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A CRITICAL EVALUATION OF THE ACCURACY OF TRACER GAS MEASUREMENTS IN VENTILATED SPACES

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ABSTRACT Since natural ventilation is a more energy efficient approach to provide effective ventilation, this technique is gaining more interest. The major problem of natural ventilation is a lack of an accurate, continuous and online measuring and controlling technique for air exchange rates, which is crucial for the monitoring of the buildings emissions and for the control of indoor air conditions. In a number of studies, several techniques were suggested to measure ventilation rates through naturally ventilated buildings. Both for research and field applications, the proposed techniques should be tested under controlled, laboratory conditions to evaluate their ultimate accuracy. Due to lack of any 'reference technique' on field trials, this study aims to test the possible techniques in laboratory test installations. The majority of the studies use tracer gas technique as a reference method. Therefore, the accuracy of the tracer gas method should definitely be studied against a standard measuring technique. Although tracer gas measurements are widely used in literature for comparison, they mostly rely on the assumption that the air and the tracer gas are perfectly mixed in the ventilated volume. Also it is assumed that the measurement point is representative of average ventilation efficiency within the space. In reality, measurement errors are unavoidable due to imperfect mixing of tracer gas in the ventilated volume. Measurements in less ventilated 'dead zones' will definitely lead to misleading results for total ventilation rate. In this study, the ventilation rate measured with the tracer gas method was compared with an accurate measurement of the ventilation rate in a laboratory test installation. This research outlines the measurement errors due to sampling position. The measurement errors inside the ventilated airspace on the ventilation rate can rise up to 86% of the actual ventilation rate.

Keywords: Natural ventilation, Ventilation rate, Tracer gas, Measurement error, Emission monitoring.