



Targeting ZERO Legionella

4i Water Services is a water treatment company that specialises in finding cost effective engineering solutions, to help our Clients provide a safe working environment for all.

Since working with 4i Water Services, **we've managed to successfully remove the Legionella risk and reduce compliance costs**, providing a safer environment for our patients and staff alike.

Estates Manager — Hospital



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The **Challenge**

Introduction

Hospital A is a private hospital based in North London. As such it is bound to comply not only with the approved codes of practice but also with health care technical memoranda, in the case of water, HTM04-01 part B, L8, HSG 264.

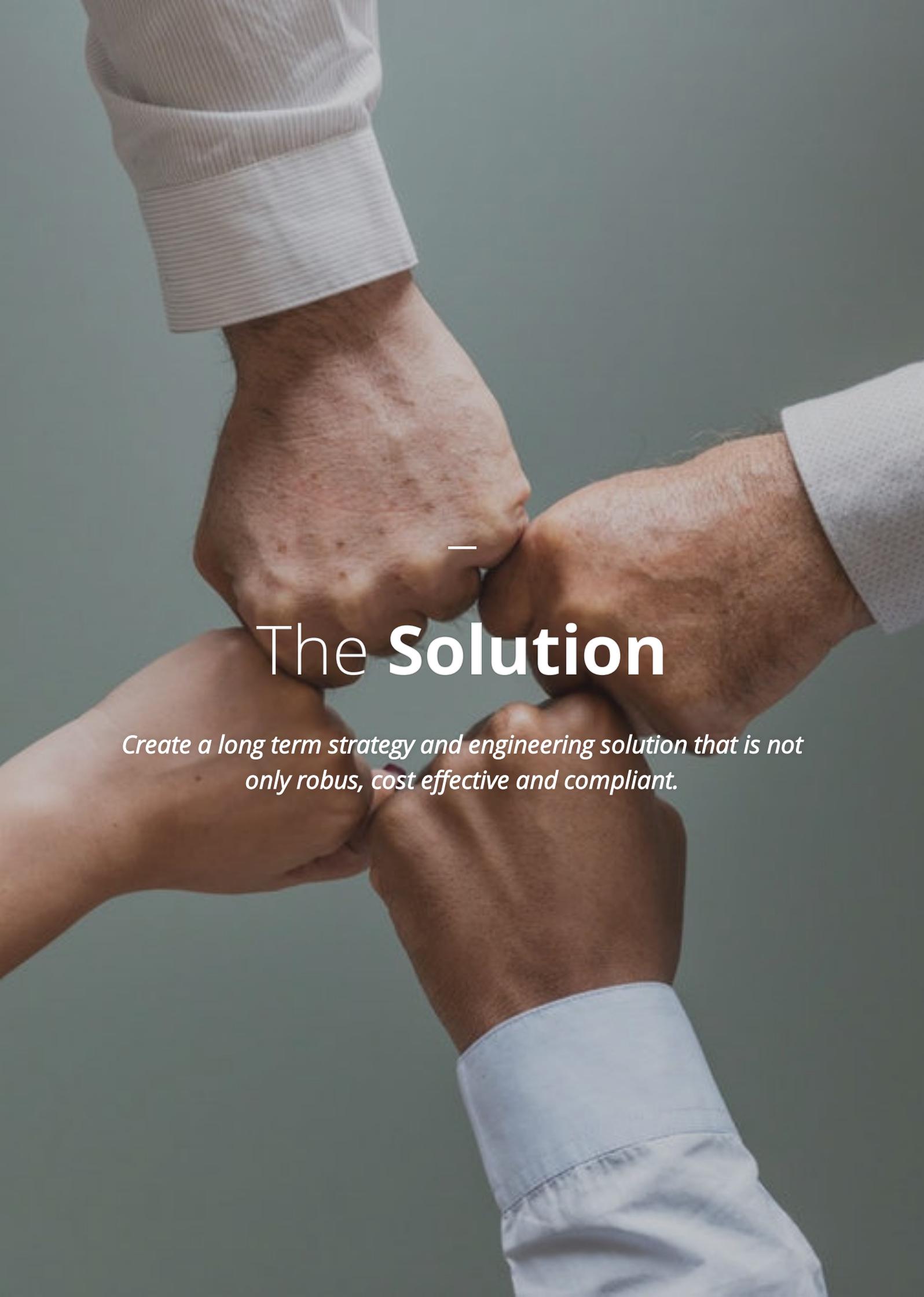
Problems arose when, during the quarterly *Legionella* and *Pseudomonas Aeruginosa* sampling undertaken as part of the Water Safety Group's compliance practice. The system was found to be contaminated with both both legionella and there were high levels of Pseudomonads in the post sampling, consistent with colonisation of the system.

Info: Pseudomonas can colonise a system by going against the flow of the water "upstream" due to its nature as a slime forming bacteria.

Disinfections were carried out of the affected outlets and down services and, samples were retaken and came back clear. The next quarter however revealed a return to the high levels of Pseudomonads in the post samples.

Considerations

- Patients groups varied from minor or low risk to high risk immunocompromised patients.
- Site engineering levels already stretched.
- Fairly large hospital with a mixture of black iron, plastic and copper pipework, inaccessible deadlegs and deadends encompassing the two sites.
- Solution had to be safe, robust and easily monitored.
- Cost effective as budgets were strained.



The **Solution**

Create a long term strategy and engineering solution that is not only robust, cost effective and compliant.

4i Water Services considered various water treatment methodologies.

- UV is an excellent method of disinfection but requires pre-filtration and has no residual. Since the problems were coming from colonisation post-mains within the system, in order to be effective, UV would have to be installed on all the outlets. This was cost-prohibitive
- Ozonolysis, an excellent method of disinfection, ozonolysis is a very effective disinfecting agent in very dirty situations with a residual for direct real time measurement. However, it is also quite expensive to run the electrical generation plant and the aggressive oxidising nature of ozone was expected to drastically shorten the life of the system.
- End of Line (EOL) or Point of Use (POU) Filtration. This can reduce bacteria results in water sent to patients to zero but does not address the problem. The bacteria remain in the system, so it is a technology to reduce exposure rather than fundamentally reduce the possible harm
- Chlorine dioxide. When produced in sufficiently high purity chlorine dioxide is an online potable biocide, meaning that it can be dosed directly into drinking water. Stringent limits on total oxidants are set by the Drinking Water Inspectorate, so any potential chlorine dioxide unit must be able to ensure that the total chlorine dioxide, chlorites and chlorates produced as by-products of its generation remain below 0.5 mg/L. Chlorine Dioxide is a more effective biocide than chlorine, requires less contact time to achieve disinfection.

The final two approaches were deemed as the most appropriate. Use filters as a short term measure to protect vulnerable patients and the **Februus MEDI-Sentinel** water purification system, a chlorine dioxide unit specifically designed to cope with the high flow rates and water usage of the clinical setting.

- The **Februus MEDI-Sentinel** has engineered out issues that have caused low yields and poor dosing in the past:
- Remotely monitored and operated, this means that onsite and offsite personnel can be alerted to problems or check the operation of the unit through a smartphone app
- Highly accurate water meter 99.998% this means that rather than dosing 50 mg/100L like a K100 mechanical water meter, it doses 0.5 mg/L avoiding the issues of “slugs” of treated and untreated water.
- High purity dosing of chlorine dioxide this means that the chemical is used efficiently and the customer is not paying for waste.
- Safe, robust and easily maintainable system with proven ClO₂ delivery.
- BMS Link-up option to manage other plant through our PLC Operating System, this can be used as another safety measure, or as a control, putting control into the site managers hands
- DWI-Approved method of continuous disinfection of drinking water which ensures statutory compliance

- BS 8558:2011 Approved method of continuous disinfection which ensures compliance with the approved code of conduct
- Water authority approved installations which ensure compliance with the Water Supply Regulations (1999).

Monitoring the Sollution

Along with the dosing system a monitoring regime was put in place to ensure efficacy as detailed below. This process was agreed by the Clinical Disinfection Lead, the Head of Estates and 4i Water Services.

Frequency	Task
Daily	CDU dosing equipment and physical check on chemical levels – confirm against PLC readings
Weekly	Remote monitoring report to be sent to Estates Manager showing water usage, stock and dosing levels – checked against onsite engineers reports
Weekly	CLO2 testing tank and sentinel points on both hot and cold services
Monthly	Random Legionella and Psudomonas Sampling
Monthly	12% of outlet sampled for CIO2 levels
Quarterly	Review with the Infection Control Team and Estates



The Results

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The results are based on 24 months of continuous sampling for legionella, pseudomonas and chlorine dioxide. As well as the microbiological sampling taking place, the performance of the Februs Medi Sentinel was closely monitored by the Estates Team.

The success of the system would be measured on the following:

- Chlorine Dioxide – Looking to provide continuous and proportional dosing within the recommended 0.1ppm and 0.5ppm.
- Legionella – Conform to the Estates goal of Zero Legionella
- Pseudomonas A. – Reduce both pre and post levels found on site.
- Cost – Reduce overall cost of high level disinfections and

Chlorine Dioxide:

These samples were carried out by both 4i Water Services and the site maintenance staff. Over 3080 chlorine dioxide samples were taken.

The vast majority of samples fell into the 0.1-0.5 ppm range. This means that zero overdosing took place and under dosing took place on only 3% of samples in 24 months achieving a correct dosing rate 97% of the time.

Legionella:

580 random legionella samples were taken according to the latest standards in microbiological sampling and sent to a UKAS accredited laboratory for culturing and analysis over a two year period. Not one sample showed the detection of *legionella spp.* In a system dedicated to running at 40 °C.

Pseudomonas Aeruginosa:

1160 random pre- and post- flush samples were taken from outlets, as per the then Appendix to the HTM 04-01 part B guidance on sampling for Pseudomonas, over a two year period, the samples sent to a UKAS laboratory for culturing and analysis.

Of the pre-flush samples less than 1% showed any signs of contamination and only then with very low levels of pseudomonas.

Upon isolation and disinfection, these outlets showed no reoccurrence of the problem.

Of the post- flush samples, used to indicate the general system health, there was not one positive sample in two years. This strongly indicates that the system was being properly disinfected by the Februs Medi Sentinal chlorine dioxide system.

Cost

The site had a prior annual spend of:

- Copper/Silver Ionisation water disinfection system - £43,200-00 per annum
- High level disinfections from sampling - £22,400-00 per annum
- POU Filters - £7200-00 per annum
- Annual cost of £72,800-00

4i Water Services supplied:

- Two Februs Medi Sentinal Chlorine Dioxide dosing systems.
- Training and test kit to measure the performance of the system.
- 24/7 remote monitoring of water usage, chemical usage and dosing levels.
- Chemical, servicing and maintenance on both systems.
- Annual cost of £10,975-00 per annum.

Due to efficacy of Februs Medi Sentinal dosing system, there has been no need to carry out any high level disinfection since. This has resulted in a direct saving of £61,825-00 per annum. The system has been in place now for three years providing a 84.9% saving year on year.

Conclusion

When faced with old buildings with various pipework configurations, inaccessible deadlegs and deadends this was always going to be a difficult problem to solve. This was exacerbated by the nature of high risk patients within the hospital.

The Februs Sentinal Dosing System has proven to be reliable, robust, cost effective chlorine dioxide disinfection system.

- The results broken down:
- Over 3080 chlorine dioxide samples were taken over a two year period. Less than 3% fell under the recommended 0.1ppm while zero fell over 0.5ppm.
- 580 Legionella samples taken - zero positives.
- 1680 Pseudomonas samples taken - <1% positive on the pre samples (all under 10cfu) and zero on the post samples.
- Delivered a cost saving of 84.9% on water treatment costs.

Following on from the success of this unit's performance the Group have installed 12 further units across its portfolio of high risk sites. All the high risk sites have shown similar results in reductions of both positive samples and emergency disinfections.

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We're Ready!

If you have a compliance challenge we'd love to hear from you — so let's continue the conversation.

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