February 2003

Presentation on "Managing Legionella" by

Philip Bradbury, Clearwater Technology

Philip started his presentation by introducing Clearwater Technology to the audience. Clearwater is a British Company specialising in all aspects of water treatment, water and air hygiene. The Aircare Division specialises in ventilation system, hygiene and indoor air quality services.

Philip went on to describe most of what he intended to say was covered by HSE Publication L8, Legionnaire's disease The control of Legionella bacteria in water systems Approved Code of Practice and Guidance. He said that he would be looking at: -

- What is Legionnaire's disease?
- What is the risk?
- What new legislation is proposed?
- Types of systems affected
- Actions to be taken

Firstly, to deal with the terminology he said: -

- **Legionellosis** is the term used to describe the subject regarding **Legionella Bacteria.**
- **Legionnaire's Disease** is a pneumonia induced by a particular bacterium, **Legionella pneumophila sero group 1.**

There are two types of disease that Legionella bacteria can cause, namely **Legionnaire's disease and Pontiac Fever.** Their symptoms and differences are: -

- **Legionnaire's disease**
  - caused by Legionella pneumophila sero group 1
  - 5% attack rate
  - incubation period 5 to 10 days
  - delirious with diarrhoea and vomiting common
  - treat with antibiotics – slow recovery
  - 12% fatality
- **Pontiac Fever**
  - 95% attack rate
  - fever lasting 3 to 5 days
  - zero fatality

Philip warned that, although Legionnaire's could be cured if treated early enough, there could be recurring health problems after recovery.

He also said that the bacteria multiply extremely quickly, starting with 2 or 3, they could multiply to about 280,000 MILLION in just 24 hours, with a weight of about 110 gms. In 48 hours there could be as much as **30 trillion tonnes,** as they increase by division, dividing every 30 minutes. 1 Gramme of soil contains 250 million bacteria.

The history of Legionnaire's is as follows: -

- 1947 The oldest, isolated case occurred
- 1972 First identified in UK.
- 1976 The first outbreak occurred in at a convention of American Legionnaires (hence the name), in the Belle View hotel in Philadelphia, USA. 221 people caught the disease and 29 died.
- 1977 Legionella Pneumophila was identified as the causative agent for the first time.
- 1978 The first case in the UK was at Corby
- 1980 Hospital outbreak at Kingston
- 1981 W.H.O. recommended all cases of pneumonia admitted to hospital should be examined for Legionella infection.
- 1984 Major outbreak of L.D. in Glasgow.
- 1985 Major outbreak at Stafford Hospital (28 deaths)
- 1987 HSE published Guidance Note EH48
- 1988 Major outbreak at BBC Broadcasting House, London
- 1989 B.A.C.S. publish a code of Practice
- 1991 HSE replaced EH48 with HS(G)70 and HSC publish and ACOP
- 1992 BSI publish BS 7592 on Methods for Sampling Legionella in Water.
- 1992 Government introduce Cooling tower Registration - Statutory Instrument 2225
- 1994 DOE publish HTM 2040 A Code of Practice for Health Care Premises
- 1997 HSE updates HS(G) 70 – Fifth Impression.
- 2000 HSE combine HS(G) 70 with ACOP and update to HSE ACOP L8 2000, effective 8th January 2001

Some other statistics are: -

- 10,000 people per annum catch LD in USA
- 200 – 300 per annum in UK (may be as much as 1000)
- 180,000 UK cases of pneumonia as a whole.
- Symptoms include dry cough, fever, delirium.
- 46% UK cases contracted abroad
- 25% cases associated with outbreaks
- L.Pneumophila is responsible for Pontiac Fever
- There are 40 species of Legionella Bacteria identified, so far
- L.Pneumophila Sero group 1 is the one most associated with LD.

Legionnaire's disease is also most likely to affect the following: -

- Persons> 50 years old.
- Males.
- Persons with impaired lung function
- Smokers
- Sick persons with depressed immune systems.

Conditions for the proliferation of Legionnaire's -

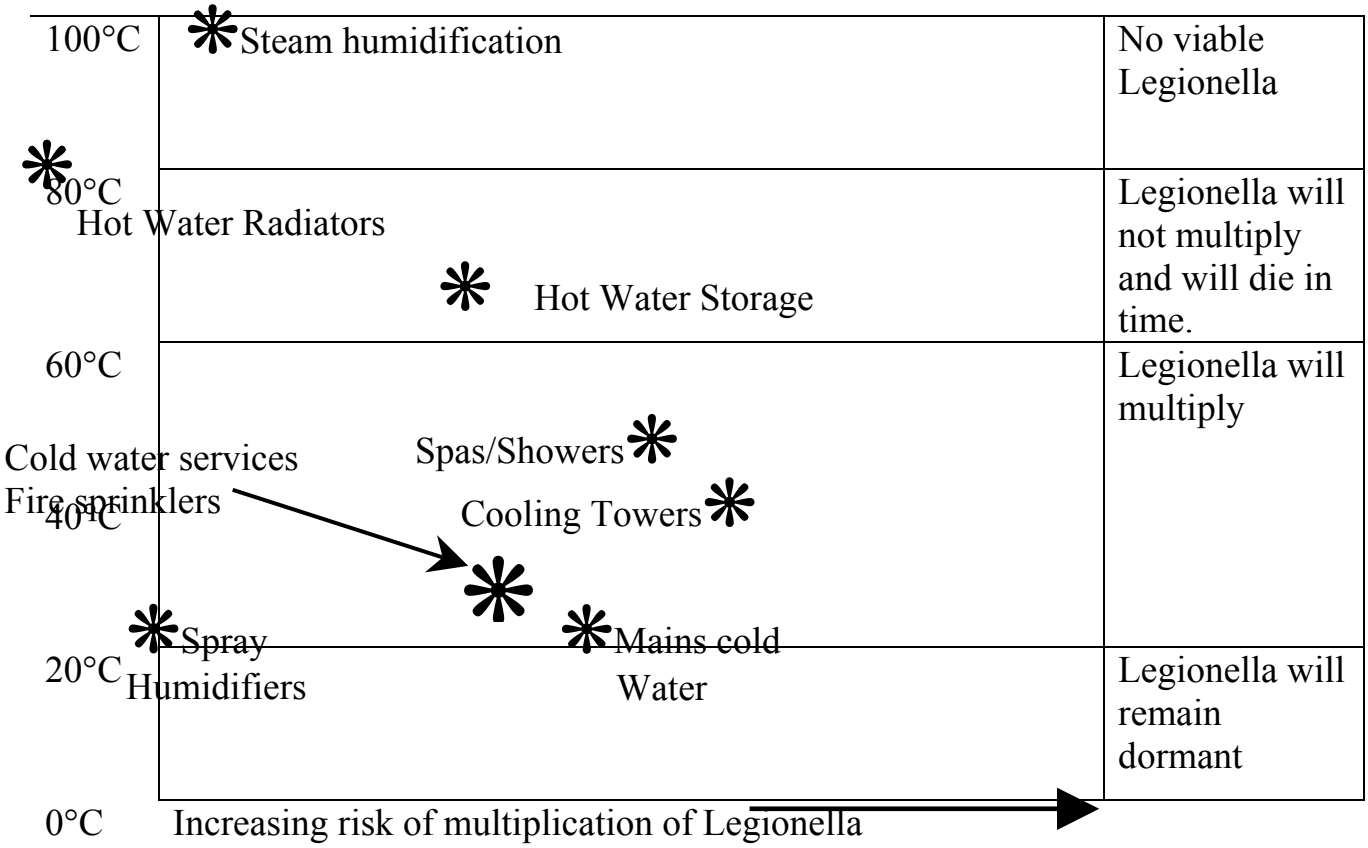
- Anywhere!
- Temperature – Maximum Virulence at 37°C, Lives 6 - 60°C, breeds 20 - 45°C.

- Stagnation
- Recirculation Systems with low make up rates
- Sludge, Slime, Algae, Scale, Rust Products, Especially biofilms.
- PH between 6- 8

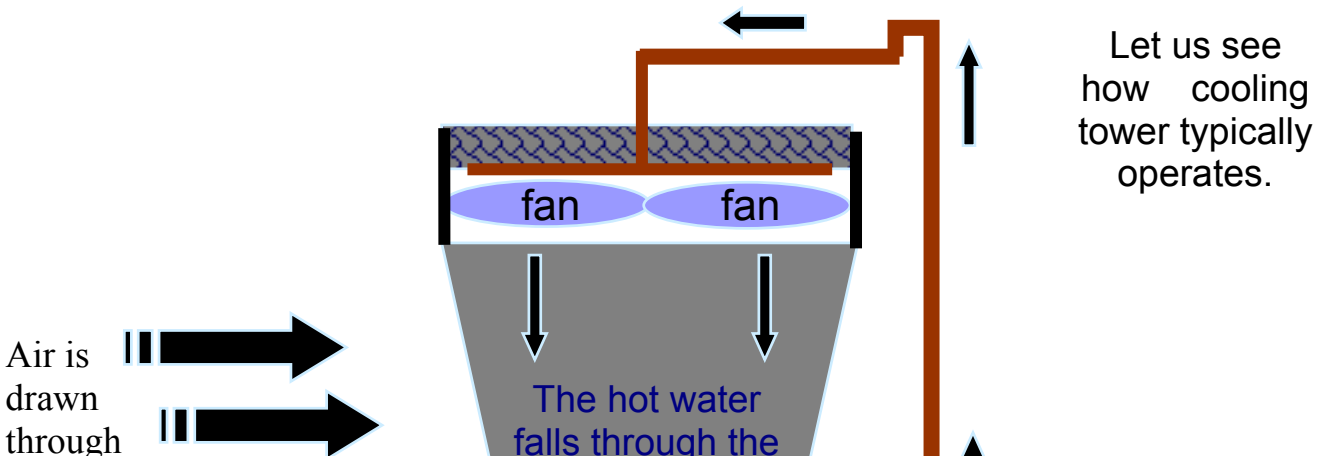
Aqueous aerosols play a crucial role in infection and the following details are relevant:
-

- Inhalation is the only route of infection
- Droplets can travel up 500 metres
- Droplet nuclei are 3 – 5 µm
- Exposure Dose related to exposure time, number present and individual's susceptibility

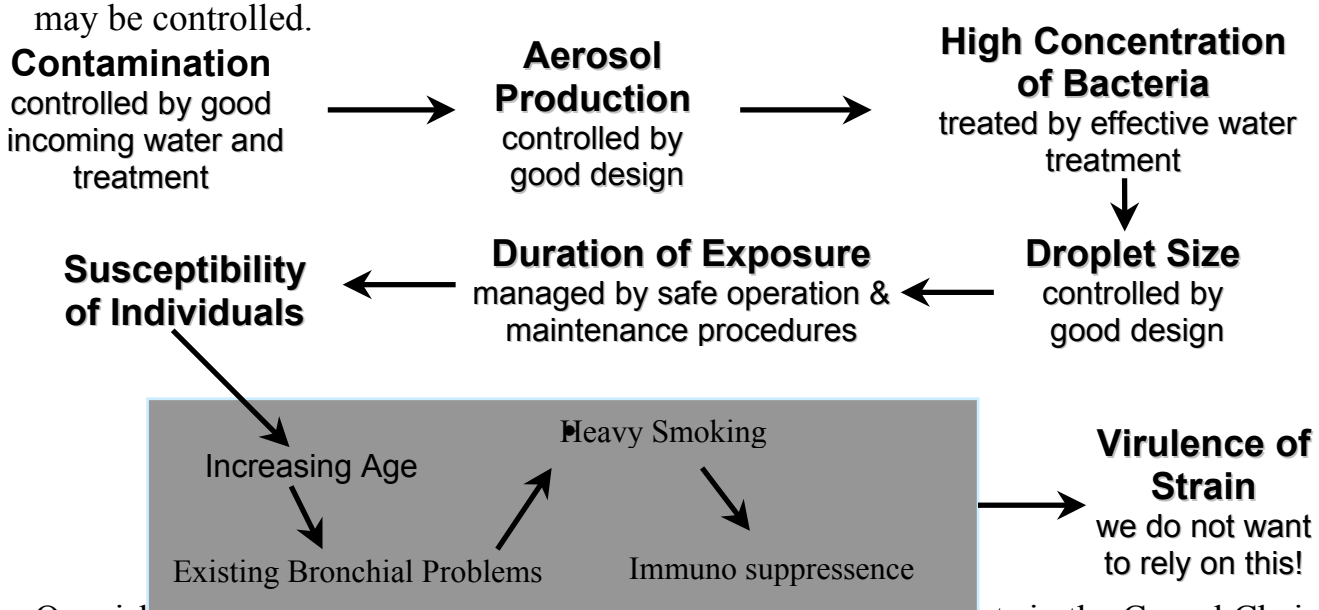
Chart of Risk Factors in Typical Systems



The Cooling Process



Kevin went on say that although Legionella is hazardous it is, on the whole, rare because a great many factors have to be in place together for a potential problem to occur. This is known as the 'causal chain', or the events leading to an outbreak. We have to break that chain in as many places as possible. The more breaks we make, the greater the reduction in 'risk' – this is what risk Assessments are designed to achieve. The following diagram shows some of the factors in the Causal Chain and how they may be controlled.

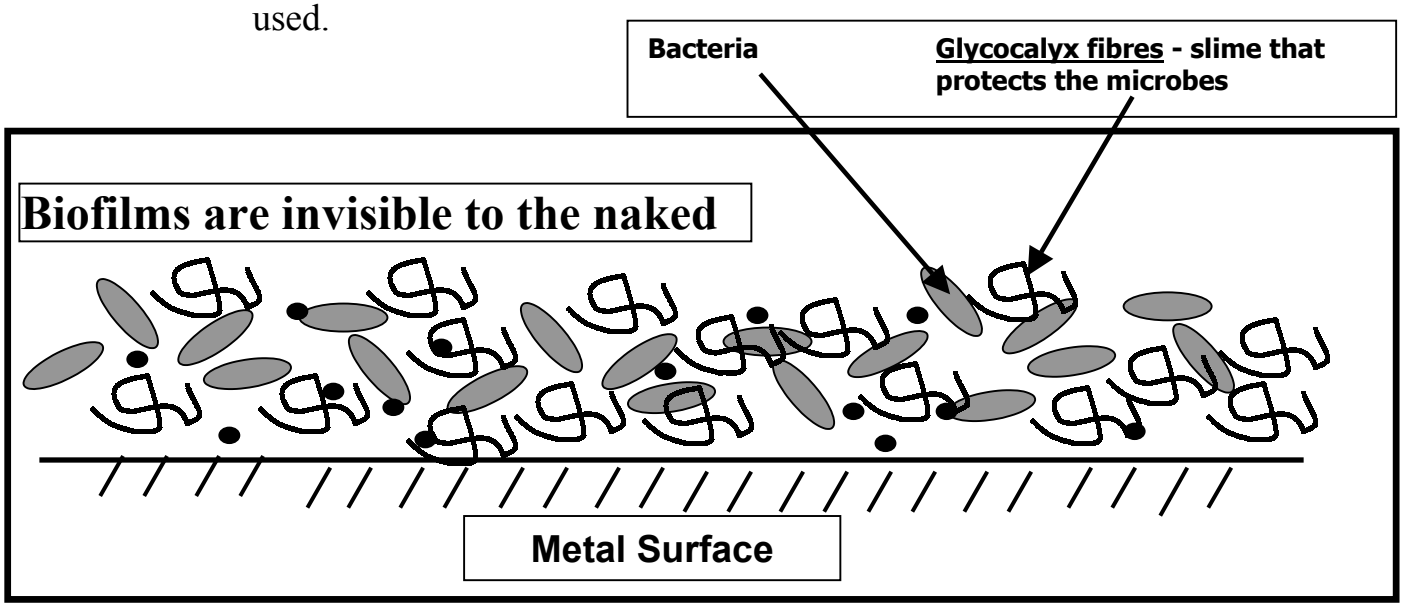


Our risk controls depend on a good understanding of the elements in the Causal Chain, starting with Water characteristics affecting the microbial growth: -

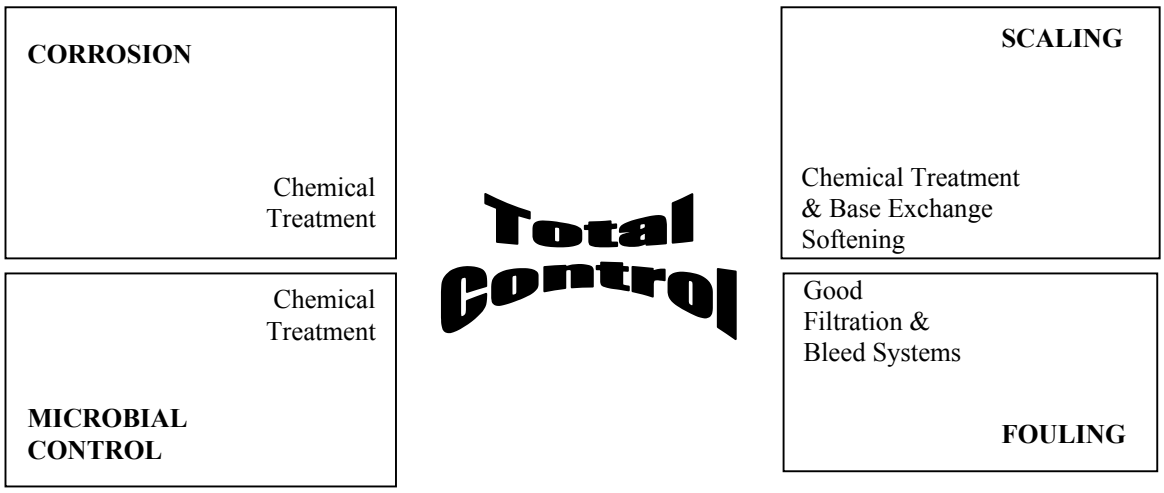
- Microscopic organisms will colonise cooling systems quickly and effectively.
- Microbes live in the planktonic phase (actually in the water itself) or Sessile (in a biofilm)
- Bacteria, algae and fungi can cause the most damage, through their growth various problems can arise: -

- Reduced heat transfer (biofilms are more insulating than much thicker layers of scale)
- Corrosion pitting through the release of chemical by-products
- Pack collapse under the weight of slime and biofouling

- Bio-films - these invisible layers occur everywhere in engineered water systems and can become the breeding ground for system contamination and bacteria like Legionella
  They have to be removed but the slime which the bacteria produce protect them against even the strongest biocides like chlorine (bleach)
  Only dispersants can break down the slime and that is why they must be used.



For successful water treatment, all these characteristics have to be addressed: -



- Mechanical systems
  - Drift and Windage eliminators (normally located on the side of cooling towers) should always be kept clean and free from debris.
  - Algae and other flora should not be allowed to grow on or near cooling tower systems. They represent continual contamination and nutritional sources for bacteria and Legionella. Their removal must be considered as part of the cleaning regime.

The law dealing with Legionella is wide ranging and comprises: -

- Health and Safety at Work Act 1974
- Management of Health and safety at Work Regulations 1999
- Control of Substances Hazardous to Health Regulations 2002
- Notification of Cooling Towers Regulations 1992
- RIDDOR 1995
- ACOP L8 (2001)
    - Cooling Towers
    - Evaporative Condensers
    - Hot & Cold Water Systems
    - Amenity Showers
    - Humidifiers and Air Washers
    - Spa and Whirlpool Baths
    - Other Systems

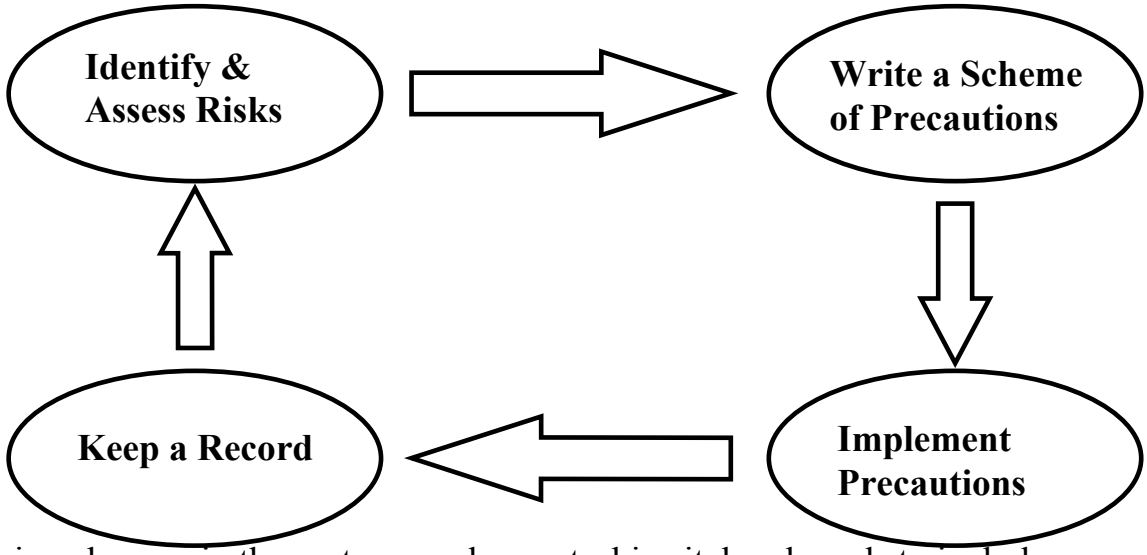
In keeping with other regulations, there is a requirement to carry out risk assessment and that responsibility falls on: -

- The employer
- Self-employed person
- Person in control of premises or systems posing a risk

The duty holder is required to appoint a competent person to assess the risks, including the identification of the sources and

- The means by which exposure to Legionella bacteria is to be prevented, or
- If prevention is not reasonably practicable, the means by which it is to be controlled.

The Key Tasks to manage the risks are: -



Monitoring changes in the systems under control is vital and needs to include: -

- Plant changes
- Process changes
- Change of building use
- New information
- Outbreaks or Illnesses.

- Control problems
- Intention to Review Regularly (Say 2 Years maximum)

The requirements for any risk assessment showing a significant risk are: -

- An up-to-date layout of systems
- Responsibilities – Internal & External
- Plant operational data
- Written Scheme for minimisation of risk
- Description of operational practise
- Checks to ensure effectiveness
- Precautions
- Presence of Legionella

Record Keeping is an essential part of proving that proper precautions have been taken, namely: -

- Copy of Risk Assessment
- Registration Document
- Responsible person / Communication
- Written Scheme for Minimisation
- Day-to-day responsibilities
- Plant utilisation
- Treatment programmes
- H & S Data
- Cleaning procedures
- Details of implementation of written scheme
- Precautions taken and control parameters
- Inspection records and results
- Remedial works record
- Signatures and Training records
- Commissioning and shut down procedures
- 5 years' history

It is also important to be aware of lines of communication, to report all matters and results promptly and to insert data into the appropriate logbooks.

Other guidance for domestic systems comprises: -

- Water Regulations 1999
- BS6700: 1997
- Use WRC Materials
- Avoid use of multiple tanks
- Be careful with showers used less than once per week
- Do not use TMV spray taps with susceptible populations
- Provide shunt pumps for calorifiers
- Watch out for calorifiers overflow to a tundish
- Be wary of low use systems upstream of high use systems
- Minimise tank sizes
- Flush unused outlets weekly
- Remove deadlegs
- Temperatures

- Hot water >60°C
- Cold Water storage <20°C
- 2°C Rise Incoming Mains to Tank
- Hot Water distribution >50°C
- Return temperature >50°C
- C.W Supply Temp of >20°C should be investigated

The guidance for domestic inspections is: -

- Monthly calorifiers temperatures
- Temperature at taps furthest from the calorifier monthly, incorporating all taps in the course of a year
- TMV input monthly
- Cold taps, representative number annually, temperature after 2 mins.
- 6 monthly Incoming tank temperature

Cleaning and disinfection should be carried out: -

- On commissioning
- When 1000 CFU/l L.P. test indicates
- When routine inspection shows necessary
- On modification or entry
- After disease outbreaks
- 6 – 12 month intervals

The Annual inspection should look at: -

- The cold water tank, visual inspection – clean and disinfect if necessary. Increase frequency if debris or vermin found.
- Sample water use to check on usage pattern
- Drain calorifier and check for debris.
- Check plans against system – update if necessary
- Check maintenance records and remedial actions
- Check connections to outside services, remove unused outlets.

Monitoring for Legionella is required whenever: -

- Biocidal control systems used in preference to temperature control systems – monthly testing until system proved OK.
- There has been a temporary loss of temperature control
- When an outbreak has been suspected
- Where the populations are ‘at risk’
- Analysis should be one at a UKAS/PHLS laboratory

In summary, Philip aid that employers must appoint a responsible person to: -

- Identify and Asses Risk
- Develop a scheme to control the risk
- Implement, manage and control the systems
- Record the Assessments and written scheme for minimisation.