

## Emerging Health Threats Forum

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### Legionella lurking in wastewater

Microbiologists in Norway link legionellosis outbreak to industrial wastewater, call for prevention



Scanning electron micrograph showing *Legionella pneumophila* bacteria.

Image credit:  
CDC/Margaret Williams; Claressa Lucas; Tatiana Travis

Three outbreaks of Legionnaires' disease, which hit a Norwegian region in 2005 and 2008, were traced to a local wood-based chemicals factory where scientists detected *Legionella* bacteria in an air scrubber — a device that controls the level of pollutants emitted from the plant.

But research published this month in *Environmental Science and Technology* suggests that the factory's microbe-rich aeration ponds, and wastewater discharged into a local river, were mainly responsible for *Legionella* escaping and spreading to the community.

"We suggest that the aeration ponds have functioned as amplifiers and disseminators of *Legionella* causing the LD [Legionnaires' disease] outbreaks in both 2005 and 2008," write Jaran Strand Olsen and colleagues. "This work emphasizes the need for preventive actions."

Legionnaires' disease, a form of severe pneumonia, is one of two clinical syndromes associated with illness caused by *Legionella* bacteria, which live in protozoa and other small organisms. Outbreaks are usually associated with exposure to contaminated water from indoor sources such as air conditioning systems or spa pools.

Legionellosis accounts for a **large share of water-related diseases in the USA**. In Europe, about 100 outbreaks of Legionnaires' disease not associated with travel were **detected in 2007 and 2008**. The latest reported outbreak occurred in August and September of this year in **Wales, UK**, where 22 people were affected in a large geographic area, and results of an investigation into the source of the bacteria were inconclusive.

Probing recent outbreaks in Norway, the researchers analysed water samples collected from the river Glomma, downstream of the factory's treatment plant, in 2005 when 10 people died and more than 50 became infected. They found two pathogenic strains of *Legionella pneumophila* bacteria at high concentrations, about 10<sup>5</sup> CFU [colony forming units] per litre.

Even higher levels were found in samples collected three years later from aeration ponds — where the wastewater produced after wood refinement at the plant was treated biologically, by encouraging microbes to thrive so they can break down organic substances.

When the first outbreak was investigated, just two samples from the factory's air scrubbers were tested, and one proved positive for strains of *Legionella* associated with the disease. But in their study Olsen and colleagues recreated the environmental conditions in the air scrubber and found that the bacteria could not survive for more than two days — suggesting that conditions in the scrubber were too harsh to encourage multiplication and spread.

They conclude that although the scrubbers could have been contaminated when the outbreaks occurred, their ability to spread *Legionella* was limited compared with wastewater held in the ponds and river.

Nicholas Ashbolt, Senior Research Microbiologist at the US Environmental Protection Agency in Ohio, questions whether the analysis of survival of the bacteria in the air scrubbers was extensive enough. He says that by using agar plate culture, for example, the authors may have failed to recover cells that were highly "stressed" by the environmental conditions.

But Ashbolt concedes that although the data are not conclusive, wastewater — a known source of the bacteria — could have caused the outbreaks. "The finding of [pathogenic *Legionella* strains] in the wastewater alone at such high densities is of concern."

The rate at which bacteria could aerosolise from aeration ponds is probably equivalent to the rate of aerosolisation from a whirlpool spa, note the authors. Airborne *Legionella* can then travel some 200 metres downwind of the ponds.

Janet Blatny, from the Norwegian Defence Research Establishment and a co-author of the study, explains that people living near the factory could also be exposed by aerosolised bacteria escaping from the river at points of high concentration. "It cannot be ruled out that e.g. factories along the river using water directly from the river can provide further dissemination of the *Legionella* bacteria," she adds in an email to EHTF News.

Ashbolt agrees with the authors' call for regulation "to reduce the release of industrial wastewater *Legionella* by some form of disinfection". He says the main concern is aerosolisation of the bacteria directly from wastewater, or from the use of these

waters in cooling towers and other engineered systems with warm conditions where the bacteria can multiply easily.

#### Reference and link

1. Olsen JS, Aarskaug T, Thrane I, Pourcel C, Ask E, Johansen G, *et al.* Alternative routes for dissemination of *Legionella pneumophila* causing three outbreaks in Norway. *Environ Sci Technol* 2010. doi: [10.1021/es1007774](https://doi.org/10.1021/es1007774)

[UK Health Protection Agency information](#) on Legionnaires' disease

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