

## Member Update - March 2014

# Mycobacteria in drinking water

### Mycobacteria – what are they?

Mycobacteria are single-celled, rod-shaped, aerobic bacteria. They are related to the antibiotic-producing streptomycetes. The mycobacteria have a very thick cell wall that prevents them drying out. Many mycobacteria are harmless and useful because they degrade organic matter in soil. Some are used industrially to help convert cheap plant sterols into useful steroid hormones. There are a few pathogenic mycobacteria which cause the ancient diseases tuberculosis (*M. tuberculosis*, *M. africanum*, *M. bovis*) or leprosy (*M. leprae*).<sup>1</sup>

Many mycobacteria are considered to be opportunistic pathogens – which generally cause disease in people whose defences are weakened in some way such as immune suppression or deficiency, injury (e.g. burns, wounds) or a pre-existing disease. Infection of humans (or animals) is not a necessary part of the life cycle of these microorganisms, and many are capable of growth in a diverse range of environmental niches.

### What is the risk?

Mycobacteria have been found in natural and treated waters, and human exposure may occur through drinking, swimming and bathing. *Mycobacterium abscessus*, (the subject species of the PhD study by Dr Rachel Thomson at QUT) is a rapidly growing mycobacterium that can cause progressive pulmonary disease and skin and soft tissue infections, especially complicating surgical procedures and injection sites.<sup>2</sup>

Dr Thomson's thesis looked at all Mycobacteria found in water and included individual chapters on 4 species (*M. lentiflavum*, *M. abscessus*, *M. kansasii* and *M. fortuitum*). Overall *M. abscessus* appears to be the most significant, with *M. lentiflavum* a rare cause of disease, and mainswater an

unlikely source of *M. kansasii* and *M. fortuitum*. Dr Thomson found that the most common causes of mycobacterial disease in Queensland, *M. intracellulare* and *M. avium*, were infrequently detected in water.

As mentioned previously, the greatest risk is to people with compromised immunity such as the elderly and very young, people with lung conditions, people with diseases such as HIV or those undergoing chemotherapy. The recent findings in Brisbane raised concern because Dr Thomson has reported that a growing number of middle-aged women – generally slender and slightly above average height, and seemingly otherwise fit and healthy – are getting the disease.

### How can the risk be reduced?

One issue is that engineered water systems, and the appliances and devices attached to them, may provide conditions which favour the growth of these organisms and/or increase the likelihood of human exposure leading to infection. Precautions, such as those recommended for minimising the risk of *Legionella* infection, would also be effective for mycobacteria.

In the home, potential exposure could come from showering in water that has not been heated sufficiently. Hot water services should be set to 60°C to ensure destruction of potentially harmful organisms in supplied water. Bathing rather than showering is also an option for people with lung conditions.

### Mycobacteria in municipal water supplies

Water Research Australia's quarterly bulletin Health Stream, Issue 71 (October 2013), contained reviews of two highly relevant recent publications.

The first was *State of the Science and Research Needs for*

*Opportunistic Pathogens in Premise Plumbing*. Report 4379, published by the Water Research Foundation in 2013. The report was developed through a critical literature review and workshop process involving over 30 participants from academia, water utilities, government agencies and industry. Current understanding and knowledge gaps were initially summarised by separate teams of authors under the headings of Epidemiology, Methodology, Microbial Ecology, and Engineering Controls. A two day workshop was then convened where participants reviewed and discussed the evidence and proposed research needs. The group also developed Requests for Proposals designed to generate fundamental and practical knowledge to address the public health challenges posed by these pathogens.<sup>2</sup>

The second review was of *Mycobacterium abscessus* isolated from municipal water - a potential source of human infection (Thomson R, Tolson C, Sidjabat H, et al. (2013) *BioMed Central Infectious Diseases*, 13:241). "In the last 10 years, *M. abscessus* has become an increasingly important clinical problem, and its presence in potable water has not previously been highlighted. This study identified some apparently identical strains in infected patients, in potable water supplies, a rainwater tank and swimming pool.\* This study strengthens the link between potable water to which patients are regularly exposed and the acquisition of infection. *M. abscessus* is highly resistant to antimicrobial agents and usually requires prolonged treatment (more than six months) with intravenous and oral antibiotics in combination. Identification of effective disinfection methods for *M. abscessus* is important given the difficulty treating these infections and the devastating effects they have for patients."<sup>3</sup>

(\*It should be noted that the isolates from the swimming pool and the rainwater tank were not identical to those in mainswater. Dr Thomson's thesis raises issues about strain typing of *M. abscessus* and whole genome sequencing will be performed to confirm that strains are truly indistinguishable.)

## What next

Dr Thomson's thesis concludes that further work is required to confirm the findings and to explore other environmental niches such as soil for the pathogens.

The next logical step for the Australian industry is to determine the importance of this issue on the public health agenda – something that would be in the remit of the NHMRC's Water Quality Advisory Committee. The fact that the US Water Research Foundation is preparing to fund five projects on different aspects of opportunistic pathogens including *Mycobacteria* makes it likely that our authorities will also look at it more closely.

## Sources and further reading:

<sup>1</sup> John Innes Centre

<http://www.jic.ac.uk/SCIENCE/molmicro/Myco.html>

<sup>2</sup> Health Stream #71 October 2013 page 1

<sup>3</sup> Health Stream #71 October 2013 page 13

*State of the Science and Research Needs for Opportunistic Pathogens in Premise Plumbing*. Report 4379, Water Research Foundation 2013.

<http://www.waterrf.org/Pages/Projects.aspx?PID=4379>

Thomson R (2013) *Characteristics of nontuberculous mycobacteria from a municipal water distribution system and their relevance to human infections*. PhD Thesis, School of Biomedical Sciences, Faculty of Health, QUT  
[http://eprints.qut.edu.au/65483/1/Rachel\\_Thomson\\_Thesis.pdf](http://eprints.qut.edu.au/65483/1/Rachel_Thomson_Thesis.pdf)

*Research Report 79: Understanding the Growth of Opportunistic Pathogens in Distribution Systems*. Water Quality Research Australia 2008

*Research Report 11: A Guide To Hazard Identification & Risk Assessment For Drinking Water Supplies*. CRC for Water Quality and Treatment 2004