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RECOMMISSIONING DORMANT WATER SYSTEMS

QUESTION & ANSWERS

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GENERAL DISCLAIMER for ANSWERS PROVIDED
All questions are answered using broad industry methods or best practices and not intended to be a specific solution for any building water distribution system since we do not have any information about your organization's building water system or water management program. All information should be reviewed in the context of your water management program and decisions of the WMP team. Additionally, you must check with any authority having jurisdiction at the local, county, state, or federal levels before taking action about recommissioning activities including disinfection and flushing activities.

Question #	Question Asked	Answer Given
1	For potable water fixture flushing, what is the range of water temperature used to flush?	The flushing would be to the temperature the system is set at to run during normal operating conditions. When flushing we suggest opening the cold water first then run the hot water to the highest temperature allowed through the system. If your question implies doing a superheating flush of the system that is a different matter and may involve raising the temperature of the entire system on a temporary basis but this should not be attempted without a coordinated water management team effort to avoid scalding, plumbing problems, biofilm sluff-off or other unintended consequences.
2	Please address Ice makers	Ice makers sitting in dormant buildings along with any other device with water

		reservoirs or storage/holding of water of any volume need to be emptied, drained, completely, cleaned, filter removed/replaced, and essentially go through a full preventive maintenance procedure per manufacturer's equipment recommendations to bring back into normal operating conditions. Also flush the "hard plumb" connection at the wall similar to other fixture flushing. If the building is going to remain dormant, your team should consider taking the ice machines out of service, empty, drain, and completely dry out the unit until you're ready to recommission the device. Then continue to flush the wall connection as you would any other fixture on your flushing schedule.
3	Expand Hyperchlorination details for buildings	We would note to your organization that significantly lower hyperchlorination levels are recommended than listed in the building codes and need to be reviewed with your local authorities having jurisdiction. By example: for new buildings disinfection / hyperchlorination at building start-up is often defined in the International Plumbing Code and Uniform Plumbing Code use 50 ppm for 24 hours or 200 ppm for 3 hours of hold time. We do not recommend levels this high for the hyperchlorination of existing buildings except in extenuating circumstances. ASHRAE 12-2000R (public review document) suggests that these levels often reference from the AWWA C651 are too high, harsh, and are not intended for potable water distribution systems (within the building systems) only water mains for connection to the building. Similarly,

		"ASHRAE 12-2000R indicates 5.5.1.1 Chlorine. Chlorine is the chemical disinfectant most often used for chemical shock of potable water systems colonized by *Legionella*. For example, under a typical chlorine shock protocol, sodium hypochlorite solution is added in sufficient amount to develop a free chlorine residual of 20 mg/L and to maintain that level tor 2 hours. Sometimes, chlorine shock protocols use lower chemical concentrations for longer periods, such as maintain a concentration of 4mg/L free chlorine residual for 4 hours (this allows the fixtures to remain open). Chlorine effectiveness is affected by pH. When using chlorine for shock chlorination, the pH of water should be maintained at less than pH 8. After completion of treatment, the system should be thoroughly flushed before use." However, in the recent ASHRAE 12-2020 final document this section was removed.
4	There appears to be significant risks with showers in university dormitory facilities. Proper operation of Hot Water Return systems is critical; however, appears to be little understanding on this. E.G legionellosis grows if the temperatures are not maintained (140 to 120 degrees F is goal).	*Legionella* optimal growth ranges are (77 - 108 degrees F) per the CDC Toolkit. Maintaining adequate temperature level is a known control for reducing the likelihood of *Legionella* growth and spread. Your organization would need to keep logs / documentation of such. Also, after dormant periods your organization may consider removing shower head and aerators and soaking in a mild bleach solution, then flush the system to assure bacteria is not stagnated in the head of the fixtures in dormitory settings.
5	Are there any testing or standards for buildings with Pex plumbing?	We are not familiar with a "standard' for PEX plumbing / piping distribution systems, however a scientific resource that reviews

		piping materials including PEX is the National Academy of Sciences Engineering & Medicine (NASEM) Management of *Legionella* in Water Systems 2020. The entire document is available free online as a downloadable PDF if you register with the site. Google search the title. This was recently published and page 186 starts a discussion on Plumbing Materials. Also search the PDF document for other PEX references.
6	Do you have any recommissioning plans tailored for airports terminal buildings and jet bridges potable water systems?	Every Water Management Program and recommissioning plan is unique and are not transferrable from one facility to another - even if the building uses are similar. That said, the water systems and fixtures in an airport and on jet bridges are no different than in many other complex buildings.
7	It was mentioned that flushing (for commissioning) should start 3 weeks prior to operations starting (resuming). What if we expect staff to return sooner than 3 weeks? Is it safe or should 3 weeks of flushing be performed as a pre-requisite for operations resuming?	Your organization is going to have to decide on the risk of specific situations. Ideally your team would begin a process of prioritizing locations/building and develop a plan of action for each building. If you expect staff in early what are the exposure fixture types? Will staff/faculty be required to wear proper PPE and face masks to reduce exposure not just for COVID-19 but for aerosolized water from fixtures? That said, it is always better to flush early and often. The question to ask is how you are going to validate (test) that the flushing was effective.
8	We don't have current water programs as described by CDC. We have a need to develop a plan to get our buildings back to operational status as soon as possible. Is	Your organization could start with a recommissioning water management program effort that dovetails into a longer-term effort of an on-going water management program. As we mentioned buildings can be sub-categorized and

	there any basic guidance on what we need to do at a minimum to ensure water safety? We have 100+ buildings on campus that we may consider dormant with possibility of stagnant water with staff wanting to come back as soon as stay at home orders are lifted and don't have time to develop a full WMP.	develop a re-commissioning plan that is scheduled based on available manpower and critical re-occupancy dates. If your team is unfamiliar with water management please go to the following training source for base information. https://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html
9	Will the CDC or state-run programs provide a fact sheet that can local government agencies can provide to businesses that plan to re-open soon during COVID-19?	The CDC has chosen to refer to basic water management program guidelines and not provide further definition from there. Some state authorities have chosen to write a guidance document about their expectations. We have actually participated in writing some of these types of policies for agencies. Your organization will have to consult with local authorities having jurisdiction. Please review the links for CDC, AWWA, and other provided in the slide presentation.
10	What type of resource should I use to test for *Legionella* and what credentials should they have?	*Legionella* testing should be conducted by a CDC ELITE Laboratory (see their website for a list). Phigenics is certified as a CDC ELITE laboratory. There are numerous new rapid testing technologies (Phigenics has a PCR test with 24-hour turnaround) available for *Legionella* testing. Be sure to understand the difference between various test methods when determining who you would like to work with and who can assist your organization with interpretation of results. Not all laboratories assist with interpretation of results.
11	What type of vendor should I use to confirm building	There are a series of steps your team should take. First, document all flushing

	flushing and disinfection is complete?	and disinfection activities. Require any company performing services to submit a short report (even if one page) on who, what, when and where services were performed if by a third party. If internal keep logs and records. These documents are necessary to perform verification of the water management program (WMP). For confirmation of a WMP this can be either verification activities or validation activities. We recommend an *independent* third-party organization to verify and validate the WMP. Phigenics performs those services on WMPs. We can audit your WMP to assure it aligns with ASHRAE Standard 188. If an independent consultant is not an option your organization could ask a different department in your organization (health and safety) to verify the WMP is being implemented as designed and then coordinate validation testing with an independent third party. The important point for defensibility is to avoid the same team members who manage the WMP from confirming it operations or testing to assure no one on the team is "rigging or gaming" the system.
12	Are there online resources that provide water management plan templates for download as a place to start?	We recommend the CDC Prevent LD On-line Training. In the learning modules are examples of spreadsheet and other documentation needed for what we might called a DYI WMP. You can also print the CDC Toolkit from their web site and pick up basic information from there. We highly recommend watching the 2 case study examples after the modules that show how a water management team navigates the spreadsheets.

		https://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html
13	Is it a good or bad idea to circulate domestic hot water?	Typically, it is a good idea to recirculate potable hot water loop, but this also assumes the loop is in use and flushing is occurring to periodically bring fresh water into the system. Processing water through any step and particularly heat cycles of water commonly reduces disinfectant levels (i.e. constantly recirculating hot water with no use could be challenging).
14	Does it matter where you start when flushing? Start at incoming water to building or at the top of the system?	Yes, it does matter. You need to move water with disinfectant from the street to the building, through the hot and cold-water distribution systems, including process and storage steps and then out through the fixtures. The key question is - does the water have disinfectant in it all the way through its journey. You should have at least 0.50 ppm of disinfectant residual coming in and never go below 0.20 ppm anywhere in the water distribution system or coming out the fixtures. If you are not receiving adequate levels of disinfectant at the main entry point contact your local water supply authority and see if the street main or other inlets can be flushed to bring in adequate disinfectant levels.
15	We have been running hot and cold water in bathrooms and flushing toilets weekly since March. Would you consider this as 'dormant"?	The short answer is no, but without knowing more details about the size of your buildings and the piping, the answer to whether the water is safe is maybe. Flushing is good, but it does not automatically equate to safety without ensuring that disinfectant made it through the water system and fixtures. And then with validation that the flushing was

		effective. And as always, document everything.
16	Aren't most mains on campus connected to fire Hydrants? should you not flush those to clear the mains?	Every building could be slightly different in terms of where and how to flush the underground main feeding the infrastructure to the building. If fire hydrants are involved those too may need to be flushed but obviously it depends whose jurisdiction those are under and qualified professionals flush fire hydrants under pressure.
17	For water fountains should we just run so many gallons through? If so what's the recommended gallons?	Measuring the number of gallons of water with adequate disinfectant in it that are run through a fixture is one way to go about flushing, until you think about how you are going to do it (a gallon bucket works). We just recommend 5 minutes of flushing with adequate disinfectant per fixture. More is better.
18	Most of our building was closed since March A catering kitchen remained open. Our water usage may have dropped 80% since March. Is the partial water flow enough to mitigate the risks?	In our opinion low flow is better than no flow but essentially all the other fixtures in the building that are not being used become dead legs. Bacteria growth can easily occur in dead-leg conditions under normal operating conditions, let alone in low or no flow operating conditions. Your organization should consider recommissioning the building to include flushing all fixtures and measure for adequate disinfection residuals.
19	Are there suggestions for applying or dosing the system with disinfectant? (Pot feeders, injection points etc.).	First, investigate your state and local regulations on adding disinfectant to drinking water. You may inject at the incoming water line or at various processing points throughout the system (like the hot water loops) depending upon the reason for the hyperchlorination. We recommend dosing at levels below 4 ppm (at the nearest fixture). We do not

		recommend higher levels in existing buildings except in extenuating circumstances. See question and response above on hyperchlorination.
20	1. Has Legionnaire's disease ever been cause by a potable water system using only groundwater as its source? The outbreaks that I have examined have all been in systems that use surface water. 2. If a facility has been using un-treated ground water with no added disinfectant, does any remediation need to be done after a period of dormancy other than thorough flushing?	1) MMWR citing 24.2% of outbreaks from 2009 - 2010 are from untreated ground water sources. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6235a3.htm Similar report in 2011-2012 (13% from ground water). Various periodic MMWR reports summarizing *Legionella* and other waterborne pathogens list a percentage of disease cases and outbreaks from untreated ground water - above are just two examples. 2) There are too many variables to answer this question and assure safe water usage. For a legal answer, you would need to consult your local/state authority having jurisdiction for water supply in your area.
21	1. Do idle potable systems using groundwater have fewer and less severe bacteria and biofilms than surface water sourced systems? Do these groundwater sourced systems need any remediation other than thorough flushing?	See above answer.
22	1. If a softener has been idle, does it need to be disinfected, or is flushing typically adequate?	Flushing is always appropriate. Whether or not it is adequate is unknown without validation testing.
23	1. What is the maximum concentration limit of *Legionella* in a potable water system, above which it would	There is no safe level of *Legionella* in a potable water system. Validation testing is performed at various levels of detection <1 CFU/mL or <10 CFU/mL. Most of our

	be considered unsafe to re-open to users?	building owner clients want to maintain *Legionella* detection at <1 CFU/mL. Also, as an indicator of water quality they typically perform routine flushing protocols to maintain THAB (total heterotrophic aerobic bacteria) count at < or = to 10^3 CFU/mL.
24	1. I have seen various organization mention a dormant period of 3 weeks as being the maximum time allowed, after which re-commissioning of the water systems is required. Do you agree with this?	ANSI/ANSRAE Standard 188 Section 8.4 Commissioning is the only published standard which addresses commissioning related to construction and states disinfection and flushing shall be completed within three weeks prior to whole or partial occupancy. As far as we know, unless a state authority having jurisdiction published its own interpretation, this is where many are leaning on a 3-week time frame to define "dormancy." These standards as far as we know did not really anticipate all buildings being closed for extended periods of time during a pandemic. Some authorities having jurisdiction are interpreting this section at 30 days of no-occupancy and others at 21 days of no-occupancy. We are using the shorter interpretation of 21 days of no occupancy suggests that formal action should be taken.
25	how long can we let a building sit idle before flushing? 2 weeks? 3 weeks? We have been flushing when chlorine goes below 0.2 ppm, is this too much?	No. We see stagnant water emerge with low disinfectant residuals after even 1 week of non-use. The objective is a have 0.5 ppm of residual disinfectant through the building water system at the tap with a minimum of no less than 0.2 ppm. Flushing protocols will vary tremendously by size, scope, and complexity of the building water system.
26	EPA has posted this: https://www.epa.gov/coronavirus/information-maintaining-or-	Thank you for this Link - Attendees may want to review the EPAs 4-page document

	restoring-water-quality-buildings-low-or-no-use	+ 1-page checklist. Aligns with CDC WMP principles.
27	What % of typical usage would be considered closure?	No use is considered closure for > 21 days. If the building was occupied for low use that is not closure, however some authorities having jurisdiction are suggesting low use (no percentage given) is cause for concern. Our firm looks at any condition with suites or floors of unoccupied areas and the overall locations in the building of the unoccupied areas as part of a recommissioning process.
28	Should you set your domestic hot water temp over 131 Degrees to help with the growth of legionaries	Hot water at scalding temperatures is a physical hazard. Water at 130 F degrees can scald a healthy adult human in 30 seconds. There are typically two temperatures to be aware of: 1) temperature at the water heating source and 2) temperature when the water is delivered at the tap/fixture for final use. Temperature ranges usually drop over long distances in larger buildings therefore water heater at the source is hotter setting vs. hot water delivered to the fixture. Your organization must review building code scalding, measure, and record the differences in water temperature at the source vs. fixture to avoid scalding and safe delivery of water temperature. After understanding that, ideal temperatures for growth and spread of *Legionella* in premise plumbing is noted in the CDC Toolkit to be (77F - 108F degrees). Higher temperatures tend to kill bacteria but as CDC notes *Legionella* can grow in water above ideal ranges (i.e. there is no guarantee). The important point is to get water out of these lukewarm ranges, and this includes cold water that can sit in piping and increase in

		temperature. Be sure cold water is cold and hot water is hot without scalding.
29	Are there any potential health issues if there are only one or two residents in a large building (7 or 8 stories)?	We would phrase this differently to say the risk of growth and spread of waterborne pathogens in a low use 'mid-rise' building of 7 - 8 stories is greater with minimal residence occupying the building. All the unused taps/fixtures become dead legs in the system creating opportunities for stagnation within turn encourages bacteria growth and spread.
30	At a University, how does a lack of use during Covid compare to a normal lack of use	In our opinion this is more extreme conditions than typical university break periods due to almost no use of water in many buildings and this period of dormancy for many universities may not end in the fall of 2020. Although organizations obviously want to resume normal operations there are concerns still looming about virus spread among minors and young adults
31	We (155 hotel rooms) have been flushing daily in Las Vegas since the statewide shutdown. We flush every guest room fixture for 10-15 minutes per week, is a good amount of flushing?	This would seem like adequate flushing if your organization is also recording disinfectant residual readings to confirm adequate levels of disinfectant are present (>0.20 ppm) at the tap. You would not have to take readings at every fixture each week but select a random few fixtures per floor/wing to confirm flushing is adequate. We would also recommend keeping a log of these activities as part of your defensive that you were acting responsibly during the COVID-19 stay-at-home orders impacting your business operations. Your team may also want to consider removing aerators, shower head or shower hoses or hang them to drain properly so the devices are not collecting bacteria within each fixture. Your team can reassemble these fixtures

		once you're ready to resume normal operations. Finally, validation that the flushing is actually working is testing.
32	Showerheads, aerators, and sensor operated fixtures. What are your recommendations during the recommissioning procedure?	During recommissioning activities, we recommend removing any fixture heads or terminal devices to perform flushing. First, shower heads, shower hoses, and aerators will collect microbes at the terminal device. A stronger flush will occur without the restriction of the device, however, your facility obviously has to check that water will not be spraying or flooding into sinks or onto floors etc. that cannot drain larger water volumes with heads removed (i.e. showers). Second, your organization should consider using a mild chlorine (household bleach 5%) bleach bath in buckets to soak shower heads, hoses, and aerators that are soaked, rinsed, dried, and placed back into service. Be sure to remove, conduct flushing, then re-install after the system is back to normal operations conditions. Re-installing prior to flushing simply re-inoculated the fixture again. For sensor operated fixtures the same process would be true, but these fixtures need an extended flushing time. From our experience during commissioning of buildings post-construction these fixtures typically do not get run at the same length of flushing time due to the auto-time off cycle on most fixtures. This is annoying to maintenance personnel and these fixtures often get "skipped" due to the excessive manpower to conduct flushing. Be sure not to ignore these sensor operated fixtures in the flushing protocol of activities for recommissioning. They are often

		challenging with test results of high total bacteria counts compared to non-sensored sinks during validation testing.
33	Question: Realizing that every university responded differently to the COVID problem - we for example never shut down any facilities and continued to maintain all systems, what is your suggestion for future situations - should all water systems be maintained to avoid dormant water problems?	The short answer is yes. Maintaining a flushing protocol [x time for y frequency (daily or weekly)] is recommended to maintain adequate disinfectant levels in the potable building water distribution system at all times to minimize growth and spread of waterborne pathogens such as *Legionella*, among others. Your team should measure disinfectant residuals at fixtures for ideally no less than 0.50 ppm and 4.0 ppm max of residual disinfectant. At no time should disinfectant residual be lower than 0.20 ppm at any fixture. We recognize that resourcing can be a problem.
34	What if there is a bacteria presence detected? What measures should be taken to disinfect the building systems? How much time would this take (size is a factor but just a ballpark duration)?	If the water management program team determined that disinfection was necessary a qualified professional should be able to perform disinfection in a 24-hour period. Typically, chlorine disinfection "contact" time is better at lower ppm with a 24 hour hold time in our opinion. Some subcontractor trades will insist on high chlorine over 3-hour periods. Harsh chemicals at high ppm for short duration can cause metallurgy problems. The subtrades typically suggest higher and shorter to avoid sending their personnel back to the site for a 2nd day thus lowering costs for their work. Whatever approach is taken, the system must be properly dosed, held, and flushed back to normal operating levels of disinfectant before anyone can use the potable water system. Records, logs, and documentation of what was done must be kept. We also recommend that

		someone from the building owner observe the process to assure what you requested is being performed.
35	How often should our systems be flushed? I might have missed that answer.	See other answers on flushing protocols. There is no one singular method.
36	We measure good chlorine (>0.2mg/L), but there are many mixer taps. Should we sample for *Legionella* at those taps?	Testing needs to be a planned and coordinated event with your Water Management Team. We do not commonly recommend testing for *Legionella* without having a formal water management program (WMP) in place. If positive detection(s) emerge from testing without having a WMP the institution is often at a loss as to what to do next. People start to panic, and they start doing the risk management process out of sequence leading to more errors and negative unintended consequences. We recommend watching the CDC Prevent LD On-line Training program for more information or consulting with a water management professional for more guidance prior to testing. https://www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html
37	Super chlorinating an existing building plumbing system is not easy, do you have suggestions? Also, the City wastewater treatment plant does not want that water directly discharged to the sanitary sewer. Are there facilities that are doing this?	See previous answer on hyperchlorination above. Regarding discharge of hyperchlorinated water to the sewer, we have clients that have experienced both reactions depending upon local authorities having jurisdiction. Most of our clients across the US are allowed to dispose of hyperchlorinated water directly to the sewer. However, separate from construction and building codes, we would recommend using lower levels of hyperchlorination in previously active buildings (similar to answer above) and

		check with local authority on a threshold reasonable hyperchlorination limit that is effective for killing bacteria while at the same time allowable to the potable sewer line.
38	Do school facilities have a good track record for summer shutdowns that could inform and guide what we are facing with these COVID 19 shutdowns?	In our experience educational organizations have primarily ignored low or no use periods for building water systems at seasonal semester breaks (spring, summer, or winter). They simply assume conditions are the same prior to and after breaks. Obviously the longer the break period the more disconcerting the situation is. The COVID-19 stay at home is now extending low and no use into extended periods of time (6+ months) which is now become worrisome to not only the educational provider but to local authorities having jurisdiction.
39	This is very detailed. While the speakers have not said this overtly is it a given that if a building is not used for 30 days that *Legionella* is present? Is there a quick on-site way to test for *Legionella* right there at the structure??	We would phrase your statement differently. If the building has low or no water use > 21 days there is a greater likelihood of increase risk from waterborne pathogens such as *Legionella*. It does not mean *Legionella* is present or live bacteria is in the system. Phigenics offers rapid testing for negative predictive value screen to detect *Legionella* DNA within 24 hours (shipped to our lab). An additional 4-day test can determine if the *Legionella* DNA is alive or dead to a limit of detection of 10 CFU/mL.
40	Does continuous supplemental disinfection fall under local DEP rules?	Regulations and the enforcement of regulations varies by state and locality. We have seen both state and local enforcement (and no enforcement) of continuous supplemental disinfection as well as intermittent supplemental disinfection.

41	How should one handle all of the water cooler fountains that have an internal reservoir for buildings that been unoccupied? Is flushing enough?	Drain and flush with water with that has at least 0.5ppm of disinfectant. The question "Is flushing enough?" cannot be answered definitively without testing. And since most facilities are not going to test all or even some of the fountains, the question is then how did my Water Management Program assess the probability of exposure and the severity of exposure for each of these fixtures and how did your program decide to control that risk.
42	Is there a minimum recommended water velocity for the flushing of the water distribution system? Do we need to worry about biofilms in the water distribution piping? Many buildings have oversized water distribution piping.	There is no standard specification for a minimum water velocity for flushing. Typically, potable water flushing is done at the maximum rate from opening taps full-on. Biofilms in water distribution is the key microbiological factor that leads to unsafe water quality conditions in buildings. Typically, maintaining continuously free residual oxidant residuals above 0.2ppm as chlorine will control development of biofilms in water distribution systems. Note that higher concentrations may be necessary in hot water recirculation loops and during the warmer months when microbial loading to source water compared to cooler months.
43	Thoughts on qPCR DNA testing that is done at the facility, not a lab?	Performing PCR in the field is now possible but not very practical, as follows. We have extensively evaluated all of the commercially available field PCR protocols, devices, and kits. The results from these products are exactly equivalent to results from the Phigenics Next Day *Legionella* PCR. However, on-site PCR analyses are not practical (in our opinion) because it takes too long to process a sample and the cost per sample is far too high: 1) more than one hour is required per sample when

		including sample filtration/DNA extraction steps, 2) only one sample at a time can be analyzed, or in some recently introduced devices, a few more samples can be processed simultaneously and 3) the capital cost of the equipment (several thousands of dollars) and the cost per sample (about $100 or so) is very high. Additionally, of note is that one of the PCR device manufactures is errantly claiming their results indicate viable *Legionella*. This is not true. Their protocol indicates that results are intact cell-associated DNA because samples are filtered (btw, field protocols for analytical filtration by people in the field are notoriously fraught with difficulty, highly tedious and prone to error). However, intact cells are not always viable especially if the antimicrobials in use are those typically applied for potable and non-potable water treatment. Therefore, there will be many PCR-positive samples that will be culture-negative. The claim by the device manager that their results correlate with viable *Legionella* is dangerously wrong; there will be many false viable-positive results from these analyses.

44	Our water quality lab has an Idexx machine for *Legionella* testing. What is an acceptable concentration? One person mentioned <10 per mL. What do you advise?	There is no “acceptable concentration” because the CDC has officially stated “there is no known safe concentration of *Legionella*”. Therefore, the WMT must consider their site-specific situation. Typically, for cooling water, a concentration at or below 10 CFU/ml *Legionella* is regarded as acceptable microbial control. For potable water systems in buildings, typically a concentration of *Legionella* at or below 1 CFU/ml is regarded as acceptable

		microbial control. Phigenics advises that validation (confirmation of hazard control) is best achieved by testing appropriate sample locations to determine total heterotrophic aerobic bacteria (THAB) and *Legionella*. For cooling water, THAB results (when the diagnostic is performed properly) at or below 10E4 CFU/ml and no detectable *Legionella* (at 10 CFU/ml limit of detection) typically indicates good microbial control. For potable water in buildings, THAB results (when the diagnostic is performed properly) at or below 10E3 CFU/ml and no detectable *Legionella* (at 1 CFU/ml limit of detection) typically indicates good microbial control. Note that results from the IDEXX Legiolert method are not adequate for validation regardless of the above answer about detected levels. There are several reasons we cannot recommend the IDEXX Legiolert diagnostic. Firstly, the method does not detect non-pneumophila species of *Legionella*. Notwithstanding claims by IDEEXX, this is a significant limitation. According to CDC and others, as much as 15% of disease cases are caused by species other than *Legionella* pneumophila. Secondly, the method does not produce an isolate that can be characterized as to serogroup; therefore, positive results have to be plated anyway in order to determine the serogroup of any detected L. pneumophila. Lastly, there is no practical difference in the time to get results (7-day incubation is required) and there is no significant cost savings. Therefore, we cannot recommend this diagnostic.