Spatial and seasonal variation of nitrogen dioxide and ozone in modern office buildings

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Lately, there is an increasing concern on indoor air quality (IAQ), as in our modern world, people are spending about 80% of their time in a built environment.

OFFICAIR is a European collaborative project focusing on IAQ and its effects in modern office buildings in the following countries: Finland, France, Greece, Hungary, Italy, Portugal, Spain and The Netherlands. In each partner country, around 20 office buildings were selected according to strictly established selection criteria and a general survey was carried out focusing on the assessment of the IAQ and health and comfort perception at work. Finally, 36 buildings were selected for further monitoring and health outcome evaluation.

One of the tasks was the determination of nitrogen dioxide and ozone by passive sampling using Gradko and Radiello samplers for 5 consecutive working days in 4 offices/building and 1 outdoor location, preferably close to the air intake of the HVAC systems. Sampling was done in summer 2012 and it was repeated in winter 2012/2013. Both nitrogen dioxide and ozone were determined spectrophotometrically. Nitrogen dioxide and ozone samples were measured at Gradko (UK) and at the Department of Analytical Chemistry of Eötvös Loránd University, respectively. Two duplicate samples per compound and per country were made. Field and travel blanks were also prepared for each building and shipped to the centralised laboratories.

In the lack of certified reference material, as a validation aspect, the results of O_3 samples collected on the roof (30-65 m high) of the office buildings in Hungary were compared with simultaneously performed on-line measurements of ozone at a station of the Hungarian Air Quality Network Service considered as urban background for Budapest. Mean of relative standard deviations for O_3 measurements was 21%. In the case of duplicate samples, deviation was between 7 and 34%.

In the case of Greece, Hungary and the Netherlands, higher outdoor ozone values were determined during the summer campaign due to the heat wave of mid June – July of 2012. Generally, in France and Spain, indoor ozone levels fell under the detection limit.

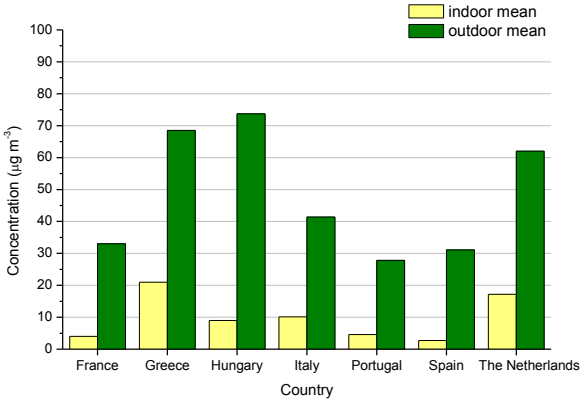

Figure 1. Indoor and outdoor ozone levels in office buildings monitored in the OFFICAIR project during summer 2012.

In most cases, the indoor / outdoor ratios were higher for NO_2 than for O_3 which indicates the higher reactivity of ozone in the indoor environment. The outdoor O_3 and NO_2 levels were mainly building location dependent.

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