Legionella: The Invisible Killer

A summary of the presentation given by Debbie Green to the IOSH London Metropolitan Branch Meeting on Tuesday 8th January 2013.

Introduction

Debbie Green, Operations Director for Nemco Utilities Limited, has been employed for the past 13 years and regularly speaks about the topic of Legionella- Management and Control.

Having previously worked for a major water utility company, she has 20 years’ experience in the water industry in a variety of roles including laboratory microbiologist, customer service manager, field scientist and legionella sales manager.

Debbie continues to make time for regular site work and specialises in inspection and assessment of systems that could potentially be affected by legionella as well as corporate governance consultancy with a range of FTSE 100 companies.

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Is Legionella really worth worrying about?

Yes, we only have to look at this year to see the fatal outbreaks which have really focused people’s attention back on the subject.

Bacteria are microscopic organisms that are invisible to the naked eye and can be seen only through the use of a microscope. Bacteria when in ideal conditions will grow, if you put legionella on an agar plate and incubate it for 7 – 10 days with a temperature range of between 20˚C and 50˚C, a colony will form of millions of bacteria that you will be able to see.

Legionellosis is the collective name given to a group of illnesses caused by legionella bacteria. Legionella is a water-borne bacteria that has to be suspended in water droplets or aerosol to be able to survive. It is naturally present in the environment and probably has been around for the last 30 – 60 million years, it has only been in the last few hundred years that it has started to cause problems because of the way we use and store water.

To date over 50 different species of legionella have been identified, of those 50, 20 are known to cause disease in man, but the one that we are most concerned about is Legionella Pneumophila (Latin for Pneumophila meaning love of the lung). Legionella Pneumophila gives rises to Legionnaires Disease that is the fatal illness that we are most concerned about. Other related illnesses include Pontiac Fever and Lochgoilhead Fever which are self-limiting versions of legionaries’ disease, the bug will die off before the host does, so people will survive an attack.
Legionella needs a certain set of conditions to be able to survive. It needs to live in a temperature range of between 20 and 50°C, above 50°C it will start to die off. Heat will kill legionella bacteria, cold will not. If you have water below 20°C it will go into hibernation, it will not die.

Its optimum temperature for growth is 37°C, body core temperature, which is why it makes such an efficient attack on the human body once it gets into our system. Like anything else it requires a food source. Legionella can survive off other bacteria, ie algae, scale wood or any organic nutrient present in our water system, and it particularly likes rust.

Slow moving or stagnant water allows Legionella bacteria the time to grow and multiply, if the water is constantly on the move it will just get flushed through the system. If you have a place that is quiet and undisturbed the bugs will take advantage of that and start to grow. All of these things in the workplace would show that the system was not managed very well. It is these conditions that give rise to the perfect environment for Legionella bacteria to grow. These are the things that we need to try to avoid.

Legionella was first identified in America at a Legion Convention in July 1976; with an outbreak of approximately 182 cases, 29 resulting in fatalities. The root cause was found to be the hotel cooling tower affecting pedestrians walking past as they breathed in aerosols, and those subject to the air conditioning unit. The air conditioning unit inlet was situated next to the cooling tower on top of the roof. At this point, the bacteria identified were called Legionella.

Each year 300+ cases are reported in England and Wales, a steady rise in cases since 2002 following Britain’s biggest outbreak in Barrow-in-Furness. European studies indicate that there are a huge proportion of cases that are presented in a hospital as pneumonia that could in fact be down to Legionnaires disease and legionella bacteria. Studies in France suggest that between 2 – 3% of the community that acquire pneumonia could actually be caused by legionella bacteria, if the testing had been done. The real picture could be more like 9000 cases per year in England and Wales. The biggest problem is that treatment is cheaper than testing. If you went into hospital and you have pneumonia you would be given some antibiotics, bed rest and hoped you get better. The only reason the doctors would take the time to conduct a test is if they had reason to believe that you had been exposed to the legionella bacteria or there had been a number of similar cases, but the vast cases of legionella are sporadic.

The legionella mortality rate is between 10-12%. Those that do survive are left very unwell. It is a very debilitating disease, often leaving people deaf or blind, or with lost limbs because over the cause of the illness they have gone into coma or they have suffered brain damage and it has affected their entire systems. Recovery can take 12 – 18 months. Often people do not ever recover fully due to complications. It is a respiratory disease; you don’t catch it from drinking water. You catch it when you breathe in the bacteria, in order to do that you need an aerosol or a fine water mist. You breathe the
bugs into your lungs at 37°C then they start growing, as they are multiplying the bugs give off a toxin which affects your lungs.

Numbers of cases have been rising since 2002, this could be due to government cut backs, and cost saving which means people are not giving this the time and attention that they should, or it could be environmental factors shorter winters, warmer summers.

If you catch legionnaire’s disease, it starts like the flu with people reporting head and muscle ache, tightness in the chest, usually dry non-productive cough, sickness and diarrhoea. Usually people present with confusion and delirium associated with the high fever, and if left untreated there is the possibility of falling into coma and death. The quicker you can get treatment the more effective it is and quicker you are likely to recover. Not everyone exhibits all of these symptoms, there are people who have had a very bad headache and have many tests done before they realise that they have legionnaire’s disease. Equally because it is a bacteria your body has the ability to fight it off, if you are a fit and well individual you may think that what you have is the flu.

Who is most at risk? Men are 3 times more likely to catch the disease, because they have a greater lung capacity. People who smoke are at risk, anybody who’s lung function is suppressed in anyway ie asthma or bronchial disease are at risk, heavy drinkers or anyone who is immune suppressed or immune compromised are most at risk.

Graphs show that we in the UK are either good at managing the risk, hence the low figures compared to Europe, or it could be that we have an appalling reporting system. Note most cases are reported over the summer, as that is when the air conditioners are operated.

A certain chain of events has to occur for you to catch legionnaire’s disease:

- There has to be bacteria present in the water.
- There has to be slow moving or stagnant water, if water is constantly on the move and you don’t have any areas that are redundant then the bugs will get washed out.
- There has to be an adequate food source.
- Temperature range has to be between 20 – 50°C. This is the easiest thing for us to control, if we can keep cold water cold and hot water hot, even if the other conditions are present the legionella bacteria are not going to be able to survive and grow.
- An aerosol has to be formed because that is the means of transmitting the bacteria to your lungs
- People have to be present.

Main risk areas include, hot and cold water systems, cooling towers, air conditioning, humidifiers, anything that creates a water drift, cold water storage tanks, hot water calorifiers, or hot water storage, dead legs and showers are all problem areas because of the temperature that they operate at and the fact that they are creating an aerosol. Spa pools and flexible hoses are new issues.
In ACOP – L8 there is not much attention given to cold water systems – the cold water storage tank usually located in the loft space has work at height issues and there are exposed loft joist issues so often these water tanks just sit about stagnating. They are a big issue as they are out of sight and out of mind.

In terms of the law all this comes under the HSAWA and the Management Regulations, but often prosecutions occur under COSHH Regulations because legionella is considered a bacteriological hazard to health. Companies with cooling towers have to be registered with the local authority under the Notification of Cooling Towers Regulations. ACOP’s and HSG70 were revised in 2001 into what we now know as ACOP L8. It says that you need to identify and assess the source of risk, prepare a scheme to prevent or control that risk, implement and manage the control programme, keep records and appoint a responsible person.

The biggest cause of an outbreak is a lack of a scheme of control. Failings often occur because control schemes either did not exist or the responsibilities were not clearly defined. Cleaning and disinfection counts for 4% of failings, 8% is down to training and competence, and 25% were because they did not have a risk assessment in the first place.

The Barrow-in-Furness case was a landmark case in terms of corporate manslaughter; it was the first time a council had been charged with manslaughter in terms of gross negligence. The learning points that came out of this case were that there was poor communication internally, people were talking but not taking any action, responsibilities had not been defined, there was a lack of training and there was a failure to record meetings and conversations. There was also insufficient contract documentation. Generally there was poor advice from management, the reason that both parties were fined in the end was because a risk assessment had not been carried out.

Apart from your legal and moral obligations that you have to your staff there are good financial reasons why you do not want an outbreak of Legionnaires Disease, things like sick pay, prosecutions, civil action, FFI and the effect of bad publicity. Many businesses have gone out business because of an outbreak of Legionnaires Disease.

What do you need to do, in terms of risk management; you need to do a risk assessment, you need to be regularly monitoring your water systems with temperature control being the most effective method of managing legionella. Where you cannot, you have to use an alternative such as water treatments. Maintenance and cleaning is essential so you can spot dead legs and basin taps that have stopped working. Your risk assessment must be suitable and sufficient and it needs to be reviewed regularly or when there is a change to plant or water system or the use of the building. It has to be carried out by a competent person.
BS8580 establishes a standard approach to working, it is used to try to get all the water treatment companies to tow the line and do a proper assessment rather than just a survey. They place a lot more emphasis on looking at records and control methods.

You need to have an on-going scheme for control; this should include weekly flushing, monthly temperature checks on the furthest taps etc., quarterly checks to get rid of lime scale on shower heads and six-monthly assessments on cold water tanks. An annual review of the scheme should ask the question - is it being effective at managing legionella? Then finally, bi-annually review your risk assessment documents.

Future trends - the population is living longer, the older you are the more likely you are to catch the disease, so there will be more cases. Thermostatic mixer valves can allow legionella to live in the valves if they are not serviced regularly. Because of MRSA people are using gels in hospitals, people are not washing their hands, as a result hospitals have tonnes of stored water that is not being used. As fast as we are getting rid of the problem of one bacteria we are causing problems with another. Global warning in general, we flush all water pipes through to get rid of the problem of legionella, but that's not really environmentally sound, we are going to have to come up with a more effective method of managing legionella.