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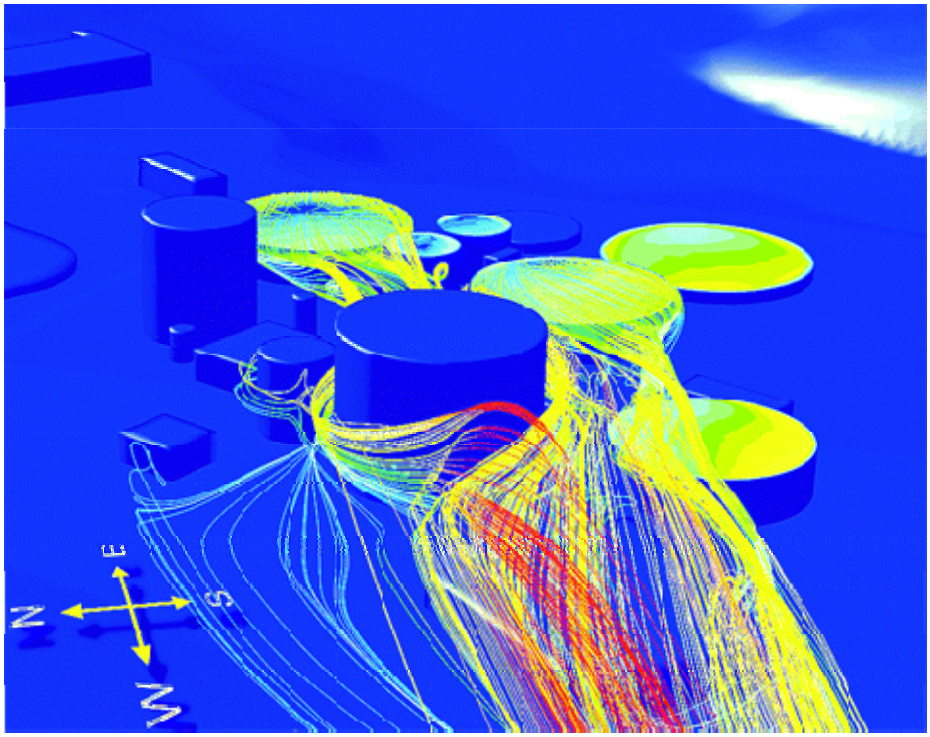
Tracking airborne Legionella downwind

The deadly bacteria can linger in biological treatment ponds and elsewhere—but how far can pathogenic strains of legionellae travel in air? New research in *ES&T* revisits the debate.

Naomi Lubick

An outbreak in Norway of legionellosis, or Legionnaires' disease, killed 10 people and made more than 50 people sick in 2005. An epidemiological study pegged the source of the infectious *Legionella* bacteria to an air scrubber at a wood-processing plant, about 10 kilometers away from where the outbreak took place. The facility also houses aeration ponds that are known to harbor all sorts of microbes, some of which may be pathogenic—including strains of *Legionella* bacteria.



Researchers modeled how *Legionella* bacteria might be carried by wind from aeration ponds at a wood-processing facility in Norway.

Now, research published in *ES&T* (DOI 10.1021/es800306m) revisits the debate over how far *Legionella* can travel. New modeling and measurements taken at the site confirm that the bacteria can travel by air at least 200 meters downwind of the ponds; however, some controversy still exists.

In 2006, lead author Janet-Martha Blatny of the Norwegian Defence Research Establishment , with co-workers from the company Borregaard, the Norwegian Institute of Public Health, and life sciences company Telelab AS, modeled the wood-processing plant's air space, using computational fluid dynamics and weather data. They looked at wind flow and other factors to figure out exactly where to place air monitors at various heights and locations around the buildings to capture *Legionella* aloft.

The researchers found that they could accurately predict the airborne path of aerosolized *Legionella* within the plant's footprint, and their monitors captured several different species, depending on weather conditions and each monitor's height. They also found that the bugs traveled 200 meters downwind, in this case remaining within the compound, where workers might inhale the bacteria.

But Blatny and colleagues needed to determine whether the captured bacteria were viable and infectious. They used real-time polymerase chain reaction and other techniques to examine the bugs. But the serotype of *Legionella pneumophila* trapped by the monitors turned out not to be the type most likely to cause infections.

Legionellae are ubiquitous in surface waters and are sometimes even found in groundwater. But the most likely sources of human exposure are cooling towers and water distribution systems (including showers and air conditioners), in addition to treatment ponds for industrial sites. The disease is passed not from person to person but only through direct inhalation of viable cells from the environment. Thousands of people get sick from legionellae every year, but those most susceptible tend to be elderly or immune-compromised patients.

None of the sources of the bug can be ruled out, says Jeroen den Boer, a legionellosis specialist at the Regional Public Health Laboratory Kennemerland (The Netherlands). But other research has placed *Legionella* bugs too far from their source, he says, including the epidemiological studies of the outbreak in Norway. "The way to prove that this person got *Legionella* from that facility is the way that Janet did it in her article: through air sampling," den Boer states. "If you have an outbreak, you should look in the vicinity of the thing" that is suspected to be the source.

Lloyd Larsen, a microbiologist at the U.S. Army's Life Sciences Test Facility at Dugway Proving Ground, says that although the researchers were successful in designing a sampling regime that could capture *Legionella*, they did not sufficiently validate their model. The experiment failed "to demonstrate the outside limits," he explains, by sampling beyond the predicted legionellae boundaries.

The monitoring techniques the team used are not groundbreaking, comments Torbjörn Tjärnhage of the Swedish Defence Research Agency. However, the way the researchers put together known technology and modeling yielded useful results, he says, and confirms that

air transport is possible. More studies are needed, he adds, particularly in different industries that use such treatment ponds. The team also needs to compare the airborne strains with those present in the ponds, Tjärnhage comments.

The new research "would be far more convincing if [DNA comparisons] would have been included," den Boer agrees, and he questions whether the researchers tested correctly for various strains that they caught in their air monitors.

However, den Boer says he "was happy to read" the results, which could bolster the idea that airborne *Legionella* stays relatively close to home. "It is an old discussion which we had in the 1980s and 1990s," he comments. "*Legionella* is a bacteria that needs water," and that's hard to find kilometers away from its source.