LEGIONNAIRES DISEASE

Mick Gray
Principal Occupational Hygienist
for
MWG Associates Ltd
QUEEN QUITS PALACE OVER KILLER BUGS

Legionnaires' disease found in her shower
**Legionella – Occurrence**

- Legionella bacteria are common in nature and can be found in low numbers in rivers, lakes & reservoirs. They can enter engineered water systems from the mains supply.
- Cases of Legionnaires’ disease have occurred amongst staff in the workplace, work related visitors and the general public.
- The are relatively few infections and the disease must be put into perspective:
  - Typically 200 to 250 cases reported annually (underestimated !)
  - About half of cases associated with travel abroad
  - 15 - 20 people die annually due to Legionnaires Disease
  - However, there are approximately 180,000 pneumonia cases each year in the UK
FACTS AND FIGURES

- 46% OF UK CASES CONTRACTED ABROAD.
- 25% OF CASES ASSOCIATED WITH OUTBREAKS.
- L. pneumophila IS RESPONSIBLE FOR PONTIAC FEVER.
- 40 SPECIES OF LEGIONELLA BACTERIA IDENTIFIED.
- L. pneumophila SEROGROUP 1 IS MOST ASSOCIATED WITH L.D.
LEGIONELLA PNEUMOPHILA
BACTERIA
LEGIONELLA PNEUMOPHILA BACTERIA
LEGIONNAIRES DISEASE

*L. pneumophila* and >40 other *Legionella* sp.

(*L. pneumophila* causes 90% of legionellosis)

14 serogroups of *L. pneumophila*

(*L. pneumophila* serogroup 1 cause 82% of legionellosis)
The species of Legionella

L.adelaidensis  L.anisa  L.birminghamensis  L.bozemanii 
L.brunensis  L.cherrii  L.cincinnatiensis  L.dumoffii 
L.erythra  L.fairfieldensis  L.feelei  L.geestiana 
L.glasguensis  L.gormanii  L.gratiana  L.hackeliae 
L.israelensis  L.jamestowniensis  L.jordanis 
L.lansingensis  L.londiniensis  L.longbeachae  L.lytica 
L.maceachernii  L.micdadei  L.moravica  L.nautarum 
L.oakridgensis  L.parisiensis  L.pneumophila 
L.quateirensis  L.quinlivanii  L.rubrilucens  L.sainthelensi 
L.santicrucis  L.shakespearei  L.spiritensis  L.steigerwaltii 
L.tucsonensis  L.wadsworthii  L.waltersii  L.worsleiensis
LEGIONNAIRES DISEASE
ROUTE OF INFECTION

• Inhalation of aerosols most likely.
• <5μm aerosols can enter alveoli.
• Legionella survive 2-3hrs in aerosols at relative humidity of 65%.
• Aerosols created by water impacting surfaces.
• No evidence of person to person spread.
LEGIONNAIRES DISEASE
LEGIONNAIRES DISEASE

- First recognised July 1976, Philadelphia
- American Legionnaires convention
- 221 cases of pneumonia
- 34 died
- McDade discovers aetiological agent.
- Retrospective analysis revealed cases since 1940’s.

PNEUMONIA = LUNG LOVING
LEGIONNAIRES DISEASE
Stafford General Hospital
LEGIONNAIRES DISEASE
Stafford General Hospital
LEGIONNAIRES DISEASE
Stafford General Hospital

• The outbreak affected 121 people
• 28 people died
• Visitors to the Out Patients Department
• Cooling Tower/ Chiller Unit
LEGIONNAIRES DISEASE
BBC Radio Portland Place

The cooling tower, BBC London
TRAVEL CAN BE AS FAR AS 2.5 KILOMETRES
LEGIONNAIRES DISEASE
DUTCH FLOWER SHOW

- March 1999
- The outbreak affected 210 people
- 32 deaths
- Two whirlpool spas in Hall 3 and 4
LEGIONNAIRES DISEASE

- Cider-maker Bulmers fined £300,000 for fatal Legionnaires' disease outbreak
- Outbreak 2003
- 26 cases Legionnaires Disease with 2 deaths
LEGIONNAIRES DISEASE

HEALTH EXPERTS SAY TUBS CAN PROVE A HOT HOUSE FOR DEADLY BACTERIA

The hidden danger that can lurk in spa pools

By Sean Poulter
Consumer Affairs Correspondent

HEALTH experts have issued a warning over the safety of hot tubs and spa pools.

After conservatories, designer gardens, water features and decking, spa pools have become the latest ‘must-have’ household accessory.

Sipping champagne in a warm bubbling tub while strolling at the spa may appear to be the height of luxury and sophistication.

But the Government’s Health Protection Agency warned yesterday that the pools could harbour dirt and disease.

The HPA said there had been five reported outbreaks of Legionnaires’ disease associated with spa pools over the last five years, leading to four deaths and 28 cases of infection.

Resident Legionnaires’ disease, the HPA says the pools can also cause folliculitis – an inflammation of the hair follicles and spread other bugs.

With spa pools becoming more popular, the HPA has issued a 124-page safety guide for the growing number of users.

The guide outlines practical measures such as testing water temperature, cleaning and disinfecting.

It says spa pool owners need to ensure that dirty water – potentially containing a wide variety of bugs – is properly removed instead of being constantly re-heated and re-used.

The pools should be emptied and drained at least once a week, say the guidelines, and bathers should refrain from putting their heads under the water, and from coughing into it.

They should also ensure that they use the lavatory and take a shower before entering the pool.

The HPA said: ‘Spa pools in the home are becoming more commonplace, with about 14,000 to 15,000 installed in homes each year.

‘The new guidance sets out practical measures that can be followed to prevent users contracting infections such as Legionnaires’ disease and folliculitis and to prevent other hazards, such as slipping.

‘Dr John Lee, an expert on water-borne infections at the HPA said: ‘Spa pools provide the perfect conditions for certain bacteria to survive, and cause infection because they have a mixed water temperature and conditions that create an aerosol of water.

‘They can also have large numbers of bathers compared to water volume. If pools are correctly disinfected, fully drained once a week and use the correct filtration they will not normally contain these bacteria.

‘However, in poorly maintained pools the conditions will be perfect for the growth of bacteria and these have been identified as a cause of infection in the past.

‘An HPA study in 2003 found 23 out of 88 spa pools contained the Legionnaires’ disease bacteria.

‘In the same year, two women in their sixties died after contracting the disease while staying at the Cricket St Thomas Hotel, near Chard, in Somerset. The hotel was used as the setting for the BBC series To the Manor Born, The infection was later traced to the hotel’s spa pool.

In 2001, Roger Russell, 61, from Crowthorne, Berkshire, died from the disease after being shown an outdoor hot pool by a salesman. He breathed in a mist from the tub during a demonstration.

Richard Bishop, of the British and Irish Spa and Hot Tub Association, said: ‘There are in excess of 100,000 hot tubs being used domestically in the country with little, if any, incidence of infection.

‘The problems tend to be in commercial premises where there is a much higher usage and a failure of maintenance and management.

s.poulter@dailymail.co.uk
ONE hundred and fifteen people are believed to have been affected by the Legionnaires’ disease bug in an outbreak at a Sunderland leisure club, a report said yesterday.

The Health Protection Agency traced the outbreak last year to faults in the water treatment system at the Springs health club, which led to the legionella pneumophila bug colonising the spa pool system.

It is now known that the 115 people became ill after visiting the leisure club from August 11 to 25 last year. Of these, two have been confirmed as having Legionnaires’ disease and five of having Pontiac Fever, a milder version caused by the same legionella organism. Three people needed hospital treatment after the outbreak, which led Springs to shut the health club earlier this year.
Dosing and control

- Normally two stages
  - Filtration
  - Disinfection
- Control system will maintain control over pH
- Control system will maintain control over chlorine/bromine via redox
Complex pipe work

- Makes full draining difficult.
- Potential dead legs
- Areas for bacteria to “hide”.
- Corrugated pipes should be avoided.
Dubai Legionnaires Disease

- Bill Frindall  Cricket Scorer and Broadcaster
Pot death risk: The killer in the garden

- Opened a new bag of potting mix
- Admitted to hospital
- Induced a coma
- 50/50 chance
- Legionella longbeachae

Christchurch, New Zealand, 4 Cases from Potting Mix, October 2005
Four people in Christchurch, New Zealand contracted Legionnaires’ disease from potting mix and compost bags, including an elderly man who has died.
Approved Code of Practice & Guidance

Legionnaires’ Disease
The Control of legionella bacteria in water systems
Design Temperatures & Associated Risks

Temperature °C

- Steam Humidification
- Hot Water Boilers
- Hot Water Storage
- Spas, Showers
- Cooling Towers
- Cold Water Services
- Fire Sprinklers
- Spray Humidifiers
- Mains Cold Water and Air
- Cooling Coil Condensate

Increasing Risk of Multiplication of Legionella

- No Viable Legionella
- Legionella will not Multiply and will Die in Time
- Legionella will Multiply
- Legionella will Remain Dormant
Relevant Systems

- Water systems with cooling towers
- Water systems with evaporative condensers
- Hot & cold water services
- Any system containing water >20°C which may release a spray or aerosol
- Spray humidifiers, air washers, water softeners, emergency showers, eye wash, spa baths, sprinkler & hose reel systems, car/bus washes, dental eqpt etc. see pg 53 checklist 3.
B. Tanks

Example of a tank meeting the requirements of bylaw 30

- Screened air inlet corrosion resistant mesh (0.65 mm max opening)
- Securely fixed access cover
- Servicing valve
- Tank lining or material is suitable for contact with drinking water
- Screened overflow
- Tank insulation
- Drain at lowest point
- Sleeve for vent
5.1 Document the management structure

Provide details of the following:

1. The Legionella Manager
2. Names of deputies and responsibilities
3. Water treatment company and maintenance contractors employed
4. Consultants used in control scheme
5. Who is responsible for reacting to results outside the safe operating range?
An organogram is useful for larger organisations to display who is responsible for which building.
## Water system management

### 5.2 Recommended monitoring regime

**Cooling Towers - checks recommended**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Timing</th>
<th>Make up</th>
<th>Cooling Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardness</td>
<td></td>
<td>Monthly</td>
<td>Monthly</td>
</tr>
<tr>
<td>Alkalinity</td>
<td></td>
<td>Quarterly</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Chloride</td>
<td></td>
<td>Monthly</td>
<td>Monthly</td>
</tr>
<tr>
<td>Sulphate</td>
<td></td>
<td>Quarterly</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Conductivity</td>
<td></td>
<td>Monthly</td>
<td>Weekly</td>
</tr>
<tr>
<td>Suspended solids</td>
<td></td>
<td>Quarterly</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Inhibitor Level(s)</td>
<td></td>
<td>-</td>
<td>Monthly</td>
</tr>
<tr>
<td>Oxidising biocide</td>
<td></td>
<td>-</td>
<td>Weekly</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td>-</td>
<td>Quarterly</td>
</tr>
<tr>
<td>pH</td>
<td></td>
<td>Quarterly</td>
<td>Weekly</td>
</tr>
<tr>
<td>Iron</td>
<td></td>
<td>Quarterly</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Concentration factor</td>
<td></td>
<td>-</td>
<td>Monthly</td>
</tr>
<tr>
<td>Microbiological activity</td>
<td></td>
<td>Quarterly</td>
<td>Weekly</td>
</tr>
<tr>
<td>Legionella</td>
<td></td>
<td>-</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>
## Cooling Towers - (continued)

### Interpretation of microbiological monitoring

<table>
<thead>
<tr>
<th>Aerobic Count</th>
<th>Legionella bacteria</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>cfu/ml @ 30°C minimum of 48 hours incubation</td>
<td>cfu/litre</td>
<td></td>
</tr>
<tr>
<td>10,000 or less</td>
<td>100 or less</td>
<td>System under control</td>
</tr>
<tr>
<td>More than 10,000 and up to 100,000</td>
<td>More than 100 and up to 1,000</td>
<td>Confirm count with immediate re-sampling. If similar count review control measures and identify remedial action</td>
</tr>
<tr>
<td>More than 100,000</td>
<td>More than 1,000</td>
<td>Re-sample then shot dose with biocide. Shut down fans. Review control procedures.</td>
</tr>
</tbody>
</table>
**Cooling Towers - (continued)**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly to 3 monthly</td>
<td>Clean and check calibration of conductivity sensor for blow down function</td>
</tr>
<tr>
<td>6 Monthly</td>
<td>Clean and disinfect towers.</td>
</tr>
</tbody>
</table>
# Water system management

## Hot and cold water systems

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Check</th>
<th>Cold water</th>
<th>Hot water</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly</td>
<td>Sentinel taps</td>
<td>Should be less than 20°C after 2 minutes</td>
<td>Should be more than 50°C in one minute</td>
<td>Supply and return temperatures on loops should be the same</td>
</tr>
<tr>
<td>Monthly</td>
<td>Calorifier flow and return</td>
<td>-</td>
<td>Should leave at 60°C and return at 50°C</td>
<td>Install thermometers on flow and return limbs</td>
</tr>
<tr>
<td>Six monthly</td>
<td>Cold water at inlet</td>
<td>Should be less than 20°C at all times</td>
<td>-</td>
<td>Measure in Summer and winter at the ball valve</td>
</tr>
<tr>
<td>Annually</td>
<td>Representative taps on a rotational basis</td>
<td>Should be less than 20°C after 2 minutes</td>
<td>More than 50°C in one minute</td>
<td>To ensure the whole system is working properly</td>
</tr>
</tbody>
</table>
### Water system management

#### Hot and cold water systems (continued)

<table>
<thead>
<tr>
<th>Inspections</th>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annually</td>
<td>Calorifiers</td>
<td>Visual check on internal surfaces for scale and sludge and clean if necessary</td>
</tr>
<tr>
<td>Annually</td>
<td>Cold water tanks</td>
<td>Inspect for cleanliness and integrity. Carry out cleaning and repair if required.</td>
</tr>
<tr>
<td>Quarterly</td>
<td>Shower heads</td>
<td>Dismantle, clean and de-scale</td>
</tr>
<tr>
<td>Weekly</td>
<td>Little used outlets</td>
<td>Flush and purge to waste</td>
</tr>
</tbody>
</table>
# Water system management

## Other risk systems

<table>
<thead>
<tr>
<th>System</th>
<th>Action to take</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spray Humidifiers</td>
<td>Clean and disinfect</td>
<td>6 monthly</td>
</tr>
<tr>
<td>Sprinklers</td>
<td>Ensure minimum exposure to aerosols when testing</td>
<td>-</td>
</tr>
<tr>
<td>Fire hose reel systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency showers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eye washes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lathe and machine tool coolant systems</td>
<td>Clean and disinfect storage and distribution systems</td>
<td>6 monthly</td>
</tr>
<tr>
<td>Spa baths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check filters</td>
<td></td>
<td>Backwash sand filters daily</td>
</tr>
<tr>
<td>Check water treatment</td>
<td></td>
<td>3 times daily</td>
</tr>
<tr>
<td>Clean and disinfect</td>
<td></td>
<td>Weekly</td>
</tr>
<tr>
<td>Confirm operation of non-chemical water treatment (if present)</td>
<td></td>
<td>Weekly</td>
</tr>
</tbody>
</table>
### Water system management

**Other risk systems (continued)**

<table>
<thead>
<tr>
<th>System</th>
<th>Action to take</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horticultural misting systems</td>
<td>Clean and disinfect distribution pipework, spray heads and make-up tanks. De-scale if necessary</td>
<td>Annually</td>
</tr>
<tr>
<td>Dental Equipment</td>
<td>Drain and clean</td>
<td>At the end of each working day</td>
</tr>
<tr>
<td>Car/bus washes</td>
<td>Check filtration and treatment system, clean and disinfect as necessary</td>
<td>See manufacturers instructions</td>
</tr>
<tr>
<td>Indoor fountains and water features</td>
<td>Clean and disinfect ponds, spray heads and make-up tanks</td>
<td>Interval depending on condition</td>
</tr>
</tbody>
</table>
Record Keeping

- Dedicated Logbook
- Details of plant operation
- Evidence that precautionary measures were correctly carried out
- Record of all inspections and tests
- Details of any remedial works
- Signature of persons undertaking tasks

Maintain for at least five years
Risk Assessment - Responsibility

• The employer

• A self employed person

• The Person who is in control of the premises
The Assessment will Generate...

- Details on the risk decision
- Prevention and control measures
- Asset register of systems and plant
- Sufficient information to demonstrate that all pertinent factors have been considered
- A management system for preventing or minimising risks and including review procedures
- Reviewed every 2 years