



Pro*Economy* | **orca**

Copper and Silver Water Treatment

Case Study

Benenden Hospital

Controlling Legionella risk in a UK hospital using copper and silver ionisation

Background

Benenden Hospital is a private, modern, unquestionably clean hospital. This trust hospital has a professional approach to infection prevention and control.

Legionella pneumophila is a waterborne bacterium which actively grow in water system at temperature from 28 to 46 degrees Celsius.

Identified disease that make the patient at risk of contracting Legionnaires' disease caused by *L. pneumophila* include renal disease, malignancy, or immunosuppression (Marston et al., 1994). In severe cases it can lead to death. Patients, especially those with low immune system, like new-borns, and the elderly, are at risk of infection simply by inhaling water droplets/spray from water taps, showers, and cooling towers.

To meet a higher standard of infection control, Benenden Hospital started to use copper and silver ionisation system to prevent Legionella infection.

This case study reports a long-term performance of copper and silver ionisation system on *L. pneumophila* control in Benenden Hospital. The system had been applied in Benenden Hospital since 2011, and 477 samples were collected from outlets between 2011 and 2017. Data has been analysed for *L. pneumophila*, copper and silver.

Installation of Orca copper and silver system

Before installation, 20 pre-commissioning samples were analysed in 2006. A total of 35% of samples have shown *L. pneumophila* positives.

After installation in 2011, around 2 to 15 samples were collected monthly from different outlets in Benenden Hospital.

Results

Original measurement result is shown in Figure 1, which shows the monthly measurements for *L. pneumophila* at Benenden Hospital from 2011 to 2017. The graph shows an effective elimination of *L. pneumophila* between September 2012 to May 2013, June 2016 to June 2017. *L. pneumophila* had been consistently detected, but the overall percentage of *L. pneumophila* has declined.

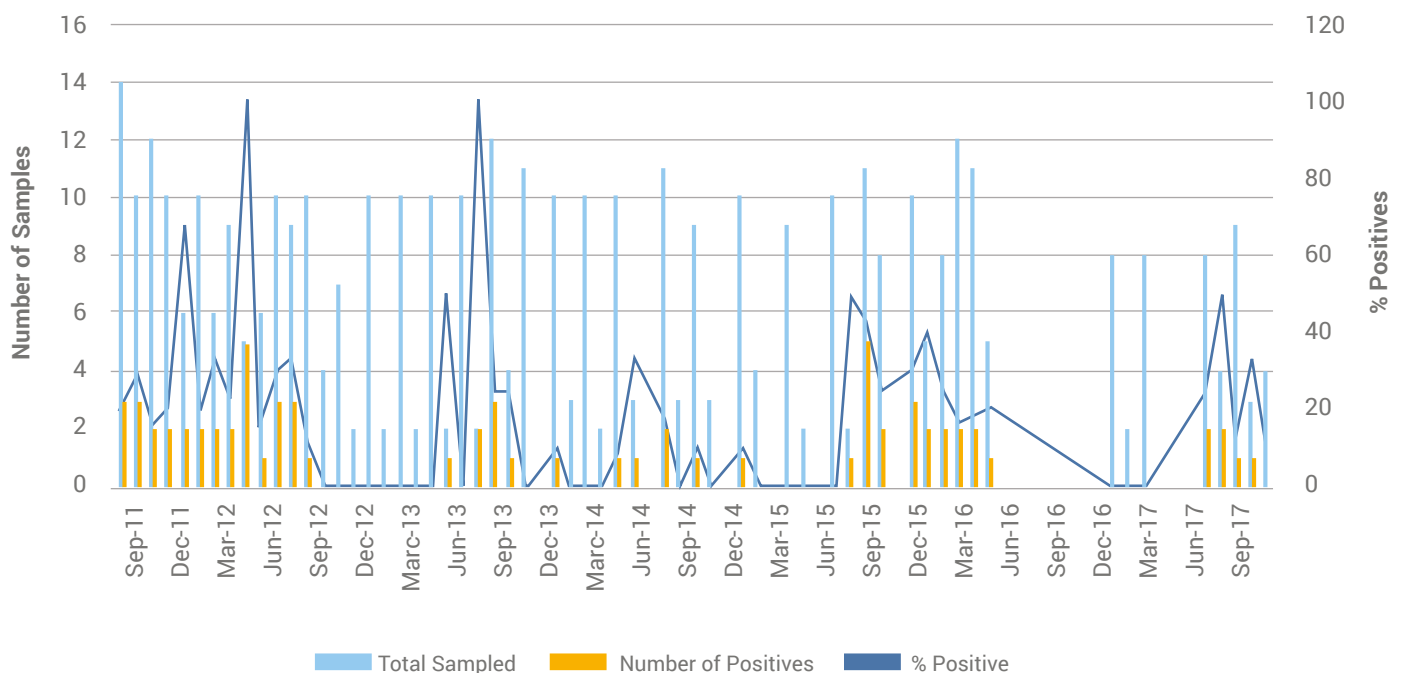


Figure 1. Monthly measurement of *Legionella pneumophila* in Benenden Hospital from 2011 to 2017.

To better summarise the results, an annual graph is shown in Figure 2, which shows total samples taken, number of *L. pneumophila* positives and percentage positives. There was an overall decrease trend in *L. pneumophila* count from 2011 to 2017. Annual percentages of legionella positives are lower than in the pre-commissioning percentage. The lowest rate of legionella positives was between 2013 and 2014 with only 9.33% and 9.37% annual average.

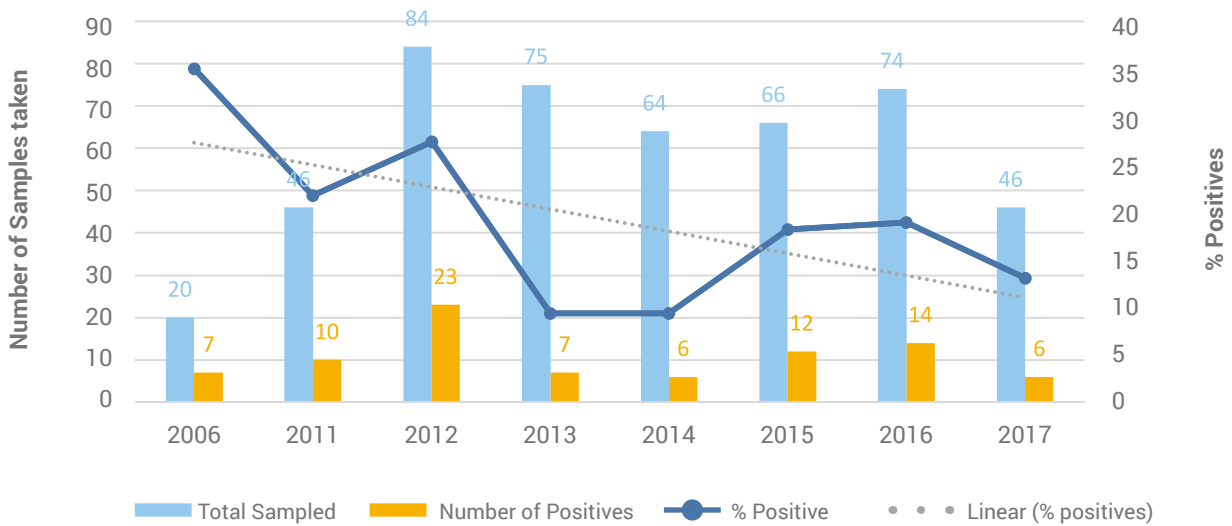


Figure 2. Total samples, number of *L. pneumophila* positives and percentage positives in Benenden Hospital.

Part of the outlets were sampled twice. The first sample was taken directly when water started to run, and the second was taken after running the water for 10 minutes. The result is shown in Figure 3. A total of 45% of outlets showed a decrease in *L. pneumophila* positive after 10 minutes. This suggests that the contamination with legionella was at the outlet. A total of 40% of outlets increase after 10 minutes, which suggests that the contamination was further away from the outlet or further up the pipework. A total of 15% of outlets had no change in legionella counts after 10 minutes.

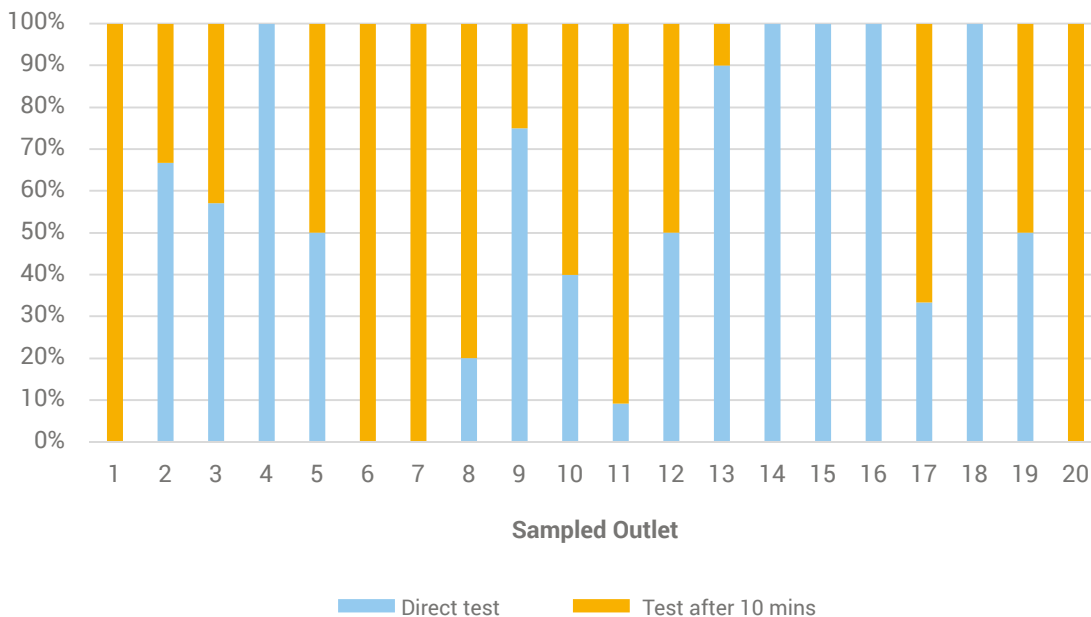


Figure 3. *Legionella pneumophila* percentage, direct sample and after 10 minutes for 20 samples in Benenden Hospital.

Table 1 shows the number of outlets sampled up to November 2017. A total of 477 outlets were sampled and analysed for *L. pneumophila* with 85 (17.8%) of these showing positives and of these 25 were non-pneumophila. Of the 85 positives, 30 samples showed 100 cfu/L and 14 samples showed 200 cfu/L. The highest count was 6000 cfu/L which was recorded in May 2012.

Table 1. Samples analysed and *L. pneumophila* counts – Benenden Hospital – 2006-2017

| | |
|----------------------------------|----------------|
| Total number of samples analysed | 477 |
| Total number of positives | 85 |
| Percent positives | 18 |
| Colony forming units (cfu) range | 100-6000 cfu/L |
| Number of samples with 100 cfu/L | 30 |
| Number of samples with 200 cfu/L | 14 |

Discussion and Conclusion

Overall, the copper and silver ionisation system has showed effectiveness for *L. pneumophila* control in Benenden Hospital water system. However, other variables might decrease the system's effectiveness. A fraction of outlets showed a result of increased *L. pneumophila* after water running for 10 minutes. Low used water tap can be a possible reason. Even though copper and silver system effectively eliminate *L. pneumophila*, biofilms can still form if the outlets were not constantly circulated by copper and silver system. This can explain why some of the outlets have an increased *L. pneumophila* after water running for a while. Most of the samples with an increased *L. pneumophila* were collected in the shower of male staff changing room, and this outlet might not be used as often as other outlets.

L. pneumophila had been consistently detected, but the overall percentage of positives has declined which shows the treatment is working generally. Over 50% of positive samples showed low legionella counts (100-200 cfu/L) and 25 of positives were *L. non-pneumophila*.

Circulation and regular monitoring of the copper and silver system is crucial for a better control of *L. pneumophila* in the long term.

Study carried out and written by Xinyuan Liu, Intern MSc Student, King's College London
March 2018

Reference

Marston, B.J., Lipman, H.B. and Breiman, R.F., 1994. Surveillance for Legionnaires' disease: risk factors for morbidity and mortality. *Archives of Internal Medicine*, 154(21), pp.2417-2422.