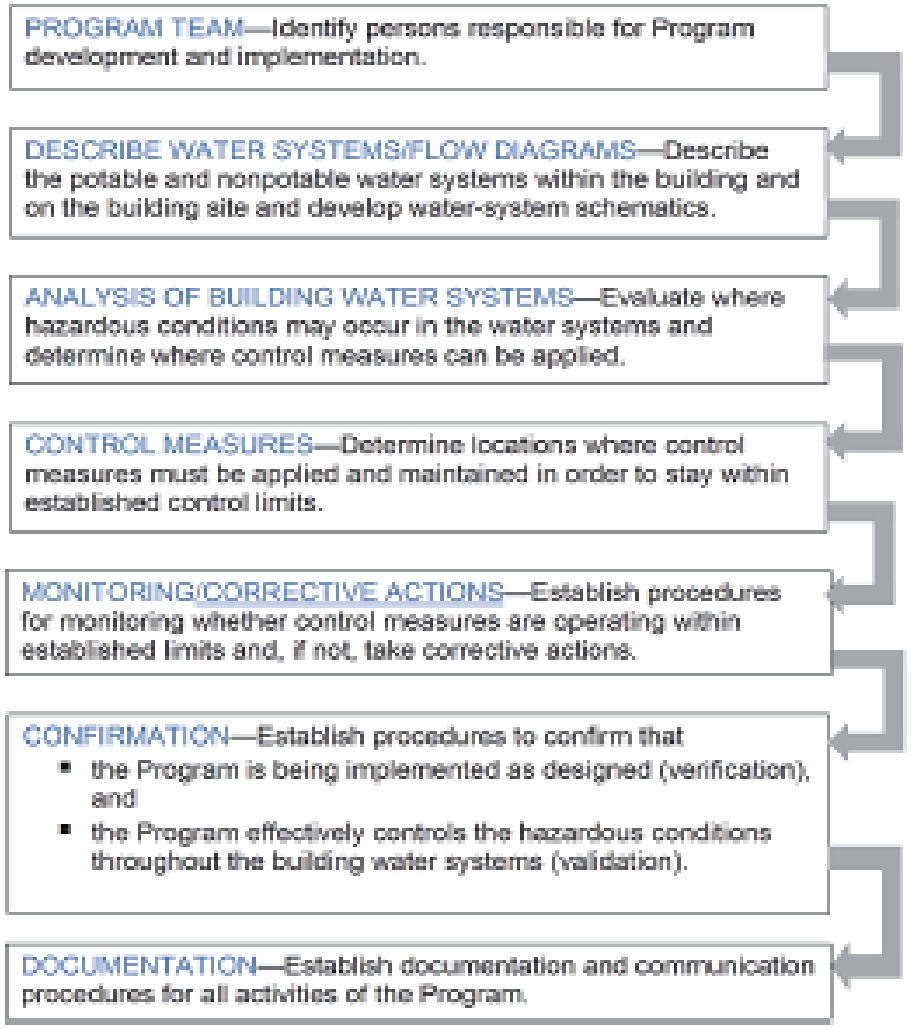


WPM Details
Corrective Actions

§ 6.2.7 Corrective Actions

- *Establish procedures when monitoring shows out of spec control measures*
- *Identify:*
  - *The responsible party for corrective action*
  - *The required response time*
  - *All persons to be notified*
  - *I.e. Cooling tower condenser water treatment*
    - "Check oxidant levels to maintain not less than 20% of capacity. If level falls below 20%, notify XYZ Water Treatment Company at 555-555-5555. If level is below 20% for 2 days, notify supervisor at ext-5555. If levels falls to 5%, notify VP Operations at ext-6666."

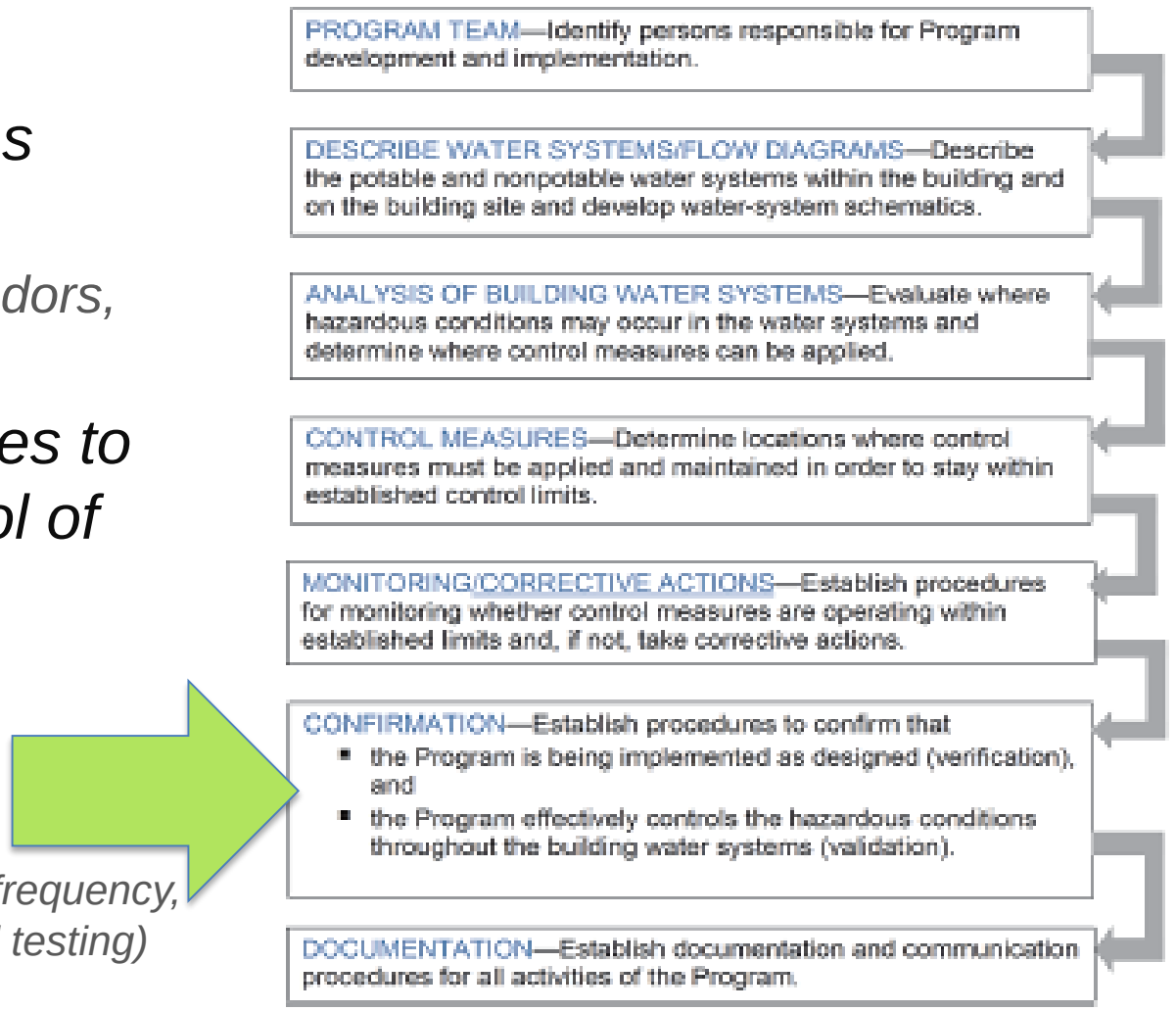




WMP Details
Confirmation

§6.2.8 Program Confirmation

- *Program Team shall develop procedures program implementation (Verification)*
  - *Institute changes if needed, (personnel, vendors, add consultants, equipment)*
- *Program Team shall establish procedures to confirm initial & ongoing effective control of hazardous conditions (Validation)*
  - *Consider whether sources are up to date*
  - *Have there been advances in the science?*
  - *Is sampling/testing required for validation?*
    - *Specify & document; testing approach, (sampling frequency, # of samples, locations, methods for sampling and testing)*



WMP Details
Confirmation

Validation Testing: To test or not to test

§6.2.8 Considerations

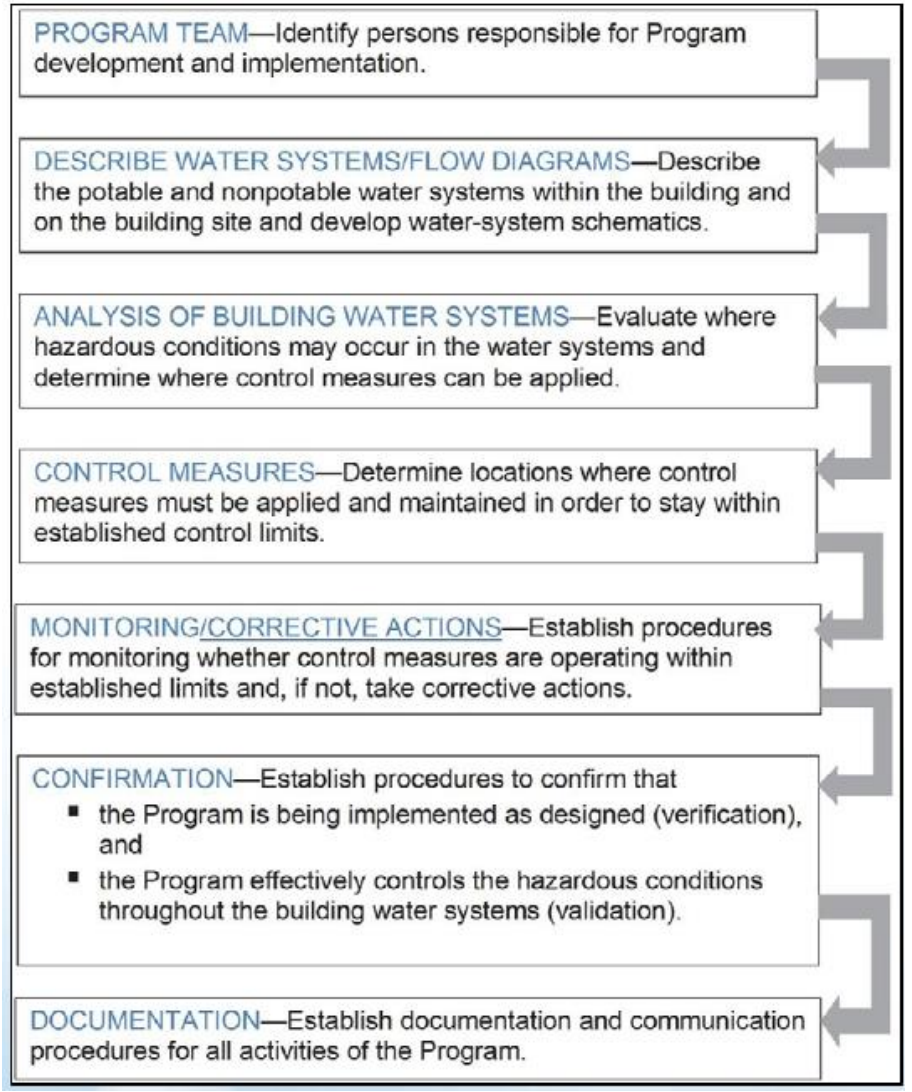
- Are control limits not being maintained?
- In-patient healthcare – at-risk populations
- Prior history of legionellosis
  - *If yes, specify & document as previously noted – (testing approach, sampling frequency, # of samples, locations, methods for sampling and testing)*
  - *If no, document decision. No additional requirements*

WMP Details
Documentation

§6.2.9 Documentation and Communication

Establish procedures for documentation and communication for all activities of the program.

- *All water systems*
- *Communication and coordination among sub groups*
- *Different portions of the building water systems*
- *All associated equipment*
- *Develop a master document providing the location of all Program documents*



Specific Requirements for Building Water Systems

§7 Requirements for Building Water Systems

- *Applies to all sections named in section 4:*
  - *7.1 “Potable Water Systems”*
  - *7.2 “Cooling Towers and Evaporative Condensers”*
  - *7.3 “Whirlpool Spas”*
  - *7.4 Ornamental Fountains and other water features”*
  - *7.5 Aerosol-Generating Misters, Atomizers, Air Washers, and Humidifiers”*

Requirements for Building Water Systems

Includes detailed WMP instructions for:

- *System Start-up and Shutdown*
- *System Maintenance*
- *Disinfection*
- *Water Treatment*
- *Contingency Response Plans (this is the only section that mentions testing)*
- *Equipment Siting*
- *Other requirements for specific water systems such as filter changouts, microbiological testing and bather requirements for spas*

Additional Sections 8 and 9

§8 Requirements for Design

- *Documentation – primarily for inclusion in the management plan*
- *Such items as: monitoring diagrams, code compliance, maintenance schedules, heat loss or gain, or no-flow or low-flow in piping systems, potential cross-connections, locations of inadequate access.*

§9 References

Annexes

Normative, (Included as part of the Standard)

- *Normative Annex A – Health Care Facilities*
  - *Additional required team members – Senior organizational leadership person authorized to make command decisions about water restrictions etc. A member of the facilities management staff. A certified Infection Control Preventionist for the health care facility*
  - *Expanded Water System Flow Diagrams*
  - *Expanded Risk Management Plan Documentation*
  - *Minimum yearly legionellosis risk evaluation for existing buildings, new construction, and renovations.*
  - *Thorough water system management procedures*

Annexes

Informative (Not a part of the Standard)

- *Informative Annex B – Bibliography*
- *Informative Annex C – Guidance if Legionella Testing is Required*

Selected Resources

- ASHRAE Standard 188-2015 Legionellosis: Risk Management for Building Water Systems www.techstreet.com/ashrae/products/1897561
- ASHRAE Guideline 12-2000 Minimizing the Risk of Legionellosis Associated with Building Water Systems. www.techstreet.com/ashrae/products/232891
- AIHA - Recognition, Evaluation, and Control of Legionella in Building Water Systems www.aiha.org
- Cooling Technology Institute Legionellosis Guideline: Best Practices for Control of Legionella *www.cti.org/downloads/WTP-148.pdf*
- VHA Directive 1061: Prevention of Healthcare-Associated Legionella Disease and Scald Injury from Potable Water Distribution Systems www.va.gov/vhapublications/ViewPublication.asp?pub_ID=3033
- The State of New York Department of Health Prevention and Control of Legionnaires' Disease Guidance for Clinicians: Background and Diagnosis
- CDC US Department of Health and Human Services - Developing a Water Management Program to Reduce Legionella Growth & Spread in Buildings. A Practical Guide to Implementing Industry Standards. www.cdc.gov/

Questions?

25th Annual Rocky Mountain Chapter ASHRAE Technical Conference

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