# Building Water System Operator Certification

White paper prepared for the Association of State Drinking Water Administrators (ASDWA) by ESPRI

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# Introduction

## The Safe Drinking Water Act and Implications for Building (Premise Plumbing) Water System Regulation and Operator Certification

The Safe Drinking Water Act Coverage (SDWA, 42 U.S.C. §300f et seq., 1974) says that each and every public water system (PSW) must comply with SDWA requirements unless it meets all of the following conditions:

1. Obtains all of its water from, but is not owned or operated by, a PWS to which such regulations apply;
2. Does not sell water to any person;
3. Is not a carrier which conveys passengers in interstate commerce; and
4. Consists only of distribution and storage facilities (and does not have any collection and treatment facilities).

When supplemental disinfection is added in a building, the 4th condition, 'treatment', is triggered and the building may be defined as a PWS. The building is then subject to SDWA requirements including sampling for certain regulated parameters and having a certified water operator as the operator of record for that system (unless the facility is considered a transient non-community system). Further complicating the issue is that each state primacy agency may have varying operator certification and system inspection regulations.

In the past two years, building water quality has become a focal point for the Centers for Disease Control and Prevention (CDC) and Centers for Medicare and Medicaid Services (CMS) in trying to control Legionnaires' disease associated with buildings, including the internal plumbing as well as other features – cooling towers, decorative fountains, spas, pools etc. The CMS memo (2 June 2017, modified 6 July 2018) requires hospitals, critical access hospitals and long-term care facilities to conduct a facility risk assessment, implement a water management program, identify control measures for hazardous conditions discovered, monitor that control measures are in acceptable range, and validate that they are successful in reducing *Legionella* and other opportunistic pathogens. This approach is used in *ANSI/ASHRAE Standard 188-2018, Legionellosis: Risk Management for Building Water Systems.* These guidances have highlighted the need for building water management plans (BWMPs) and in some cases supplemental water treatment. The addition of supplemental treatment requires compliance with the SDWA, which means Maximum Residual Disinfectant Limits ( MRDLs) may have to be met, and a certified operator is necessary. The question then becomes one of defining the responsibility of that certified operator, who generally has no training or experience in building water systems.

## Issues with building water systems– the building is its own ecosystem and very different from a drinking water distribution system

Once water enters a building from the PWS it encounters very different conditions from those in the distribution system. The water quality inside a building can and often does degrade as the physical conditions change. Inside the building, environmental conditions can promote the growth and dissemination of *Legionella* and other waterborne opportunistic pathogens including *Pseudomonas aeruginosa* (the number one cause of hospital-acquired pneumonia) and nontuberculous mycobacteria (NTM).

These environmental conditions include:

- A wider variety of materials than those found in a conventional distribution system
- Additional water processing (heaters, heat exchangers, softeners, recirculating systems, cooling towers)
- Varying flow conditions and variability in water demand
- Other non-potable systems including process systems, humidifiers, misters, cooling towers, pools, and spas
- Much higher surface area to volume ratio of piping
- High water age (may be months), especially in LEED buildings
- Extreme and variable temperatures
- Low to no disinfectant residual
- Pressure differentials and controls
- Proprietary treatment that may be a black box to regulators and/orfacilities managers

Unless it is for Lead and Copper Rule (LCR) compliance, or in some cases Revised Total Coliform Rule (RTCR) compliance sampling sites, water utilities do not sample and analyze building water quality parameters. The water quality in the distribution system can and does differ markedly both chemically and microbiologically from that in the building. Building water system facilities and maintenance staff rarely measure water quality parameters if at all. It is assumed that the water quality delivered from the PWS is what can be expected within the building plumbing, but this is not the case. The building itself is its own ecosystem and it changes the water quality as it passes through the building plumbing. This begins with chemical changes, for example, loss of residual disinfectant as water warms or is heated. Temperatures within buildings are usually within the range (20 to 50°C; 68 to 122°F) that promotes growth of *Legionella, P. aeruginosa*, and NTM. Since potable water may contain those bacteria in low numbers, once they enter the building plumbing, they establish and grow in the absence of disinfectant residual, stagnation from low water use and dead legs (or dead ends), and temperatures that promote growth.

## Knowledge, Skills and Abilities to Operate a Building Water System (BWS)

Whether a BWS is regulated or not, its operation to prevent or mitigate water quality degradation requires specific knowledge, skills and abilities (KSAs). Those KSAs overlap in some cases with those required to operate a water treatment plant or water distribution system. However, there are many KSAs specific to BWSs and there are many KSAs relevant to treatment plant and distribution system operation that are not relevant for operating BWSs. Persons qualified to run a building water system don't necessarily understand what is needed to run a PWS water treatment and distribution system and would have challenges getting certified under current programs. This section of the paper describes the operation of BWSs and contrasts the KSAs required to operate a BWS with those required to operate treatment plants and distribution systems.

The section begins with a description of the framework recommended by the CDC and others for managing BWSs – the Building Water Management Plan (BWMP).

### *Building Water Management Plan Organization and Standards/Requirements*

Guidances for BWMPs, as provided by the CDC, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the World Health Organization (WHO), encourage or require the following seven steps:

1. Establish a facility water management team
2. Describe the building water system(s)
3. Identify control measures and corrective actions, and where control can be applied
4. Develop a monitoring plan for the control measures
5. Verify the plan is being implemented as designed
6. Validate the plan is effective
7. Document the processes and results.

To properly participate in these activities, operators as team members will need organizational, communication, and reporting skills, as well as specific technical skills related to the building water system as detailed below.

### *Building water system components and operation*

#### Water delivery system

The piping that delivers potable water from a facility's point of entry (POE) to its points of use (POU) can be viewed as a small scale public water distribution system. Similar to a PWS, operators of a BWS need essential knowledge including intimate awareness of where the plumbing is located, from whence it is supplied, to where it is delivered (or not), how much and frequently it flows, and the water quality as it moves through the system. Just as PWS mains may be constructed of different materials along the route, different pipe materials can be present in a given facility. The suitability and compatibility of these materials must be understood and confirmed to avoid acute or chronic water quality and infrastructure problems, such as those caused by galvanic corrosion. Developing an appreciation of water age by monitoring disinfectant and temperature levels throughout the building and initiating a flushing program to assure that fresh water is consistently available, are objectives of a BWMP. A building operator will need specific skills on how to make these measurements and design and implement a flushing program.

Components impacting water age in a facility may include storage tanks, dead legs or other stagnant areas, seasonal or chronic low-use pipe runs, and long non-circulated pipe reaches. Certainty that the potable water lines are securely separated from non-potable water or chemical lines requires installation and maintenance of back flow prevention devices and cross-connection control at appropriate sites within the building, not just at the POE.

## Water quality quantification

An essential component of a BWMP is monitoring of the effects of control actions, and analytical methods are used to do this. Methods may range from simple reading of thermometers or temperature gauges, to grab sampling for field analysis or outside laboratory processing. On-line instrumentation may be employed in larger facilities or where timely sample collection by staff is not practical.

If supplemental disinfection is instituted at a facility, techniques of residual measurement associated with the applied disinfectant will be necessary, as may parameters that impact the disinfectant, such as pH where free chlorine is applied. For systems applying total chlorine (chloramine), additional parameters such as ammonia, nitrite and nitrate should be measured, since buildings are susceptible to nitrification. For systems applying chlorine dioxide it might be necessary to monitor chlorite. In the case of disinfectants associated with secondary contaminants such as copper (copper-silver ionization), sampling for those specific parameters would also be necessary, and awareness of any applicable requirements of the Lead and Copper Rule recommended.

Validation that the controls are effective will likely necessitate the collection of samples for microbiological analysis. Operators will need to know appropriate aseptic sampling techniques and be aware of sample handling and holding requirements.

> NOTE: Validation with microbiological testing, e.g. *Legionella* sampling, is recommended as part of BWMPs, but there is disagreement among state agencies about whether or not to test water in buildings for *Legionella*. This is often because there are no specific levels of *Legionella* that are correlated with risk to public health and simply finding *Legionella* in a building water system does not mean that there is risk. Many buildings have water that is positive for *Legionella* intermittently or consistently with no associated health effects in people using those facilities. This presents challenges in understanding and communicating positive findings to the public. This is an area where more work is needed to understand occurrence and risk in building water supplies. However, if one of the objectives of a BWMP is to control *Legionella*, then measuring for the bacteria before and after implementation of the BWMP, and ongoing monitoring as part effective water management is necessary. Development of communication tools on building water quality is needed in order to discuss this information with the public in the appropriate context.

Currently the SDWA considers a building that adds treatment to be a PWS and subject to the requirements of the SDWA. Depending on the jurisdiction, this newly acquired designation may add many more requirements for monitoring unrelated to those directly associated with the treatment that has been added. States have taken different approaches to dealing with buildings as SDWA PWSs.

## Hot water systems

Hot water systems could be comprised of storage water heaters, tankless or on-demand water heaters, branched connected plumbing, mixing/tempering valves and recirculating systems. To maintain water quality throughout building water systems, operators would need to know the impact of the water heater set point temperature on *Legionella* and other microorganism growth, the impact of valve and faucet choice on water quality at the point of use, and proper operation of recirculation loops (described below).

Plumbing codes require hot water recirculation so that heated water is immediately available at taps distant from the water heater. As such, the purpose of recirculation is to save water by preventing lengthy water draws to pull heated water to the tap. Even when the recirculation loop is mechanically functioning as designed, the physical layout of a hot water loop can have negative impacts to water quality. A consequence of recirculation is that a significant volume of water is held within the hot water loop (comprising the supply and return piping). Though the water is being recirculated (and so reheated with each return to the water heater), this water is subject to cooling, aging and disinfectant residual decay, leading to optimal conditions for amplification of opportunistic pathogens if not managed properly. Though hot water is not used for drinking, some of its more common uses, such as showers and spray cleaners, create an opportunity for aerosolization of microorganisms growing in the recirculated hot water, with the potential for subsequent inhalation by users. Hot water recirculation loop controls are essential to the protection of public health. Water heater outlet temperature, adequate and balanced flow, hot temperature maintenance through the loops and moderation of temperature at points of use (to prevent scalding) will be assessed and managed in a BWMP.

### Secondary water processes

Many facilities have water uses that are supplied by the domestic water piping for further potable applications (softeners, ice-makers) or non-potable applications (chillers, deionizers, sterilizers, etc.). Some of these processes increase the potential for microbial amplification by removing the disinfectant with carbon pre-filters (many ice makers, deionizers). Though these systems typically have pre-filters for particle and microorganism removal, those filters may not maintain their integrity over the course of time, and microbial populations may become established within the process itself. In the absence of disinfectant (which was removed by the carbon filter), this community may proliferate. Therefore, a BWMP should identify these processes as control points if there is a risk that their use could be a hazard. Operators would need to be aware of how these systems operate and are maintained. Backflow prevention on the feed lines and cross-connection control of the product lines must be incorporated in the BWMP and carried out on a regular schedule.

One approach taken in anticipation of degraded building water quality is to install POU filtration. While filters can provide health protection when properly installed and maintained, they may also trap significant other materials from the water, and eventually become a center of microbial amplification. Should these filters lose their integrity, they could pose a public health liability rather than pathogen barrier. Operators would need to be aware of what type of filter is appropriate for the application at hand, how to properly install them, and when to replace them as part of the BWMP.

Other secondary water processes can create hazardous situations by the way the water is released. These include water features such as decorative fountains and waterfalls that typically involve the pumped recirculation of water from sumps to discharge orifices to create a flowing or spraying visual effect. Potable water may be meted in as make up for evaporative or spray loss. However, water age, heat (in features that are lighted) and loss of residual create an environment conducive for opportunistic pathogen amplification, for which the spray/aerosolization of the features are ideal disseminators.

In a similar fashion, cooling towers create fine mists and cascades of water to cause warmed water to lose heat, creating a cool body of water that subsequently cools recirculated loops that are used in the facility's air conditioning system. Cooling tower maintenance is essential to reduce the risk of pathogen growth and dissemination. As part of this maintenance, cooling tower waters are typically treated with biocides to control microbial growth. Many facilities rely on water treatment contractors to maintain cooling towers.

## Comparison of building water system operation requirements with those of distribution systems and treatment plants

The knowledge, skills and abilities associated with operating PWS treatment plants, PWS distribution systems and BWSs are listed and contrasted in Table 1. Note that while some of these criteria overlap, many do not. Those specific to BWSs are not within the scope, training or certification of PWS operators.

*Table 1. Comparison of Knowledge, Skills and Abilities Needed for Certification of Operators of PWS Water Treatment Operations, PWS Distribution Systems and Building Water Systems*

| General Category | Specific Field of Concern | Treatment System | Distribution System | Building Water System |
|---|---|---|---|---|
| * = with BWMP; X† = with in-house treatment; X‡ = with copper-silver ionization | | | | |
| **Source Water** | Watershed protection | X | | |
| | Wells | X | | |
| | Groundwater | X | | |
| | Surface water | X | | |
| | Reservoirs | X | | |
| | Raw water storage | X | | |
| **Primary Water Treatment Processes** | Coagulation | X | | |
| | Flocculation | X | | |
| | Sedimentation | X | | |
| | Filtration | X | | |
| | Primary disinfection | X | | |
| | Corrosion control | X | | |
| | Taste and odor | X | | |
| | Iron and manganese removal | X | | |
| | Fluoridation | X | | |
| **Finished Water Storage and Delivery Processes** | Clear well storage | X | | |
| | Disinfection | X | X | X† |
| | Baffle factor | X | | |
| | Contact time | X | X | X† |
| | Water main booster disinfection | | X | |
| | Disinfectant by-products | X | X | |
| | Chloramination | X | X | |
| | Chlorine curve chemistry | X | X | |
| | Storage tank structural maintenance | X | X | |
| | Storage tank cleaning | X | X | |
| | Storage tank disinfection | X | X | |
| | Pipe cleaning | | X | |
| | Pipe excavation | | X | |

| General Category | Specific Field of Concern | Treatment System | Distribution System | Building Water System |
|---|---|---|---|---|
| * = with BWMP; X†= with in-house treatment; X‡ = with copper-silver ionization | | | | |
| | Pipe installation | | X | |
| | Pipe repair | | X | |
| | Pipe joints and fittings | | X | |
| | Pipe selection | | X | |
| | Service line installation | | X | |
| | Backflow prevention | X | X | X |
| | Cross connection control | X | X | X* |
| **Secondary Water Processes** | Softeners | | | X |
| | Point-of-use filters | | | X |
| | Ice makers | | | X* |
| | Reverse osmosis units | | | X |
| | Sterilizers | | | X |
| | Chillers | | | X |
| | Cooling towers | | | X |
| **Hot Water Systems** | Water heaters | | | X |
| | Balancing valves | | | X |
| | Recirculation loops | | | X |
| | Expansion tanks | | | X |
| | Thermal mixing valves | | | X |
| **Operation / Maintenance** | Chemical feeders | X | X | X†‡ |
| | Pumps and motors | X | | X |
| | Blowers and compressors | X | | X |
| | Water meters | | X | X |
| | Pressure gauges | X | X | X |
| | Instrumentation | X | X | X* |
| | Electrical generators | X | X | X |
| | Isolation valves | X | X | X |
| | Water meters | X | X | |
| | Hydrants | X | X | |
| | Corrosion | X | X | X |
| | In-Line sensors | X | X | X* |
| | Power generators | X | X | |
| | SCADA | X | X | |
| | Pump types, uses, and sizes | X | X | X |
| | Pump troubleshoot and repair | X | X | X |
| | Equipment installation and repair | X | X | X |
| | Flushing | X | X | X* |
| **Laboratory/ Analytical Procedures** | Sampling | X | X | X* |
| | General lab practices | X | | |
| | Jar tests | X | | |
| | Disinfectant analysis | X | X | X† |
| | Alkalinity analysis | X | | X† |

| General Category | Specific Field of Concern | Treatment System | Distribution System | Building Water System |
|---|---|---|---|---|
| * = with BWMP; X†= with in-house treatment; X‡ = with copper-silver ionization | | | | |
| | pH analysis | X | X | X† |
| | Turbidity analysis | X | X | X* |
| | Specific conductance | X | | |
| | Hardness | X | | X† |
| | Fluoride analysis | X | | |
| | Color analysis | X | X | |
| | Taste and odor analysis | X | X | |
| | Microbiological analysis | X | | X* |
| | Coliform bacteria | X | | |
| | Heterotrophic bacteria | X | | |
| | Organic and inorganic contaminants | X | | |
| **Water Quality Assessment** | Sanitary survey | | X | X† |
| | Water age | | X | X* |
| | Water temperature | | X | X* |
| | Dead legs | | | X* |
| | Waterborne disease investigations | X | X | X* |
| | Safety | X | X | X |
| | Planning | X | X | X |
| | Organizing | X | | X* |
| | Directing | X | | |
| | Controlling | X | X | |
| | Implementing regulations, management plan | X | X | X* |
| | Recordkeeping | X | X | X* |
| | State water standards | X | X | |
| | Safe Drinking Water Act | X | X | X |
| **Regulations, Administrative Duties** | Surface Water Treatment Rule | X | X | |
| | Primary contaminants | X | X | |
| | Secondary contaminants | X | X | X‡ |
| | Lead and Copper Rule | X | X | X‡ |
| | Revised Total Coliform Rule | X | X | |
| | Stage 1 and 2 DBP Rules | X | X | |
| | Operator certification regulations | X | X | X† |
| | FIFRA 40 CFR 40 §152 (treatment devices) | | | X†‡ |
| | State/local plumbing code | | | X |
| | ASHRAE 188 - 2018 | | | X* |
| | CDC *Legionella* Tool Kit, 2016 | | | X* |
| | CMS 2017, revised 2018 | | | X* |

* = with WMP
†= with in-house treatment
‡ = with copper-silver

# BWS Operation and Regulation – Results from an ASDWA Survey and Phone Interviews

Prior to the initiation of this project, in mid-2018 ASDWA conducted outreach to state regulators to understand current and near-future plans for regulating BWSs as consecutive systems. Key findings from that survey are presented here because they provide the backdrop for BWS operator qualifications and certification and demonstrate the range of states' likely approaches to regulating BWSs.

At present, responding state agencies vary widely in their approach to regulating BWSs and the number of facilities currently regulated as consecutive systems. Some states report that they are not currently regulating any BWSs, even those with supplemental treatment, as consecutive systems. In some cases, states do not regulate BWSs because they are waiting for US EPA guidance and decisions. At least one state has decided not to regulate BWSs because it believes BWSs regulation is under plumbing regulations. On the other end of the spectrum, several states report currently regulating BWSs as consecutive systems and are regulating between tens and hundreds of systems at present.

Regulators were asked to specify whether particular treatment processes trigger regulation of a BWS as a consecutive system in their states. Results of answers to those questions are summarized in Table 2. Generally, chemical disinfection is highly likely to trigger regulation and other processes are less likely. Other processes mentioned that might trigger regulation included corrosion control, reverse osmosis (not specified whether this was for whole buildings or at POU), mixed oxidant (MIOX) on-site generation, green sand filtration and pH adjustment.

*Table 2. Summary of Technologies Triggering Regulation as a Consecutive PWS*

| | **Would trigger regulation as a consecutive system?** | |
|---|---|---|
| **Treatment process** | **N** | **Y** |
| Softening | 25 | 8 |
| Chlorine dioxide | 5 | 28 |
| Free or total chlorine | 5 | 29 |
| Shock chlorination | 31 | 1 |
| Copper-silver | 7 | 23 |
| Ozone | 4 | 27 |
| UV | 17 | 16 |
| Treatment in hot water only | 16 | 12 |
| Temperature control | 32 | 0 |
| POU devices | 24 | 7 |

All respondents except one indicated that operator certification is required for BWSs regulated as consecutive systems. One respondent noted that requiring certified operators for buildings would "not only protect the system they serve, but to also protect the wholesaler."

All respondents indicated that BWS operators would be required to monitor for process control and most of the respondents indicated that regulated BWSs would be required to monitor routinely as required for consecutive non-transient non-community water systems. Respondents were mixed on requiring routine monitoring for specific contaminants such as *Legionella pneumophila*.

For this white paper, two states responded to requests for phone interviews for collecting additional information on how operators are certified in their states and how BWS operators are or could be certified. Results of those interviews are presented below.

*Q1. Do you currently regulate buildings as public water suppliers in your state?*

State 1 only regulates one or two buildings as consecutive systems because of treatment applied in the BWS. This is more because of copper than *Legionella* for now. State 1 is starting to draft a strategy based on approaches other states are using. They will finalize the strategy around the end of 2019. Might be regulating, but not sure to which level. Some older laws refer to "water companies." An alternative approach for state 1 is to regulate BWSs as water companies rather than public water systems. The designation "water company" has been used in state 1 since before the SDWA.

State 2 already regulates BWSs as consecutive system. If the applicability criteria under 40 CFR 141.3 (National Primary Drinking Water Regulations, or NPDWRs) are met (treatment installed or own source of potable water supply) and staff know about it, then staff must regulate the facility as a public water system. The state maintains a document entitled "When an institutional building becomes a water system" online and available to the public.

*Q2. What operator certification levels are there in your state and which one does or could apply to BWS operators?*

State 1 anticipates using current treatment plant and distribution system operator certifications for BWS operators. More complex systems would require treatment plant operator certification, whereas simpler BWS operators would require distribution system operator certification.

State 2 follows the ABC criteria for scope of operator certification. They do not require water treatment plant operators for simple chemical injection facilities. An operator of a consecutive system can be a distribution system operator. In the estimation of state 2, a water distribution classification is appropriate for operators of BWSs.

*Q3. Do you use NPDWR exemptions for buildings?*

State 1 does not use NPDWR exemptions. State 2 uses exemptions as specified in 40CFR121.29. Monitoring of consecutive PWSs includes NPDWR exemptions for certain monitoring activities. Those are mainly exemptions for monitoring. If the supplier (wholesaler) monitors for certain parameters, the BWS would not have to monitor for those parameters if it is unlikely that they would change in the BWS.

*Q4. What is the BWS operator's role – what do you expect the operator to do? What is your expectation of the operator's responsibility?*

State 1 responded that, broadly, they have direct responsible charge of the system. This includes oversight of all daily operational and maintenance decisions. Operators make all decisions with respect to water quality and quantity, centered on public health. Similarly, state 2 responded that operators ensure the safe and reliable operation of any equipment installed that adjusts water quality.

*Q5. Do you apply other guidances, standards and regulations to building water systems? If so, which ones and for what aspects, e.g., ASHRAE 188?*

For state 1, these guidances and regulation are administered under the health care licensure program (nursing homes and hospitals) and outside of the drinking water program. The health care licensure program is applying the CDC toolkit for water safety plans. Inspectors are using the toolkit to enforce certain parts of the water management plan. Regulators are using the guide as a regulation to meet CMS requirements and are citing health care facilities that don't have a complete water management plan. Inspections are done on an annual basis. Inspections could provide an opportunity for the drinking water program to learn where treatment is in place. In all interviews the regulators indicated that BWSs would need to meet regulatory requirements AND develop a BWMP. There was no indication of whether there would be any review of the BWMP by any external party.

For state 2, in the drinking regulatory water context (authority related to NPDWRs and state related regs) the primacy agency can guide, recommend and advise to use other materials/guidelines and standards. However, they don't apply those materials as a component of regular regulations. For example, the CMS guidelines are on *Legionella* control are outside the regulator's drinking water regulatory lanes. Drinking water staff do work with and support their colleagues in the department of health who conduct hospital inspections and make them aware of the thresholds for becoming a public water system.

*Q6. What compliance parameters are likely to be under the umbrella of the water supplier (and not the responsibility of the BWS operator)? E.g., would a BWS operator have to collect RTCR and or Disinfection Byproducts Rule (DBP) samples, or is it acceptable that the water supplier is ensuring compliance with the rules?*

For state 1, entry point monitoring is likely to be the responsibility of the water supplier (PWS; wholesaler). Total coliforms, lead and copper, chlorine, DBPs etc. in the building would be the responsibility of the BWS operator. Generally, compliance could be similar to that already in place for consecutive systems. Meter readings, flushing etc. could be conducted by a certified operator, like a consecutive system.

For state 2, RTCR, DBP, and LCR samples have to be collected and analyzed for a building water system regulated as a consecutive public water system. When it comes to source samples, the SOC/VOC/radionuclide samples are not collected by the building PWS. Anything that impacts water quality would require monitoring. That is, if chemicals are added or water quality changes in the consecutive system, related parameters need to be monitored.

*Q7. Please share additional thoughts or comments*

State 1 is moving ahead developing a strategy for regulating or overseeing BWSs because of an increased incidence in legionellosis in recent years and because there is a good relationship between all of the relevant state departments and many disciplines are involved (toxicologists, epidemiologists, drinking water specialists and others). Open questions for state 1 are:

- How to handle RTCR and DBP monitoring of cold water, given that many treatment systems target hot water?

- Intermittent operation of building water systems v. continuous disinfection. How would compliance monitoring be administered? For example, how would one account for shock chlorination/disinfection?

State 2 mentioned that their planning program is the primary means by which they help water systems develop, demonstrate, and assess that they have the technical, managerial, and financial capacity to run a water system. Planning requirements are intended for "typical" water systems, so staff are working to tailor these planning requirements to institutional buildings (hospitals, other medical facilities, schools, etc.).

## Recommendation for a New Class of Operator for BWSs

Building water systems are very different from municipal PWS distribution systems. Some people have described them as vertical distribution systems, but this is an oversimplification and incorrect. A simple description of the differences can be summed up as follows: PWS distribution systems move cold water through large pipes, generally in one direction and to waste. A BWS moves both hot and cold water in many directions throughout the building and its associated fixtures (cooling towers, decorative fountains, spas), often has periods of stagnation that can lead to extreme water age, has multiple in-building processes including heating and recirculation, and provides a unique ecosystem different from the PWS. There is direct exposure to people from the water in a building. And every building is a dead end.

The skills needed for PWS distribution system and BWS operation have some overlap, but each has unique training and experience requirements. This poses the idea that if states regulate buildings that have installed treatment as PWSs, then a new class of operator may be needed for BWSs. Points to be considered as states review their positions on how to deal with building water systems include:

1. What is the role of the certified operator requirement for a building (compliance or holistic water quality management)?
    a. For example, it appears that in some states where copper-silver ionization is used in a building to control *Legionella*, the operator's role is to sample and make sure the water quality does not exceed the copper LCR action level of 1.3 mg/L. There is no requirement to assess whether the levels of copper and silver are bactericidal or if the treatment is controlling *Legionella* by monitoring for it. In this situation, the certified operator role appears to be focused on LCR compliance and does not address any of the issues related to building water quality. This also means that the fallback for assessing if treatment is effective or not is whether disease is observed related to the facility, which is not protective of public health. The full role of the operator for a building with copper-silver ionization treatment should be to ensure compliance with the LCR *and* to ensure the treatment process is operated as intended and is meeting target concentrations for silver and copper throughout the BWS and is controlling *Legionella.*
    b. Similarly, with chlorine-based disinfectants, is the role of the certified operator focused on maintaining a specific residual level at certain points in the building (e.g., distal taps) and/or compliance with the DBP Rule? If specified residuals are being met at distal taps,

are pathogens controlled? Do the disinfectant concentration targets apply to both cold and hot water? The role of the operator should be to both ensure compliance with regulations and to operate the building water system according to the water management plan and within specified control limits to manage overall water quality and control *Legionella*.

2. If the role of the certified operator is compliance with current SDWA regulations, this is different than managing building water quality from the holistic perspective. Certified water treatment and distribution system operators are not trained, skilled or certified to manage overall building water quality as described previously in this paper. Having a certified operator requirement where the focus is on regulatory compliance can give a false sense of public health protection with respect to the building since the operator is not managing overall building water quality.

3. Should states decide that a holistic approach for building water quality is needed when treatment is added, or to ensure proper management of water quality independent of supplemental treatment through ASHRAE-based WMPs, a new class of certified operator (e.g., BWS operator) could be established. This falls into place within the current SDWA regulatory framework since states manage water treatment and distribution and the operator certification programs. A certification program for BWS operators is best developed from the drinking water perspective by drinking water professionals (American Water Works Association [AWWA], ASDWA) vs ASHRAE, the NSF International, American Society of Sanitary Engineering (ASSE) or other organizations which serve a different role.