Understanding Water Safety for Construction:
From Design to Occupancy

phigenics®
Independent Water Management

Presented by:
Rick Dandrow & Gage Alvarez

Phigenics' Definition of Independence

Phigenics provides INDEPENDENT expert guidance for the development and implementation of water management programs to prevent building-associated injury and disease and to improve operational efficiency for facilities.

We provide real-time monitoring solutions, cloud-based data management, and environmental testing for all waterborne pathogens and analytical services for water chemistry.

Phigenics does not sell water treatment chemicals or disinfection products, nor do we have commercial affiliation or funding from suppliers or manufacturers of such products.

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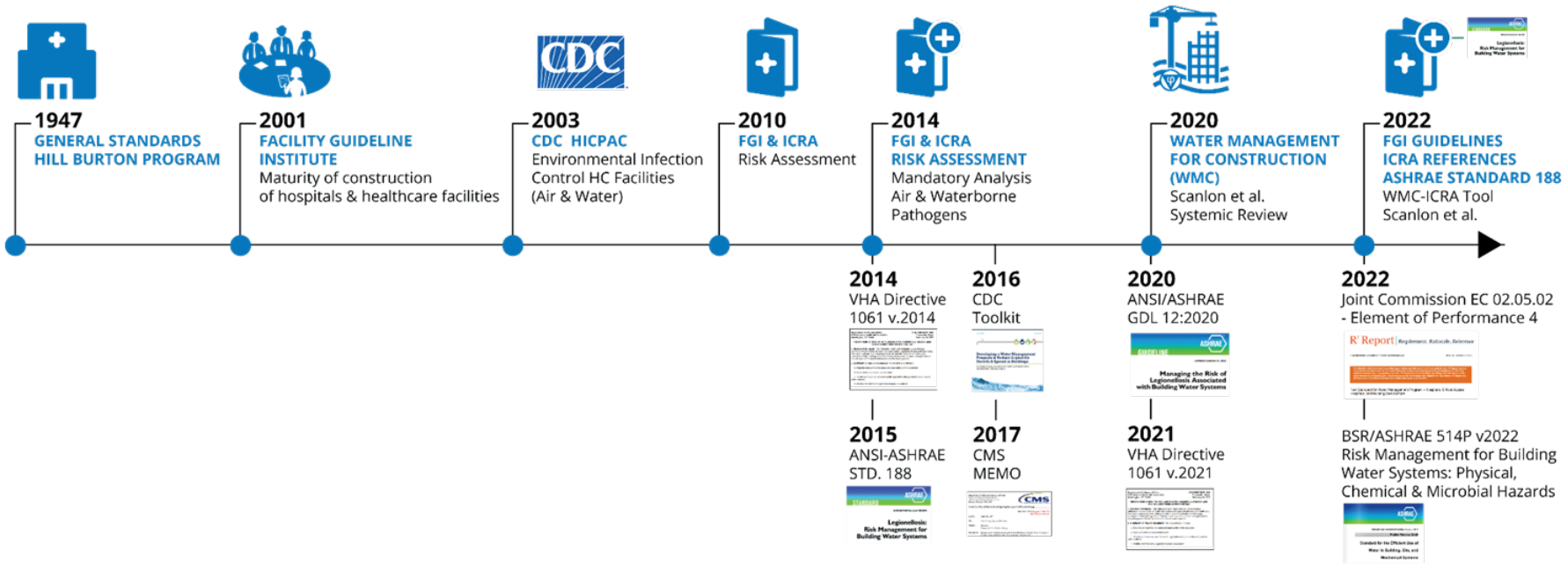
Learning Objectives

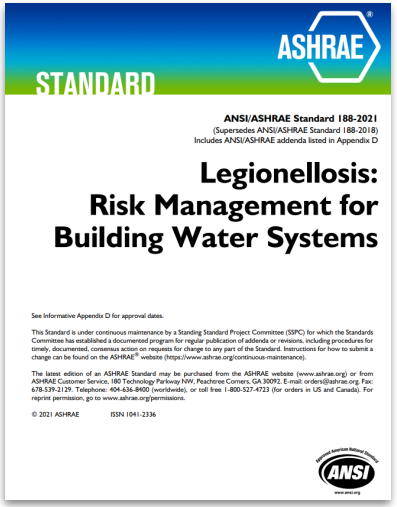
1. **Review** key documents and standards that water management teams (WMTs) should reference to achieve alignment with regulatory agencies
2. **Analyze** construction risk factors and related impacts on water safety
3. **Examine** how an Infection Risk Control Assessment (ICRA) for water can provide valuable insight to WMTs for risk mitigation measures
4. **Understand** the importance of documenting verification and validation data of water during construction activities

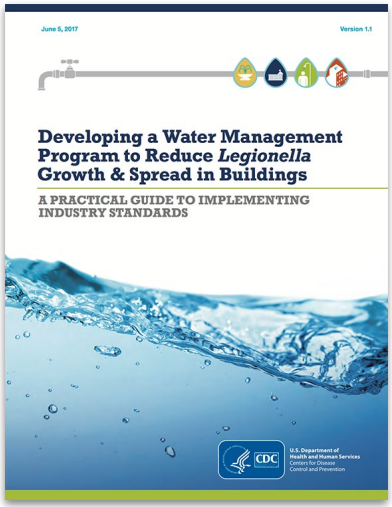
Review the standards, codes, and guidance related to water management for construction

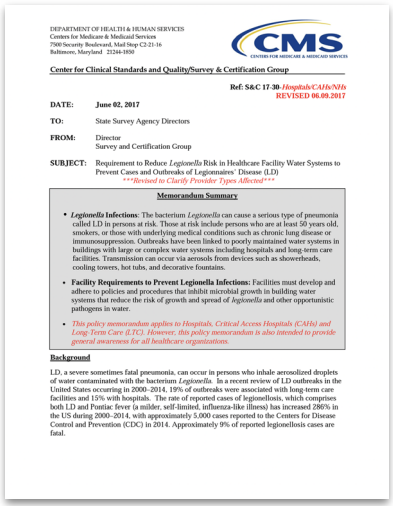
History of Healthcare Design & Construction Standards

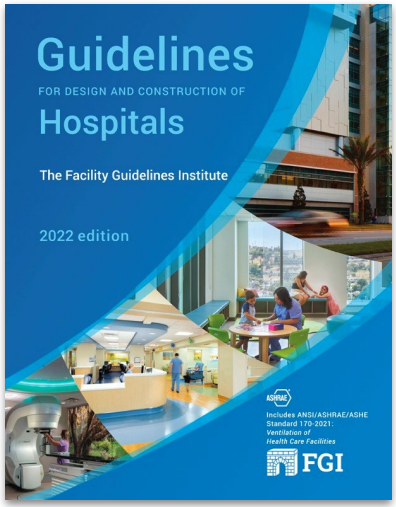


Key WMC Documents



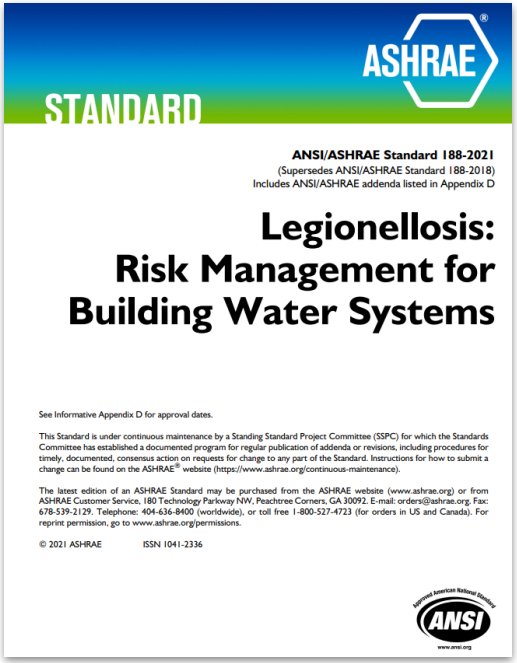






Water Management Training: CDC Prevent LD (Legionnaires' Disease)
https://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html

ASHRAE Standard 188 Compliance w/Construction Activities



Section 4.2 Building Owner Requirements

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.

ASHRAE Standard 188 Compliance w/Construction Activities

Section 8.0 Designing Building Water Systems

Section 8.4 Commissioning

- **Instructions for Commissioning shall be provided to the building owner.**
- **Procedures for disinfection follow AWWA Standard C651 & C652**
- **Procedures for disinfection and flushing**
  - Complete within **3 weeks prior** to whole or partial beneficial occupancy
  - If beneficial occupancy delayed 2 weeks but not more than 4 weeks after disinfection, flushing of **all fixtures** shall again be completed
  - If beneficial occupancy of any part of the building is **delayed 4 weeks or more** after disinfection, the need for disinfection, flushing, or both disinfection and flushing of unoccupied areas shall be determined by the (Water Management) Program Team

The Joint Commission

Changes Related to Water Management
EC.02.05.02 EPs 1 - 4

- Hospital Accreditation Programs (HAPs)
- Critical Access Hospitals (CAHs)
- Nursing Care Centers (NCCs)

https://www.jointcommission.org/standards/prepublication-standards/new-water-management-requirements/

Element of Performance 4: the individual or team responsible for WMP reviews the program annually and when the following occurs:

- Changes have been made to the water system that would add additional risk.
- New equipment or at-risk system(s) [generate aerosols] or be potential source of *Legionella*.
- This includes the **commissioning of a new wing or building**.

2018/2022 Facility Guideline Institute (FGI Guidelines)

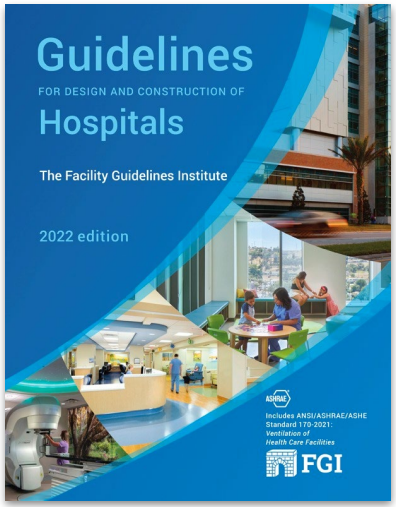
Guidelines for Design & Construction of Hospitals

https://www.fgiguidelines.org/guidelines/state-adoption-fgi-guidelines/

1.2-4.2 Infection Control Risk Assessment (ICRA)

A1.2-4.2 ICRA. The infection control risk assessment is a documented process to proactively:

c. Identify potential risk of transmission of airborne and ***waterborne biological contaminants during construction and/or renovation and commissioning***.



1.2-4.2.3 Infection Control Risk Mitigation

1.2-4.2.3.1 Infection control risk mitigation recommendations (ICRMRs).

These written plans shall describe the specific methods by which transmission of airborne **and waterborne biological contaminants will be avoided during construction as well as during commissioning, when HVAC and plumbing systems and equipment (e.g., ice machines, steam sterilization systems) are started/restarted.**

A1.2-4.2.2.1 (3)(b) See ANSI/ASHRAE Standard 188: *Legionellosis: Risk Management for Building Water Systems* for implementation of water management programs which may impact the design, construction, and commissioning of building water systems during renovation, additions, or modifications to an existing building, or prior to the occupancy of a newly constructed building.

VHA Directive 1061- Updated 2/2021

J. VA MEDICAL FACILITY CHIEF ENGINEER OR VA MEDICAL FACILITY MANAGER are responsible for:

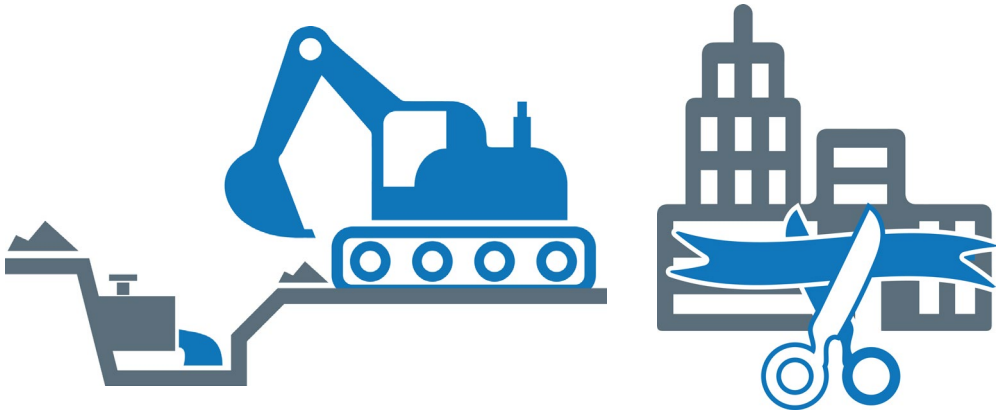
Item (7) Ensuring **an *Infection Control Risk Assessment*** is conducted in cooperation with other VA medical facility stakeholders, to address the potential impact of **construction and maintenance** of water systems ***on growth or transmission of waterborne pathogens*** *and to determine the extent of* ***precautions, disinfection and system or component commissioning requirements.***

Item (8) Ensuring that service ***newly installed potable water piping, equipment and distribution system components are flushed of debris and disinfected prior to being placed*** into as defined by VHA specifications and American Water Works Association (AWWA) through the following:

(a) Documentation of flushing and disinfection maintained for at least 3 years.
(b) Equipment must be commissioned to ensure operation meets the design intent (i.e., water heaters, circulation pumps, injections systems) and documentation retained for 3 years for record.
(c) Newly installed water piping, equipment and distribution system components that had been disinfected but ***not put into use within a week of the action must be disinfected again*** **prior to building occupancy** due to stagnation of water in the system.

Analyze construction risk factors and related impacts on water safety

WMC Myth Buster #1
Water management is only for ongoing operations.



Construction activities are associated with contributing to disease cases and death from building water systems.

WMC Myth Buster #2
Plumbing specifications covers water safety

Typically Contractor's general conditions, specifications, and commissioning practices lack water management criteria and proper verification and validation methods to assure water safety.

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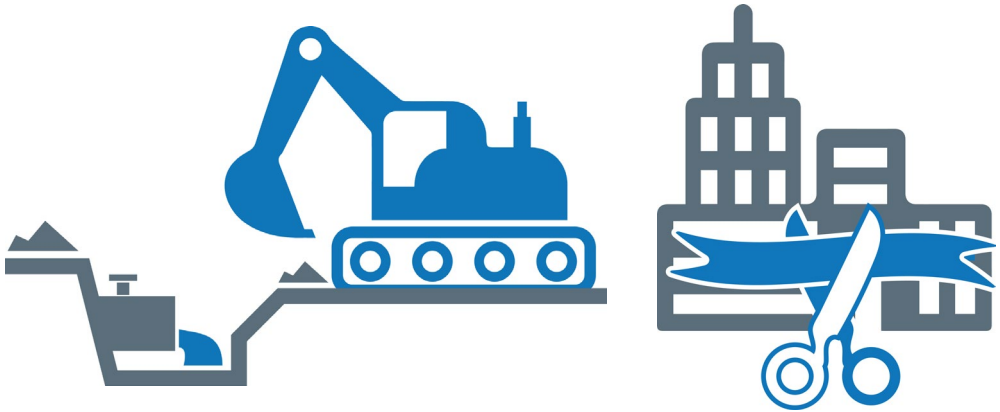

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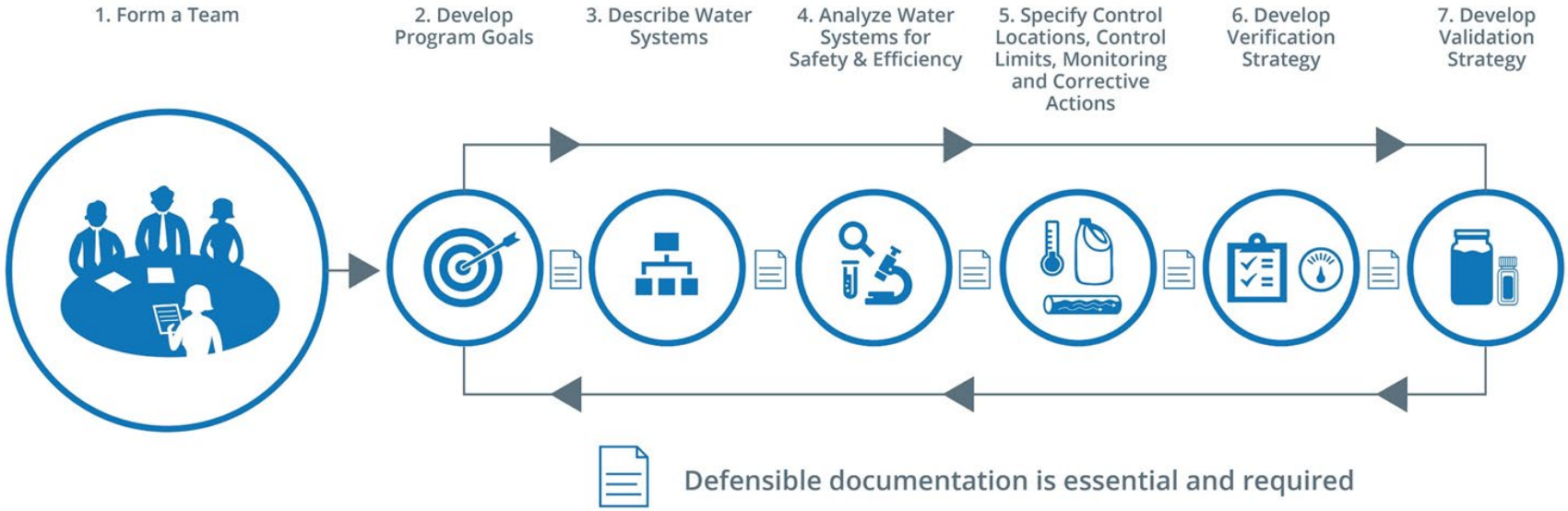
7 STEPS OF THE COMPREHENSIVE AND DEFENSIBLE WATER MANAGEMENT PROGRAM

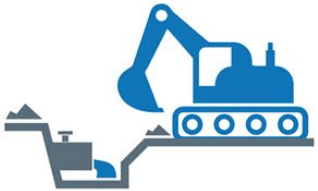


Adapted from Figure 1 of ASHRAE 188:2018

Known Risk Factors

COMMISSIONING

EXCAVATION



REPRESSURIZATION

DEMOLITION

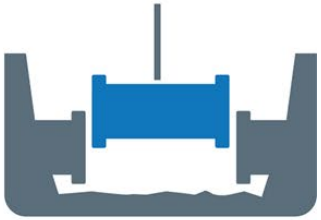
CONSTRUCTION EQUIPMENT

WATER MAIN BREAKS

VIBRATION

EFFICIENCY DESIGN

UNDERGROUND UTILITY CONNECTIONS



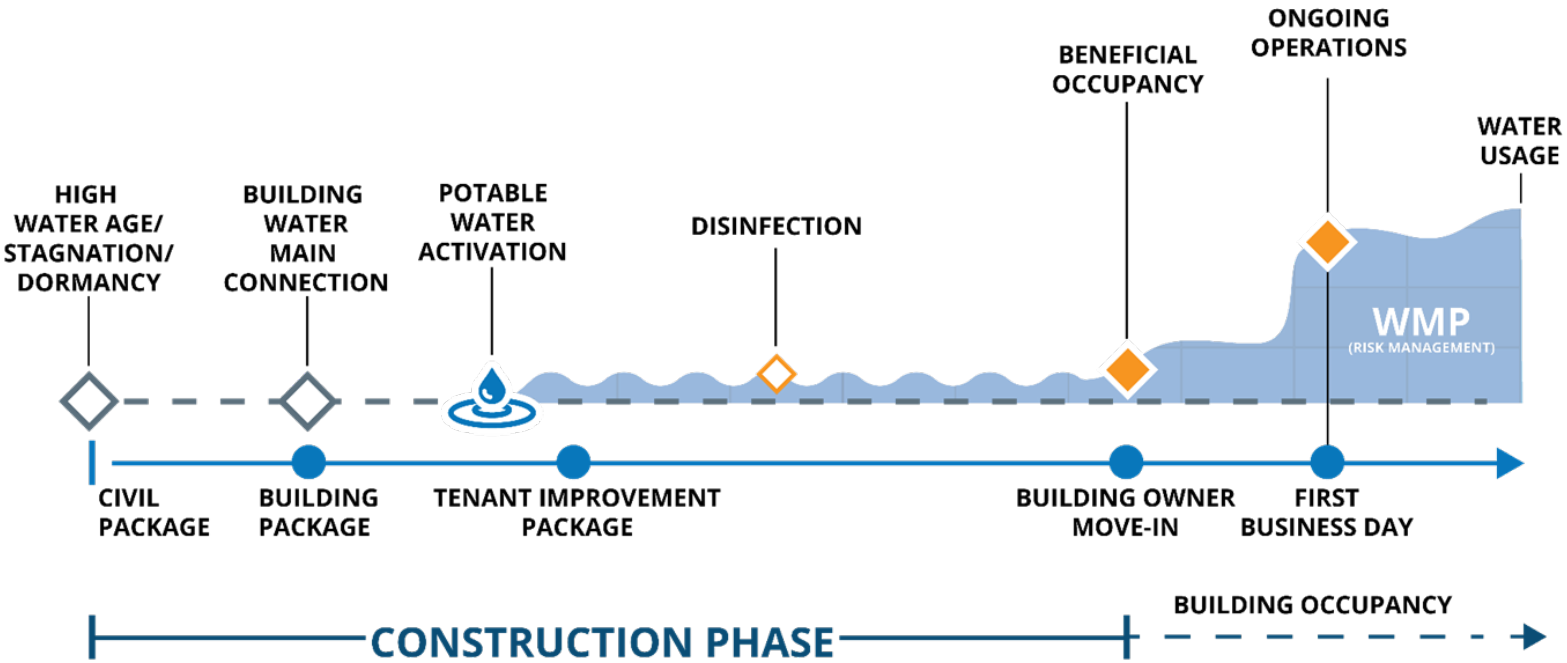
Known Risk Factors: Commissioning

Improper disinfection, flushing, monitoring, and balancing of the building water distribution system leading to poor water quality at building start-up.

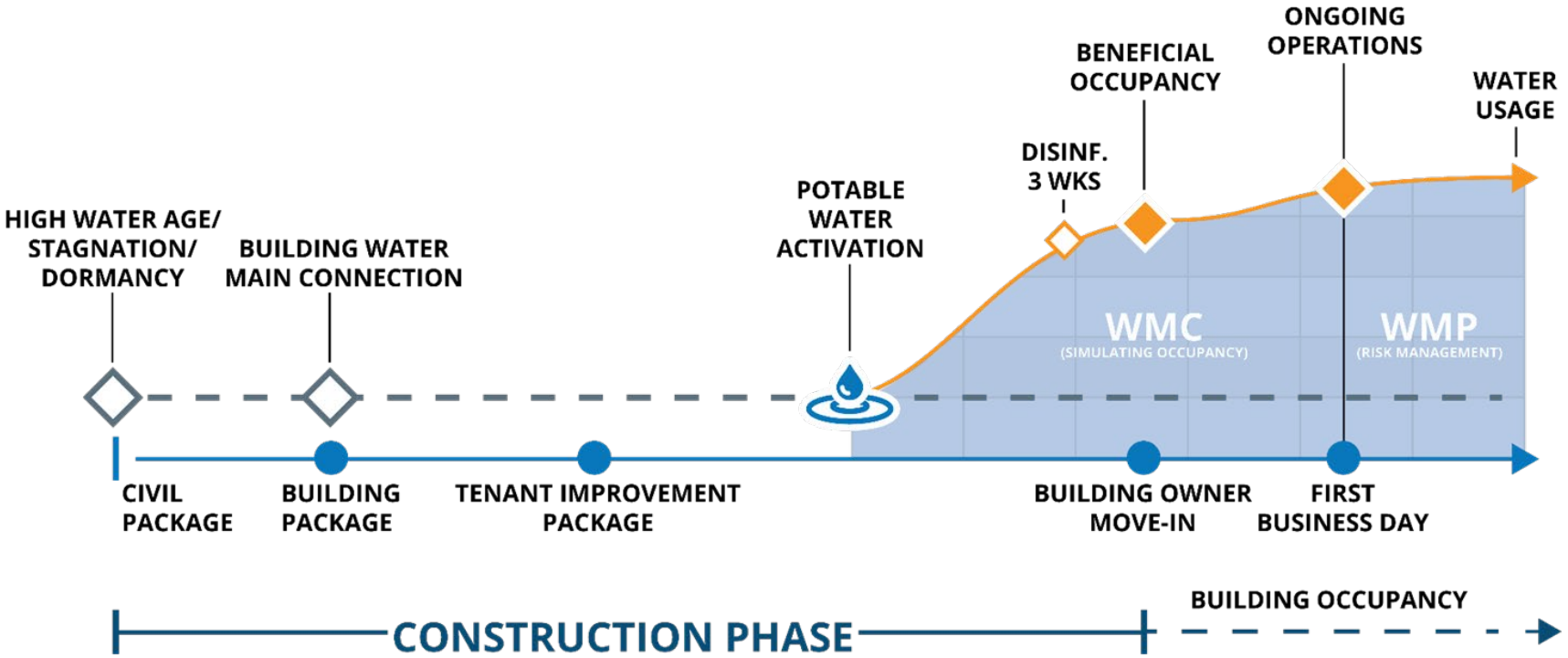
Often the water distribution system is checked to be functioning, however the quality of the water is not **verified** or **validated** through proper water management at building start-up.

Most notable risk factor for disease cases & deaths.

Historical Building Water Distribution System Project Schedule



Best Practice Water Management Project Schedule



phigenics Independent Water Management

Reducing the Risk of Healthcare Associated Infections from *Legionella* and Other Waterborne Pathogens Using a Water Management for Construction (WMC) Infection Control Risk Assessment (ICRA) Tool

Scanlon MM, Gordon JL, Tonozzi AA, Griffin SC — Infectious Disease Reports, May 2022

Step #1: Evaluate the BWDS construction activities and scope of work to be performed, the duration of project, and level of water age for the project.
Determine the WMC Category (A, B, C, or D).

Step #2: Identify the Building Occupant Risk Group(s) impacted by the BWDS construction activities, scope of work, and level of water age. Include analysis of patient care areas located adjacent, above, or below the designated construction zone.

	Building Water Distribution System (BWDS) Construction Activities and Scope of Work			
	Minimally invasive BWDS, brief duration, and low water age. (≤ 24 hours)	Small scale BWDS, short-duration and modest water age (≤ 7 days)	Moderate to high levels of BWDS construction; medium water age (≤ 30 days)	Major BWDS demolition, renovation, infrastructure, and/or new construction; high water age (> 30 days)
BUILDING OCCUPANT RISK GROUP	**CATEGORY A**	**CATEGORY B**	**CATEGORY C**	**CATEGORY D**
Low Risk	WMC-1	WMC-2	WMC-3	WMC-3 OR 4
Modest Risk				WMC-4
High Risk	WMC-2	WMC-3	WMC-3 OR 4	
Severe Risk		WMC-3 OR 4		

Step #3: Determine the WMC Risk Mitigation Level (WMC-1, 2, 3, or 4) for hazard control strategy to be implemented over the entire duration of the constriction project scope. WMC-1 is less stringent and WMC-4 is the highest level of risk mitigation strategies.

Project Categories for Construction Activities

A

BWDS Inspection, maintenance, and non-invasive activities of brief duration.

Low water age: ≤ 24 hrs

B

Small scale BWDS, short duration activities with minimal water disruption

Modest water age: ≤ 7 Days

C

High BWDS disruption or removes any fixed BWDS components or assemblies

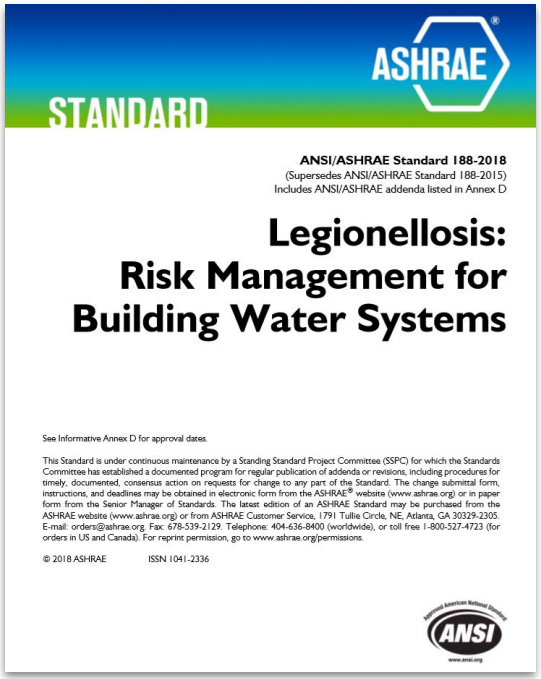
Medium water age: ≤ 30 Days

D

Major BWDS demolition, renovation, infrastructure, and/or new construction projects

High water age: > 30 Days

Verification and Validation



As defined in ASHRAE Standard 188 - 2018:

Verification: initial and ongoing confirmation that the program is being implemented as designed.

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

Both require documentation— if you didn't document it then you didn't do it.

Building Occupant Risk Groups




Low

- Office Areas
- Conference Rooms
- Administration

Modest

- Cafeterias
- Lobbies
- Family Waiting Areas

High

- Emergency Department
- Acute Surgical Unit
- Low-Risk Maternity

Severe

- Dialysis
- ICU's
- Bone Marrow Transplant Units

Risk Mitigation Levels

WMC-1

Baseline measurements: temperature, pH, residual oxidant (FRO), etc.

Focus on pre- and post-work Flushing with measurements of temperature & FRO on hot & cold water

Log & report data.

WMC-2

All components of WMC-1

Establish enclosure to prevent aerosolized water from leaving work area and keep up until work is complete.

EVS to perform cleaning prior to use/occupancy.

WMC-3

All components of WMC-1 & 2

Additional protocols for verification through regular (daily/weekly) flushing, FRO logs, evaluating of any disinfection procedures to be performed, and inspection of work completed. Validation through environmental testing.

WMC-4

All components of WMC-1-3

Conduct pre-work risk assessment and prepare a project-specific WMC plan following risk, establish risk management aligned with ANSI/ASHRAE Std. 188. Set up milestones leading up to first day of patient occupancy. Implement with WMC Team

Example 1

Location: Labor and Delivery Staff Break Room and Patient Rooms| **Duration:** < 7 Days

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BUILDING OCCUPANT RISK GROUP	CATEGORY A	✔ CATEGORY B	CATEGORY C	CATEGORY D
Low Risk	WMC-1	WMC-2	WMC-3	WMC-3 OR 4
Modest Risk				WMC-4
High Risk	WMC-2	WMC-3	WMC-3 OR 4	
✔ Severe Risk		✔ WMC-3 OR 4		

Example 2

Location: New Emergency Department (Addition/Expansion) | **Duration:** 4 months

	Building Water Distribution System (BWDS) Construction Activities and Scope of Work			
	Minimally invasive BWDS, brief duration, and low water age. (≤ 24 hours)	Small scale BWDS, short-duration and modest water age (≤ 7 days)	Moderate to high levels of BWDS construction; medium water age (≤ 30 days)	Major BWDS demolition, renovation, infrastructure, and/or new construction; high water age (> 30 days)
BUILDING OCCUPANT RISK GROUP	CATEGORY A	CATEGORY B	CATEGORY C	✔ CATEGORY D
Low Risk	WMC-1	WMC-2	WMC-3	WMC-3 OR 4
Modest Risk				✔ WMC-4
High Risk	WMC-2	WMC-3	WMC-3 OR 4	
✔ Severe Risk		WMC-3 OR 4		

WMC During Construction Activities — Review

Facilities should develop a project specific water management plan for construction plan using the 7-steps of water management per ASHRAE Standard 188.

Water Management team and the construction team should analyze hazards and controls related to construction activity risk factors based on the WMC-ICRA.

Program should address building water distribution systems impacted by construction project scope of work. Applicable to renovation, addition, demolition, addition, expansion or new construction projects.

Documentation

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

Documented defensible records of independent, third-party verification and validation are essential.

In the absence of clear, defensible records documenting that something was done, it is as if that something was not done.

Q&A