

Experimental measurement protocol of aerosol deposition relating to a bend in a large ventilation network with rectangular ducts

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Aerosol deposition in ventilation plays a key role in particulate pollution transfers inside buildings, but has been mostly studied in ventilation systems by applying models developed on the basis of experimental results obtained mainly on aerosol sampling lines. The size of these lines differs greatly with the size of industrial ventilation ducts, whose cross-sections are larger than 50 centimeters. Besides, in the literature, few experimental studies focused on singularities, like bends, mostly at a medium scale with circular or square cross-sections. By applying these models, aerosol deposition measurements are affected by a scale effect and possibly by airflow patterns specific to rectangular ducts due to secondary flows.

In this study, we focus on aerosol deposition relating to a bend, in rectangular ducts (600 x 400 mm²) of the DIESE research facility, a new ventilation network of industrial size built at IRSN. We present the corresponding experimental protocol and aerosol deposition velocity measurements.

Experimentally, we need to generate enough aerosols to compensate the dilution due to high airflows. Furthermore, monodisperse aerosol generators are generally lab-scale devices, leading to detection challenges: we need to come to a compromise and find a measurement technique with a low enough limit of detection. Consequently, we used a fluorescent aerosol and verified a) the aerosol size distribution and the injected mass flow; b) the repeatability of the volume concentration in the bulk, sampled on filters and c) the repeatability of aerosol deposition measurements, carried out by wiping wall surfaces and completed by fluorescence spectroscopy analyses. Additionally, we carried out aerodynamic measurements, such as velocity measurements with hot wire anemometry and PIV.