T-safe Talks

Claire Jackson
Authorising Engineer (Water)

Legionella species; a risk not to be ignored or underestimated

Welcome to T-safe Talks

In this edition of T-safe Talks, we explore the emerging challenges posed by different Legionella species with Claire Jackson, Authorising Engineer (AE) (Water) for Lakeside Water. Interviewed by our own Nick Barsby, National Sales Manager for T-safe and Legionella Control Association Chair, the pair discuss the evolving situation with Legionella anisa (L. anisa) at a healthcare site facing a prolonged challenge with Legionella colonisation.

Meet the Interview Panel

Claire Jackson, Authorising Engineer (Water) / Senior Contracts Manager, Lakeside Water

Claire is an Authorising Engineer (Water) and is responsible for providing independent expert water safety management advice to a portfolio of over 800 healthcare properties including major acute hospitals, mental health facilities and clinics throughout the UK.

Claire started out in the Legionella industry in 2007, working initially as a Trainee Legionella Risk Assessor before progressing to undertaking surveys of complex and diverse water systems across the healthcare sector. With over 10 years' experience as a specialist risk assessor, Claire also spent time working in Microbiology and service delivery as a Team Leader. Here she was responsible for day-to-day operation of the laboratory and field works including monitoring and risk assessment works across the North of the UK. Subsequently, Claire moved into contract management before taking up her current role as an Authorising Engineer for Lakeside Water. In addition to working in healthcare, Claire also advises Universities, the MoD and Commercial sector clients on the management of their water systems.

Nick Barsby, MWMSoc, Chairman of the LCA and National Sales Lead – Water Hygiene for T-safe

Nick has over 15 years' experience in Legionella control. Having worked for some of the UK's leading testing laboratories as a BDM, Sales Manager and Commercial Manager Nick has a vast knowledge of analytical test methods and procedures. Nick is currently National Sales Manager for T-safe and heads up our water hygiene service provider partner initiative.

Playing a pivotal role in the introduction of MALDI-ToF confirmations in the UK market, Nick has a proud track record of innovation and driving positive changes in every organisation he has worked with.

Nick is the Chairman and Director of LCA and was heavily involved in the re-writing of the Service Standards, he also presented and chaired the webinar series introducing these standards to LCA members. Having written and co-written numerous published articles on a range of subjects covering Microbiology and Laboratory methods, Nick is a well-known and respected individual within the sector.

Q1 Regarding Legionella bacteria, should we be primarily focused on Legionella Pneumophila Sero Group 1?

No, and it's important to note that the HTM's, HSG's, British Standards and ACoP L8 all refer to total legionella count. None of the guidance states that one strain or species is of more, or less, importance than another. The focus is purely on the identification of total Legionella bacteria and its control.

A large proportion of my time is spent managing legionella risk. Its vitally important for your readers to understand that it's the total Legionella population we are concerned with, not just *L. pneumophila*, or more specifically *L. pneumophila* Sero Group 1. There is emerging evidence from the Legionella Control Association (LCA) that over half of the positive legionella results from the laboratory come from a species known as Legionella anisa (*L. anisa*).

Q2 Why should we be concerned with *L. anisa* and how does it relate to *L. pneumophila*?

L. anisa is a human pathogen and has been proven to cause Legionnaire's disease. There is clinical evidence that confirms *L. anisa* has caused fatalities, all of this is well documented. It's important to remember though, as stated previously, the UK legislation and guidance makes no differential between Legionella species and therefore your actions should be risk based on your counts and not your species.

Furthermore, the LCA recently released some data that suggests that over 50% of the positive Legionella samples from around the UK were *L. anisa*; yet only 32% were *L. pneumophila*. This, for me, makes *L. anisa* a bigger threat due to its frequency and prominence across over 70,000 results from the LCA study.

Q3 Why does the industry default to focussing on *Legionella Pneumophila*?

In the UK the predominant clinical diagnostic tool in patients is the Urinary Antigen Test (UAT). It gives a quick and cost effective yes/no for Legionella bacteria being present in the patient's urine. Sadly, the majority of these tests are biased towards *L. pneumophila* and some UAT's just focus on Sero Group 1 which a clear limitation in the method. This may contribute to the lower reporting of infection from *L. anisa* than is actually the real-world situation.

Q4 Is there an example of a site which had a particular water safety problem involving *Legionella Anisa*?

Lakeside Water have a healthcare site where we undertake routine annual surveillance sampling for a client, as a spot check to measure effectiveness of the control scheme. The spot check found sporadic positive Legionella results, spread across an entire water system in both the Hot and Cold. The sampling identified the presence of *L. pneumophila* Sero Group 1 and *L. anisa*, but more about that later. One of the initial response measures was to undertake a system wide chemical disinfection. Post disinfection re-sampling was undertaken two days later (as per HSG 274 Part 2 para. 2.132), and the results came back as 'not detected'.

Q5 So, the issue was quickly resolved?

Unfortunately, or perhaps fortunately, not. The site had a policy of requiring three "not detected" results before a water sample non-conformance could be closed out based on a systemic infection. The second set of samples, taken a month later, had numerous positive results on the Hot Water System, it appeared to be re-colonised. This raised some questions in regard to the guidance that allows samples to be taken between two and seven-days post disinfection; if the site policy was for just one "not detected" result, then these issues may not have been identified until the next annual sampling activity. This could have posed a significant risk to patient safety over an extended period.

Q6 What where the next steps?

This led to a process involving major investigatory works with our client and their tenant. At this point we discovered that the hot water cylinders were sitting at around 41°C. Upon review of the logbook, (which was hard to find as it had been moved), the flow and return temperature monitoring page of the logbook had been blank for 4 years. There was no knowledge as to how long the cylinders had been running at this temperature. The site had not been made aware of this issue, so they continued to manage it under the premise that all control parameters were being achieved. Thankfully, the policy of employing periodic surveillance sampling helped identify the issue.

The cylinders were fixed, however, when we came to perform a thermal disinfection, the cylinders were not able to achieve the pasteurisation levels required unless you were to override the temperature and pressure safety release; these were pre-set at the point of manufacture. Consequently, the cylinders had to be replaced, and capital expenditure which was earmarked for other water safety works was re-directed to resolve the issue. The money was supposed to be spent on re-locating cold water storage tanks due to Health and Safety concerns relating to access.

The new cylinders were installed and commissioned which included a thermal disinfection. A heightened flushing regime was implemented across approximately 1,200 outlets, in tandem with further surveillance sampling to aid in risk mitigation on site. With no further chemical disinfection, Lakeside successfully eradicated all the Legionella positive results from the site, apart from a one problematic and challenging ward area.

Q7 So, what happened next on this "Challenging" Ward?

Further sampling identified very high counts of Legionella, peaking at 45,000 CFU/L, and a pattern of *L. anisa* being detected emerged. Our response was to install point of use filters, as an immediate safeguard and a temporary control measure. Such was the concern from IPC regarding the high counts, additional verification sampling was undertaken on the filters to provide assurance to the WSG that the control was effective. Samples of the filtrate (the water through the filter) were taken and compared to the pre-filtered results. This demonstrated that the filters delivered a total retention of Legionella bacteria, in what was a very challenging system with high microbiological load. The underlying problem was still there but the filter was proven to be an effective risk mitigation tool, until such times as a permanent engineering control could be implemented.

We continued with the heightened flushing of outlets, in tandem with surveillance sampling that also provided an indicator as to the effectiveness of the remedial works being undertaken. Over what was a six-month period we undertook several disinfections targeting the challenging ward area, using various chemicals, to eradicate what was a seemingly immovable Legionella colonisation. These disinfections were undertaken via injection points using Hydrogen Peroxide to disrupt and remove the biofilm and Chlorine (which was at the request of a fellow AE on site) to counter any resistance that may have developed to Hydrogen Peroxide. Despite this, we were unable to achieve the required three sets of "not detected" as Legionella bacteria (specifically *L. anisa*) continued to be detected.

To make matters worse, the ward was temporarily converted to treat COVID patients during that time. For obvious reasons this significantly hampered the remedial works effort, as access to the ward and the extent of works that could be completed was restricted.

Q8 Was the root cause of the colonisation identified?

Once the COVID status of the ward was lifted, a more intrusive investigation of the system was undertaken, which has involved collecting swab samples of the pipework for analysis. The results of swab testing identified the presence of *L. anisa*. Subsequently, it was identified that this ward had been piped using plastic pipework and crimped fittings, the type that is typically used for under floor heating systems. It was discovered that there was a large amount of jointing compound on the pipework, while there were concerns raised about the jointing material used. The WSG decided that the plastic pipework and jointing material would have to be removed to reduce the risk from Legionella, and that the system would have to be re-piped.

Q9 You mentioned earlier the site had challenges with *Legionella Anisa*; can we go into more detail on that please?

Certainly, this "challenging" ward had a mix of *L. pneumophila*, both Sero Group 1 and 2-15, as well as species counts, of which over 90% of these were identified as *L. anisa*. When multiple chemical disinfections using different biocides didn't remove *L. anisa* we approached our chemical supplier for support. They stated the "normal" chemical would remove the bacteria, but the data showed that this wasn't the case. This suggested that *L. anisa* was more resistant to chemical disinfection than other strains of Legionella by comparison.

Therefore, I undertook took a cursory review of all of Lakeside Waters Legionella sampling data over two years, culminating in 13,500 samples in total. I isolated the Legionella species positive results and found that over 65% of positives identified were caused by *L. anisa*. With this piece of information, we collated the sites where the initial chemical disinfection was unsuccessful against the main pathogen known on site and discovered that *L. anisa* was the main pathogen of concern in over 80% of these sites. The other Legionella species were successfully removed following the first chemical disinfection treatment in over 85% of the cases.

It seems common from our data set and with the example of the 'challenging' ward in mind, that once *L. anisa* colonises a water system it can be a difficult to remove using chemical disinfection treatment. This is demonstrated by the incidence of recurring positive results over a long period, involving multiple disinfection treatments using different biocide modalities.

Q10 Does this tell us anything we didn't already know?

The assets with no *L. anisa* positive results often had positive *L. pneumophila* counts. This suggests that the bacteria do compete with each other. Looking at the full data set the threshold for competition seems to be around 800CFU/L on this ward; past this point only one species is reported by the laboratory.

The results from this case study suggest that *L. pneumophila* and *L. anisa* do not like to co-exist together on a laboratory agar plate. Now this could be an oversite at the lab and an error in the analytical process; but the consistency of this over a 2-year period raises doubts about this. When I reviewed the full Lakeside Water dataset of over 13,500 positive results, the highest mixed colony count was 6,000 CFU/L, so it seems fair to suggest they do compete with each other; but the threshold may be higher than the initial 800CFU/L from my "challenging" site.

Q11 Are there any other lessons you feel we could learn from this case study?

The site, when re-piped, was done so using an independent third-party plumber who utilized "crimped" fittings. This raises some industry wide questions for me.

EPDM is not recommended for use in healthcare settings due to concerns about the impact of EPDM on microbiological growth. In-fact there is a mandate to actively replace any flexible hoses that contain EPDM that has been effective for several years now. The crimped fittings use an EPDM 'O' ring , and there were approximately 1,700 connections in this ward. Is there enough data, research, or evidence regarding the long-term use of EPDM in crimped connections? They are preferential from a Fire Risk point of view; but have we just inadvertently added over 2.5 meters worth of EPDM across an entire ward. Are we going to get to a point in 10 to 15 years' time where we identify that the EPDM jointing compound is leading to an issue again and it turns out we have installed it as part of the perceived solution?

Q12 On a site level should the Site be doing more on this?

The Site AE signed off this specification to include Crimped fittings. The Minor Works team chose this path due to the benefits of the Fire Risk.

The AE's view doesn't match mine on this matter; my concern is if you can't use EPDM in a flexible hose then why would you use it in your fittings. Yes, a single connection has a minute amount of EPDM, but spread over 1,700 plus fittings isn't the result a wide spread of a nutrient source for bacteria, especially on a ward that has an underlying issue? Have we just put a food source into the system and ultimately, as an industry, are we setting ourselves up for a fail in years to come?

All AE's see it differently, and a few I have spoken to don't agree with me. If we are talking one or two crimped fittings then the amount of EPDM is negligible, but when that increases to several hundred or thousand connections I wonder if we have enough research and evidence to support the use of crimped fittings that incorporate EPDM; especially given the fact Lakeside Water have a trust that recently spent over £500k on removing flexible hosing only to replace it with crimped fittings. This equated to over 20 meters of EPDM being added to the portfolio to remove flexi hoses, that's ten times the amount inadvertently installed on the "challenging" ward.

What are your key messages to our readers from this case Claire?

There are 4 key messages that your readers can take from this case study;

1) In my view, three "not detected" results for Legionella are critical for systemic infections on a healthcare site. If this site only had to have one "not detected" Legionella result, then the issues on the challenging ward would never have become apparent. Three "not detected" results have almost certainly saved lives in this case.
2) Logbooks should be present, accountable and auditable. It's a simple step but a critical one.
3) *L. anisa* is a human pathogen and should be treated with the same urgency as any other positive Legionella result.
4) Have we understood the risk associated with EPDM in fittings sufficiently? Have we replaced one issue (EPDM in Flexible Hosing) with another (EPDM in fittings)?

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