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# *South Cumbria Occupational Health & Safety Group*

*Preventing Legionella and stagnation  
in water services – awareness of  
problems, especially in a post  
Covid world*

# Presenter- Niall Phillips

- Chemistry at Manchester Polytechnic
- Technical Manager at Hydraclean Ltd
- Worked for ABK Technical services, which then became Rentokill W&V as Laboratory Manager, looking at biocidal efficacy among other things.
- Hydraclean for 29 Years.
- Experienced Legionella control across Chemical, Nuclear, Manufacturing, Housing, Education, Government and Property Portfolios etc. etc.

# WHAT IS LEGIONELLOSIS

(1.) Legionellosis Covers:-

- Legionnaires Disease (Legionella Pneumophila (or L. Longbeachae in composts))
- Pontiac Fever
- Lochgoilhead Fever (L.micdadei)

(2.) It Is A Bacterium - Not A Virus

(3.) Legionella Pneumophila has various forms known as serogroups.

Serogroup 1 is known to be the most virulent form.

(4.) Legionella Pneumophila is known to be the species most commonly responsible for infection in humans.

(5.) The first identified outbreak of Legionnaires Disease was amongst people who attended the Pennsylvania State convention of the American Legion in 1976 - An “apparently” new bacterium was isolated from living specimens. (234 ill: 34 dead)

(6.) Legionella is ubiquitous i.e... it is widely found in natural and man made systems.

(7.) Over 58 species have been identified of which over 20 associated with disease in humans

# Species of Legionella

- Legionella adelaidensis
- Legionella anisa
- Legionella beliardensis
- Legionella birminghamensis
- Legionella bozemanii
- Legionella brunensis
- Legionella busanensis
- Legionella cherrii
- Legionella cincinnatiensis
- Legionella donaldsonii
- Legionella drancourtii
- Legionella drozanskii
- Legionella erythra
- Legionella fairfieldensis
- Legionella fallonii
- Legionella feeleii
- Legionella geestiana
- Legionella genomospecies 1
- Legionella gratiana
- Legionella gresilensis
- Legionella hackeliae
- Legionella impletisoli
- Legionella israelensis
- Legionella jamestowniensis
- 'Candidatus Legionella jeonii'
- Legionella jordani
- Legionella lansingensis
- Legionella londiniensis
- Legionella longbeachae
- Legionella lytica
- Legionella maceachernii
- Legionella micdadei
- Legionella moravica
- Legionella nautarum
- Legionella oakridgensis
- Legionella parisiensis
- Legionella pneumophila
- Legionella quateirensis
- Legionella quinlivanii
- Legionella rowbothamii
- Legionella rubrilucens
- Legionella sainthelensi
- Legionella santicrucis
- Legionella shakespeareii
- Legionella spiritensis
- Legionella steigerwaltii
- Legionella taurinensis
- Legionella tucsonensis
- Legionella wadsworthii
- Legionella waltersii
- Legionella worsleiensis
- Legionella yabuuchiae

# How does one catch it? – aerosol formation

- Inhalation of air containing the *Legionella* bacteria (aerosol)
- Rarely by aspiration (water going down the “wrong way”) of water containing *Legionella* bacteria.
- NEVER from someone else

# Legionnaires' Disease-Epidemiology

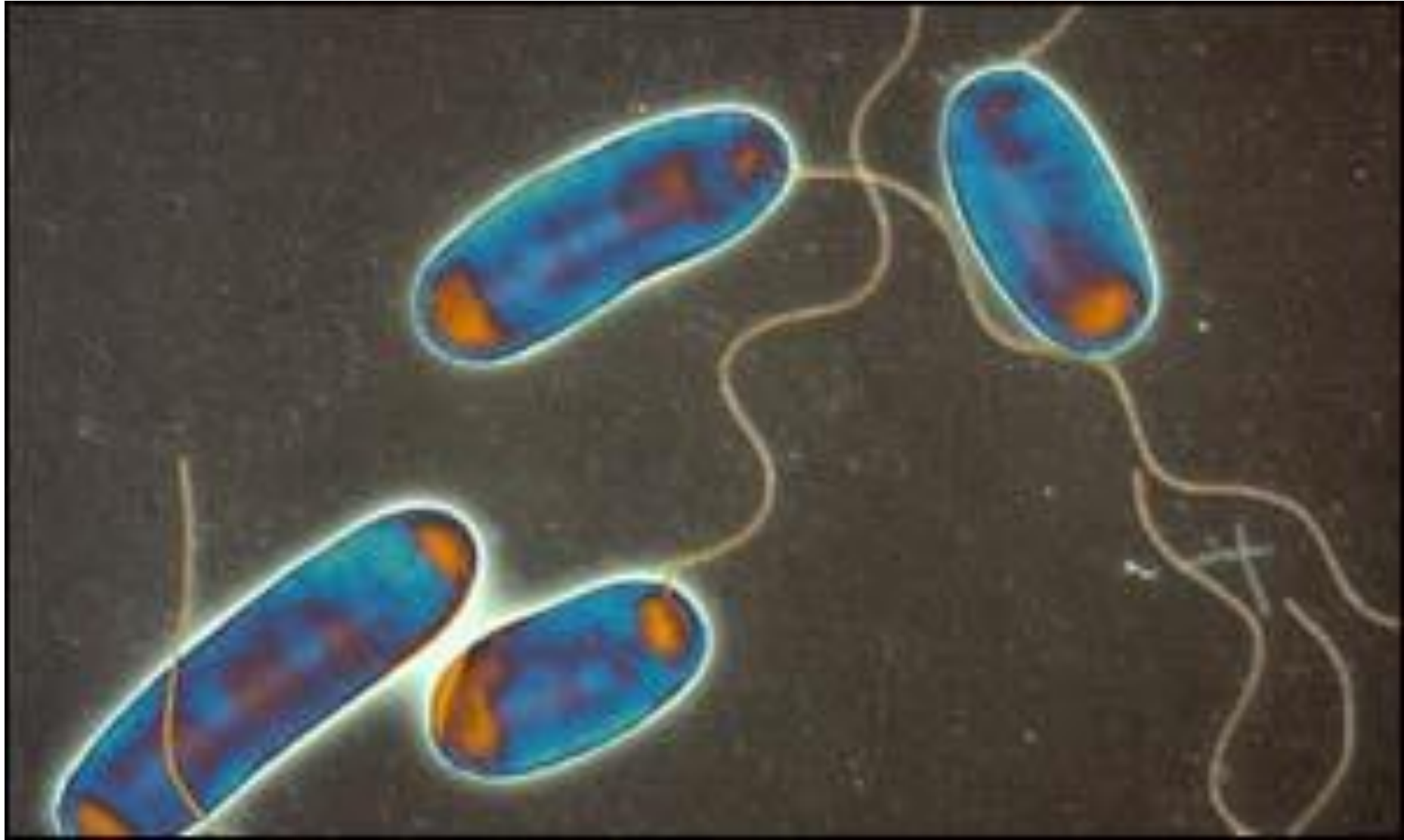
- Legionnaires' disease is caused by Legionella Pneumophila (Usually Sero Group 1.) **It is an atypical Pneumonia**
- <5% Attack rate i.e. upto 5 in every 100 people exposed may contract the illness.
- 10-30% mortality rate.
- Incubation period is usually 2-19 days. Normally 6 to 7 days
- Symptoms include Fever, being delirious, Vomiting and Diarrhoea.
- Illness can range from mild cough and low grade fever to stupor, respiratory failure and multi-organ failure.
- Treatment with Antibiotics. Slow recovery.
- Approximately 400-500 reported cases of Legionnaires' Disease per year
  - About 1/3<sup>rd</sup> to 1/2 travel associated. 6% in hospital in UK.
- 2-5% of Pneumonia patients caused by Legionella Pneumophila.
  - Suggests true annual incidence of Legionnaires' Disease in England and Wales between as high as 8,000 to 10,000 cases per annum
  - **ELDSNet** (EWGLI) estimate infection across Europe at 100 cases per Million inhabitants.
- Men 3 times more likely to be infected than women.

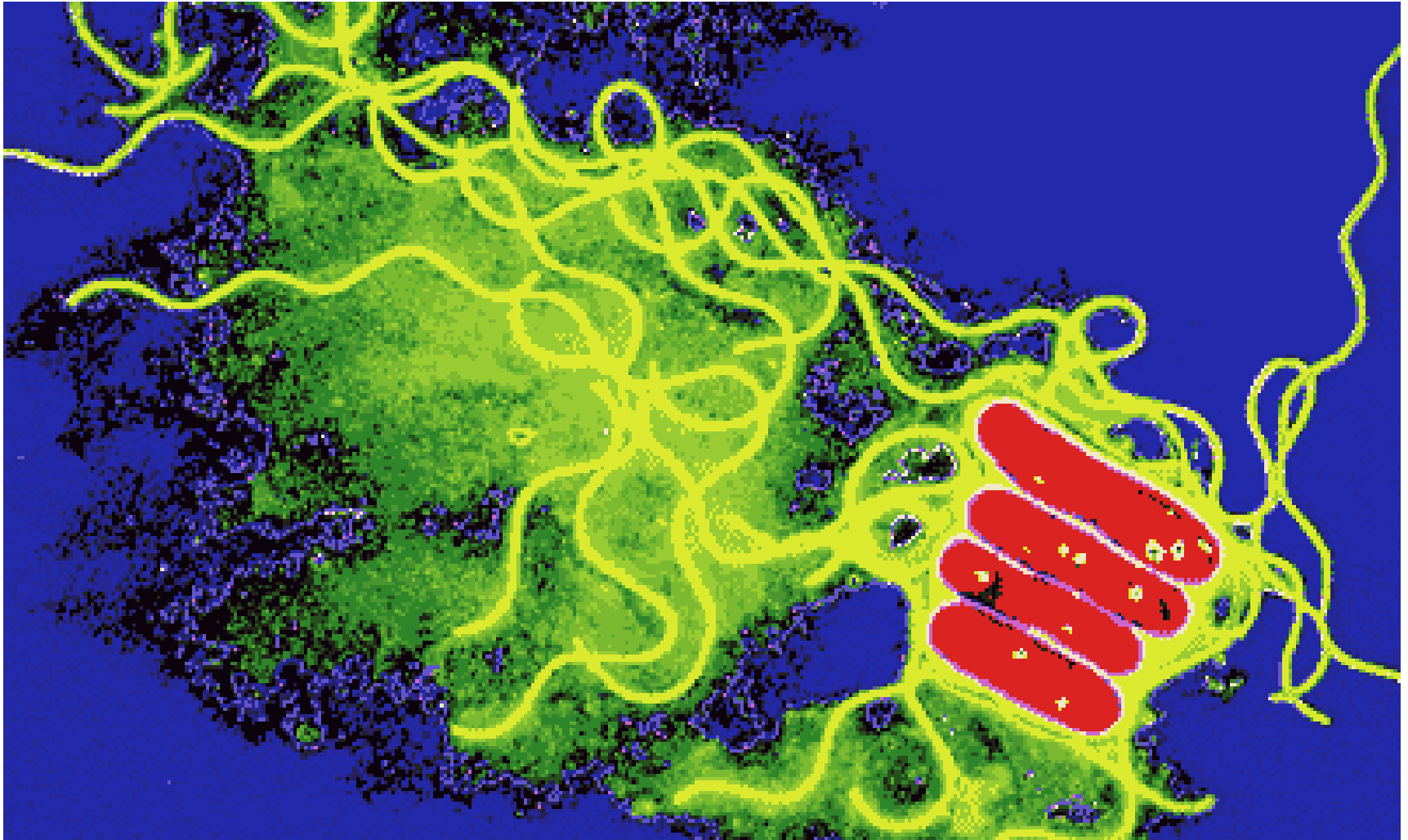
# Pontiac Fever

- 95% Attack Rate
- more than 90 per cent of people exposed to legionella bacteria in whirlpool baths catch Pontiac fever.
- Self limiting influenza like illness without development of pneumonia
- Symptoms mainly confined to fever lasting 3 to 5 days. Onset of symptoms normally within 12Hrs to 24 Hrs
- Zero Fatality.

	Legionnaires' disease	Pontiac fever
Clinical features	Pneumonia, cough, fever	Flu-like illness (fever, chills, malaise) without pneumonia
Radiographic pneumonia	Yes	No
Incubation period	2-14 days after exposure	24-72 hours after exposure
Etiologic agent	<i>Legionella</i> species	<i>Legionella</i> species
Attack rate	< 5%	> 90%
Isolation of organism	Possible	Never
Outcome	Hospitalization common Case-fatality rate: 5-30%	Hospitalization uncommon Case-fatality rate: 0%







# FACTORS AFFECTING GROWTH OF LEGIONELLA

## (1.) TEMPERATURE

Legionella Grows Between 20°C & 45°C  
Optimum Temperature =37°C

## (2.) SCALE

Scale can protect Legionella from Biocides and Disinfecting Agents.

## (3.) SLUDGE

Iron deposits (i.e. rust) and organic detritus are known to help legionella breed and act as nutrients.

## (4.) BIOFILMS

Legionella can live and breed in biofilms and slimes. From this it can then infect the main body of water.

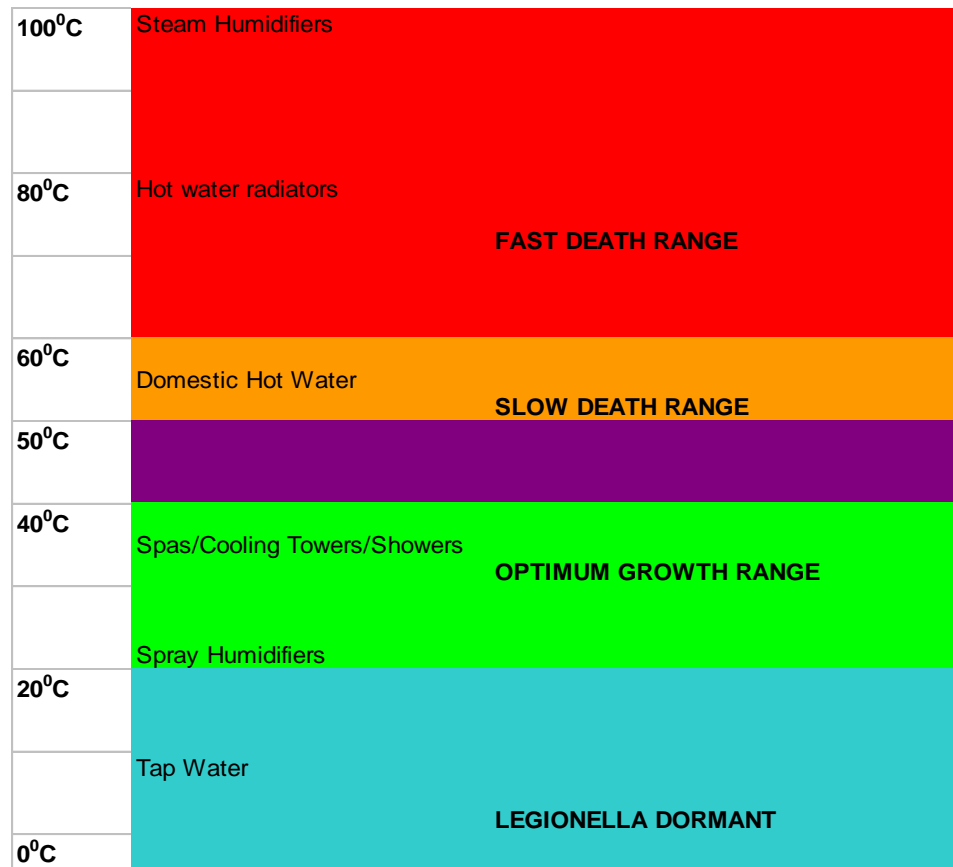
## (5.) DEADLEGS

These provide stagnant water which can contain the right ingredients (i.e.. temperature, rust etc..) for Legionella growth.

Examples include:-

- Lengths of pipework that have been blanked
- Pumps connected but not run
- Taps never or rarely used
- Stagnant tanks are also an effective deadleg

# Temperature Control



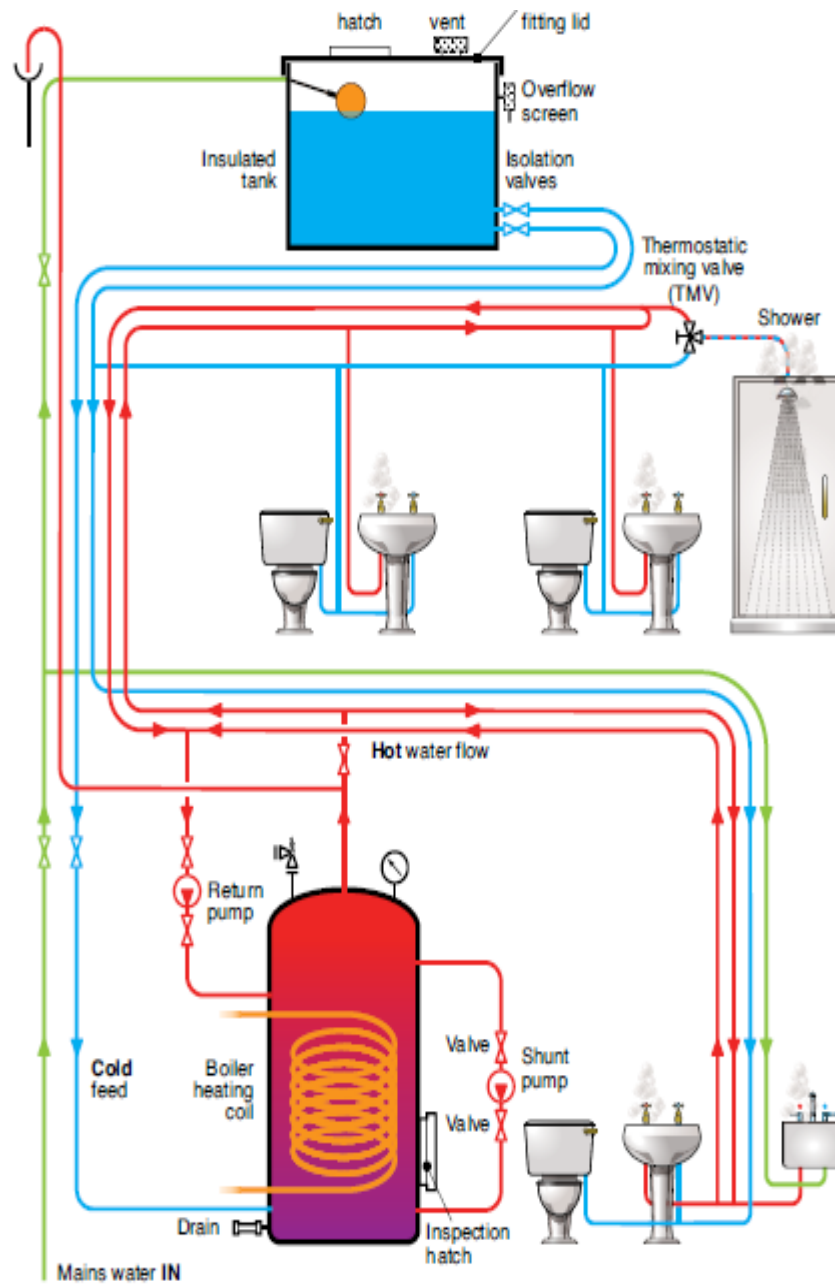
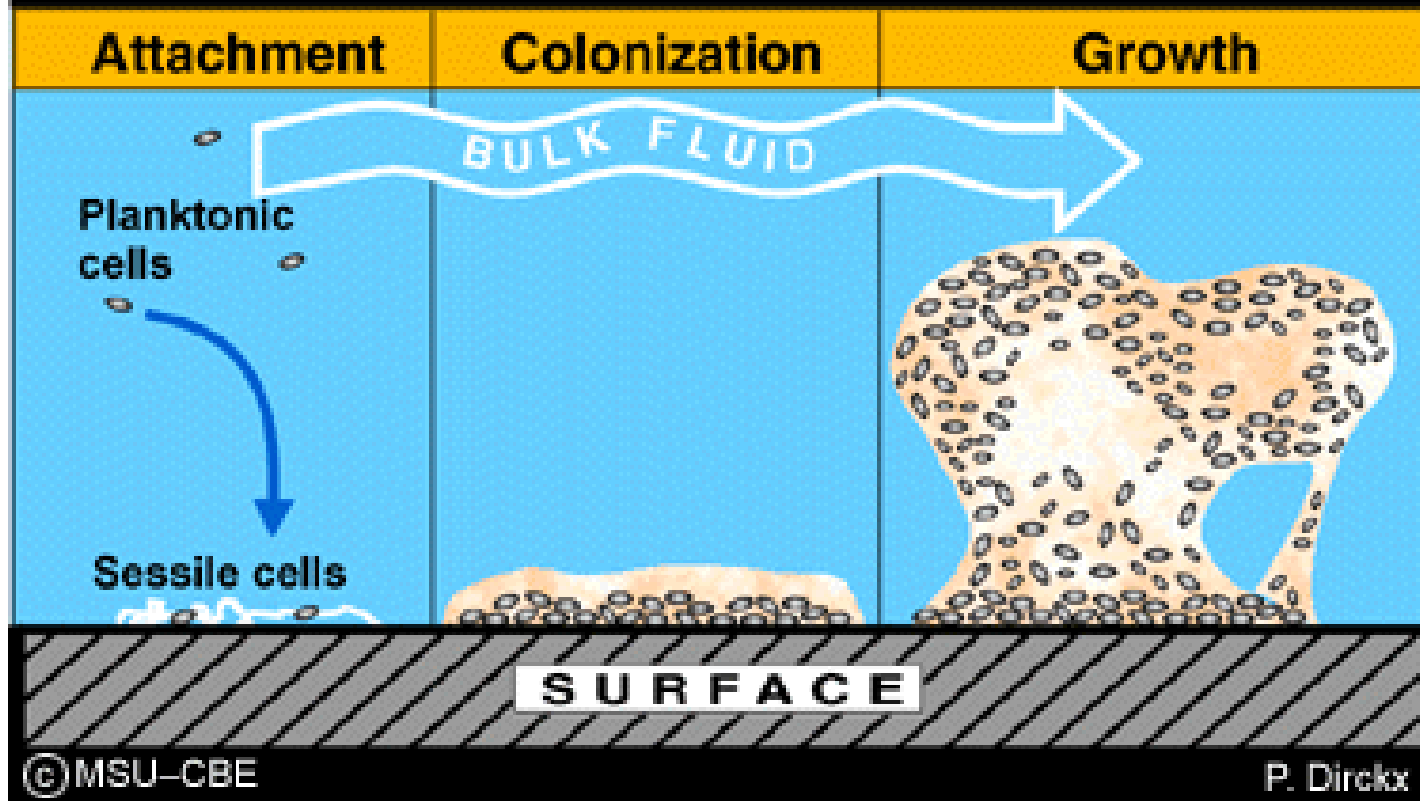


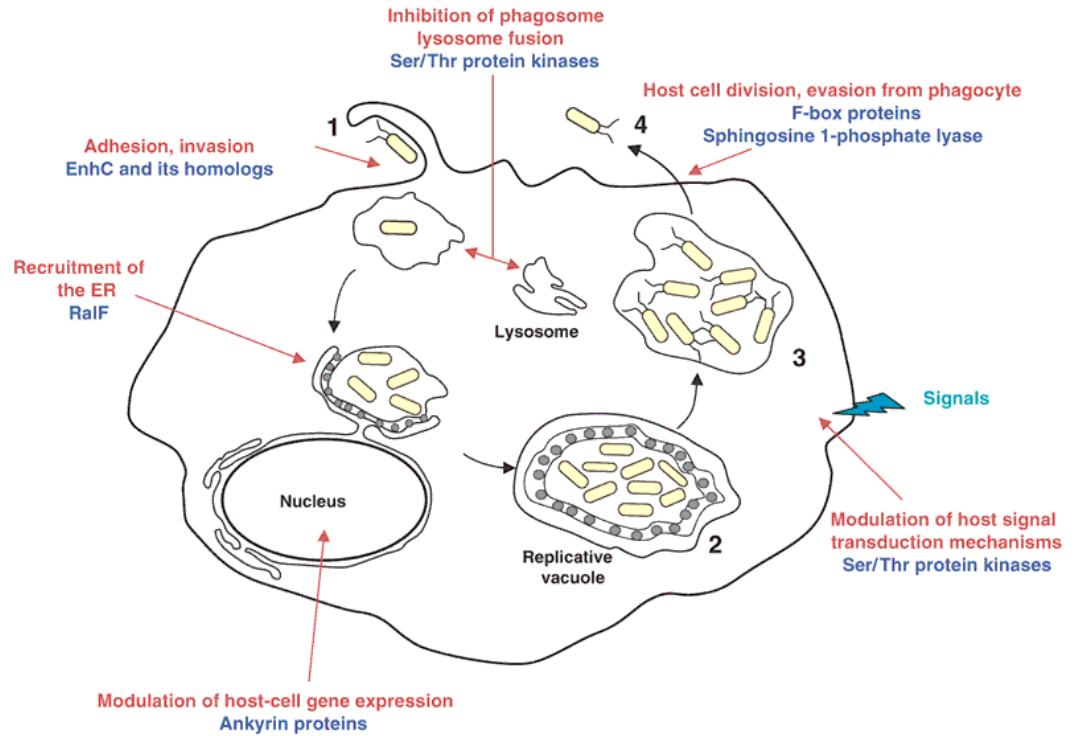
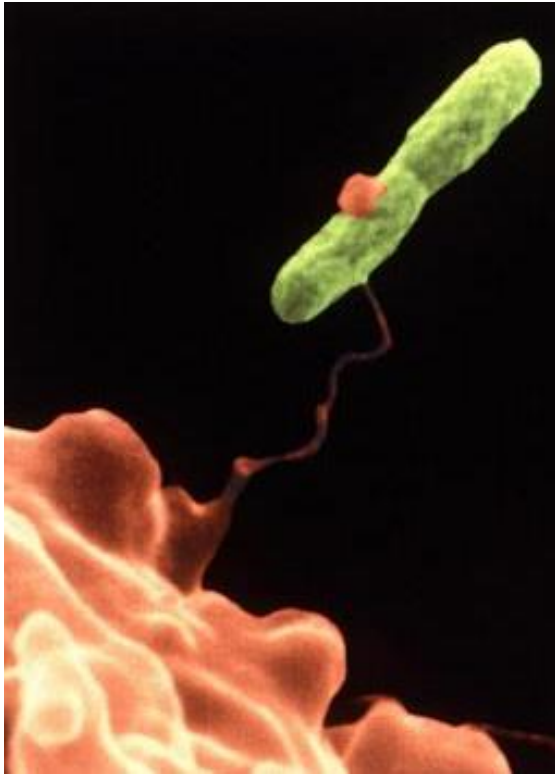
Figure 2.5 Gravity-fed system with recirculation



- Look for evidence of low use like discoloured water.
- Report any problems so they can be corrected or removed.

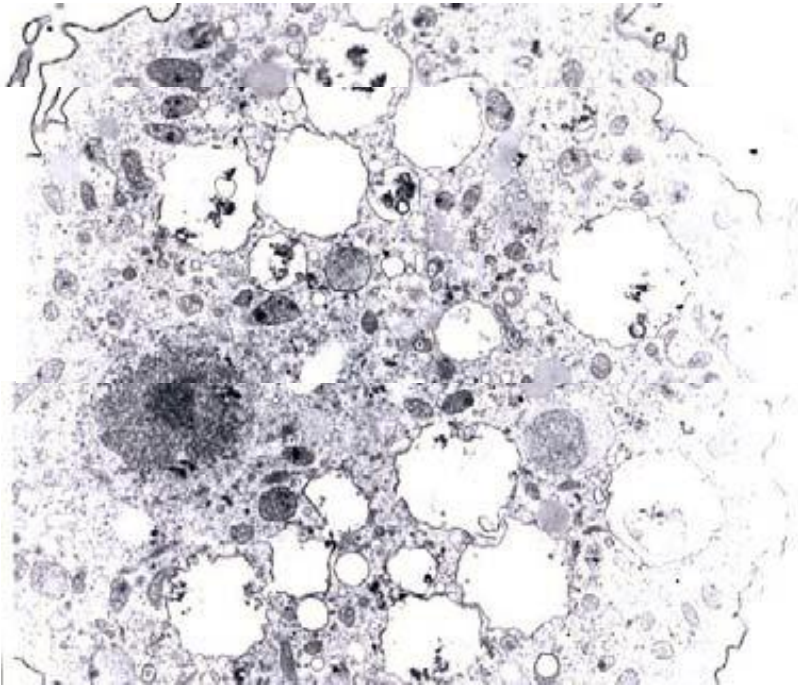
# Biofilm formation:



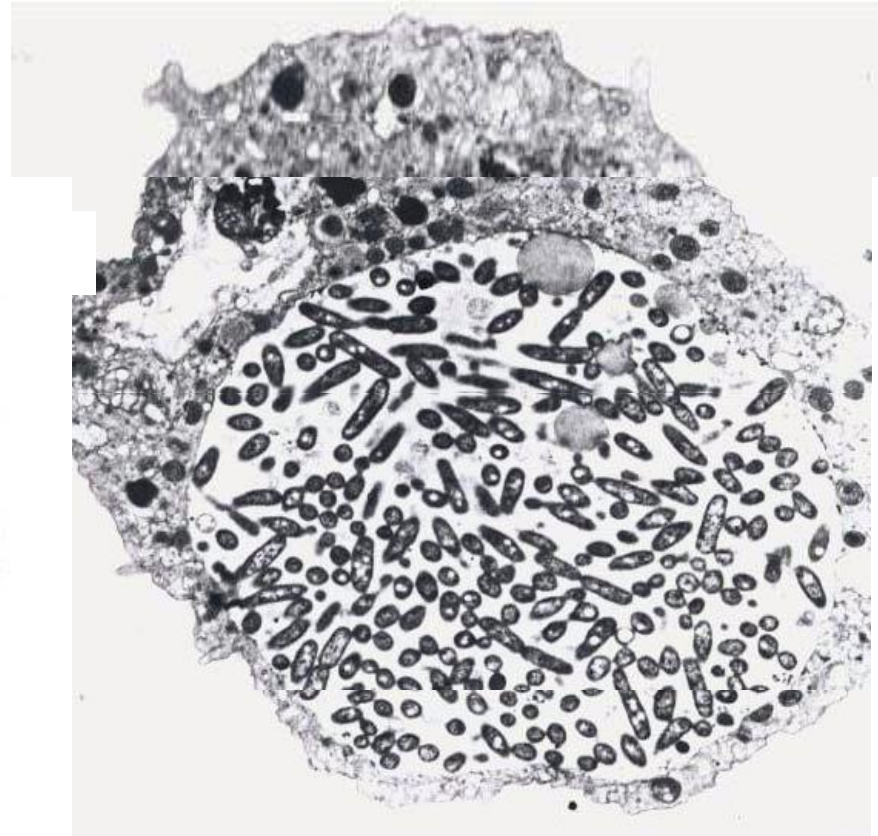




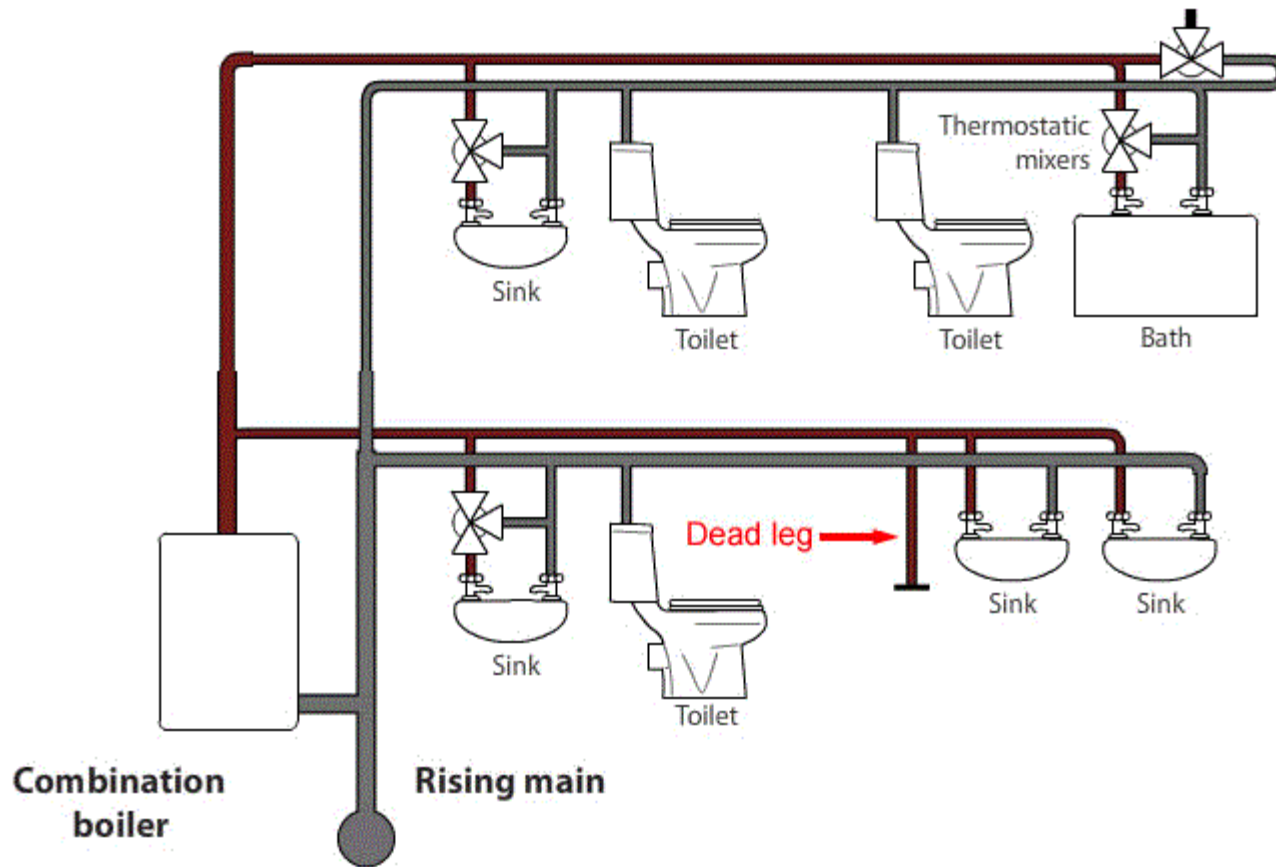
# *Acanthamoeba polyphaga*

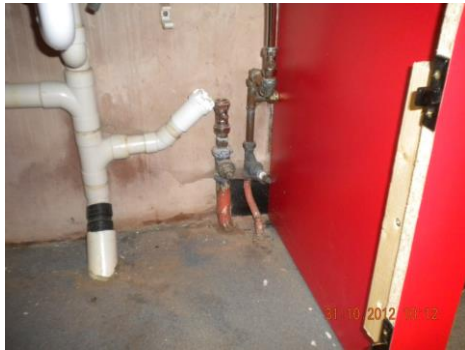


Uninfected



Infected





# Low Use Problems

Low flow / Partial Stagnation	Can allow biofilm Formation
Biofilm Formation	Can allow Legionella to proliferate
Temperature increase in cold water	Legionella growth range
Temperature decrease in hot water /pipework	Legionella growth range
Intermittent building use	Risk from aerosol from spray outlets that may now have biofilm / Legionella bacteria

# Possible Solutions

Solution	Advantage	Disadvantage
Increased flushing (all outlets?)	Controls Legionella from proliferating, if flushed rapidly can remove biofilms	High labour High water use May need to turn over complete volume of stored water
Treat systems with biocide	Can be carried out and keep water available for drinking Reduces biofilm formation Reduced water use and Labour	Needs Monitoring Still needs some movement to keep chemical in all areas. Needs initial capital cost
Mothball building	Reduced water use and Labour. Simple stratgey	Building cannot be used Lead time before re-opening

# Mothballed Building Extract from HSG 274-2

- ***Buildings temporarily taken out of use (mothballing)***
- 2.50 Where a building, part of a building or a water system is taken out of use (sometimes referred to as mothballing), it should be managed so that microbial growth, including legionella in the water, is appropriately controlled.
- 2.51 All mothballing procedures are a compromise between adequate control of microbial growth, the use of water for flushing (while avoiding waste) and degradation of the system by any disinfectant added. Where disinfectants are used, these should leave the system fit for its intended purpose.
- 2.52 In general, systems are normally left filled with water for mothballing and not drained down as moisture will remain within the system enabling biofilm to develop where there are pockets of water or high humidity. The water in the system also helps to avoid other problems associated with systems drying out, including failure of tank joints and corrosion in metal pipework. The systems should be recommissioned as though they were new (ie thoroughly flushed, cleaned and disinfected) before returned to use.

# IN SUMMARY

- KEEP THE HOT WATER HOT
- KEEP THE COLD WATER COLD
- **KEEP IT MOVING**
  - Minimum Weekly flushing of ALL little used outlets
  - More often if higher risk e.g. Vulnerable groups
  - Tanks should turn over every day!
- KEEP IT CLEAN

## Action Levels Following Microbial Monitoring for Hot and Cold water Systems

Legionella bacteria action levels (cfu/litre)	Action Required
More than 100 but less than 1000	Either: (a) If only one or two samples are positive, the system should be resampled. If a similar count is found again, a review of the control measures and risk assessment should be carried out to identify any remedial action. Or (b) If the majority of samples are positive, the system may be colonised, albeit at a low level, with legionella. Disinfection of the system should be considered but an immediate review of control measures and risk assessment should be done to identify other remedial action required.
More than 1000	The system should be re-sampled and an immediate review of the control measures and risk assessment carried out to identify any remedial actions, including possible disinfection of the entire system.