

Printer Air Contaminant Emissions Fact Sheet

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A recent research paper (Morawska et. al., Environmental Science & Technology, 2007) reports measurements of the emission rates of particles from printers and lists the manufacturer and model of those with no, low, medium, and high emissions of particles. This has many owners of printers that are listed as high emitters concerned. See <http://www.youtube.com/watch?v=3CajHu-psqc>.

The following are some facts regarding air contaminant emissions from printers:

- Printers produce a number of contaminants including:
 - nano-particles (extremely small 50-100 nm diameter particles)
 - volatile organic compounds (primarily ethylbenzene, xylene, and styrene)
 - ozone
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- The emissions of air contaminants from printers depends upon a large number of factors including the manufacturer/model, toner cartridge type, pages per minute printed, toner coverage per page, and maintenance. The impact of these variables is apparent in the recently published list of printer emissions, where two different HP Laser Jet 8000DN printers are listed as both a non-emitter and a high emitter of particles.

In the Morawska et. al. paper, the field measurements for rating the printer particulate emission rates were made with printers of unknown age and with unknown toner cartridges (e.g. age, manufacturer) and in an uncontrolled field setting. Thus, the actual emissions from your printer may be substantially different than those listed in this paper for your manufacturer/model printer.

- Using the emission rate data from the Morawska paper and others published in the last 10 years, the worst case air contaminant concentrations (i.e. a private office of 225 ft² with a minimum outside air exchange rate and a printer continuously printing 10 pages per minute for a 15 minute period every hour) were all less than 1% of the Cal/OSHA 8 hour exposure limit. We note that there are no specific occupational exposure regulations for printer generated particles, so we have used the default exposure limit for particulates not otherwise classified or “nuisance dust”.

- Comparing these worst case projected indoor air contaminant concentrations to non-industrial irritant guidelines (i.e. California Office of Environmental Health Hazard Assessment - Chronic Reference Exposure Levels, and the California Air Resources Board Ambient Air Quality Standards and Indoor Air Guidelines) the indoor concentrations are all less than 20% of the irritant guideline with the exception of particles, which was at 50% of the irritant guideline. We note that there are no specific non-industrial irritant guidelines for printer generated particles so we have used the California Air Resources Board guideline for indoor PM_{2.5} particles (i.e. particles less than 2.5 μm or 2,500 nm in diameter).

- Thus, under the worst case scenario of operation of a printer in a small minimally ventilated private office, our analyses indicate that while the concentrations of indoor air contaminants are well below occupational exposure regulations, in some cases the concentrations approach recommended irritant guidelines. We note that these projected indoor contaminant concentrations assume well mixed indoor concentrations, and if a printer is located next to an occupant the exposure to that occupant may be substantially higher.

- The most significant contaminant emitted from printers from a health perspective appears to be particulates. There are no specific exposure limits for particles produced by printers. Clearly there is a need to develop health and irritation exposure guidelines specifically for particulates generated from printers.