Laser Printers Particles Emissions Revisited

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Introduction

More than a decade ago, we encountered a problem of high particle concentrations in large open-plan offices when conducting investigations on the impact of a nearby motorway on air quality in the offices. Eventually the particles were linked to the operation of numerous laser printers in the offices and we designed a study to characterize and classify the printers according to their impacts as particle emitters (He et al 2007). We demonstrated that the particles were in the ultrafine range, and our subsequent studies showed that they were secondary liquid particles formed from volatile compounds emitted during the printing process (Morawska et al 2009), and that the operating temperature the printer was the key factor in this process (He et al 2010). Ten years later, we decided to revisit the issue and examine whether the new generation of printers is improved and emit less.

Methods

In our investigations, we followed the method used in our original study (He et al 2007), where particle number concentrations (PNC) were measured 1 m above each printer in-situ before printing (background level) and immediately after printing 1 page. The ratios of these two values were calculated, and then the printers ranked according to the values of the ratios. In total, 166 printers were investigated in offices of the Queensland University of Technology and University of Queensland (Brisbane, Australia), and 24 in the offices of the University of Cassino and Southern Lazio (Cassino, Italy). The particle concentrations were measured by the P-Trak ultrafine particle counter in Brisbane and the condensation particles counters (CPC) in Cassino. In addition, according to the same method, we also measured TVOC concentrations using a Photoionization Detector (PID).

Conclusions

In our analyses, we separately investigated small desktop printers, and large, stand alone and multifunction machines, the relationship between the model of the printers and their emissions, and compared the results (of particle emissions) with the results of our first study (He et al 2007). Some of our main results are presented in Figure 1, where we combine the results of the Brisbane and Cassino measurements, as well as PNC and TVOC.

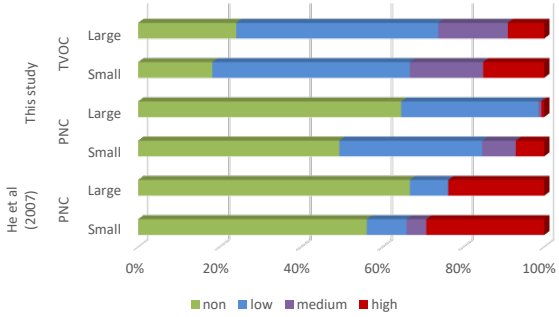

Fig. 1. Comparison of emissions from small and large printers, and with the He et al. (2007) study.

We concluded that: (i) Printers belonging to different classes (non, low, medium and high emitters) in the two cities are in general similar; (ii) In general, large printers are non- or low emitters of particles. Small printers, unlike large printers, have a higher proportion of high emitters. This is different compared to the 2007 study, where the proportion of high emitters was larger; and (iii) There is no clear relationship between the printer ranking in terms of TVOC and particle emissions.

We hope that this evidence will bring the issue of printer emissions again in focus, whether to either influence the establishment of emission limits, or for better self-regulation by the printer industry

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