ecas 4 Engineering for Health & Hygiene™

Decreasing water-borne pathogen risks in Australian aged-care facilities

Sampling location	4th May (baseline)	9th May (baseline)	13th May (Day 1)	20th May (Day 8)	3rd June (Day 22)	17th June (Day 36)	1st July (Day 50)	29th July (Day 78)	12th Aug (Day 92)
Room B	<10	100	500	600	<10	<10	<10	<10	<10
Room D	100	<10	<10	10	<10	<10	<10	<10	<10
Room E	<10	100	<10	10	<10	<10	<10	<10	<10
Room F	<10	200	<10	<10	<10	<10	<10	<10	<10
Room G	<10	<10	20	<10	<10	<10	<10	<10	<10
Room I	100	<10	<10	<10	<10	<10	<10	<10	<10
Room L	<10	<10	<10	600	<10	<10	<10	<10	<10

Table 1: "*Legionella* species" counts before and after installation of the Ecas4 disinfection system (analysis conducted by the hospital's regular NATA accredited testing laboratory).

Legionnaires' disease causes severe pneumonia and is a major health risk linked to poor water quality in aged-care facilities. *Legionella* bacteria, which cause this infection, are common in potable water distribution systems, but are particularly problematic in the complex pipe networks of hospitals and aged-care facilities where vulnerable populations are also more likely to contract infections. A combination of factors leads to heightened risk in these settings. For example: extensions and renovations can create 'dead legs' in pipe networks, where reduced water flow creates an ideal environment for *Legionella* colonisation and growth; installation of thermal mixers to decrease scalding risks also creates areas of warm water ideally suited to *Legionella* growth; and water softeners, installed with the intention of improving water quality, also happen to remove the chlorine residual from the water. Together, these factors and others add to the challenge of maintaining adequate water quality in aged-care facilities.

In order to address the problem of water-borne infections in the elderly and immunocompromised, water quality management plans are increasingly being implemented in Australian aged-care facilities. Newly developed guidelines, such as the enHealth *Guidelines for Legionella control in water distribution systems in health and aged care facilities* (Australian Government, 2015), underline the importance of operational controls such as the installation of continuous in-line disinfection systems for limiting *Legionella* bacterial counts and other microbiological risks.

Over the past few months, exciting results have been obtained using an on-site electrochemical water disinfection system to control *Legionella* in an Australian hospital and aged-care facility. In May 2016, an in-line **Ecas4 water disinfection system** was installed at the North Eastern Community Hospital (NECH) in Adelaide, where water quality monitoring had previously indicated systemic *Legionella* contamination of the water distribution system. The residential aged-care facility at the NECH is joined to the main hospital and provides permanent and respite accommodation for 84 residents in a purpose-built facility. Substantial investment in building works have resulted in significant structural changes to this facility over the last 40 years and increased the complexity of the water distribution system. In an attempt to decrease the risks of waterborne disease, the hot water at the NECH was previously heated to 80 °C, but despite the high energy costs, this approach proved to be insufficient, and *Legionella* and microbial cell counts continued to exceed potable water quality guideline limits.

In order to proactively manage this risk, an in-line Ecas4 water disinfection system (subject to worldwide patent) was installed at the NECH. This technology facilitates continuous dosing of a dilute disinfectant solution (the Ecas4 Anolyte) into the hot and cold water distribution systems to provide continuous disinfection without altering the potability of the water. This continuous dosing facilitates the control of microbiological contaminants, including pathogens such as *Legionella*. In addition, it can also help prevent the build-up of biofilms (sessile microbial communities) that are commonly found on the surfaces of pipe materials and typically implicated in increased microbiological risks. The Anolyte solution produced by the Ecas4 system is pH neutral and contains active chlorine, mainly in the form of hypochlorous acid, which is a powerful disinfection agent. Continuous in-line dosing of the dilute Anolyte solution is safe for humans and suitable for use in potable water. Due to its neutral pH, it is also less aggressive on treated surfaces and infrastructure than other disinfection agents such as bleach.

Installation of the Ecas4 dosing system at the NECH was preceded by baseline sampling of the tap water throughout the hospital to determine the initial contamination level and facilitate verification monitoring of the disinfection process. Samples were collected every 1-2 weeks for analysis (Table 1). By the third post-installation sampling event (Day 22 post installation), consistently improved water quality was observed throughout the system, with no positive *Legionella* plate counts recorded thereafter. The positive effect on the water quality following installation of the Ecas4 system was further confirmed by *Legionella* qPCR analysis, a DNA-based method which is significantly more specific and sensitive than the plate count method and highly reproducible (Figure 1).

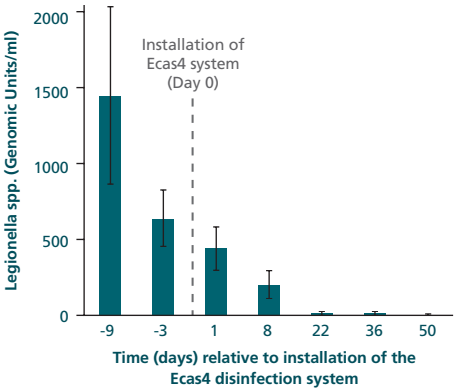

Figure 1: DNA-based Legionella species quantification data for water sampled from the hot water taps of basins in 11 hospital rooms; the same 11 basins were sampled on each occasion.

The qPCR data, obtained thanks to an independent verification program by researchers at the University of South Australia, clearly showed that the *Legionella* counts decreased significantly following installation of the Ecas4 system, and a consistently low *Legionella* cell count was achieved within 2-3 weeks of continuous treatment. Water management optimisation at this facility is ongoing, and the next steps will include a monitored, progressive decrease of the hot water temperature to save energy and reduce the heat stress on infrastructure and equipment.

Check the Spring 2016 issue of *The Australian Hospital Engineer* (pp. 63-66) for further details.