Public Comments by Tim Keane, Legionella Risk Management, Inc.
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In my presentation to National Academy of Sciences, Engineering and Medicine I discussed the many public health failures regarding Legionella. One of the worst public health failures on this issue is VA Directive 1061 which this 160°F Illinois proposed plumbing code change is based upon. https://www.youtube.com/watch?v=MzwAfOlE0eo

Illinois Veterans Home at Quincy (IVHQ) was the trial site for this 160°F solution to the Legionella problem. This solution was implemented at IVHQ in 2015-2016. IVHQ proceeded to have additional Legionnaires' disease cases followed by CDC investigations in 2016, 2017 and 2018. The 160°F hot water solution was proven ineffective over multiple years at IVHQ.

In 2018, I proposed a simple, cost-effective solution to the LD issues at IVHQ by replacing the chlorine / chlorine dioxide disinfectant with chloramine. Virginia Tech was contracted to provide an independent study of these proposed and implemented changes. These changes were implemented December 6,2018. Data form both Virginia Tech and my reports shows excellent results with this program. On a January 9 email Dave Clifford stated, *"I am sleeping well for the first time in a long time!"*

Our success in addressing this issue in December of 2018 proved the years of CDC reports stating the problem was due to old pipes were wrong.

CDC report Feb 2018 epi-aid investigation

> "Despite the considerable time, effort, and resources committed to achieving an optimal water management program at IVHQ, there continues to be *Legionella* growth and cases of Legionnaires' disease associated with the Elmore and Somerville buildings, likely attributable to plumbing age and materials and resident population characteristics"

CDC report from Aug 8 – 11, 2016 epi-aid investigation

> "Both residents lived in buildings that had older galvanized pipes and persistent *Legionella* positive results from sinks, despite adequate chlorination and hot water temperatures. We hypothesize that the sloughing of biofilm within the potable water systems was still occurring, given the evidence of extensive biofilm and sedimentation in old pipes and by the fouling of thermostatic mixing valves noted in their sink faucets."

In addition to increasing public health risk for both Legionella and scalding, the 160°F system is a huge increase in construction, operation and maintenance cost. It also increases energy losses. Plumbers at IVHQ keep buckets of these failed point of use mixing valves as a reminder of the constant issues with operation and maintenance of these valves.

This proposed Illinois plumbing code prohibits use of master mixing valves and requires use of point of use mixing valves. In my two decades of first-hand experience as an engineering consultant providing cost-effective solutions to Legionella issues in building water systems such as IVHQ, I've found;

1. In almost all cases, master mixing valves are extremely beneficial in reducing Legionella risk and
2. In all cases, point of use mixing valves are always a significant risk for Legionella growth.

VA Directive 1061 requires extensive monitoring which IVHQ is in the process of installing in their buildings at a cost of over $80,000 per building. This monitoring isn't best practice or best technology. It is a very high cost method of very intensive, unsustainable monitoring for a very poor program. Since we've eliminated free chlorine / chlorine dioxide at IVHQ we also eliminated the need for extensive testing, testing results have been consistent because the chloramine is dramatically more persistent than free chlorine and chlorine dioxide. But if we could eliminate the point of use mixing valves at IVHQ we would yield even better, more consistent results yielding a dramatically more effective risk management plan.

I am and have always been, a strong advocate of increased monitoring of hot water systems as part of cost-effective Legionella Risk Management, including;

1. temperature monitoring of;
    a. hot water in the heater,
    b. hot water distributed to the mains,
    c. hot water return in each loop
2. differential pressure monitoring across each hot water return pump.

Implementing the above temperature and pressure monitoring would be cost-effective, sustainable and provide sufficient information to manage an effective building water management program and would be about $2,000 in cost, at least 50 times less expensive than the $80,000 per building used to implement VA Directive 1061 monitoring. The 160F / HACCP program in place at IVHQ has cost tens of millions of dollars for Illinois Veterans Administration.

Lessons learned from IVHQ should be used to help Governor Pritzker's task force implement sound, successful, sustainable solutions to Legionella.

Excerpts from Tim Keane report titled "Illinois Veterans Home at Quincy Project Title: Identify and resolve root causes of water system issues and deliver cost effective engineering solutions."[1]

Recommendations

1. Add electronic master mixing valves (Armstrong Brain or Watts Intellistation) Installation of an electronic master mixing valve at each hot water heater system discharge reducing temperature from >150°F at heater to 120°F (if IDPH modifies present code) or 110°F.
2. Eliminate all POU mixing valves. These POU mixing valves are a large cost and maintenance item and a significant risk for *Legionella* growth. This POU mixing valve elimination could initially be done as a trial at selected non-patient care buildings and monitored. Quincy plumbers have seen first-hand significant issues with these mixing valves failing and causing cross connections between hot and cold water.

Discussion of Key Findings

1. 110°F vs 120°F temperature limit in Illinois nursing homes. Present healthcare and plumbing code temperature limits were created long ago, prior to any knowledge of impact of temperature on risk of *Legionella* growth in potable water systems. To-date, there has been no effort by CDC or CMS to address this issue which they are aware of. CDC and CMS are both very concerned with alarming rates of Legionnaires' disease in healthcare facilities but have failed to address this simple and significant issue of some states requiring 110°F in nursing homes.
    a. The vague CMS Immediate Jeopardy definition of scalding greatly exacerbates the issue. It only defines immediate jeopardy to healthcare patients as, "Access to hot water of sufficient temperature to cause tissue injury". Accordingly, healthcare facilities will typically run much lower temperatures than allowed by the state in order to insure they do not get cited for Immediate Jeopardy. If 110°F is a published state limit for nursing homes, typically exceeding that temperature by any amount can be considered Immediate Jeopardy. The failure mode criteria which results in Immediate Jeopardy action should be significantly higher than the allowable limit.
    b. VA, the largest hospital system in the world, had a *Legionella* control policy in place from 2009 to 2014 requiring temperature at every sink and shower be maintained between 120°F to 130°F. In 2014, VA changed their very effective 2009 policy to a new policy that requires 110°F at every sink and shower. This policy change was based on scalding concern feedback from VA Pittsburgh after the outbreak in 2012. It was later revealed that VA Pittsburgh never complied with VA Directive 2009 and had 140°F at heaters as required but no master mixing valve, resulting in a dangerous temperature of 140°F at sinks and showers. VA understands requiring 110°F at sinks and local mixing valves is a huge cost with serious *Legionella* control issues but has failed to address this flawed policy.
    c. One of the first *Legionella* codes in the US was the 1987 South Dakota plumbing code21 which allows healthcare facilities to maintain up to 125°F at fixtures.

Excerpts from Tim Keane report titled, "Illinois Veterans Home at Quincy Project Title: Resolution of Legionella control issues at IVHQ. January 11, 2019"[2]

VHA

Department of Veterans Affairs VHA Directive 1061[14] is also partly responsible for this long-term *Legionella* issue. VHA Directive 1061 is a very poor and extremely expensive reactionary response to a high-profile outbreak, the 2012 VHA Pittsburgh hospital Legionnaires' disease outbreak. It is estimated this 1061 Directive cost over $1.5 Billion to implement and unknown amounts to maintain. This 2014 Directive replaced the excellent, very effective and cost-effective VHA Directive 2009. The VA Hospital Pittsburgh 2012 outbreak occurred not because the 2009 Directive[16] failed but because the hospital failed to ever comply with the 2009 Directive which required 140F in the heater and between 120F and 130F at all sinks and showers using a master mixing valve at the heater and no point of use mixing valves. VA hospitals I audited in 2012 prior to the Pittsburgh outbreak were in full compliance with Directive 2009 and had no issue with *Legionella* or scalding.

The 2014 Directive requires hot water to be a minimum of 124°F at all points in the hot water distribution system. *And states, "to limit the risk of scald injury, hot water in the distribution piping be maintained at the lowest temperature that will ensure the minimum of 124°F (51.1°C) throughout".* This Directive also requires a maximum of 110°F at every faucet. This 20°F drop in maximum temperature due to scalding concerns was done, even though in 2012 VA states they knew of no scalding issues with the 2009 Directive.

Presently IVHQ is installing extensive monitoring systems as required by VHA Directive 1061. These monitoring systems cost about $87,000 per building, close to $1 Million total. Under the HACCP program, because control levels were erratic, these systems would provide some benefit documenting all the issues but would not have solved problems. Now with the chloramine system in place and excellent control, these very high cost monitors will provide little benefit or value. For the $87,000 of one buildings' system, all the key recommendations we've identified could be implemented at significant benefit to risk reduction and operation.

Illinois Plumbing Code[17]

Illinois Register plumbing code modification Volume 42, Issue 52 dated December 28, 2018 out for public comment now, if approved will require much more dangerous and costly hot water controls than the VA 1061 Directive. It will require all buildings, except residential, maintain 160°F or higher throughout the entire hot water system and up to a mixing valve which must be located within 12" of the fixture. This code proposal is essentially requiring the same very costly to install controls, very costly to maintain equipment that was not effective in controlling *Legionella* at IVHQ.

Bucket of failed mixing valves

This Illinois code requirement will;

- ✓ increase energy consumption
- ✓ as stated in the VA Directive quote above, will greatly increase scald risk and
- ✓ will increase *Legionella* risk and dramatically increase risk where ever free chlorine is used.
- ✓ will greatly increase installation and operation costs

This Illinois plumbing code change is without merit. The plumbing industry is trying to get away from code change errors from the past decades that required 110°F in public handwashing sinks. The healthcare industry is getting away from electronic handsfree faucets because of the mixing valve and *Legionella* risk. This Illinois plumbing code is a strong indication of the danger that can occur when people believe the Veterans Administration, the largest hospital system in the world, must know what they are doing and must be implementing practices such as the 1061 Directive that are beneficial and cost effective.

I strongly recommend IDPH increase hot water temperature limits in nursing homes and all healthcare facilities to 120°F.

Simple, safe, proven and cost-effective steps that can be taken regarding temperature and Legionella risk reduction are detailed in Discussion of Key Findings Item #1 of report dated 10/26/18[30]

References

1. Tim Keane. Illinois Veterans Home at Quincy Project Title: Identify and resolve root causes of water system issues and deliver cost effective engineering solutions. October 26, 2018.
2. Tim Keane. Illinois Veterans Home at Quincy Project Title: Resolution of Legionella control issues at IVHQ. January 11, 2019.
3. William J Rhoads, Matheu Storme Spencer, Marc A Edwards. Investigation of continued *Legionella pneumophila* positivity at the Illinois Veteran's Home in Quincy, IL 30-Day Progress Report After Switch to Chloramines. January 10, 2019.
4. Kool, J.; Carpenter, J.; & Fields B, 1999b. Effect of Chloramines Disinfection of Municipal Drinking Water on Risk of Nosocomial Legionnaires' Disease. *Lancet* 353:9149:27
5. Heffelfinger J.: Kool, J. et al. Risk of Hospital-Acquired Legionnaries' disease in cities using chloramines versus other water disinfectants. Infection Control and Hospital Epidemiology. August 2003
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