Researchers propose new building guidelines to clean up city air

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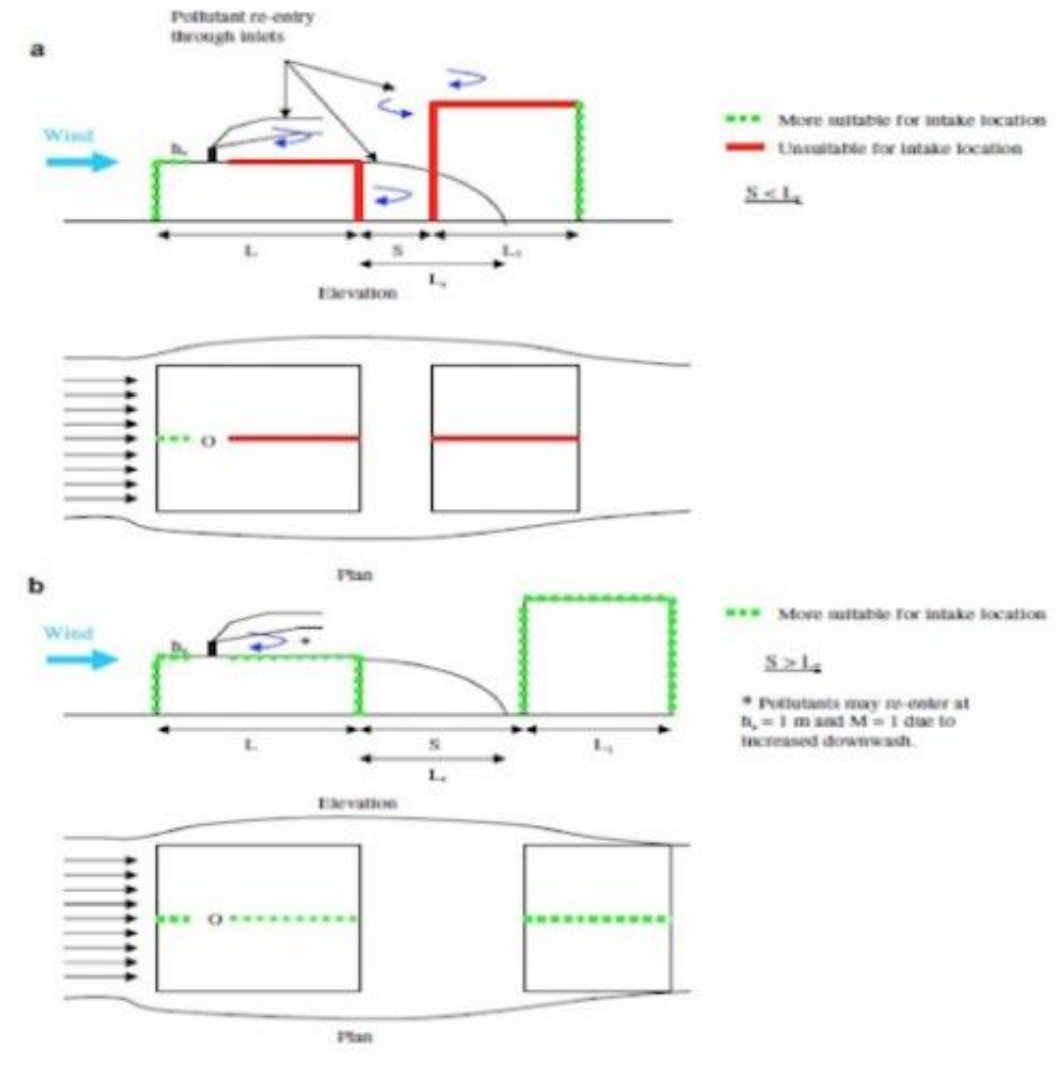

Research graph. Credit: Ted Stathopoulos

As urban populations expand, downtown buildings are going nowhere but up. The huge energy needs of these skyscrapers mean that these towers are not only office buildings, they're polluters with smokestacks billowing out toxins from the rooftop. Our cities are dirtier than we think. New research from Concordia University just might clean them up.

By examining the trajectory and amount of air pollution from a building to its neighbours downwind, Concordia researchers Ted Stathopoulos and Bodhisatta Hajra have come up with environmentally friendly building guidelines for our modern cities. This provides a much-needed update to the industry standards developed decades ago by the American Society of Heating, Refrigerating and Air-Conditioning Engineers – the international technical society that sets the rules for building ventilation.

Stathopoulos – a professor in Concordia's Department of Building, Civil and Environmental Engineering – partnered with emerging researcher and recent Concordia graduate Hajra to pen the study, recently featured in the peer-reviewed journal, *Building and Environment*. To perform the research, they hunkered down in Concordia's cutting-edge wind tunnel laboratory, a huge underground research facility which allows engineers to test the atmospheric dispersion of pollution and toxins in any given setting.

"We created model configurations consisting of buildings of various sizes and shapes," says Stathopoulos, an inveterate researcher who was awarded the prestigious Davenport Medal by the International Association for Wind Engineering in September 2012.

Hajra, who received his doctorate during Concordia's fall convocation on October 30, goes on to explain: "we then placed our models downwind of a building that was emitting toxins to trace the path from polluter to polluted. That allowed us to see how much pollution was

being absorbed by buildings downwind and where on those buildings that pollution was most concentrated."

Their findings show that the process by which air pollution spreads from one building's exhaust stack to another's intake is affected by the height and spacing between buildings, something that can be optimized by architects and engineers as new towers are constructed.

What does this mean for the future of downtown buildings? "We came up with three main guidelines for the placement of stack and intake in order to minimize the amount of air pollution that makes its way into downwind buildings," says Stathopoulos.

First, intake vents on buildings downwind of a polluter need to be placed upwind of that building's stack, and closer to its more sheltered wall. Second, air intakes should not be placed on rooftop locations downwind of a low stack and the protected wall of the emitting building. Lastly, increased spacing between buildings can reduce the possibility that pollutants from one will be re-ingested by another.

"While our research may not reduce the amount of outdoor pollution in our cities," explains Stathopoulos, "it can certainly help ensure that this same dirty air is not re-circulated indoors."

Provided by Concordia University