

## Detecting airborne microorganisms by experimental and numerical tools: application to the spreading of *Legionella pneumophila* from cooling towers.

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*Legionella pneumophila* is a causative agent of respiratory illness in humans. Most of community outbreaks of legionellosis have been linked with an airborne transmission of pathogen from cooling towers. During the outbreak in Pas-de-Calais, France, 2003, it was observed that *L. pneumophila* could be transported in air at least 6 km from the source (Nguyen *et al.*, 2006). To support investigations during epidemics, dispersion models could be used to optimize air sampling strategy for detecting airborne *L. pneumophila* and evaluate how far contaminated aerosols would be spread from cooling towers. The objective of this research is to investigate the performance of available plume models for predicting concentrations of airborne microbes, by iterative model-to-experimental data comparisons.

A dispersion field campaign of biological aerosols was performed at CSTB during August 25 to 29, 2008. Spores of *Bacillus globigii* were disseminated from the roof of a building on site. Air was sampled at 5 various locations from the source as showed on the Figure 1.



Figure 1. Sampling sites selected from predictions of the distribution of aerosols generated from the source (S). A, B, C were located at 50 m from the emission, D at 70 m on another roof and E at 70 m at the ground.

The sampling sites were selected from preliminary numerical simulations performed with ADMS, developed by CERC (Cambridge Environmental Research Consultants

(<http://www.cerc.co.uk/software/adms4.htm>), a Gaussian dispersion model using current understanding of the structure of the atmospheric boundary layer. To simplify calculations, paths of biological aerosols were estimated by assuming the bioaerosol is an inert particle. Atmospheric dispersion of aerosols was computed following local daily weather forecasts (temperature, humidity, wind speed and direction). Topography and buildings surrounding the emission source were also taken into account by the model. Slit and six-stage Andersen samplers were used for collecting the airborne microorganisms directly onto TSA agar. Wetted-wall cyclones and SKC Biosamplers were also runned for sampling air into distilled water. Liquid samples obtained in this way were then plated on TSA agar. Typical colonies of *B. globigii* were enumerated after 16-20 hours at 37°C.

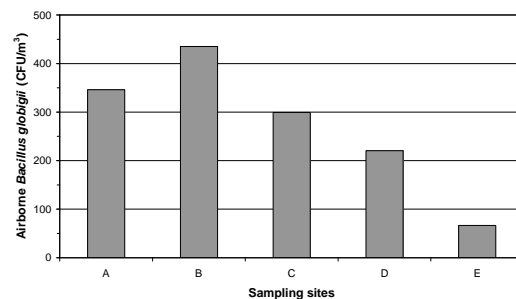


Figure 2. Concentrations of airborne *B. globigii* detected at sampling sites

The results showed a good correlation between predictions and *in situ* measurements. Spores of *B. globigii* were detected at all sampling locations selected following simulations with the ADMS4. These first observations suggest the potential operational use of models in case of epidemics of legionellosis or all another threat linked to biological aerosols dispersion.

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