ProEconomy | orca

Copper and Silver Water Treatment

Case Study

Devon Centre for Women's Health

Controlling Legionella risk in a newly commissioned hospital building using copper and silver ionisation

Background

This case study reports the application of a copper and silver ionisation (CSI) system for the long-term control of Legionella in a health centre that had previously tried to control Legionella using the temperature regime but had consistently detected Legionella contamination at outlets.

Methods

Setting: The building is a purpose-built extension of a large district hospital in Devon, UK, covering over 9000 m2 serving a catchment of 350,000 and employing over 400 staff. Most rooms have en-suite facilities and washrooms are provided between the delivery rooms.

The hospital installed the Orca CSI system when, following occupation of the building in June 2007, water analysis results confirmed the presence of L. pneumophila serogroup 1 in the blended water system in samples taken on the 28th November 2007 and 30th January 2008. The Orca CSI system from ProEconomy Ltd was commissioned on the 04th February 2008.

Orca System Installation and Continued Sampling:

The Orca CSI system (99.99% pure copper and 99.99% pure silver electrodes) was installed in February 2008, prior to two 20,000-L storage tanks to allow adequate build-up of copper and silver levels so that good levels of copper and silver were available at outlets. Flow regulating valves were installed in tanks, which are required by the Orca system, as these activate the system regularly and good levels of these ions are, therefore, released into the tanks. The water was heated by two steam generated calorifiers, each fitted with a shunt pump. The water was not softened, as the calcium carbonate (CaCO3) value of the water supply was low (91 mg/L CaCO3) indicating moderately soft water. A Southwest Water quality report was consulted, as certain parameters could influence the biocidal efficacy of the ionic copper and silver. The 12-month averages were: chloride 18.5 mg/L; conductivity 163 µS/cm; and manganese <2.3 µg/L. None of these values presented potential interference with the system's biocidal efficacy. The average water pH value was 7.9 (Southwest Water Quality Report).

Water Sampling and Analyses

Before the CSI system was activated, pre-commissioning samples were taken from 20 outlets identified as being at risk of Legionella contamination. After activation of the CSI system, samples were taken every month from 10 outlets that showed risk of Legionella contamination and were analysed for Legionella by the culture method, for total viable bacteria (TVC) at 37 °C and at 22 °C by the culture method, and for copper and silver by Inductively Coupled Plasma-Optical Emission Spectroscopy/ Mass Spectrometry (ICP-OES/MS), by UKAS accredited laboratories (RD&E NHS foundation Microbiology Laboratory and ALControl Laboratories, UK). The outlet points were rotated from June 2010 and Legionella was, therefore, monitored at 20 outlets.

Results

The results of the pre-commissioning samples (04/02/2008) are shown in Table 1. Legionella (100 cfu/L) was found at one cold outlet and at three blended outlets (1100, 1200, and 500 cfu/L). A total of 21 outlets were tested, around 20%, therefore, were contaminated. The average Legionella count of the 21 outlets sampled was 138 ±77 cfu/L.

Table 1. Results from samples taken before commissioning of copper and silver ionisation system

Sample Point	Temp °C	Silver mg/L	Copper mg/L	TVC at 37 °C day 2 cfu/ml	TVC at 22 °C day 3 cfu/ml	Legionella cfu/L Detection Limit = 100
APN58MT	35	0.004	0.034	9	4	ND
APN49CT	16	16	0.043	18	2	100 np
APN49MT	39	39	0.056	7	6	1100 np
NE12CT	17	17	0.035	8	8	ND
NE46MT	34	34	0.047	78	23	ND
PE30CT	16	16	0.069	6	4	ND
DS82SH	34	34	0.042	84	40	ND
DS99HT	57	57	0.063	0	0	ND
DS55CT	20	20	0.029	4	10	ND
DS50MT	39	39	0.044	0	2	ND
ANC18CT	15	15	0.037	22	8	ND
ANC18MT	41	41	0.054	69	12	ND
ANC23MT	Not Taken	Not Taken	Not Taken	Not Taken	Not Taken	1200 s1*
ANC28CT	14	14	0.109	23	6	ND
Toilet Near 9CT	12	12	0.033	8	1	ND
GW1MT	38	38	0.057	57	8	ND
GW25SH	41	41	0.059	330	220	ND
GW50MT	38	38	0.058	24	6	500 np
GW85MT	38	38	0.051	29	12	ND
SO37SC	13	13	0.034	495	550	ND
SO37SH	42	42	0.073	550	330	ND

MT = Mixer Tap, CT = Cold Tap, HT = Hot Tap, SH = Shower Hot, SC = Shower Cold, ND = Not Detected, TVC = Total Viable Count, np = Legionella non-pneumophila, s1 = Legionella pneumophila serogroup 1. * Analysed by the study hospital on the 30th January 2008.

The average water temperature recorded at cold water outlets was 16 ± 1 °C, which is within the limit advocated for the traditional temperature control regime of <20 °C. The temperature recorded at the contaminated cold water outlet was 16 °C. The average temperature at the hot water outlets was 38 °C (± 2.5 °C). The temperatures recorded at the three contaminated hot water outlets were below 50 °C, because the water was blended to obtain safe (from scalding) hot water temperatures below 45 °C.
The average copper concentration before installation of the CSI system was 0.051 ± 0.004 mg/L, which is background copper from the copper pipes. The CSI system was activated on the 04th February 2008.
Table 2 shows analyses results for samples taken on the 6th March 2008, one month after the ionisation system installation. Samples were taken from the four outlets (APN49CT, APN49MT, ANC23MT and GW50MT) that were contaminated before the system activation and from six other outlets identified as being at risk of Legionella contamination (DS82SH, DS50MT, DS50CT, SO37SC, SO37S, and GW25SH). No Legionella were found in these samples, with silver levels of 0.039 to 0.115 mg/L.

Table 2 - Results from samples taken one month (March 2008) after commissioning of CSI system

Sample Point	Temp °C	Silver mg/L	Copper mg/L	TVC at 37 °C day 2 cfu/ml	TVC at 22 °C day 3 cfu/ml	Legionella cfu/L Detection Limit = 100
DS82SH	41	0.039	0.155	0	0	ND
DS50MT	42	0.043	0.156	0	0	ND
DS50CT	10	0.083	0.183	0	0	ND
APN49MT	40	0.045	0.162	1	2	ND
APN49CT	10	0.092	0.199	2	13	ND
ANC23MT	40	0.049	0.188	3	0	ND
SO37SC	11	0.115	0.287	5	0	ND
SO37SH	42	0.044	0.150	2	1	ND
GW25SH	41	0.046	0.157	6	0	ND
GW50MT	41	0.041	0.158	0	1	ND

MT = Mixer Tap, CT = Cold Tap, SH = Shower Hot, SC = Shower Cold, ND = Not Detected